

Dec. 24, 1935.

H. HOVLAND

2,025,389

TELEPHONE SYSTEM

Filed June 9, 1934

9 Sheets-Sheet 1

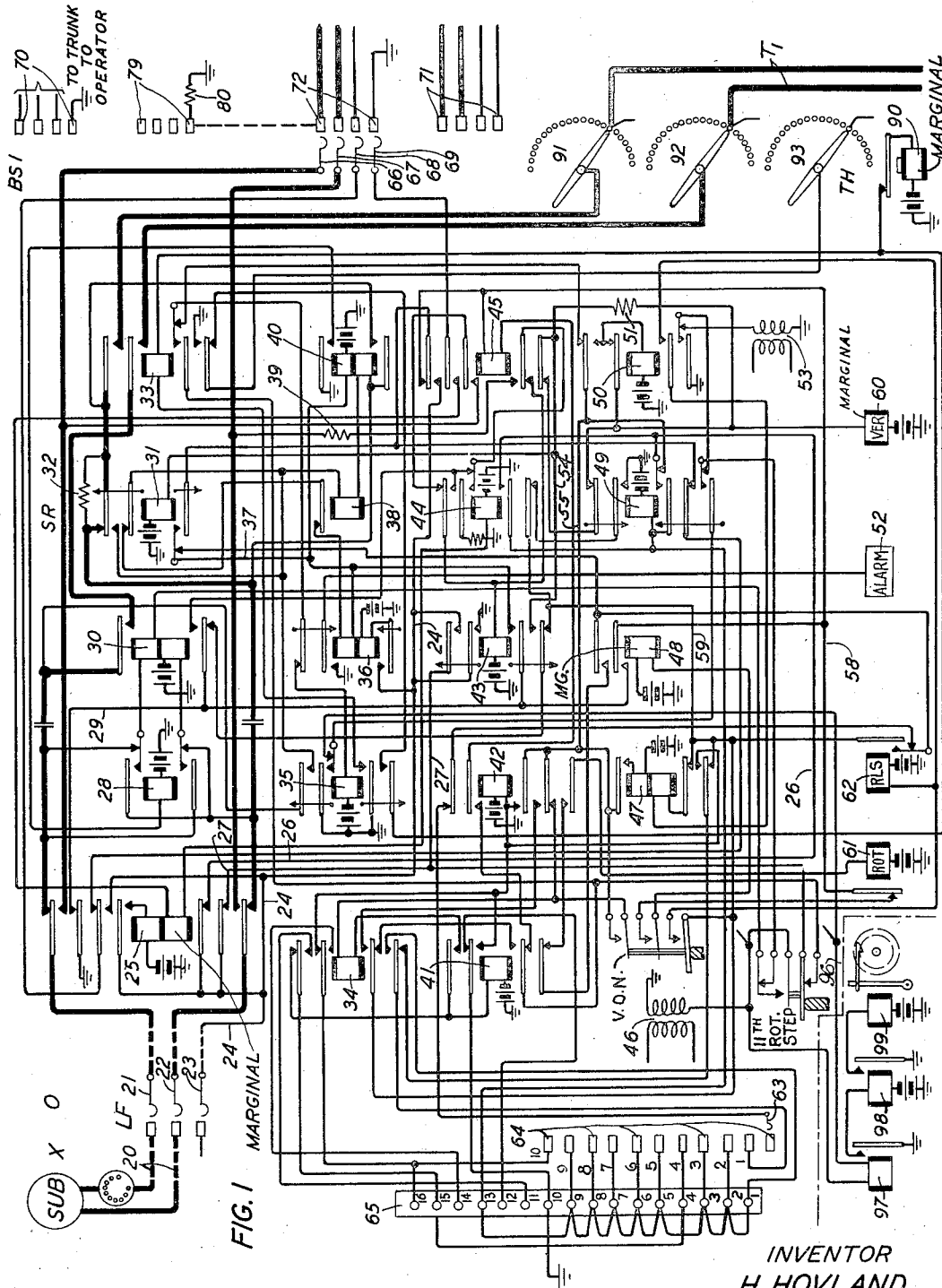


FIG. 1 MARGINAL

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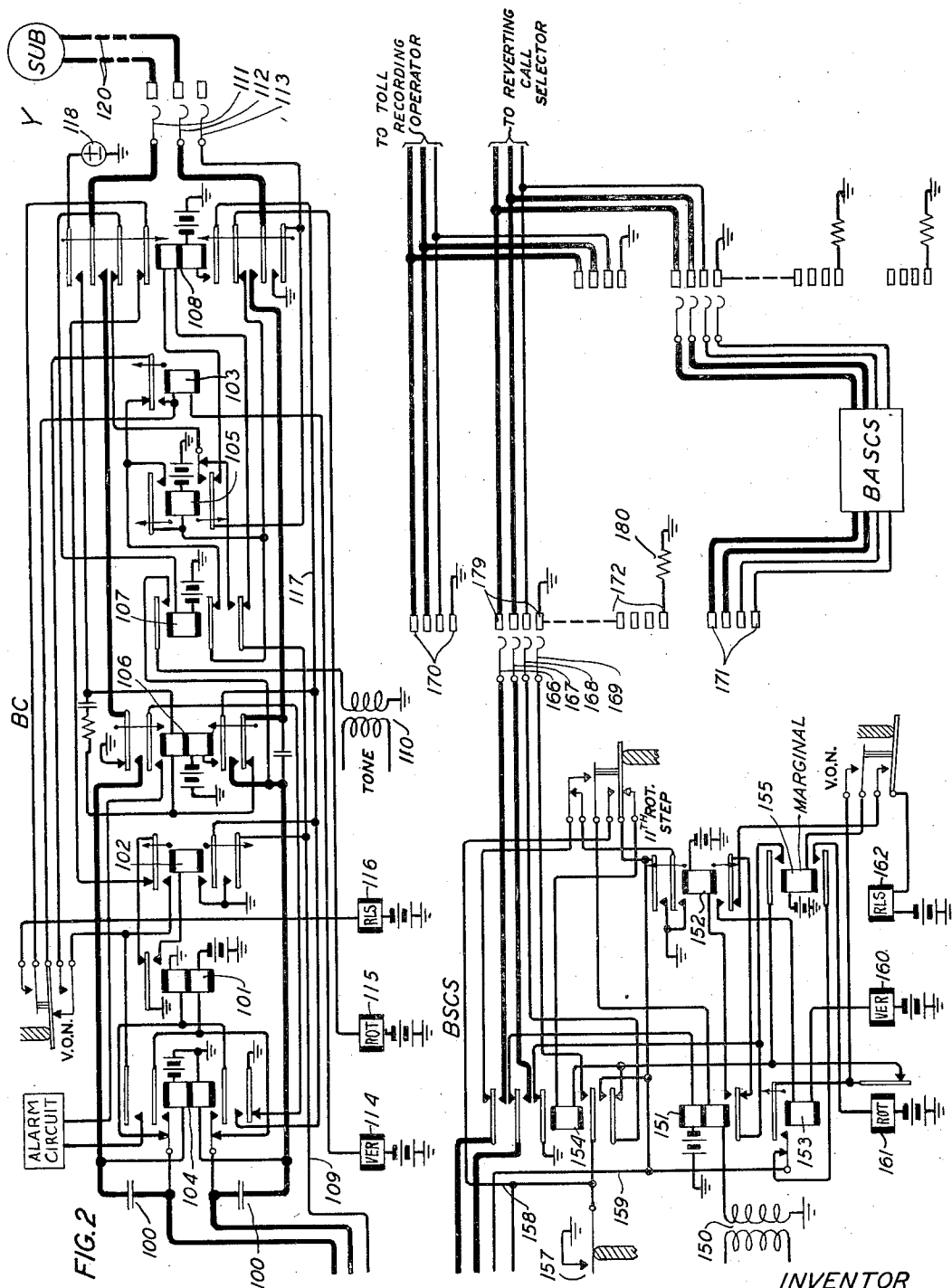
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TELEPHONE SYSTEM

Filed June 9, 1934

9 Sheets-Sheet 2



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Filed June 9, 1934

9 Sheets-Sheet 3

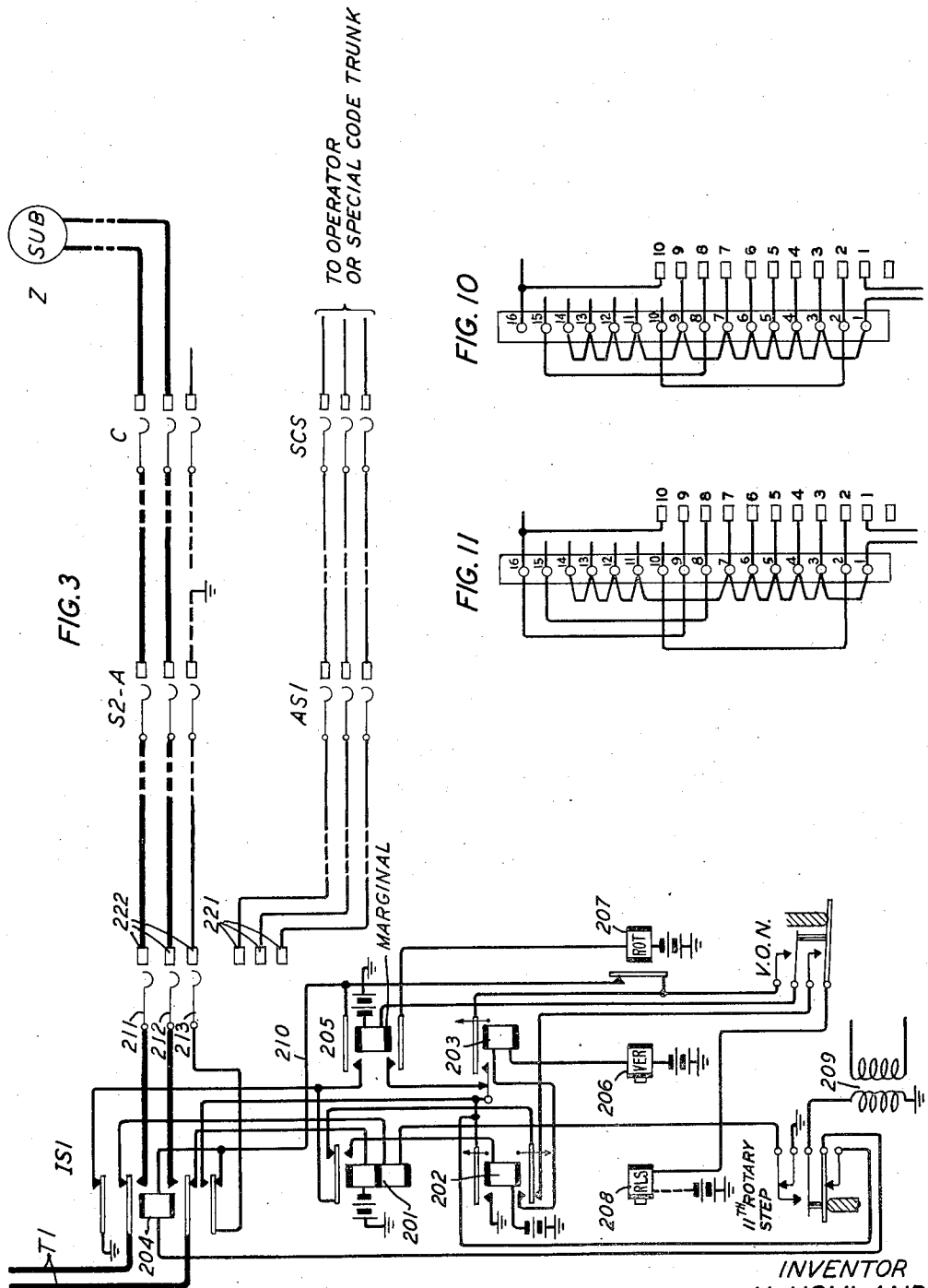


FIG. 10

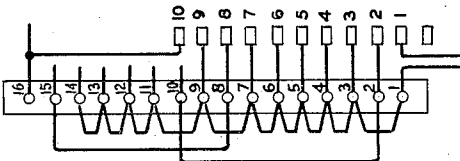
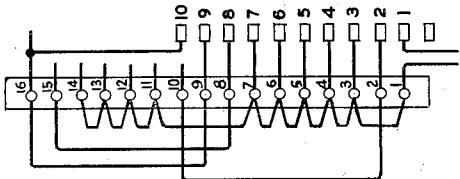


FIG. 11



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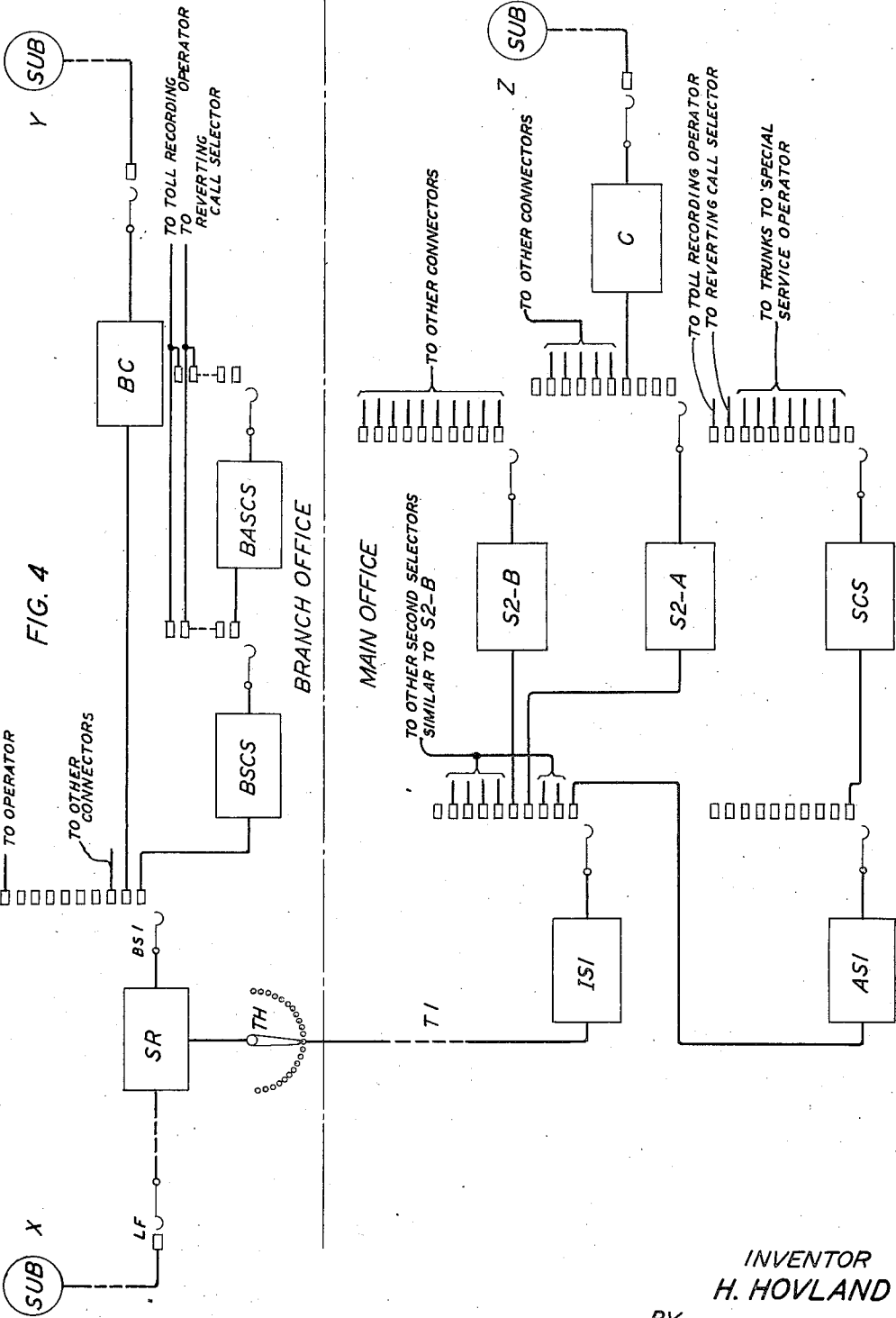
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TELEPHONE SYSTEM

