

March 8, 1938.

W. W. CARPENTER ET AL

2,110,460

SELECTIVE SWITCH

Filed Sept. 25, 1936

3 Sheets-Sheet 1

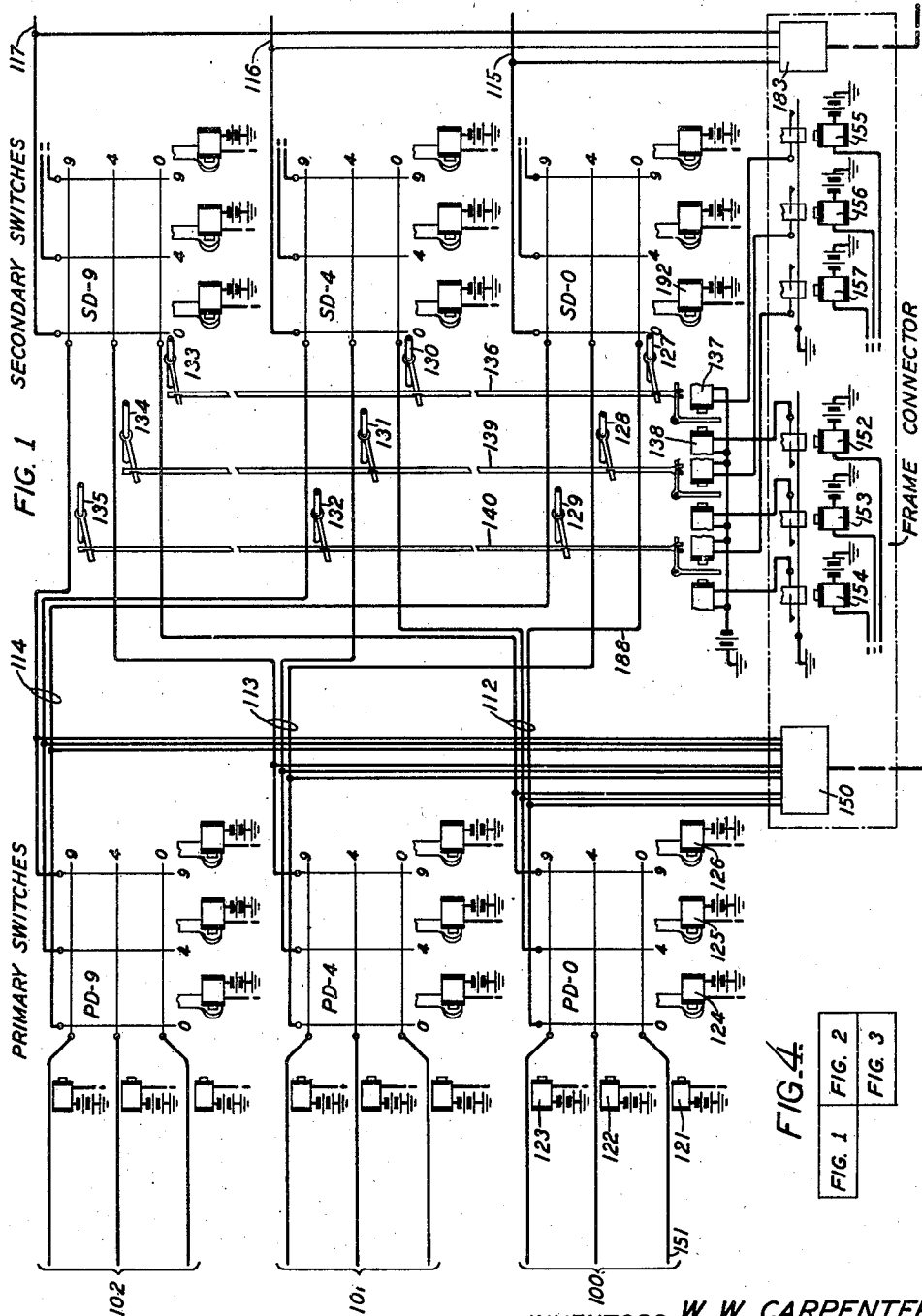


FIG. 1

FIG. 2