Filed June 9, 1934

9 Sheets-Sheet 4



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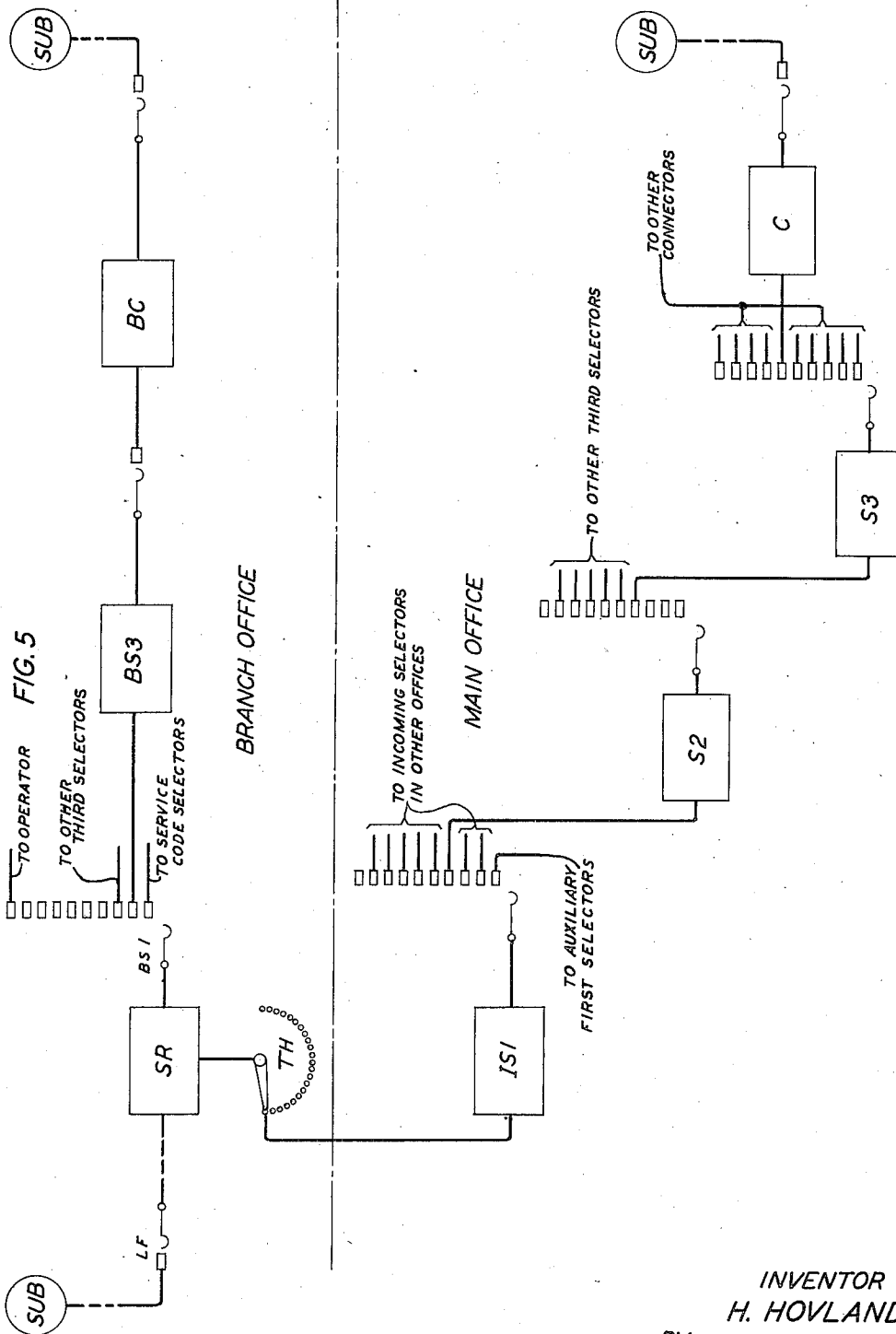
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Filed June 9, 1934

9 Sheets-Sheet 5



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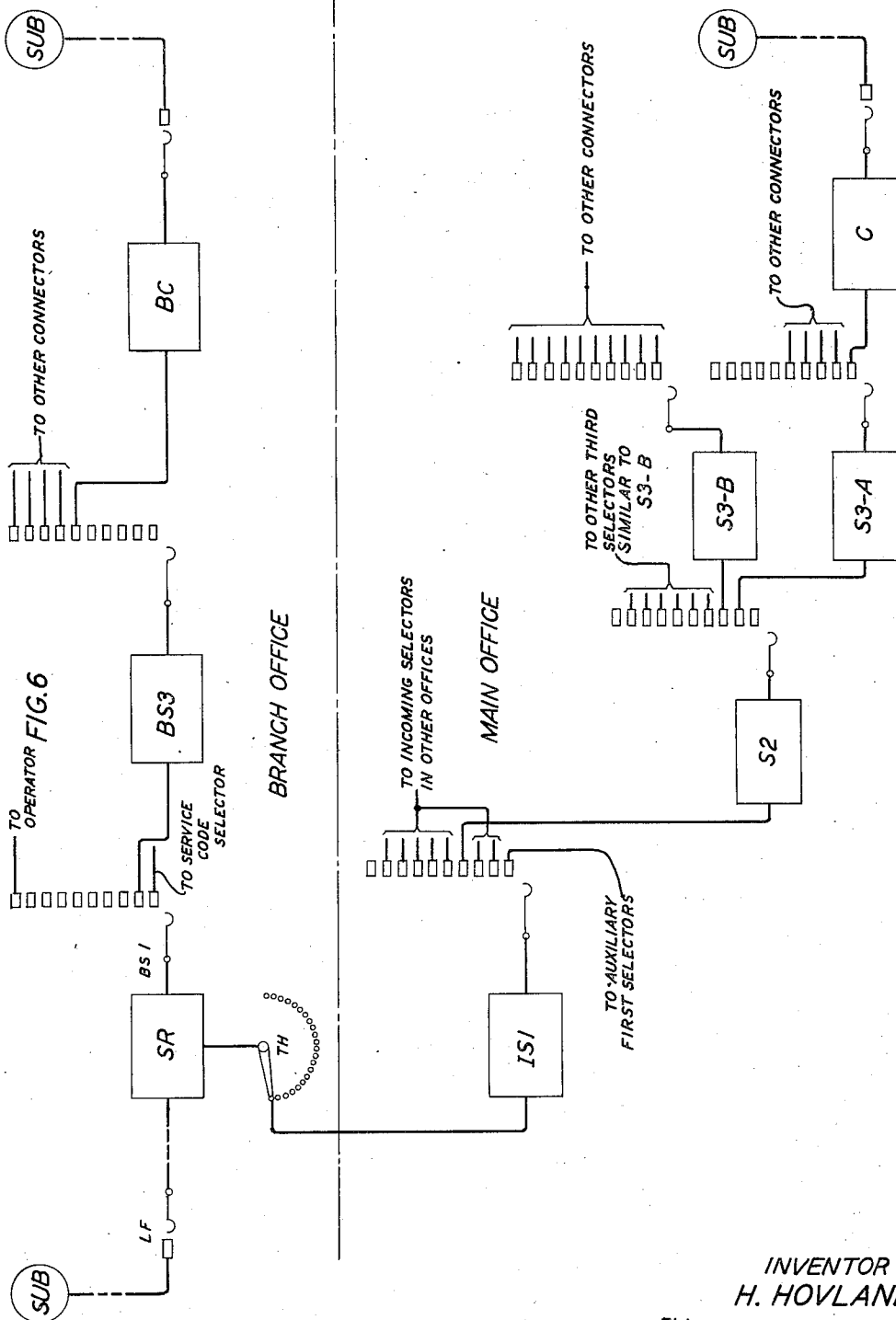
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Filed June 9, 1934

9 Sheets-Sheet 6



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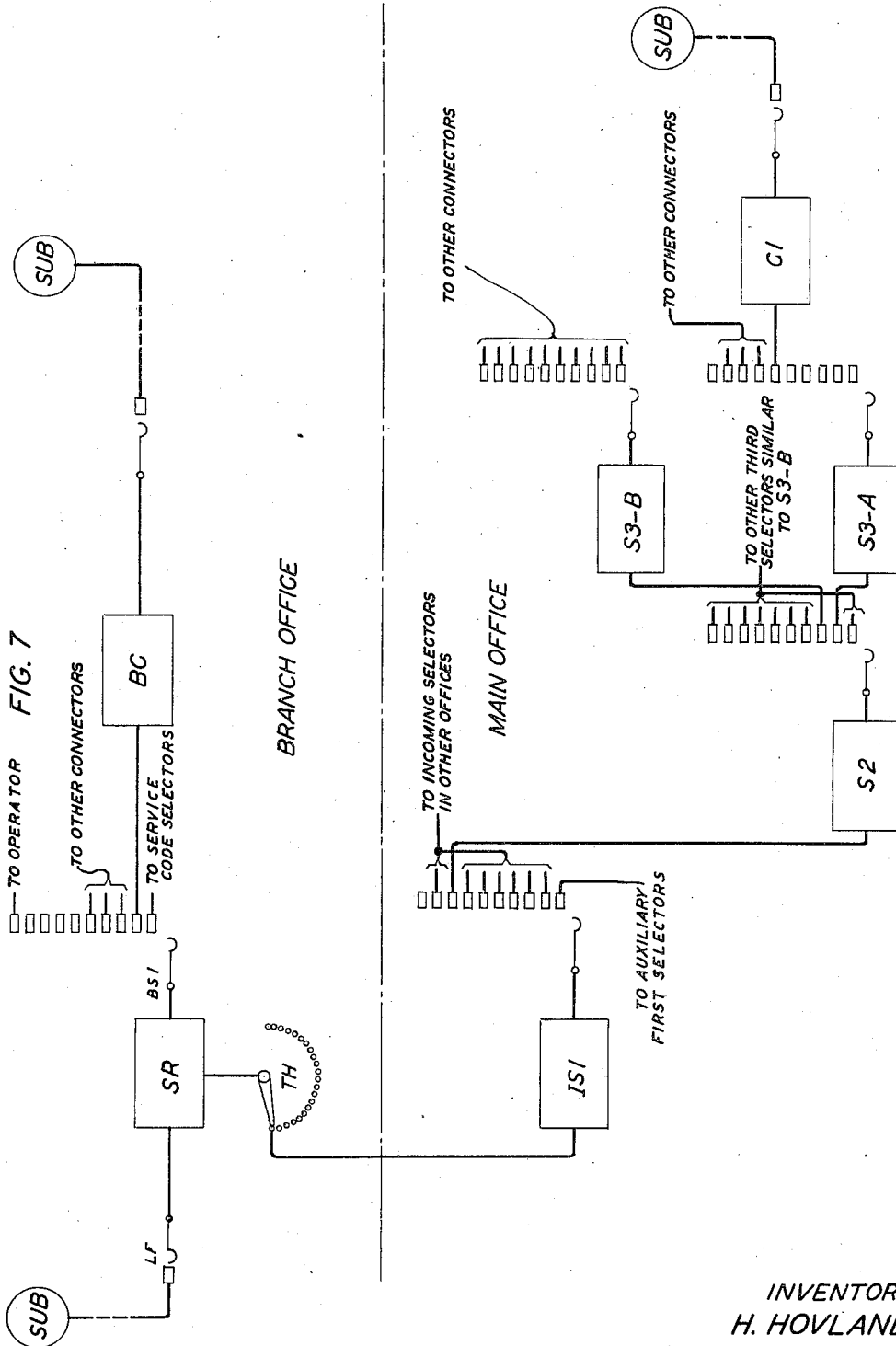
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9 Sheets-Sheet 7