FIG. 3

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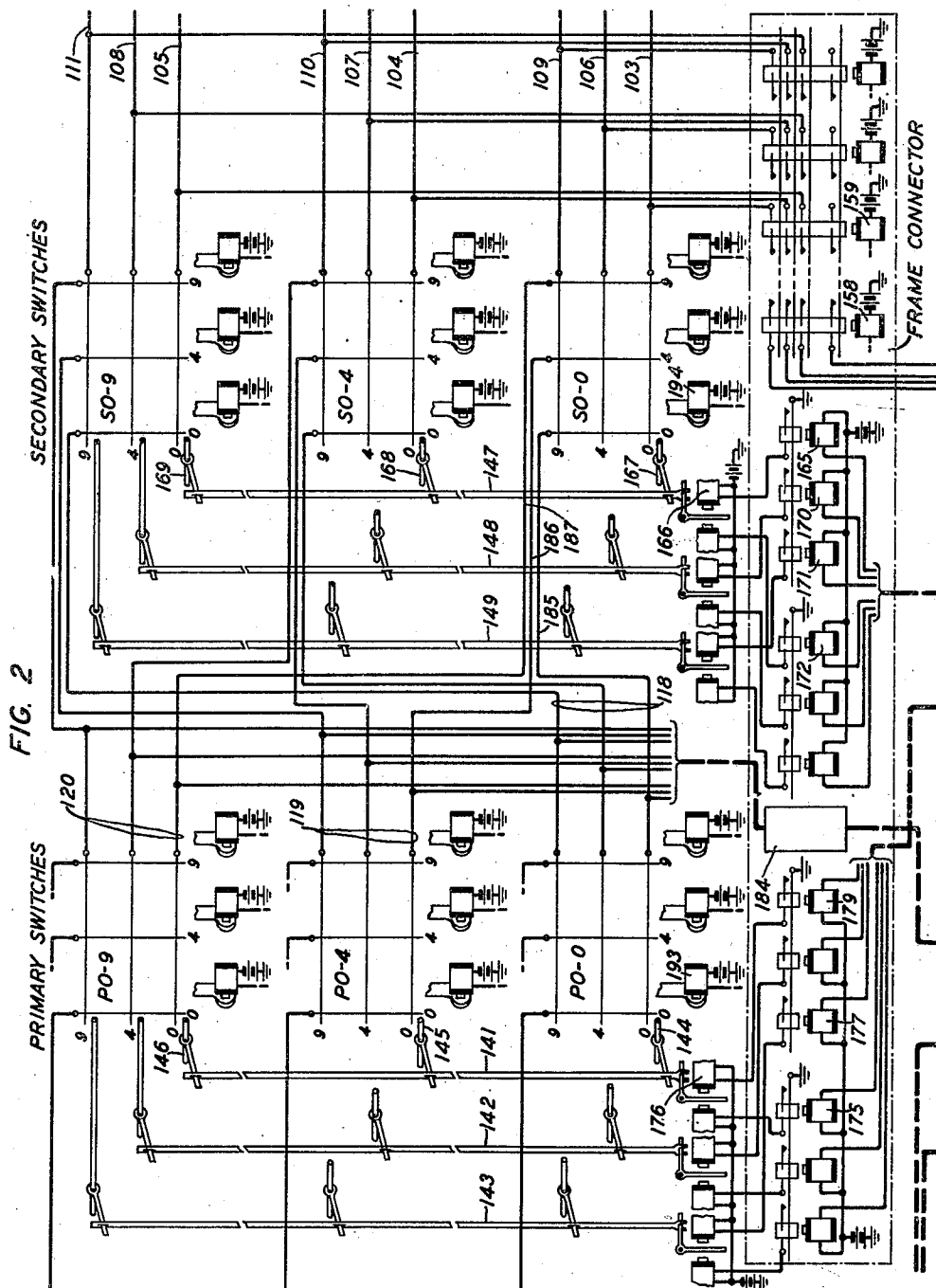
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SELECTIVE SWITCH