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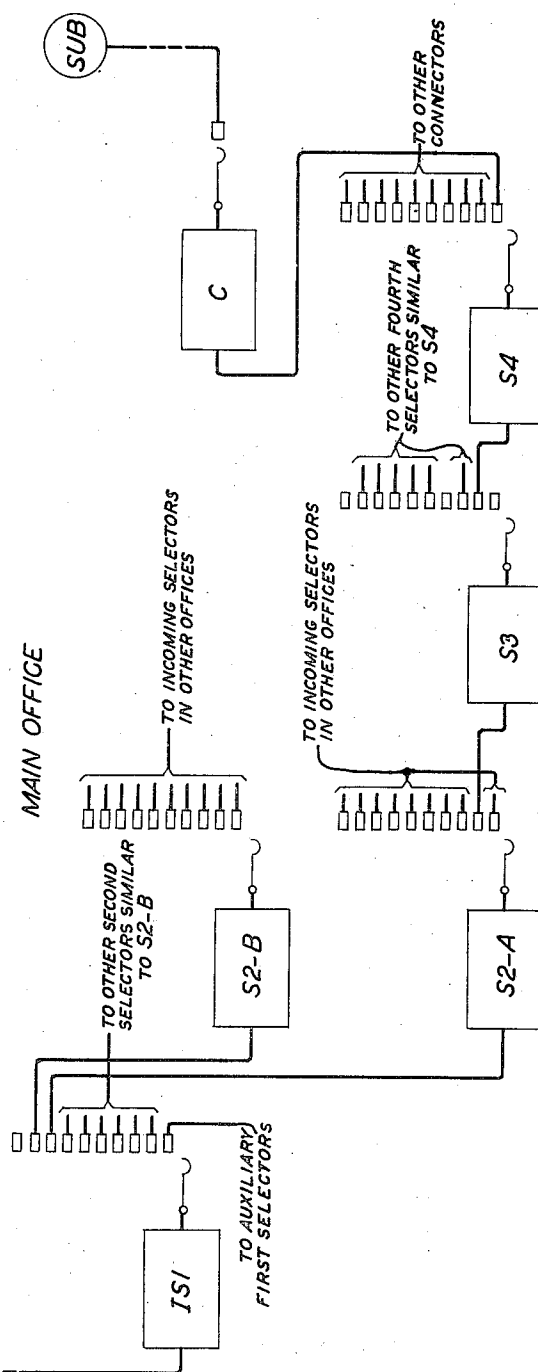
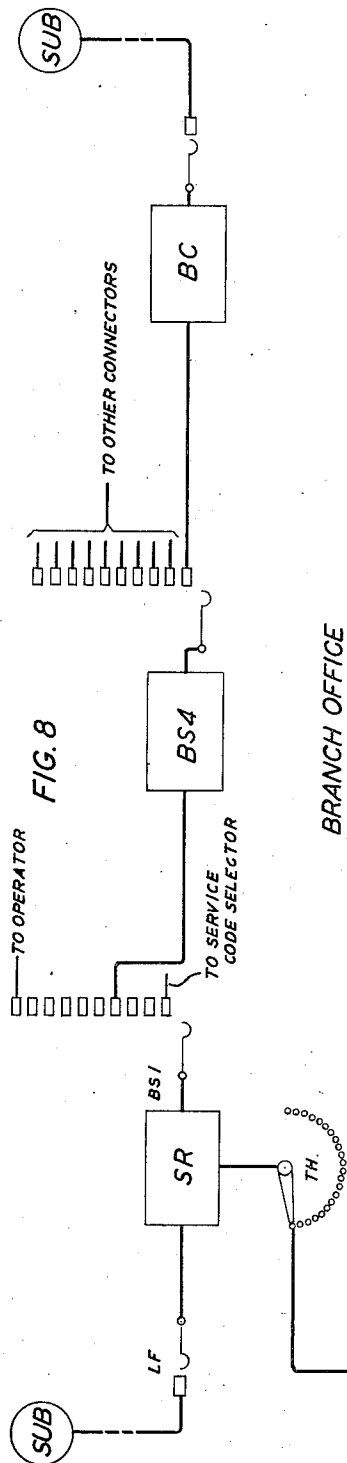
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Filed June 9, 1934

9 Sheets-Sheet 8



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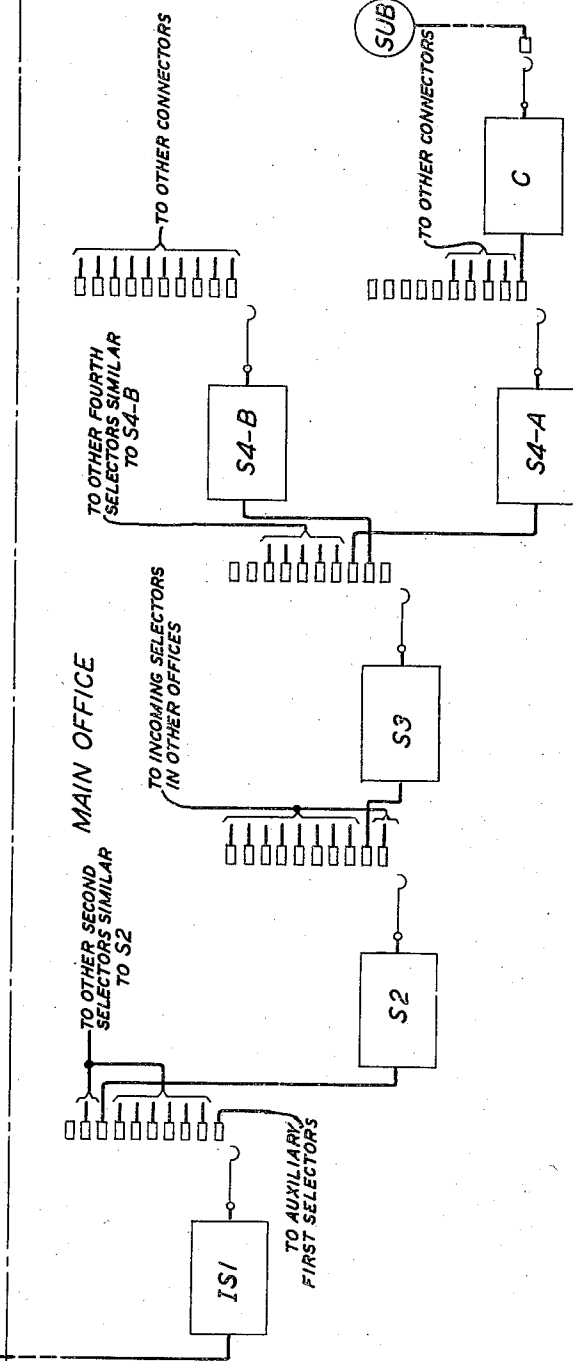
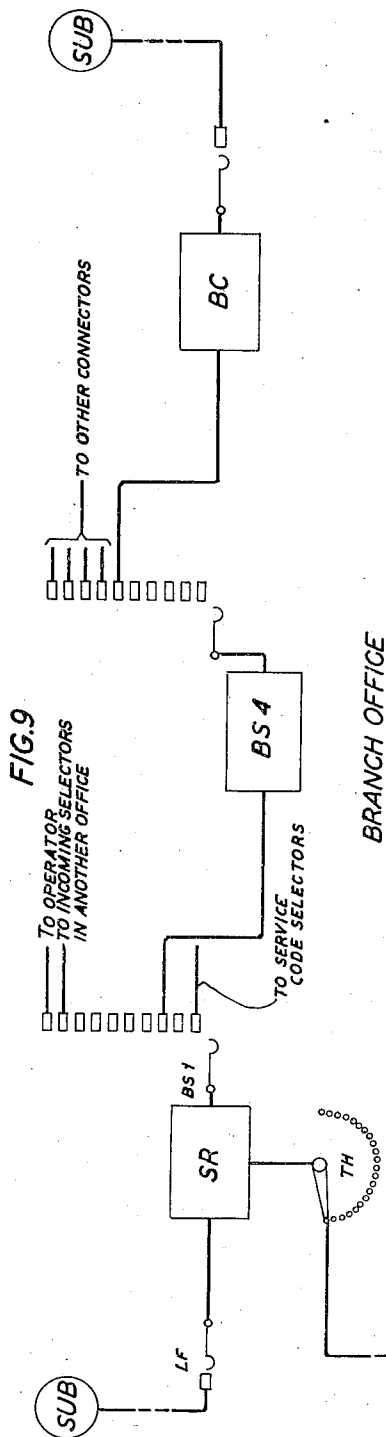
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2,025,389

TELEPHONE SYSTEM

Filed June 9, 1934

9 Sheets-Sheet 9



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UNITED STATES PATENT OFFICE

2,025,389

TELEPHONE SYSTEM

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Application June 9, 1934, Serial No. 729,737

17 Claims. (Cl. 179—26)

This invention relates to automatic telephone systems and more particularly to systems which include a main office and one or more branch offices.

5 The object of this invention is to provide a branch-office telephone system adapted for use under widely varying traffic conditions, to increase the flexibility and efficiency of the trunking, and to otherwise improve such systems.

10 In branch-office telephone systems it is desirable that connections between subscribers of the branch office be completed entirely through local switches. In such systems, the numbering scheme and trunking ordinarily necessitate the dialing of one, two or three digits of a called number before it is fully determined whether or not the call is one requiring the use of main-office switches. Upon origination of a call in the branch office, the calling line is usually extended to a selector-repeater comprising a discriminating selector switch, an auxiliary trunking switch for selecting an idle trunk to the main office, and means for repeating impulses from the calling line over the trunk to operate selector switches in the main office. In response to the dial impulses incoming over the calling line, the discriminating selector operates in synchronism with a selector in the main office, the brushes of the discriminating selector being restored to normal after each digit prior to the one that completes determination of the route. The trunk to the main office is released or the branch-office switches rendered unresponsive to further dial impulses, as soon as the determination is completed. The discriminating selector is variously arranged to control the trunk-switching operation; in some cases shaft-operated level springs are provided, in some cases a vertical commutator and brush are provided, and in other cases a distinguishing potential is connected to a terminal of the first set in one or more levels of the bank.

A feature of this invention is a digit-absorbing selector-repeater in which the trunk-switching operation is dependent upon the character of the terminals in the group selected in response to the last digit required for determining the route of the call. To this end a fourth brush is provided and additional terminals added to the bank of the discriminating selector. Such an arrangement permits the use of the absorbed digits for numbers in both the main and branch offices without increasing the complexity of the means for controlling the trunk-switching operation.

Another feature of the invention is a digit-absorbing selector-repeater which is arranged to

repeat impulses to the main office and simultaneously repeat the same impulses to a succeeding selector of the branch office. This arrangement is necessary where the route of the call is determined by two or more digits in addition to the digits absorbed by the discriminating selector.

A further feature is a branch-office system in which a digit-absorbing selector-repeater simultaneously repeats impulses to the main office and to a succeeding selector of the branch office and in which the trunk-switching operation of the selector-repeater is determined by the character of the terminals in the group selected by said succeeding selector in response to the last of the digits which determine the route of the call.

A further feature of the invention is a branch-office system in which special-service-code calls are completed through the main office with the exception of reverting calls and calls to recording-completing toll boards, both of which are completed through switches in the branch office.

A further feature of the invention is a selector-repeater arranged to operate an overflow register in case an idle trunk to the main office has not been found prior to the receipt of the first dial impulse.

The drawings which form a part of this specification represent in diagrammatic form a telephone system arranged in accordance with the features of this invention. Referring to the drawings:

Fig. 1 shows schematically a subscriber's station X and line 20, a line-finder LF having access to the line 20, a selector-repeater SR permanently associated with the line-finder LF and comprising a digit-absorbing selector switch BS¹ and a rotary trunk hunting switch TH, all of which equipment is located in a branch office.

Fig. 2 shows schematically a connector BC and a called subscriber's station Y, a special-service-code selector BSCS and an auxiliary special-service-code selector BASCS, all of which are located in the same branch office with the equipment shown in Fig. 1.

Fig. 3 shows schematically a selector IS¹ in a main office to which T¹, one of the trunks incoming from the branch office of Figs. 1 and 2, is connected. Fig. 3 also shows in schematic form a second selector S2—A, a connector C and a subscriber's station Z. Fig. 3 also shows an auxiliary first selector AS¹ and a special-service-code selector SCS.

Figs. 4, 5, 6, 7, 8 and 9 show various trunking arrangements for a main and branch-office system in which it is necessary to provide in the

branch office a selector-repeater arranged in accordance with the features of this invention.

Fig. 10 represents the bank of the selector-repeater SR of Fig. 1 when the trunking arrangement is as shown in either of Figs. 7 or 8.

Fig. 11 shows the commutator connections for the selector-repeater SR of Fig. 1 when the trunking arrangements is in accordance with Fig. 9.

The system represented by the drawings is one in which the subscribers are provided with dial impulse senders and the automatic switches used in establishing desired connections in accordance with the dial impulses are of the well known two-motion step-by-step type. For a detailed description of the structure and operation of switches of this type, reference may be had to pages 53 to 65 inclusive of the second edition of "Automatic Telephony" by Smith and Campbell published in 1921.

With the exception of the selector-repeater SR (including switches BS1 and TH) of Fig. 1, the connector BC and selector SCS of Fig. 2, and the selector IS1 of Fig. 3, all of which are shown in detail, the various automatic switches and associated apparatus are represented in the drawings by the enclosures within which the designations are placed, the set of brushes extending from the enclosures, and the associated sets of terminals.

Referring to Fig. 4, the trunking arrangement is designed to provide for a total of 7,800 four-digit subscribers' numbers in a main office and a branch office. Numbers from 2000 to 3999 inclusive and 4400 to 9999 inclusive are assigned to the main office and numbers from 4200 to 4399 inclusive are assigned to the branch office. It is apparent that it requires the dialing of a maximum of two digits to determine whether a called number is located in the branch or in the main office. The first digit of the branch-office numbers might be, in another similar arrangement, any one of the digits except 0 or 1. The digit 0 is used for calling an operator and the digit 1 is employed only for special codes comprising three digits of which the first two digits are 11. A maximum of 700 numbers can be assigned to the branch office in which case there could be but 7100 numbers assigned to the main office.

In the branch office the subscribers' lines terminate in line-finder switches such as LF and in the banks of connector switches such as BC. The line-finders are used to establish a connection with lines when calling and the connectors are used to establish a connection with lines when called. The station X represents the station of a calling subscriber and the station Y represents the station of a called subscriber. Each line-finder is permanently associated with a selector-repeater such as SR which includes a selector switch BS1 and a trunk-hunting switch TH. The terminals in the banks of the selector switches, such as BS1, are connected to succeeding selector or connector switches in the branch office or to trunks to an operator. The terminals in the banks of the trunk-hunting switches connect to trunks, such as T1, leading to and terminating in incoming selectors, such as IS1, in the main office. The terminals of the first level of the bank of the selector switches, such as BS1, are connected to special-service-code selectors such as BASCS; the terminals of the second and third levels are connected to connector switches such as BC; the terminals of levels 4 to 9 inclusive are vacant; and the terminals of

the tenth or 0 level of the bank are connected to trunks leading to an operator's position, either local or centralized. The "0" operator's position may therefore be in the main office, the separate group of trunks from the tenth level of selector BS1 being provided instead of completing such calls through the tenth level of the incoming first selectors in the main office so that the operator will know whether an incoming call originated in the main office or in the branch office. If special-service-code selectors are not provided in the branch office, the terminals of the first level would also be vacant. The terminals of the first level of the special-service-code selectors, such as BASCS, are connected to auxiliary special-service-code selectors, such as BASCS; the terminals of the ninth level connect to reverting call selectors in the branch office; and the terminals of the tenth level connect to trunks leading to a toll recording-completing operator's position. While direct trunks would not ordinarily be provided from the branch office for completing other special code calls, such trunks might be connected to the terminals of the other levels of the special-service-code selectors. To illustrate, direct trunks might be provided for completing calls from the branch office to an information operator's position; assuming the information operator code to be 113, these trunks would be connected to the third level of the special-service-code selectors. The terminals of the first level of the auxiliary special-service-code selectors, such as BASCS, are vacant but the terminals of all other levels are multipled to the terminals of the special-service-code selectors BASCS.

In the main office the subscribers' lines may, in like manner, terminate in the banks of line-finder switches (none being shown) and in the banks of connectors such as C; the station Z represents a called subscriber's station to which the connector C has access. In addition to the incoming first selectors such as IS1 for extending calls originated by subscribers in the branch office, other first selectors (not shown) are provided for use in extending calls originated by subscribers in the main office. The first selectors, both incoming and local, have access to the same or similar groups of trunks. The terminals of the first level of the incoming selectors, such as IS1, are connected to auxiliary first selectors; the terminals of the tenth level are vacant; the terminals of the fourth level are connected to second selectors represented by S2—A; and the terminals of all other levels are connected to other second selectors represented by S2—B. The terminals of the first level of the bank of the auxiliary first selectors, such as AS1, are connected to special-service-code selectors, such as SCS, which in turn have access to the special-service-code groups of trunks as hereinbefore illustrated. The terminals of all levels of the banks of the second selectors which are represented by selector S2—B are connected to connector switches thereby giving access to a total of 7000 subscribers' lines. The terminals of levels 4 to 9 inclusive of the banks of the second selectors which are represented by the selector S2—A, are connected to connector switches giving access to the remaining 600 lines in the main office; the terminals of levels 1, 2, 3 and 0 of these second selectors are vacant.