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3 Sheets-Sheet 2



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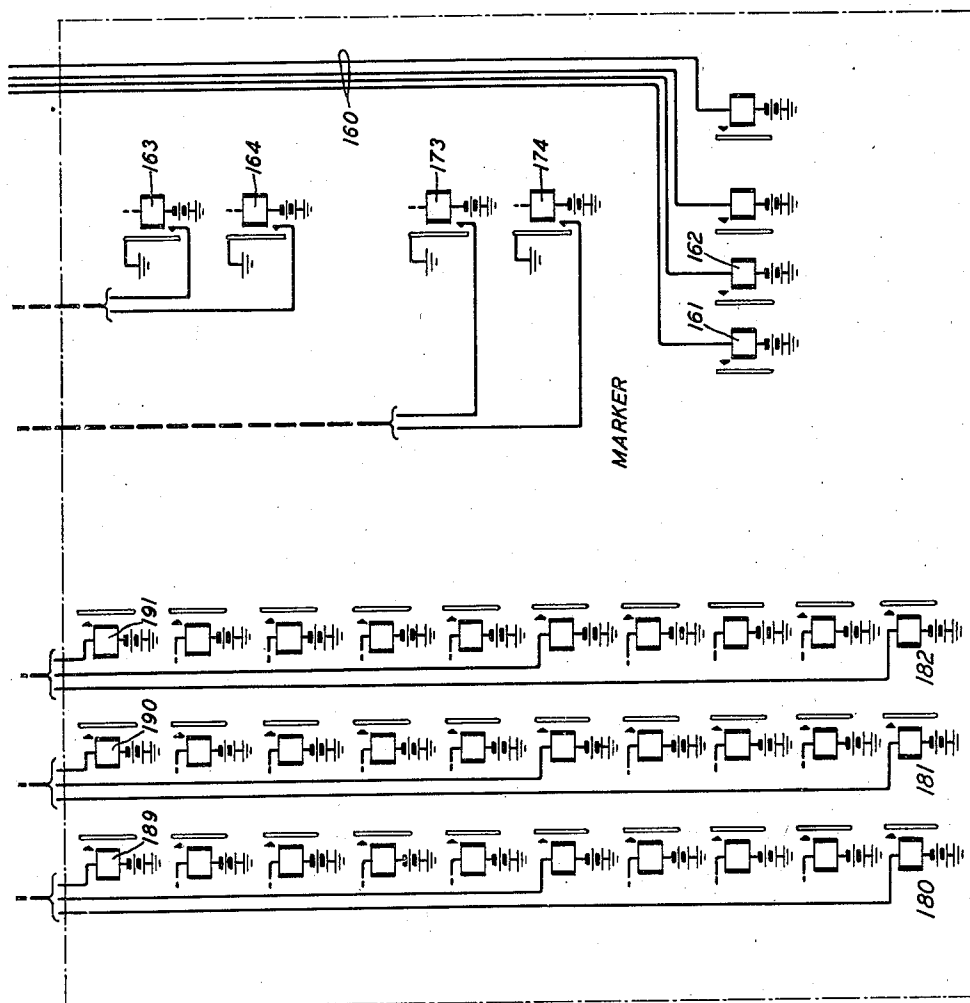
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SELECTIVE SWITCH

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FIG. 3



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UNITED STATES PATENT OFFICE

2,110,460

SELECTIVE SWITCH

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Application September 25, 1936, Serial No. 102,454

9 Claims. (Cl. 179—18)

This invention relates to the construction and operation of selective switches and to the controlling equipment therefor and particularly to switches of the class used for the establishment of connections in telephone systems.

The objects of the invention are to increase the operating speed of selective switches; to simplify the circuits used for controlling the operation of these switches; and to effect other improvements in equipment of this character.

In automatic telephone systems of the prior art in which switches of the cross-bar type are used it has been the usual practice to provide a circuit controlling means for determining the particular switch through which the desired connection is to be extended and then for operating the cross-bars of the switch to establish the connection. More recently it has been found that in systems of large capacity a more efficient use of the cross-bar switch can be realized by arranging the switches in a primary and secondary relation at the successive stages and interconnecting these stages with link circuits. Since the testing of the successive links comprising the paths through these stages requires a very brief interval of time, the best results are obtained by allowing the common controlling and testing mechanism to have exclusive use of an entire frame of switches while it is testing links and establishing a connection therethrough. This makes it possible for the testing mechanism to examine all possible link paths through a stage, each of which leads through a different cross-bar switch at each portion of the stage, in an effort to find at least one idle path. With this arrangement any one of ten equivalent switches on a frame may have a link circuit that could serve the particular connection involved provided this link can be matched with a link preceding it and also with a link succeeding it in the path. At the time the controlling mechanism seizes the frame it is not known which one of the switches will ultimately take part in the connection. For these reasons it is highly desirable from the standpoint of circuit operation to have all of the switches prepared in advance so that the operation of the one finally chosen for use can be completed without delay.