The system disclosed in Figs. 1, 2 and 3 conforms to the trunking arrangement of Fig. 4 and the operation of this system will now be described. The associated apparatus and circuit connections for selector-repeater SR, connector BC, special-

service-code selector BSCS and incoming selector IS1 are shown; but the line-finder LF and all other selectors and connectors are represented by a set of brushes and one or more sets of terminals without showing the magnets, relays and other apparatus associated with each of these switches. The line-finder LF may be similar to that disclosed in my Patent No. 1,711,682 granted May 7, 1929. The selectors AS1, SCS, S2-A and S2-B are substantially the same as the incoming selector IS1. The selector BASCS is substantially the same as the selector BSCS and the main office connector C is substantially the same as the branch-office connector BC.

The selector-repeater SR is permanently associated with the line-finder LF and comprises a non-numerical rotary trunk-hunting switch TH, a two-motion selector switch BS1 of the well known step-by-step type and associated control and switching apparatus. The switch TH includes the stepping-magnet 90, the brushes 91, 92 and 93 and the associated bank of terminals to which these brushes have access. The selector BS1 includes the brushes 66, 67, 68 and 69 which have access to a bank of ten levels of terminals, there being ten sets of terminals in each level; the terminal bank is represented by one set of terminals in each of the first, second, ninth and tenth levels. The terminals 71 of the first level are connected to a four-conductor trunk and illustrate the condition where final determination of whether the call is to be completed locally or over a trunk to the main office awaits the dialing of one or more additional digits. The terminals 72 and 70 of the second and tenth levels are each connected to three-wire trunks and illustrate the condition when seizure of an idle trunk in such a level causes immediate release of the trunk to the main office, the ground connected directly to the fourth terminals of each set of terminals in such a level being effective to cause the operation of a switching relay 25 to accomplish this result. The terminals 79 of the ninth level represent vacant levels and illustrate the condition where seizure of an idle trunk in such a level causes the return of the selector brushes to normal, the call being one which is completed through the main office; the resistance 80, through which the fourth terminal of each set of terminals in such a level is connected to ground prevents the operation of the switching relay 25. The selector BS1 has a vertical-stepping magnet 60, a rotary-stepping magnet 61, a release magnet 62, a set of vertical off-normal springs "VON", a set of "11th rotary step" springs, a commutator brush 63, and a commutator 64 comprising a normal segment and ten off-normal segments corresponding in position to the ten levels of the terminal bank. A terminal strip 65 is provided for connecting the commutator segments as required for use in any particular trunking and numbering arrangement. The control apparatus for the selector-repeater SR includes a line relay 30, a release relay 43 and the aforementioned switching relay 25. The all-trunks busy relays 97 and 98 and register 99 common to a group of selector-repeaters are provided for registering the failure of switch TH to find an idle trunk to the main office.

Upon extension of the calling line through the brushes of line-finder LF to the selector-repeater SR, the switch TH operates to select and seize an idle trunk to the main office. When the calling subscriber dials the first digit of a number, the impulses received by line relay 30 are effective to step the brushes of selector BS1 up to a

corresponding level and to repeat the impulses over the trunk to the main office. If the first digit is 0, the brushes are then advanced step-by-step in the tenth level of the bank until an idle set of terminals is encountered, whereupon the operation of the switching relay 25 is effected to cause the release of the trunk to the main office and the extension of the calling line over the trunk connected to the seized set of terminals to an operator's position. If the first digit is any other than 0, the brushes of selector BS1 are advanced to the corresponding level and immediately restored to normal. If the first digit alone indicates that the call is to be completed over the trunk to the main office, the impulses created by the dialing of the remaining digits of the called subscriber's number are repeated over the trunk to the main office without causing further advance of the shaft and brushes of selector BS1. If the first digit alone is not sufficient to indicate whether or not the call is one which is completed over the trunk to the main office, the impulses created by the dialing of the second digit are repeated over the trunk to the main office and also effect the advance of the brushes of selector BS1 to a corresponding level; the brushes of selector BS1 are then rotated to select an idle set of terminals in that level. After selector BS1 has seized an idle set of terminals and if the first two digits finally determine that the call is to be completed over the trunk to the main office as indicated by the connection of the fourth terminal of the selected set to ground through a resistance such as the resistance 80, the selector shaft and brushes are again restored to normal and succeeding trains of dial impulses are repeated to the main office without affecting further operation of selector BS1; but if the first two digits finally determine that the trunk to the main office is not required for completion of the call as indicated by the connection of the fourth terminal of the selected set in the bank of switch BS1 directly to ground, this trunk is released and the calling line is extended directly through the brushes of selector BS1 and the seized set of terminals to a succeeding switch in the branch office. If the first two digits are insufficient to determine whether the call is to be completed locally or over the trunk to the main office, such, for instance, as is the case when the first two digits are 11, the third train of impulses is repeated over the trunk to the main office and also repeated through the brushes of selector BS1 to a special-service-code selector BSCS in the branch office; if the third digit is either 0 or 9, seizure of an idle set of terminals in the selected level of the selector BSCS effects the operation of the switching relays of the selector-repeater SR to release the trunk to the main office, the special-service-code selector BSCS having direct access to toll recording trunks (code 110) and to reverting call selectors (code 119). Should a preliminary impulse have preceded the code 110 or 119, the special-service-code selector BSCS is advanced to the first level by the single impulse comprising the third train of impulses and seizure of an idle set of terminals in this level extends the call to an auxiliary special-service-code selector BASCS. The selector BASCS extends the call to a toll recording trunk or a reverting call selector upon the further dialing of 0 or 9.

Whenever all trunks to the main office are busy, a busy tone is transmitted to the calling station after the dialing of the first digit. An

all-trunk busy condition encountered by the brushes of selector BSI in any level to which the brushes have been advanced is also effective to cause a busy tone to be transmitted to the calling station.

When the subscriber at station X removes the receiver to originate a call, the line and group relays (not shown) operate thereby causing the operation of the start relay of an idle line-finder. Assuming the line-finder LF to be the one in question, the operation of its start relay (not shown) temporarily connects ground to the sleeve conductor 24 thereby causing the operation of relay 35 of the selector-repeater SR. The circuit for energizing relay 35 is traced from battery through the winding of this relay, upper back contact of relay 36, inner lower back contact of relay 33, uppermost back contact of relay 50, inner lower back contact of relay 49, conductor 26 and through the inner lower back contact of relay 25, over conductor 24 to the ground at the start relay (not shown) of line-finder LF. Relay 35 closes a circuit from battery through the winding and interrupter contacts of stepping magnet 90 of trunk-hunting switch TH, through the winding of relay 33, to ground at the inner lower front contact of relay 35. The magnet 90 is marginal and does not operate in series with the winding of relay 33 but relay 33 operates in this circuit unless the trunk to which the brushes of switch TH are connected is busy, in which case the winding of relay 33 is short-circuited by the busy ground potential on the sleeve terminal of the busy trunk. The short-circuiting connection is traced from the interrupter contacts of magnet 90 through the lowermost front contacts of relay 35, and the lowermost back contact of relay 33 to the sleeve brush 93 of switch TH. If brush 93 is in contact with the grounded sleeve terminal of a busy trunk, the magnet 90 is operated to step the brushes to the next set of terminals. As soon as an idle trunk is encountered, the lack of ground potential on the sleeve terminal permits the operation of relay 33, the magnet 90 being insufficiently energized to cause further advance of the switch TH. With relay 33 operated, the sleeve terminal of the selected trunk is connected to ground at the lowermost front contact of relay 33 as a guarding potential to prevent seizure of the same trunk by other trunk-hunting switches similar to TH. Relay 33 closes a holding circuit for relay 35 which is traced from battery through the winding of relay 35, upper back contact of relay 36, inner lower front contact of relay 33, lower back contacts of the "11th rotary step" springs and through the middle lower back contact of relay 25 to the ground potential on conductor 24.

When the brushes 21, 22 and 23 of line-finder LF have been advanced into engagement with the set of terminals to which the line 20 is connected, the line relay 30 of the selector-repeater SR operates due to the energization of its windings in a circuit which is traced from battery through its lower winding, lower back contact of relay 28, lowermost back contact of relay 25, brush 22 of line-finder LF, over line 20 and through the telephone instrument at station X, back through brush 21, uppermost back contact of relay 25, upper back contact of relay 28, upper winding of relay 30, upper back contact of the "11th rotary step" springs, lowermost back contact of relay 49, lower back contact of relay 50 and through the right winding of the dial-

tone transformer 53 to ground. The operation of relay 30 closes a circuit from battery through the winding of relay 43, inner lower back contact of relay 45, inner upper back contact of relay 44, lower front contact of relay 30, conductor 29 and through the middle upper back contact of relay 25 to ground. Relay 43 connects ground through its inner upper front contact to sleeve conductor 24 to hold the line-finder switch LF and thence through brush 23 to hold the cut-off relay (not shown) of the line 20 in the well known manner. Relay 43 also closes a circuit from battery through the upper winding of relay 40 and inner lower front contact of relay 43, over conductor 29, to ground at the middle upper back contact of relay 25; but the energization of the upper winding of relay 40 is insufficient to operate this relay until its lower winding is also energized by current in the aiding direction.

The aforementioned operation of relay 30 also closes a bridge across the line conductors of the trunk T1, which was seized by the operation of relay 33 thereby causing the operation of the line relay 201 of the associated incoming selector ISI in the main office. The circuit for operating relay 201 is traced from battery through the upper winding of relay 201, inner lower back contact of relay 204 over one conductor or trunk T1, brush 92 of switch TH in the branch office, inner upper front contact of relay 33, upper front contact of relay 30, outer upper front contact of relay 35, winding of relay 38, lower winding of relay 40, uppermost back contact of relay 31, uppermost front contact of relay 33, brush 91 of switch TH over the other conductor of trunk T1, inner upper back contact of relay 204, lower winding of relay 201 to ground at the upper back contact of the "11th rotary step" springs of switch ISI. The operation of relay 201 closes an obvious circuit for operating relay 202. No further action takes place until the calling subscriber dials the first digit of the number of the station with which a talking connection is desired.

When the calling subscriber dials the first digit of a number, relay 30 is alternately released and reoperated each time the impulse contacts of the dial are opened and closed,—that is, as many times as there are units in the digit dialed. Relay 43, being slow in releasing, remains operated during the receipt of each train of dial impulses by relay 30. The impulses are repeated by the upper contacts of relay 30 to cause the alternate release and reoperation of relay 201 of the incoming selector ISI in the main office. The release of relay 30 in response to the first impulse closes a circuit from battery through the winding of relay 31, conductor 54, lowermost front contact of relay 43, back contact of relay 30 over conductor 29 to ground at the middle upper back contact of relay 25; it also closes a circuit from battery through the winding of vertical-stepping magnet 60 in parallel with battery through the winding and inner upper back contact of relay 50, through the upper back contact of relay 49, lowermost back contact of relay 45, conductor 54, lowermost front contact of relay 43, back contact of relay 30 and over conductor 29 to the ground at relay 25. Relays 31 and 50 and magnet 60 are thereby operated. The operation of magnet 60 steps the shaft and brushes of switch BSI up to the first level of the terminal bank. The operation of relay 31 closes a short-circuit around the winding of relay 38 and lower wind-

ing of relay 40; since relay 31 is slow in releasing, this short-circuit remains closed until all of the impulses in a train have been received, the current over the trunk to the main office being

5 thereby increased to insure the reoperation of relay 201 of incoming selector ISI between impulses. Relay 59 locks through its upper front contact, inner lower back contact of relay 49, over conductor 26, through the inner lower back
10 contact of relay 25 and over conductor 24 to the holding ground potential at relay 43. At its lower continuity contacts, relay 50 substitutes a direct ground connection for the connection through the right-hand winding of dial-tone transformer
15 53. Should relay 33 not yet have been operated when dialing begins due to the failure of switch TH to find an idle trunk, relay 35 releases when relay 50 operates thereby preventing further trunk hunting on the part of switch TH. When
20 relay 30 reoperates at the end of the first dial impulse, magnet 60 releases. Each succeeding release and reoperation of relay 30 in response to the impulses generated by the dialing of the first digit, cause a corresponding operation and
25 release of magnet 60 resulting in the elevation of the brushes of selector BSI to the correspondingly numbered level of the terminal bank. The VON springs of selector BSI are actuated as soon as the shaft and brushes are moved out of their
30 normal position thereby closing a circuit from battery through the winding of relay 48, middle contacts of the VON springs, back contact of the rotary-stepping magnet 61, conductor 58, upper
35 back contact of relay 45, lower front contact of relay 31, conductor 37, inner lower front contact of relay 43 over conductor 29 to ground at the middle upper back contact of relay 25. Relay
40 48 operates and locks through its own inner front contact under control of the magnet 61 to the same ground.

If the first digit is either 2, 3, 5, 6, 7, 8 or 9, and the selector-repeater is arranged in accordance with the trunking and numbering scheme of Fig. 4, it is immediately determined upon receipt of the first train of impulses that the called
45 line is located in the main office or can be reached only by routing the call through the main office. The release of relay 31, after all of the impulses in the first train have been received, closes a circuit from battery through the winding of relay
50 49, terminal 13 of terminal strip 65 through the conductors connecting terminal 13 to terminals 9, 8, 7, 6, 5, 3 and 2 of the same terminal strip, and from any one of the latter mentioned terminals through that one of the correspondingly
55 numbered segments of commutator 64 with which commutator brush 63 is in contact, through brush 63, upper back contact of relay 42, back contact of release magnet 62, lower back contact of relay 31, conductor 37, inner lower front
60 contact of relay 43 over conductor 29 to ground at the middle upper back contact of relay 25. Upon closure of this circuit, the operation of relay 49 causes the release of relay 50 and the operation of release magnet 62. The circuit for operating
65 release magnet 62 is traced from battery, through the winding of this magnet, lower contacts of the VON springs over conductor 59, lower back contact of relay 44 to ground at the upper front
70 contact of relay 49. The operation of magnet 62 causes the shaft and brushes of the selector to be returned to normal position. Relay 49 remains operated, being locked through its inner lower front contact over conductor 26, through the inner lower back contact of relay 25 to ground

on sleeve conductor 24. The impulses created by the dialing of the remaining digits of the called subscriber's number are repeated by the upper contacts of relay 30 over the trunk T1 to the main office.

In case relay 35 has released prior to the operation of relay 49 on account of no idle trunk to the main office having been found by switch TH before the dialing of the first digit, a trunks-busy tone is transmitted to the calling station, the
10 upper conductor of line 20 being connected through the upper winding of line relay 30, through the upper back contact of the "11th rotary step" springs, the lowermost front contact of relay 49, the upper back contact of relay 35,
15 over conductor 96, through the winding of relay 97 and through the right winding of the busy-tone transformer 46 to ground. Relay 97 operates, closing a circuit for operating relay 98 and the operation of relay 98 closes a circuit for
20 operating the "trunks-busy" register 99. Upon the receiver being replaced at the calling station, the line relay 30 releases. Relay 43 then releases, thereby disconnecting the holding ground from sleeve conductor 24 to cause the release of the
25 cut-off relay (not shown) of the calling line and the holding relay (not shown) of the line-finder LF. The line-finder LF is thereupon returned to normal in the usual well known manner. Relay 49 also releases when the holding ground is dis-
30 connected from sleeve conductor 24, the selector-repeater SR being normal in readiness for use on another call.

Assuming the trunk T1 to have been seized as hereinbefore described, the line relay 201 of the
35 incoming selector ISI in the main office responds to the first train of impulses repeated by line relay 30 of selector-repeater SR in the branch office to advance the brushes 211, 212 and 213 to the corresponding level of the terminal bank,
40 the first level of which is represented by the set of terminals 221 and the second level of which is represented by the set of terminals 222. The release of relay 201 upon receipt of the first repeated impulse closes a circuit from battery
45 through the winding of the vertical-stepping magnet 206, winding of relay 203, lower front contact of relay 202 and back contact of relay 201 to ground at the uppermost back contact of relay 204. The current in this circuit operates
50 magnet 206 and relay 203. The operation of magnet 206 steps the brushes of switch ISI up to the first level of the terminal bank. When the shaft of the selector switch moves out of its normal position, the vertical off-normal springs
55 VON are actuated, thereby closing a circuit for operating relay 205 from battery through the winding of this relay, upper contacts of the VON springs, front contact of relay 203 to ground at the uppermost front contact of relay 202. Re-
60 lay 205 closes a holding circuit for itself which includes the contacts of the rotary-stepping magnet 207 and its own upper front contact to the ground at the uppermost back contact of relay 204. When relay 201 reoperates at the end of
65 the first impulse, magnet 206 releases. Each succeeding release and reoperation of relay 201 causes a corresponding operation and release of magnet 206 thereby stepping the brushes 211, 212 and 213 up to the desired level of the bank.
70 Relay 203 is slow in releasing and remains operated until all of the impulses corresponding to the first digit have been received. Relay 202 is also slow in releasing and remains operated during the receipt of impulses by relay 201. The
75

release of relay 203, after the last impulse of the first digit has been received, closes a circuit for operating the rotary-stepping magnet 207; this circuit is traced from battery through the winding of magnet 207, lower front contact of relay 205, back contact of relay 203 to ground at the upper front contact of relay 202. The operation of magnet 207 advances the brushes 211, 212 and 213 into engagement with the first set of terminals in the previously selected level. Relay 205 releases when magnet 207 operates and the release of relay 205 causes the release of magnet 207. If the first set of terminals is idle, no further operation of magnet 207 occurs; but if test brush 213 encounters a ground potential on the terminal which it engages, which potential indicates that this set of terminals is busy, relay 205 reoperates in a circuit from battery through its winding, upper contacts of the VON springs, back contact of magnet 207, conductor 210, lowermost back contact of relay 204, through test brush 213 to the grounded terminal. A parallel circuit path extends from conductor 210 through the winding of relay 204, the lower contacts of the "11th rotary step" springs to ground at the upper front contact of relay 202; but relay 204 is short-circuited and does not operate if the first set of terminals is busy. The reoperation of relay 205 recloses the circuit for operating magnet 207, the brushes 211, 212 and 213 being thereby advanced to the next set of terminals. Relay 205 and magnet 207 repeat their cycle of operations until the brushes engage an idle set of terminals at which time relay 204 operates in series with the winding of relay 205; being marginal relay 205 does not reoperate. The operation of relay 204 connects the ground at the upper front contact of relay 202, through the lowermost front contact of relay 204 and through brush 213 to the test terminal of the selected set to guard this set of terminals against seizure by any other selector. Relay 204 disconnects the incoming line conductors of trunk T1 from the windings of line relay 201 and extends these conductors through brushes 211 and 212 to the line conductors of the selected trunk. Relays 201 and 202 release, the ground for holding relay 204 operated being supplied in usual manner from the succeeding selector to which the seized set of terminals is connected.

If the first digit is any other than 1 or 0, the connection over trunk T1 is extended through a set of terminals represented by the terminals 222, to a second selector S2—A. Upon receipt of the next train of impulses repeated over trunk T1, the selector S2—A operates to select the corresponding level and to hunt for and seize an idle trunk which leads to a connector such as C. The connector C operatively responds successively to the next two trains of impulses repeated over trunk T1; these impulses correspond to the last two digits of the called number and cause the completion of the connection to the called subscriber's line. The called line is tested in the usual manner to determine whether it is idle or busy. If busy, a busy-tone is transmitted to the calling subscriber in the usual manner. If idle, a ringing circuit is closed to signal the called station; and, upon removal of the receiver thereat, the talking circuit is established between the calling and called stations, all in the usual and well known manner.

Upon the receiver of the calling station being placed upon the receiver hook to release the connection, relay 30 of the selector-repeater re-

leases causing the return of the line-finder LF and selector-repeater SR to normal as hereinbefore described. The release of relay 30 also causes the release of the line relay (not shown) of the connector C, the holding ground being thereby disconnected from the sleeve conductor of selectors S2—A and S1 in the main office to cause their return to normal in the usual manner. The connector C is also returned to normal in the usual manner upon the receiver at the called station being placed upon the receiver hook.

If the first digit, dialed by the subscriber at station X is 4, the called line may be in the branch office or in the main office. In this case, the release of relay 31 closes a circuit for operating relay 41; this circuit is traced from battery through the winding of relay 41, uppermost back contact of relay 34, terminals 15 and 4 of terminal strip 65, segment 4 and commutator brush 63, upper back contact of relay 42, back contact of release magnet 62, lower back contact of relay 31, inner lower front contact of relay 43, conductor 29, to ground at the middle upper back contact of relay 25. Relay 41 closes a circuit for operating relay 42. Relay 41 also closes a circuit for operating release magnet 62, from battery through the winding of magnet 62, lower contact of the VON springs, inner lower back contact of relay 34, inner lower front contact of relay 41, lower back contact of the "11th rotary step" springs, uppermost front contact of relay 43, to ground at the inner upper front contact of relay 43. The operation of magnet 62 opens the operating circuit for relay 41, this relay now being held operated by a locking circuit from battery through its winding and uppermost front contact, winding of relay 34, upper contact of the VON springs, conductor 55, inner lower back contact of relay 49, conductor 26, and through the inner lower back contact of relay 25 to the holding ground on sleeve conductor 24; the winding of relay 34 is also operatively energized in this circuit. The shaft and selector brushes 66 to 69 inclusive and commutator brush 63 are restored to normal due to the operation of release magnet 62. The magnet 62 and relays 41 and 34 are thereby released; relay 42 remains operated on account of the locking circuit through its winding and inner lower front contact, over conductor 55 through the inner lower back contact of relay 49 to the sleeve conductor holding ground as hereinbefore traced. When the second digit is dialed, relay 30 responds as hereinbefore described to cause the advance of brushes 66 to 69 inclusive and commutator brush 63 up to the corresponding level and to repeat the impulses over trunk T1. The second operation of the VON springs closes a circuit for operating relay 48 from battery through the winding of relay 48, middle contacts of the VON springs, back contact of the rotary-stepping magnet 61, over conductor 58, through the uppermost back contact of relay 45, lower front contact of relay 31, conductor 37, inner lower front contact of relay 43, conductor 29 to ground at the middle upper back contact of relay 25. When relay 31 releases at the end of the second train of dial impulses, the rotary-stepping magnet 61 is energized in a circuit from battery through its winding, lowermost front contact of relay 42, lowermost back contact of relay 41, uppermost front contact of relay 43, lower back contact of relay 31, conductor 37, thence as above described to ground at the back contact of relay 25. The operation of magnet 61

steps the brushes 66, 67, 68 and 69 into engagement with the first set of terminals in the level corresponding to the second digit dialed. The operation of magnet 61 causes the release of relay 48 and the release of relay 48 causes the release of magnet 61. If this first set of terminals is busy, a guarding ground potential on the test terminal is connected through brush 68, inner upper back contact of relay 25, middle lower back contact of relay 49, uppermost back contact of relay 45 to conductor 58 to reoperate relay 48. This busy ground potential is also effective to short-circuit the winding of relay 45. Relay 48 again closes the circuit for operating magnet 61 thereby advancing the brushes to the next set of terminals. Relay 48 and magnet 61 thus repeat their cycle of operations to advance the brushes one step at a time until an idle set of terminals is reached; whereupon relay 45 operates, its winding being energized in a circuit from battery through the winding of relay 48, middle contact of the VON springs, back contact of magnet 61, conductor 58, winding of relay 45, upper front contact of relay 42, inner lower back contact of relay 41, lower back contact of the "11th rotary step" springs, over conductor 27, through the uppermost front contact of relay 43, and over conductor 24, to the holding ground at the inner upper front contact of relay 43. Relay 48 is marginal and does not operate in series with the winding of relay 45. If all trunks happen to be busy, the brushes are advanced beyond the tenth set of terminals and the "11th rotary step" springs become operated, thereby causing the successive release of relays 35 and 33 and the connection of the right winding of busy-tone transformer 46 through the front contact of these springs to the upper winding of line relay 30 to transmit a busy-tone to the calling station.

Assuming that the first digit dialed is 4 and that the second digit dialed is any other than 0, 1, 2 or 3, the terminal engaged by brush 69 is permanently connected to ground through a resistance such as the resistance 80 associated with the set of terminals 79 representative of the ninth level of the terminal bank. In this case, with relay 45 operated, a circuit is closed from battery through the winding of relay 44, lower winding of relay 25, middle upper front contact of relay 45, through brush 69 and resistance 80 (or a similar resistance) to ground. Relay 44 operates but relay 25 being marginal does not operate due to resistance 80. Relay 44 closes a circuit for operating relay 49 from battery through the winding of relay 49, lower front contact of relay 44, over conductor 26 and through the inner lower back contact of relay 25 to holding ground on conductor 24. Relay 49 locks through its inner lower front contact to the same ground and causes the release of relays 42 and 50. The release of relay 42 causes the release of relay 45 and the release of relay 45 causes the release of relay 44. The release of relay 44 closes a circuit for operating release magnet 62 from battery through the winding of magnet 62, lower contacts of the VON springs, lower back contact of relay 44 to ground at the upper front contact of relay 49. The shaft and brushes of the selector switch of the selector-repeater SR are thereby restored to normal. The impulses created by the dialing of the remaining digits are repeated by relay 30 over trunk T1 to the main office to complete the connection to the called station.

If the first digit dialed is 4 and the second digit dialed is 2 or 3, the terminal engaged by brush 69

of selector BS1, upon seizure of an idle set of terminals in the corresponding level is connected directly to ground and the aforementioned operation of relay 45 is, in this case, effective to cause the operation of the marginal relay 25 as well as the operation of relay 44. Being somewhat slow in operating, relay 49 remains normal. Relay 25 closes a locking circuit from battery through its upper winding and inner upper front contact to the holding ground on conductor 24. The operation of relay 25 causes the release of relays 30 and 43, the release of relays 42, 45 and 44, and the release of relay 50. Relay 25 also extends the talking conductors of line-finder LF through brushes 66 and 67 to the succeeding branch office switch which is connected to the seized set of terminals. Assuming the seized set of terminals to be connected to the connector switch BC, line relay 101 of this switch operates, closing a circuit for operating the release relay 102; and relay 102 connects ground through its lowermost front contact over sleeve conductor 109, through brush 68 and the middle upper front contact of relay 25 to sleeve conductor 24 thereby maintaining a holding ground on this conductor after the release of relays 30 and 43. The line-relay 101 of connector BC responds to the impulses created by the dialing of the last two digits of the called number. The first release of relay 101 closes a circuit from battery through the winding of the vertical-stepping magnet 111 winding of relay 103, normally closed contacts of the vertical off-normal springs VON, upper front contact of relay 102, to ground at the back contact of relay 101. The operation of magnet 114 steps the brushes 111, 112 and 113 up to the first level of the terminal bank thereby operating the VON springs; the circuit for energizing magnet 114 and relay 103 is now traced through the front contact of relay 103 and the lower front contact of the VON springs. The reoperation of relay 101 at the end of the first impulse causes the release of magnet 114. Each succeeding release and reoperation of relay 101 in response to additional impulses in the same train causes the reoperation and release of magnet 114 to advance the brushes to the level corresponding to the digit dialed. Relay 102 is slow in releasing and remains operated during receipt of dial impulses. Relay 103 is also slow in releasing so that it remains operated until the last impulse of the train has been received. When the first impulse of the train corresponding to the last digit of the called number is received by relay 101, a circuit is closed from battery through the winding of rotary-stepping magnet 115 and lower back contact of relay 108 in parallel with battery through the winding of relay 105, then through the inner back contact of relay 107, back contact of relay 103, lower front contact of the VON springs, and through the upper front contact of relay 102 to ground at the back contact of relay 101. The rotary-stepping magnet 115 operates to advance the brushes 111, 112 and 113 into engagement with the first set of terminals in the selected level and relay 105 operates to connect the winding of test relay 107 to the sleeve or test brush 113. The upper front contact of relay 105 maintains the energization of this relay and magnet 115 independently of the inner back contact of test relay 107. The reoperation of relay 101 at the end of the first impulse of the last train causes the release of magnet 115. Each succeeding release and reoperation of relay 101 in response to impulses cre-

ated by the dialing of the final digit of the called number causes the operation and release of magnet 115 to advance the brushes 111, 112 and 113 into engagement with the corresponding set of terminals. Relay 105, being slow in releasing, remains operated between impulses and long enough after the brushes 111, 112 and 113 have engaged the terminals of the called line to insure the operation of test relay 107 if the test terminal is connected to ground due to the line being busy. If relay 107 operates, it locks through the inner back contact of relay 105 and its own lower front contact to ground at relay 102. The operation of relay 107 connects the right winding of busy-tone transformer 110 through its upper contact to the lower talking conductor of the connector thereby transmitting a busy-tone to the calling station. If the selected line is idle, relay 107 remains normal and the release of relay 105 closes a circuit from battery through the winding of the cut-off relay (not shown) of the called line which is represented by line 120 through the test terminal and brush 113, outer back contact of relay 105, upper winding of relay 108, and through the outer back contact of relay 107 to ground at relay 102. Relay 108 operates due to the energization of its upper winding in this circuit sufficiently to close its inner lower front contact and thus energize its lower winding in a circuit over conductor 117 to ground at the inner lower front contact of relay 102. Relay 108, when fully operated, connects a holding ground through its lowermost front contact to the sleeve brush 113 to hold the cut off relay of line 120 operated and closes a signaling circuit from the ringing current source 118, through the uppermost front contact of relay 108, upper winding and lower back contact of the tripping relay 106, middle lower front contact of relay 108, brush 112 over the line 120 and through the ringer at station Y, back through brush 111 and the inner upper front contact of relay 108 to ground at the upper back contact of relay 106. When the receiver is removed at station Y to answer the call, relay 106 operates, closing a locking circuit from battery through its lower winding and inner lower front contact over conductor 117 to ground at relay 102. With relay 106 operated, talking current is supplied to the called station Y in a circuit from battery through the upper winding of relay 104, through the uppermost front contact of relay 106, the inner upper front contact of relay 108, brush 111, over the called line 120 and through station Y, back through brush 112, middle lower front contact of relay 108, lowermost front contact of relay 106 and through the lower winding of relay 104 to ground. Relay 104 operates thereby connecting ground through its lowermost front contact to conductor 117 so as to hold relays 106 and 108 operated until relay 104 also releases in case the connection is released by the calling station before it is released by the called station. Relay 104 also reverses the connection between the calling line and the windings of relay 101 as a supervisory indication that the call has been answered. The talking current is transmitted through condensers 100.