Accordingly a feature of the present invention is a system in which a selective switching stage includes a plurality of separate cross-bar switches for effecting connections between incoming and outgoing circuits and in which the bars on a plurality of switches are operated simultaneously by a single common operating device to cause the

establishment of a desired connection through some one of the switches at the switching stage. As soon as the connection has been extended through a particular one of the switches, the operating device is permitted to release and restore the operated bars on the several switches in readiness for the next call through the stage. To illustrate this feature more explicitly, it may be considered that a stage includes ten cross-bar switches, each having ten rows of contacts accommodating ten incoming circuits and ten outgoing circuits, and each switch having five select bars, each bar serving two rows of contacts, or two of the outgoing circuits. If now a given group of ten outgoing circuits is so distributed over the ten switches that each switch has one circuit, then it will be possible for any given call for said group to be completed over any one of the ten switches. And the switch finally chosen to complete the call is determined by the busy or idle condition of the circuits incoming to the switches as well as the condition of the circuits of the desired outgoing group. Since the said desired outgoing group is known before the tests for idle circuits are completed, it is expedient to prepare all switches having access to the group. And this is done as above explained by means of a common operating device which sets at once the ten select bars which are individual in the respective ten switches to the corresponding ten circuits of the outgoing group. As soon as the particular circuit to be used is determined, the hold bar of the switch in which it appears is operated to effect the connection, and all of the operated select bars are released. In a similar manner the remaining four sets of ten select bars, each of which sets includes a bar in each of the ten switches, are operated respectively by four common operating devices in connection with calls to other groups of outgoing circuits.

A related feature of the invention is a stage of switches in which a single bar in each switch controls selection of two outgoing circuits, and in which the bars in a plurality of switches are provided with a common actuating mechanism which operates all of them simultaneously either in one direction or another according to the circuits desired.

These and other features of the invention will be described more fully in the following detailed specification.

In the drawings which accompany the specification:

Figs. 1, 2 and 3, when arranged as shown in Fig. 4, illustrate in diagrammatic form a portion

of the equipment at a switching stage in an automatic telephone system, together with certain parts of the switch controlling equipment;

Fig. 1 shows a number of trunks incoming to a district selector frame and also a number of the primary and secondary district switches;

Fig. 2 shows a number of primary and secondary selectors of an office frame accessible to the district frame of Fig. 1, together with a number of groups of trunks outgoing from the office frame; and

Fig. 3 discloses parts of a marker for controlling the switches of the district and office frames.

The purpose of the selective switching stage comprising the district switches of Fig. 1 and the office switches of Fig. 2 is to establish connections between the incoming district trunks, which have been seized by subscribers' lines, and an idle trunk in any one of a number of outgoing groups, as determined by the office code of the designation dialed by the subscriber. The district selectors are arranged in frames of primary switches and frames of secondary switches. A frame of primary switches may comprise ten cross-bar switches, of which three, switches PD-0, PD-4 and PD-9, are illustrated in the drawings. Each of these primary district cross-bar switches, and the same is true of the other cross-bar switches disclosed in the drawings, has ten horizontal rows of contacts and ten vertical rows of contacts. The incoming district trunks appear in the horizontal rows of contacts of these switches, there being ten groups of ten or one hundred district trunks appearing in a district frame. In the drawings three of these groups of district trunks, 100, 101, and 102, are illustrated.

There are also ten secondary switches on the district selector frame, three of which, SD-0, SD-4, and SD-9, are shown. The primary and secondary district switches are interconnected by links which appear in the vertical rows of contacts in the primary switches and in the horizontal rows of contacts in the secondary switches, as illustrated in Fig. 1.

In a similar manner each of the office frames comprises ten primary office switches, including switches PO-0, PO-4 and PO-9, and ten secondary office switches, including switches SO-0, SO-4 and SO-9. Each of the district frames has access to each of the office frames by means of groups of link circuits interconnecting the district secondary switches and the office primary switches. And the primary selectors of an office frame are interconnected with the secondary selectors of the same frame by means of link circuits which appear in the horizontal rows of contacts of the primary office switches and in vertical rows of contacts in the secondary office switches, as illustrated in Fig. 2.