When the receiver at the calling station is replaced upon the receiver hook, relay 101 releases and when the receiver at the called station is replaced upon the receiver hook relay 104 releases. The release of relay 101 causes the release of relay 102 thereby disconnecting the holding ground from conductor 109. Relay 25 of the selector-repeater SR, the holding relay (not

shown) of the line-finder LF, and the cut-off relay (not shown) of the calling line 20 are thus released and the line-finder LF is thereupon restored to normal in the usual manner. The release of relay 25 closes a circuit for operating the release magnet 62 to restore the selector BS1 to normal. The circuit for operating magnet 62 is traced from battery through the winding of magnet 62, lower front contact of the VON springs, conductor 59, lower back contacts of relays 43 and 30, to ground at the middle upper back contact of relay 25. Restoration of springs VON when the selector reaches normal, opens the circuit through the winding of release magnet 62. The release of both relays 102 and 104 of the connector BC causes the release of relays 106 and 108 and the operation of release magnet 16 whereby the connector switch is restored to normal in the usual manner.

If the first digit dialed by the calling subscriber is 0, to obtain connection with an operator, the brushes of selector BS1 are advanced up to the tenth level. Upon release of relay 31 a circuit is closed from battery through the winding of relay 42, inner upper back contact of relay 34, segment 10 of commutator 64 and brush 63, upper back contact of relay 42, back contact of release magnet 62, lower back contact of relay 31, conductor 37, inner lower front contact of relay 43, over conductor 29 to ground at relay 25. Relay 42 operates in this circuit and closes a locking circuit as hereinbefore described. Relay 48 having been operated by the actuation of the VON springs, the operation of relay 42 closes the circuit for energizing the rotary-stepping magnet 61 as hereinbefore described. The brushes 66, 67, 68 and 69 are advanced into engagement with the first set of terminals in the "O" level of selector BS1. If the first set of terminals is busy, relay 48 and magnet 61 effect the further advance of the brushes until an idle set of terminals is reached and relay 45 is operated as hereinbefore described. The terminal with which brush 69 is in contact being connected directly to ground, relays 25 and 44 both operate and the connection is extended over the trunk which is connected to the seized set of terminals to the "O" operator's position. This trunk circuit (not shown) is arranged so that the release of the connection is controlled jointly by the operator and 50 the calling subscriber. (If no trunk were provided directly from the branch office to the "O" operator's position, the terminal with which brush 69 is in contact would be connected to ground through a resistance so as to cause the operation of relay 44 without causing the operation of relay 25; in this case relay 49 is operated and the call is completed over the main-office trunk, through the "O" level of the incoming selector ISI, over a trunk to an operator's position, the 60 brushes of selector BS1 being restored to normal as hereinbefore described.)

If the calling subscriber dials a special service three digit code, the first two digits of which are 11, the brushes of incoming selector ISI in 65 the main office and the brushes of selector BS1 of the selector-repeater SR are advanced to the first level. The selector ISI thereupon selects an idle trunk leading to an auxiliary first selector ASI; but the brushes of selector BS1 are immediately restored to normal, the circuit for operating release magnet 62 being from battery through its winding, lowermost contacts of the VON springs, lowermost back contacts of relays 47 and 34, segment 1 and commutator brush 75

63, upper back contact of relay 42, back contact of magnet 62, lower back contact of relay 31, inner lower front contact of relay 43, to ground at the middle upper back contact of relay 25. This circuit is opened by the operation of magnet 62 but the winding of magnet 62 is held operated until the shaft of selector BS1 reaches its normal position by a circuit from the winding of magnet 62, through the lower contacts of the VON springs and front contact of magnet 62, through the lower back contact of relay 31, conductor 37, inner lower front contact of relay 43, conductor 29, to ground at the middle upper back contact of relay 25. When the shaft and brushes of switch BS1 reach normal, this circuit is opened at the VON springs but magnet 62 is now held operated in a circuit which includes the inner lower front contact of relay 50, lower winding and inner back contact of relay 47, front contact of magnet 62, lower back contact of relay 31, thence to the ground at relay 25. Relay 47 operates sufficiently to close a circuit through its upper winding and front contact, over conductor 55, through the inner lower back contact of relay 49, over conductor 26, to the holding ground on conductor 24. The current through the upper winding of relay 47 completes the operation of this relay, thereby causing the release of magnet 62. The dialing of the second digit of the number 110 or 119 once again advances the brushes of selector BS1 to the first level; the repeating of the impulse created by the dialing of the second digit 1 over trunk T1 to the main office causes the operation of the auxiliary first selector AS1 in the main office to select an idle trunk in the first level leading to a special-service-code selector SCS. Relay 42 of selector-repeater SR is operated, as soon as relay 31 releases, by the current in a circuit which includes the lower front contact of relay 47, lowermost back contact of relay 34, segment 1 and commutator brush 63, thence to ground at relay 25 as above traced. The inner lower front contact of relay 42 closes before this operating circuit is opened at the upper back contact of relay 42 so that relay 42 locks through its inner lower front contact and the inner lower back contact of relay 49, over conductor 26 to the holding ground on conductor 24. Relay 43 having been operated, as hereinbefore described, the operation of relay 42 starts the rotary trunk-hunting operation of selector BS1. Upon seizure of an idle trunk in the first level, relay 45 is operated thereby connecting the windings of relays 44 and 25 in series to brush 69 as hereinbefore described. Relays 44 and 25 do not operate since the selected set of terminals are connected to a special-service-code selector such as BSCS. Relay 45 closes a circuit from ground at the middle upper back contact of relay 25, conductor 29, lower front contact of relay 30, inner upper back contact of relay 44, inner lower front contact of relay 45, resistance 39, brush 67 of selector BS1, middle upper back contact of relay 154 of selector BSCS, and through the upper winding of line relay 151 to battery. Relay 151 operates, closing a circuit for operating the release relay 152. Relay 152 connects ground through its outer upper front contact, over sleeve conductor 159, through brush 68, inner upper back contact of relay 25, middle lower back contact of relay 49, uppermost front contact of relay 45, to the sleeve conductor 24 of the selector-repeater; relay 152 also connects ground through its inner upper front contact,

the upper normally closed contact of the "11th rotary step" springs, uppermost back contact of relay 154, brush 66 of selector BS1, inner upper front contact of relay 45, uppermost back contact of relay 44, through the winding of release relay 43 of selector-repeater SR to battery; relay 43 is thus held operated under control of the succeeding selector in the branch office. The response of relay 30 to the impulses created by the dialing of the third digit of the special three digit code is effective to repeat these impulses through its lower front contact to the line relay 151 of the special-service-code selector BSCS in the branch office and through its upper front contact to the line relay of the special-service-code selector SCS in the main office. The release of line relay 151 of selector BSCS closes a circuit from battery through the winding of vertical-stepping magnet 160, winding of relay 153, lower front contact of relay 152, back contact of relay 151, to ground at the inner upper back contact of relay 154. Magnet 160 operates, advancing the shaft and brushes to the first level of terminals. The VON springs are actuated when the shaft moves out of its normal position and with relay 153 operated, a circuit is closed from battery through the winding of relay 155, upper contact of the VON springs, front contact of relay 153, over conductor 159, to ground at the upper front contact of relay 152. Relay 155 locks independently of the continued operation of relay 153 through the back contact of the rotary-stepping magnet 161 and the upper front contact of relay 155. The reoperation of relay 151 at the end of the first impulse causes the release of magnet 160. Each succeeding release and reoperation of relay 151 in response to the third digit dialed by the calling subscriber causes a corresponding operation and release of magnet 160 to advance the brushes up to the desired level of the terminal bank. Being slow in releasing, relay 152 remains operated during the receipt of dial impulses by relay 151. Relay 153 is also slow in releasing and remains operated until the last of the train of impulses has been received by relay 151. When relay 153 releases, a circuit is closed from battery through the winding of rotary-stepping magnet 161, lower front contact of relay 155, back contact of relay 153 over conductor 159 to ground at relay 152. The operation of magnet 161 steps the brushes 166, 167, 168 and 169 into engagement with the first set of terminals in the selected level. The operation of magnet 161 causes the release of relay 155 and the release of relay 155 causes the release of magnet 161. If the trunk connected to the first set of terminals is busy, a ground potential is encountered by brush 168 thereby causing the reoperation of relay 155 and magnet 161. The circuit for reoperating relay 155 is traced from battery through its winding, upper contact of the VON springs, back contact of magnet 161, lower back contact of relay 154, through brush 168 to the busy ground potential. As long as brush 168 encounters a busy ground potential, relay 155 and magnet 161 repeat their cycle of operations. When an idle trunk is found, relay 154 operates due to the energization of its winding in a circuit from battery through the winding of relay 155, upper contact of the VON springs, back contact of magnet 161, winding of relay 154, lower back contact of the "11th rotary step" springs to ground at relay 152. If the third digit dialed is any other than 1, 9 or 0, the terminal with which brush 169 is in engage-

ment, is connected to ground through a resistance such as 180 associated with the set of terminals 172 which represents the second level of the terminal bank and this connection is extended from brush 169 through the inner lower front contact of relay 154, over conductor 158 through brush 69 of selector BS1, thence through the windings of relays 25 and 44 as hereinbefore described. Relay 44 operates and closes a circuit for operating relay 49, the selector switch BS1 being thereby restored to normal as hereinbefore described. The special-service-code selector SCS in the main office having been advanced to that one of the levels 2 to 8, inclusive, which corresponds to the third digit dialed, the call is completed over an idle trunk in this level to a special service operator or to an intercepting operator if the code dialed is not in use. If, however, the third digit dialed is 9, the terminal with which brush 169 is in engagement is connected directly to ground thereby causing the operation of both of relays 25 and 44 of selector-repeater SR; the main office trunk is thereupon released and the calling line is connected through brushes 66 and 67 of selector BS1, thence through the upper front contacts of relay 154 and through brushes 166 and 167 of the special-service-code selector BSCS to a trunk which terminates in a reverting call selector (code 119). If the third digit dialed is 0 (code 110), the brushes of selector BSCS are raised to the tenth level thereby immediately connecting ground to the control conductor 158 by the actuation of the level springs 157. Relays 25 and 44 of selector-repeater SR are thus operated to cause release of the trunk to the main office before the main-office service-code selector SCS has selected an idle trunk in its tenth level.

Should a preliminary impulse have accidentally preceded the dialing of the service codes 110 or 119, the brushes of switch BSCS are also advanced to the first level and an idle trunk selected in this level to extend the call to an auxiliary special-service-code selector represented by BASCS which is in all respects similar to the switch BSCS except that the terminals of the first level connect to trunks to an intercepting operator. All other levels of the bank of switch BASCS are multiplied to the corresponding levels of the switch BSCS.

If the trunking arrangement of Fig. 4 is modified by omitting special-service-code selectors in the branch office so that reverting calls (code 119) and toll recording calls (code 110) are completed through the main office, numbers from 4100 to 4199, inclusive, are assigned to the main office. In this case the terminals of level 1 representative of the first level of the bank of switch BS1 are connected as shown for the terminals of level 9; and the lower front contact of relay 47 is connected to the winding of relay 49 instead of to the winding of relay 42, so that the selector BS1 is released in response to the dialing of each of the first two digits (11) of the special-service code. The operation of relay 47 prevents the further operation of selector BS1 and the call is completed over a trunk to the main office.

In case a selector-repeater becomes connected to a line which is permanently short-circuited or to a line the ring conductor of which becomes permanently grounded, a permanent signal alarm circuit (not shown) is closed by the incoming first selector in the main office in well known manner. To transfer the permanent sig-

nal indication from the main office to the branch office and free the trunk to the main office, the maintenance attendant in the main office opens the connections between the conductors of the trunk and the line relay of the incoming selector and connects battery through not more than 200 ohms resistance to the tip conductor of the trunk thereby operating relay 36. Relay 36 locks through its lower winding and front contact to the holding ground on conductor 24 and causes the release of relays 33 and 35. Relay 36 also connects ground to the conductor connecting to the alarm apparatus 52 thereby causing a permanent signal condition to be indicated in the branch office. Relay 36 is slow in operating so that it does not operate when relay 31 releases after the dialing of each digit and before relay 38 has had time to reoperate or when relay 38 releases momentarily due to the usual reversal of current over the trunk when the called subscriber answers. If the trunk selected by switch TH is open, a permanent signal condition on the calling line is ineffective to cause the operation of the permanent signal indicator in the main office.

Referring to Fig. 5, the trunking arrangement provides for a total of eight thousand five-digit subscribers' numbers in a main office and a branch office, all of these numbers having the digit 4 as the first digit. Numbers from 42000 to 43999, inclusive, are assigned to the branch office and numbers from 44000 to 49999, inclusive, are assigned to the main office. The branch office is equipped with special-service-code selectors for completing toll recording and reverting calls. The commutator connections and the terminal bank arrangement for the selector BS1 of the selector-repeater SR are the same for the trunking arrangement of Fig. 5 as for the trunking system of Fig. 4. As in the system represented in Fig. 4, the selector-repeater SR is arranged to absorb one digit and the dialing of a maximum of two digits is required to determine whether a called number is located in the main or in the branch office. Since the line numbers are five-digit numbers, third selectors are provided in both the main and branch offices. In the branch office, the selector switch BS1 of the selector-repeater SR has access through the terminals in the second and third levels of its bank to third selectors which are represented by BS3. The branch-office third selectors have access through all levels of their banks to connectors which are represented by BC. In the main office the incoming selectors, represented by IS1, have access through the terminals of the first level to auxiliary first selectors through the terminals of the fourth level to second selectors which are represented by S2, and through the terminals of all other levels except the tenth level to incoming selectors in other offices of the system. The second selectors have access through the terminals of levels 4, 5, 6, 7, 8 and 9 to third selectors, such as S3; and the third selectors S3 have access to connectors which are represented by C. The operation of a system arranged as shown in Fig. 5 is similar to the operation of the system disclosed in Figs. 1, 2, 3 and 4 except that on branch office calls a third selector is included in the connection. The operation of the branch-office third selector BS3 is similar to that of the main-office selector IS1.

Referring to Fig. 6, the trunking arrangement provides for a total of eight thousand five-digit subscribers' numbers in a main and a branch of-

fice, all of these numbers having the digit 4 as
 the first digit. Numbers from 42000 to 42099, in-
 clusive, and from 42600 to 42999, inclusive, are
 assigned to the branch office and numbers from
 42100 or 42599, inclusive, and from 43000 to
 49999, inclusive, are assigned to the main office.
 Numbers having any one of digits 2, 3, 5, 6, 7, 8 or
 9 as the first digit are assigned to subscribers in
 other offices of the system, calls to such offices
 being routed through the main office shown.
 Special-service-code selectors are provided in the
 branch office for completing toll recording and
 reverting calls. The cross connections for the
 commutator segments of selector-repeater SR
 are the same for the trunking arrangement of
 Fig. 6 as for the trunking arrangement of Fig. 4,
 as shown in Fig. 1. The terminals of levels 1, 2
 and 0 of selector switch BS1 are connected the
 same for the trunking arrangement of Fig. 6 as
 are the terminals of these levels for the trunking
 arrangement of Fig. 4 as shown in Fig. 1; and
 the terminals of levels 3 to 9, inclusive, are con-
 nected the same as shown for the terminals of
 level 9 in Fig. 1. The branch-office third selector
 BS3 of Fig. 6 is similar to the special-service-code
 selector BSCS shown in Fig. 2 except that the
 fourth or control terminal of the sets of terminals
 in levels 1, 2, 3, 4 and 5 are connected to ground
 through a resistance such as resistance 80 in Fig.
 1; and the control terminal of the sets of ter-
 minals in levels 6, 7, 8, 9 and 0 are connected
 directly to ground. The selector-repeater SR is
 arranged to absorb one digit and the dialing of a
 maximum of three digits is required to determine
 whether a called number is located in the branch
 office or is to be completed over a trunk to the
 main office. If the first digit of the number
 dialed is any other than 0, 1 or 4, it is immedi-
 ately determined that the call is for a subscriber in
 some office other than the branch and main of-
 fices and is to be completed over a trunk to the
 main office; the switch BS1 is, therefore, im-
 mediately restored to normal and rendered non-
 responsive to further dialing, the dial impulses
 of the succeeding digits of the called number be-
 ing repeated over the trunk to the main office.
 If a special-service-code 11X (X being any digit
 from 0 to 9) is dialed, the call is completed as
 hereinbefore described for similar calls in the
 system represented in Fig. 4. If the digit 0 is
 dialed, the call is completed over a trunk from
 the tenth or 0 level of the bank of switch BS1,
 the trunk to the main office being immediately
 released. If the first digit of the number dialed
 is 4, the selector BS1 is restored to normal and
 the incoming selector IS1 extends the connection
 through a set of terminals in the fourth level to
 an idle second selector S2. If the next digit
 dialed is any other than 2 the selector BS1 is re-
 stored to normal a second time and rendered
 non-responsive to further dialing, the call being
 for a station located in the main office; but if
 the next (second) digit dialed is 2, the selectors
 BS1 and S2 are each advanced to hunt for an idle
 trunk in the second level of their banks; the trunk
 selected by BS1 leads to a branch-office third
 selector BS3 and the trunk selected by the main-
 office selector S2 leads to a main office third
 selector S3-A. The impulses corresponding to
 the next (third) digit of the number dialed, are
 repeated over the trunk to the main office to
 selectively operate the third selector S3-A and
 are also repeated over the trunk selected by
 switch BS1 to operate the branch-office third
 selector BS3. The brushes of each of selectors

BS3 and S3-A are thereby stepped up to the
 level corresponding to the third digit and then
 automatically advanced from one set of ter-
 minals to another in that level until an idle
 trunk is encountered. If this third digit is 1, 2,
 3, 4, or 5, the potential encountered by the fourth
 or control brush of the selector BS3 is such as to
 cause the release of switches BS1 and BS3, and
 the connection is extended through the brushes
 of selector S3-A and an idle trunk in the select-
 ed one of levels 1, 2, 3, 4 or 5 to a connector switch
 C. The switch C then responds to the dialing of
 the last two digits of the number of the called
 station to complete the desired connection. If
 the brushes of selector BS3 are advanced to one
 of levels 6, 7, 8, 9 or 0, the potential encountered
 by the fourth or control brush of this selector is
 such as to cause the release of the trunk to the
 main office, the connection being extended
 through the brushes of selector BS3 and the
 selected trunk to a connector switch BC. The
 connector BC responds to the dialing of the last
 two digits of the called subscriber's number to
 complete the desired connection.

Referring to Fig. 7, the trunking arrangement
 provides for a total of 9800 five-digit subscribers'
 numbers in a main and a branch office, all of
 these numbers having the digit 8 as the first
 digit. The numbers from 82200 to 82599, inclu-
 sive, are assigned to the branch office: the num-
 bers from 80000 to 81999, inclusive, and from
 82600 to 89999, inclusive, are assigned to the
 main office. Special-service-code selectors are
 provided in the branch office for completing toll
 recording and reverting calls. The selector-
 repeater SR is arranged to absorb two digits and
 the dialing of a maximum of three digits is re-
 quired to determine whether a called number is
 located in the branch office or is to be completed
 over a trunk to the main office. The segments of
 the commutator of switch BS1 of selector-re-
 peater SR are connected as shown in Fig. 10.
 The terminals of levels 1 and 0 of selector BS1
 are connected the same for the trunking arrange-
 ment of Fig. 7 as for the trunking arrangement
 of Fig. 4 as shown in Fig. 1; the terminals of
 levels 2, 3, 4 and 5 of selector BS1 are connected
 the same as shown for level 2 in Fig. 1; and the
 terminals of levels 6, 7, 8 and 9 are connected
 the same as shown for level 9 of Fig. 1. If the
 first digit dialed is any other than 0, 1 or 8,
 it is immediately determined that the call is for
 a subscriber in some office other than the branch
 and main offices and is to be completed over a
 trunk to the main office; the switch BS1 is there-
 upon restored to normal and rendered non-re-
 sponsive to further dialing, the dial impulses of
 the succeeding digits of the called number being
 repeated over the trunk to the main office. If the
 first digit is 0 the call is completed over a trunk
 from the tenth or 0 level of the bank of switch
 BS1, the trunk to the main office being immedi-
 ately released. If one of the three-digit special-
 service codes having 11 for the first two digits is
 dialed, the selector-repeater SR operates as here-
 inbefore described for a similar call in the system
 shown in Figs. 1, 2, 3 and 4. If the first digit
 dialed is 8, selectors BS1 and IS1 are advanced
 to the eighth level and relays 41 and 34 of the
 selector-repeater SR are operated, as hereinbe-
 fore described when the first digit is 4 on a call
 in the system according to Fig. 4; but in this
 case, relay 41 does not cause the immediate op-
 eration of relay 42. When the second digit is
 dialed (8 having been the first digit) selectors

BS1 and S2 advance their brushes to the corresponding level. If the second digit is any other than 2, relay 49 is operated to cause the release of switch BS1 and render this switch non-responsive to the dialing of the succeeding digits of the called subscriber's number; the connection is completed over the trunk to the main office through selectors IS1, S2 and S3—B. But if the second digit dialed is 2 relay 42 is operated to cause the operation of the release magnet 62 and thereby again restore switch BS1 to normal; and selector S2 in the main office is operated to select an idle third selector S3—A. Relays 41 and 34 release when switch BS1 reaches normal; and when the third digit is dialed, the brushes of each of switches BS1 and S3—A are advanced to the corresponding level and both of these selectors hunt for and select an idle set of terminals in that level. If the third digit is 2, 3, 4 or 5, the fourth or control brush 69 of selector BS1 is in engagement with a terminal connected directly to ground, thereby causing the operation of relays 25 and 44, the release of the trunk to the main office, and the completion of the desired connection to the called line in the branch office. But if the third digit is 6, 7, 8 or 9, the brush 69 is in engagement with a terminal connected to ground potential through a resistance similar to resistance 80 in Fig. 1. Relay 44 operates but relay 25 remains normal; the switch BS1 is again released and the connection is completed through switches IS1, S2, S3—A and a connector C1 in the main office.

Referring to Fig. 8, the trunking arrangement provides for a total of 8000 six-digit subscribers' numbers in a main and a branch office, all of these numbers having the digits 82 as the first two digits. Numbers from 824000 to 824999, inclusive, are assigned to the branch office. Numbers from 822000 to 823999, inclusive, and from 825000 to 829999, inclusive, are assigned to the main office. Numbers having 80, 81, 83, 84, 85, 86, 87, 88 and 89 as the first two digits, as well as numbers having 2, 3, 4, 5, 6, 7 and 9 as the first digit are assigned to other offices. Special-service-code selectors are provided in the branch office for use in completing toll recording and reverting calls. The operation of the branch-office fourth selector BS4 is similar to that of the incoming selector IS1 in the main office. The selector-repeater SR is arranged to absorb two digits and the dialing of a maximum of three digits is required to determine whether a called line is located in the branch office or is to be completed over a trunk to the main office. The segments of the commutator of switch BS1 of selector-repeater SR are connected as shown in Fig. 10. The terminals of levels 1 and 0 of selector BS1 are connected the same for the trunking arrangement of Fig. 8 as for the trunking arrangement of Fig. 4 as shown in Fig. 1; the terminals of level 4 are connected the same as the terminals of level 2 of Fig. 1; and the terminals of levels 2, 3, 5, 6, 7, 8 and 9 are connected the same as the terminals of level 9 of Fig. 1. If the first digit dialed is 2, 3, 4, 5, 6, 7 or 9, relay 49 of selector-repeater SR is operated as hereinbefore described and the call is completed over a trunk to the main office. If the first digit is 0 or if a three-digit special-service-code (having 11 as the first two digits) is dialed, the call is completed as hereinbefore described for a similar call in the system shown in Figs. 1, 2, 3 and 4. If 8 is the first digit dialed, selectors BS1 and IS1 are each advanced to the eighth level. Re-

lays 41 and 34 of the selector-repeater SR are operated and switch BS1 is restored to normal. The selector IS1 selects an idle trunk in the eighth level leading to a second selector S2—A. If the next (second) digit dialed is 0, 1, 3, 4, 5, 6, 7, 8 or 9 (8 having been the first digit), relay 49 of selector-repeater SR is operated and the call is completed over the trunk to the main office through selectors IS1 and S2—A and a trunk to a distant office. If the second digit is 2 (8 having been the first digit) the switch S2—A selects an idle trunk is the second level leading to a third selector S3, relay 42 of selector-repeater SR is operated, and the switch BS1 is again restored to normal. When the third digit is dialed (82 having been the first two digits) selector BS1 is again directly advanced to a corresponding level and relay 42 having been operated, an idle trunk is selected in that level leading to a fourth selector BS4 in the branch office. The third selector S3 is also directly advanced to the level corresponding to the third digit and an idle trunk selected in that level. If the level selected by switches BS1 and S3 is any one of levels 2, 3, 5, 6, 7, 8 or 9, the brush 69 of selector BS1 is in engagement with a terminal which is connected to ground potential through a resistance such as resistance 80 shown in Fig. 1; in which case, relay 44 of the selector-repeater SR operates and relay 25 remains normal. Switch BS1 is thereby returned to normal and the call is completed over the trunk to the main office through selectors IS1, S2—A, S3 and S4 and a connector C. If the level selected by switches BS1 and S3 is the fourth level, brush 69 is in engagement with a terminal connected directly to ground, in which case relays 25 and 44 are both operated, the trunk to the main office is released, and the call is completed through the selector BS4 and a connector BC.

Referring to Fig. 9, the trunking arrangement provides for a total of 8000 six-digit subscribers' numbers in a main and a branch office, all of these numbers having the digit 82 as the first two digits. Numbers from 823000 to 823099, inclusive, and from 823600 to 823999, inclusive, are assigned to the branch office. Numbers from 822000 to 822999, inclusive, from 823100 to 823599, inclusive, and from 824000 to 829999, inclusive, are assigned to the main office. Numbers having 2, 3, 50 4, 5, 6 or 7 as the first digit and numbers having 80, 81, 83, 84, 85, 86, 87, 88 or 89 as the first two digits are assigned to other offices and calls to such numbers are completed through the main office. Numbers having 9 as the first digit are assigned to another office, direct trunks to this other office being connected to the terminals of the ninth lever of selector BS1. Special-service-code selectors are provided in the branch office for completing toll recording and reverting calls. The branch office fourth selector BS4 is similar to the branch office special-service-code selector BSCS shown in Fig. 2; the fourth or control terminal of each set of terminals in levels 1, 2, 3, 4 and 5 is connected to ground potential through a resistance such as resistance 80 in Fig. 1 and the control terminals in each of levels 6, 7, 8, 9 and 0 are connected directly to ground. The segments of the commutator of selector BS1 are connected as shown in Fig. 11. The terminals of 70 levels 1 and 0 of selector BS1 are connected the same as the terminals in these levels as shown in Fig. 1; the terminals of level 3 are connected as shown for level 2 in Fig. 1; the terminals of levels 2, 4, 5, 6, 7 and 8 are connected as shown 75

for level 9 in Fig. 1; and the terminals of level 9 are connected as shown for level 10 in Fig. 1. If the first digit dialed is 2, 3, 4, 5, 6 or 7, relay 49 of selector-repeater SR is operated as hereinbefore described and the call is completed over a trunk to the main office. If the first digit is 0 or if a three-digit special-service-code (having 11 as the first two digits) is dialed, the call is completed as hereinbefore described for similar calls in a system arranged according to Figs. 1, 2, 3 and 4. If 9 is the first digit dialed, relay 42 is operated through commutator brush 63 and segment 9 to cause the selector BS1 to trunk hunt immediately. Upon selection of an idle trunk in the ninth level, control brush 69 is in engagement with a terminal connected directly to ground potential so that relays 25 and 44 both operate. The trunk to the main office is thereby released and succeeding digits are transmitted directly from the dial at the calling station through brushes 66 and 67 of selector BS1 over the selected trunk in level 9 to control the operation of selector and connector switches in the distant office in which the trunks from level 9 terminate. If the first two digits dialed are 82, the selector BS1 is twice restored to normal as hereinbefore described and upon dialing of the third digit, selector BS1 in the branch office and selector S3 in the main office are each advanced to the corresponding level and select an idle trunk in that level. The dialing of the fourth digit causes the advance of the selector BS4 in the branch office and the advance of the selector S4—A in the main office to select an idle trunk in the level corresponding to the fourth digit dialed. If this fourth digit is 1, 2, 3, 4 or 5, the terminals with which the control brush and selector BS4 is in engagement is connected to ground potential through a resistance similar to resistance 80 in Fig. 1 so that relay 44 of the selector-repeater SR is operated but relay 25 remains normal in which case the selector BS1 is restored to normal and the call is completed through the selector switches IS1, S2, S3 and S4—A and a connector C in the main office. If this fourth digit is 6, 7, 8, 9 or 0, the terminal with which the control brush of selector BS4 is in engagement is connected directly to ground; in which case, both of relays 25 and 44 of selector-repeater SR are operated, the trunk to the main office is released and the call is completed through a branch office connector BC.

What is claimed is:

1. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector switch in said branch office comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, means responsive to the seizure of said selector for automatically selecting an idle one of said trunks, means responsive to a train of dial impulses incoming over said line for advancing the brushes of said selector and for immediately restoring said brushes to normal, means responsive to the next train of impulses for advancing the brushes of said selector to a desired group of terminals and for automatically selecting an idle set of terminals in said group, and means effective upon the seizure of said idle set of terminals for releasing said trunk.

2. In a telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector switch in said branch office comprising a set of brushes and a bank of terminals, means for extending a calling line

to said selector, means responsive to the seizure of said selector for automatically selecting an idle one of said trunks, means responsive to a train of dial impulses incoming over said line for advancing the brushes of said selector and for immediately restoring said brushes to normal, means responsive to the next train of impulses for advancing the brushes of said selector to a desired group of terminals, means for automatically selecting an idle set of terminals in said group, and means effective upon the seizure of an idle set of terminals for again restoring the brushes of said selector to normal.

3. In a telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector switch in said branch office comprising a set of brushes and a bank of terminals, succeeding selectors connected to terminals in said bank, means for extending a calling line to said switch, auxiliary means effective upon said extension for automatically selecting an idle one of said trunks, means for receiving trains of impulses incoming over said line, means for repeating the received impulses over said trunk, means responsive to one of said trains of impulses for advancing said brushes to a desired group of terminals, means for thereupon automatically selecting an idle set of terminals in said group, and means for repeating the next succeeding train of impulses to operate the succeeding selector which is connected to the selected set of terminals simultaneously with the repeating of said succeeding train of impulses over said trunk.

4. In a telephone system, subscribers' lines, a main office, a branch office, trunks between said offices, a selector switch for completing calls local to the branch office, said selector comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, auxiliary means responsive to said extension for selecting an idle one of said trunks, means associated with said selector for receiving impulses incoming over said line, means in said selector switch for absorbing a series of said impulses and for selecting a group of terminals in response to the next succeeding series of impulses, means for automatically advancing said brushes to an idle set of terminals in said selected group, and means thereupon effective either to release said trunk or to restore said brushes to normal dependent upon the character of said group of terminals.

5. In a dial telephone system, subscribers' lines, a main office, a branch office, a selector-repeater in said branch office for use in completing calls originating in said branch office, trunks for use in extending connections from calling lines in said branch office to said main office, means associated with said selector-repeater for selecting an idle one of said trunks to the main office, a group selector switch associated with said selector-repeater for use in extending connections from calling lines in said branch office to called lines in said branch office, means responsive to one of the trains of dial impulses incoming over a calling line to said selector-repeater for operating said group selector switch and for immediately restoring said group selector switch to normal, means responsive to the next train of dial impulses incoming to said selector-repeater for operating said group selector switch to select a corresponding group of terminals in its bank and select an idle set of terminals in the selected group, distinguishing means individual to each of the sets of terminals in said selected group, and means controlled by said distinguishing means of the selected set of ter-

minals for causing the release of the trunk to the main office.

6. In a dial telephone system, subscribers' lines, a main office, a branch office, a selector-repeater in said branch office for use in completing calls originating in said branch office, trunks for use in extending connections from calling lines in said branch office to said main office, means associated with said selector-repeater for selecting an idle one of said trunks to the main office, a group selector switch associated with said selector-repeater for use in extending connections from calling lines in said branch office to called lines in said branch office, means responsive to one of the trains of dial impulses incoming over a calling line to said selector-repeater for operating said group selector switch and for immediately restoring said group selector switch to normal, means responsive to the next train of dial impulses incoming to said selector-repeater for operating said group selector switch to select a corresponding group of terminals in its bank and select an idle set of terminals in the selected group, distinguishing means individual to each of the sets of terminals in said selected group, and means controlled by said distinguishing means of the selected set of terminals for causing the return of said group selector to normal.

7. In a dial telephone system, subscribers' lines, a main office, a branch office, a selector-repeater in said branch office for use in completing calls originating in said branch office, trunks for use in extending connections from calling lines in said branch office to said main office, means associated with said selector-repeater for selecting an idle one of said trunks to the main office, a group selector switch associated with said selector-repeater for use in extending connections from calling lines in said branch office to called lines in said branch office, means responsive to one of the trains of dial impulses incoming to said selector-repeater over a calling line for operating said group selector switch and for restoring said group selector to normal to absorb said train of impulses, means responsive to the next train of dial impulses incoming to said selector-repeater for operating said group selector switch to select a corresponding group of terminals in its bank and select an idle set of terminals in the selected group, distinguishing means individual to each of the sets of terminals in one group in the bank of said group selector, different distinguishing means individual to each of the sets of terminals of another group in the bank of said group selector, means controlled by the distinguishing means of a selected set of terminals in said first group for causing the return of said group selector to normal, and means controlled by the distinguishing means of a selected set of terminals in said other group for causing the release of the trunk to the main office.

8. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector-repeater in said branch office comprising a trunking switch having access to said trunks and a group selector switch, other group selectors in said branch office accessible through terminals in the bank of said selector switch, means for connecting a calling line in said branch office to said selector-repeater, means responsive to the extension of a calling line to said selector-repeater for operating said trunk hunting switch to select an idle trunk to the main office, means responsive to dial impulses incoming to said selector-repeater for operating said selector switch to select a corre-

sponding group in its terminal bank, means for extending a connection through a set of terminals in the selected group to an idle one of said other selectors, means in said selector-repeater for repeating incoming dial impulses to said selected other selector, means in said selected other selector for selecting in response to a series of said repeated impulses a group of terminals corresponding to the number of impulses received and for selecting an idle set of terminals in the selected group, and means effective upon seizure of said idle set of terminals for causing the release of said trunk to the main office.

9. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector-repeater in said branch office comprising a trunking switch having access to said trunks and a group selector switch, other group selectors in said branch office accessible through terminals in the bank of said group selector switch, means for connecting a calling line in said branch office to said selector-repeater, means responsive to the extension of a calling line to said selector-repeater for operating said trunk hunting switch to select an idle trunk to the main office, means for repeating dial impulses incoming over a calling line to said selector-repeater over the selected trunk to the main office, means responsive to dial impulses incoming to said selector-repeater for operating said group selector switch to select a corresponding group in its terminal bank, means for extending a connection through a set of terminals in the selected group to an idle one of said other group selectors, means in said selector-repeater for repeating incoming dial impulses to said selected other selector simultaneously with the repeating of these impulses over the trunk to the main office, means in said selected other selector for selecting a group of terminals corresponding to the number of impulses received and for selecting an idle set of terminals in the selected group, means individual to each set of terminals of one group by which the terminals of that group are distinguishable from the terminals of another group, and means controlled by said distinguishing means of the selected set for causing the release of the trunk to the main office.

10. In a dial telephone system, subscribers' lines, a main office, a branch office, a selector-repeater in said branch office comprising a trunk-hunting switch and a selector switch, trunks accessible to said trunk-hunting switch extending from said branch office to said main office, groups of trunks accessible to said selector switch, means for connecting a calling line in said branch office to said selector-repeater, means responsive to the extension of a calling line to said selector-repeater for operating said trunk-hunting switch to select an idle trunk to the main office, means responsive to dial impulses incoming to said selector-repeater for operating said selector switch to select a corresponding one of said groups of trunks, means for operating said selector switch to select an idle trunk in a selected group, means rendered operative upon the selection of one group of trunks by said selector switch in response to a train of impulses for causing the return of said switch to normal position without hunting for an idle trunk in said one group and for rendering said switch non-responsive to the next succeeding train of

impulses, means rendered operative upon the selection of another group of trunks by said selector switch in response to a train of impulses for causing the return of said selector switch to normal position without hunting for an idle trunk in said other group and without rendering said switch non-responsive to the next succeeding train of impulses, and means dependent upon the character of the group selected in response to said next train of impulses and effective upon seizure of an idle set of terminals in a selected group for causing the release of the trunk to the main office or for causing the release of said selector switch.

11. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector-repeater in said branch office comprising a trunking switch and a group selector switch, trunks extending from the terminals in the bank of said trunking switch to said main office, other selectors in said branch office, local trunks extending from one of the groups of terminals in the bank of said selector switch to said other selectors in said branch office, special-service-code selectors in said branch office for use in completing special-service-code calls, local trunks extending from another of the groups of terminals in the bank of said selector switch to said special-service-code selectors in said branch office, means for connecting a calling line in said branch office to said selector-repeater, means responsive to the extension of a calling line to said selector-repeater for operating said trunk-hunting switch to select an idle trunk to the main office, an incoming selector in said main office connected to said selected trunk, an auxiliary first selector and a special-service-code selector in said main office for use in completing other special-service-code calls, all of the special-service codes having the same first two digits, means for repeating dial impulses incoming from said calling line to said selector-repeater over the trunk to the main office, means responsive to dial impulses incoming to said selector-repeater for operating said selector switch to select a corresponding group of terminals in its terminal bank, means effective if the first train of impulses received corresponds to the first digit of the special-service codes for restoring said selector switch to normal, means effective if the second train of impulses received corresponds to the second digit of the special-service codes for rendering said selector switch operable to select an idle set of terminals in the corresponding group, means for repeating the third train of impulses received from the calling line to said special-service code selector in the branch office simultaneously with the repeating of said impulses over the trunk to the main office, means responsive to the impulses received by said special-service-code selector in the branch office for operating said special-service-code selector to select an idle set of terminals in the corresponding group of its terminal bank, means in said selector-repeater for releasing the trunk to the main office, and control means individual to each of the sets of terminals of the group in the bank of said service-code selector in the branch office through which the special-service-code trunks are accessible for causing the operation of said release means.

12. In a dial telephone system, subscribers' lines, a main office, a branch office, another office, a selector-repeater in said branch office compris-

ing a trunk hunting switch and a group selector switch, trunks leading to said main office connected to terminals in the bank of said trunk hunting switch, trunks leading to said other office connected to the terminals of a first group in the bank of said group selector, other numerical switches in said branch office for use in completing calls to subscribers' lines in said branch office, said other numerical switches being connected to terminals in a second group in the bank of said group selector, a vacant group of terminals in the bank of said group selector, means for connecting a calling line to said selector-repeater, means for operating said trunk hunting switch to select an idle trunk to the main office, means responsive to a train of impulses incoming to said selector-repeater from said calling line for operating said group selector switch to select a corresponding group of terminals, means in said selector-repeater for repeating impulses received from said calling line over the selected trunk to the main office, means effective upon selection of said first group in the bank of said group selector in response to a first train of impulses for selecting and seizing an idle trunk in said first group and for thereupon causing the release of the selected trunk to the main office, means effective upon selection of a group other than said first group of terminals in response to said first train of impulses for returning said selector switch to normal, means effective upon selection of said second group in the bank of said selector switch in response to a train of impulses incoming to said selector-repeater subsequent to said return of the selector switch to normal for causing the selection of an idle one of said other numerical switches and for thereupon causing the release of the selected trunk to the main office, and means effective upon selection of said vacant group of terminals in response to a train of impulses incoming to said selector repeater subsequent to said return of the selector switch for again causing the return of said selector switch to normal and for rendering said selector switch non-responsive to succeeding trains of impulses.

13. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector switch in said branch office comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, means responsive to the seizure of said selector for automatically selecting an idle one of said trunks, means responsive to a train of dial impulses incoming over said line for advancing the brushes of said selector and for immediately restoring said brushes to normal, means responsive to the next train of impulses for advancing the brushes of said selector to a desired group of terminals and for automatically selecting an idle set of terminals in said group, means effective upon seizure of an idle set of terminals by said selector for releasing said trunk, and means for transmitting to the calling line a busy signal, said last mentioned means being effective upon failure of said trunk selecting means to find an idle trunk.

14. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector switch in said branch office comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, means responsive to the seizure of said selector for automatically selecting an idle one of said trunks, means responsive

to a train of dial impulses incoming over said line for advancing the brushes of said selector and for immediately restoring said brushes to normal, means responsive to the next train of impulses for advancing the brushes of said selector to a desired group of terminals and for automatically selecting an idle set of terminals in said group, means effective upon seizure of an idle set of terminals by said selector for releasing said trunk, and means for recording a failure of said trunk selecting means to find an idle trunk.

15. In a dial telephone system, subscribers' lines, a main office, a branch office, trunks extending between said offices, a selector switch in said branch office comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, means responsive to the seizure of said selector for automatically selecting an idle one of said trunks, means responsive to a train of dial impulses incoming over said line for advancing the brushes of said selector and for immediately restoring said brushes to normal, means responsive to the next train of impulses for advancing the brushes of said selector to a desired group of terminals and for automatically selecting an idle set of terminals in said group, means effective upon seizure of an idle set of terminals by said selector for releasing said trunk, and means rendered operatively effective by the dialing of a called subscriber's number for recording a failure of said trunk selecting means to find an idle trunk.

16. In a telephone system, subscribers' lines, a main office, a branch office, trunks between said offices, a selector switch for completing calls local to the branch office, said selector comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, auxiliary means responsive to said extension

for selecting an idle one of said trunks, a register for operation in case of failure of said trunk selecting means to find an idle trunk, means associated with said selector for receiving impulses incoming over said line, means in said selector switch for absorbing a series of said impulses and for selecting a group of terminals in response to the next succeeding series of impulses, means for automatically advancing said brushes to an idle set of terminals in said selected group, and means thereupon effective either to release said trunk or to restore said brushes to normal and operate said register dependent upon the character of said group of terminals.

17. In a telephone system, subscribers' lines, a main office, a branch office, trunks between said offices, a selector switch for completing calls local to the branch office, said selector comprising a set of brushes and a bank of terminals, means for extending a calling line to said selector, auxiliary means responsive to said extension for selecting an idle one of said trunks, means associated with said selector for receiving impulses incoming over said line, means for stopping the operation of said trunk selecting means in case of failure to find an idle trunk prior to receipt of the first dial impulse, a register for operation in case of failure to find an idle trunk, means in said selector switch for absorbing a series of said impulses and for selecting a group of terminals in response to the next succeeding series of impulses, means for automatically advancing said brushes to an idle set of terminals in said selected group, and means thereupon effective either to release said trunk or to restore said brushes to normal and operate said register dependent upon the character of said group of terminals.

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