The outgoing trunks are arranged in groups and appear in the horizontal rows of contacts of the office secondary selector switches. For simplicity only three of these outgoing trunk groups are illustrated. One of these groups, comprising ten trunks is illustrated by the three trunks 103, 104, and 105. Trunk 103 appears in the zero horizontal row of switch SO-0, and trunks 104 and 105 similarly appear in the zero horizontal rows of switches SO-4 and SO-9. In a similar manner the other seven trunks of the same group appear in the zero levels of the corresponding secondary office selector switches. Another group of trunks is represented by the three trunks 106, 107, and 108 appearing in the No. 4 horizontal levels of the secondary office

switches. And the third group illustrated in the drawings includes trunks 109, 110 and 111, which appear in the No. 9 horizontal rows of contacts of the corresponding secondary office switches. Since each of the secondary office selector switches has ten horizontal rows of contacts, there may be as many as ten groups of outgoing trunks.

The district links interconnect the primary and secondary district switches in such manner that access may be had through any one of the ten district primary switches to any one of the ten district secondary switches. For example, the ten district links 112, which occupy the ten vertical rows of contacts in the primary switch PD-0, extend respectively and appear in the zero horizontal rows of the ten secondary switches SD-0 to SD-9. Likewise the ten district links 113 extend from the district primary switch PD-4 to the No. 4 horizontal rows of the respective secondary switches SD-0 to SD-9. Similarly the ten district links 114 extend from the primary switch PD-9 to the No. 9 horizontal rows of contacts of the ten secondary switches. And the same is true of the remaining seven groups of district links not shown. The links or office trunks interconnecting the district and office frames are divided into groups, each district frame having ten groups of trunks extending to ten respective office frames. In the drawings one of these groups, including office trunks 115, 116 and 117, is illustrated. The ten trunks, including trunks 115, 116 and 117, appear respectively in the No. 0 vertical rows of contacts of the ten secondary district switches. These trunks extend to the office frame shown in Fig. 2 and there appear respectively in the No. 0 vertical rows of the ten office primary switches PO-0 to PO-9. In a similar manner the remaining nine groups of district trunks outgoing from the district frame shown in Fig. 1 extend to nine other office frames and appear in the respective vertical rows of the primary office switches. The office links, which interconnect the primary office switches and the secondary office switches, are so arranged that any one of the ten primary office switches has access to any one of the ten secondary switches. For example, the ten office links 118, which appear in the primary office switch PO-0, are distributed and appear in the No. 0 vertical rows of the respective secondary office switches SO-0 to SO-9. In like manner the groups of office links 119 and 120 each appearing respectively in switches PO-4 and PO-9 are distributed among the ten secondary switches SO-0 to SO-9 and the same is true of the remaining groups of office links, not shown.

The cross-bar switches illustrated diagrammatically herein may be of any well-known and suitable type such as the one disclosed in the patent to Reynolds 1,139,722 of May 18, 1915. As illustrated, however, the switches disclosed herein differ from the one in the Reynolds patent in that the horizontal or select bars are rotatable in both directions so that each bar serves two horizontal rows of contacts. A switch of this general type is described in detail in the patent to Reynolds 2,021,329 of November 19, 1935. Accordingly, each of the primary district switches, such as switch PD-0, is provided with five select bars, each serving two separate horizontal rows of contacts, and ten select magnets, such as the magnets 121, 122 and 123, the magnets being associated with the bars in pairs, one magnet

for rotating the bar in one direction and the other magnet of the pair for rotating the same bar in the other direction. The switch is also equipped with ten vertical bars, one for each of the ten vertical rows of contacts and corresponding operating magnets, such as magnets 124, 125 and 126. The select magnets of any one of the primary district switches are separately and selectively energized by suitable circuit means to prepare the corresponding select bar by rotating it to its set position.

While the select bars of any one of the primary switches are operable separately from the bars of the other switches as above described, the select bars of the remaining switches at the switching state, such as the secondary district switches and the office primary and secondary switches, are mechanically joined so that a plurality of them are operated simultaneously by common means. For instance, the district secondary switch SD—0 has five select bars, three of which are illustrated. The bar 127 serves two horizontal rows of contacts, the No. 0 and No. 1 rows. The bar 128 serves two rows of contacts, such as the No. 4 and No. 5 rows. Likewise the bar 129 serves two rows, such as the No. 8 and No. 9 rows. Each of the other nine secondary district switches is also provided with five select bars, the corresponding bars 130, 131, and 132 of switch SD—4 and bars 133, 134, and 135 of switch SD—9 being shown. The bars serving the No. 0 and No. 1 rows of contacts of all ten switches, including the bars 127, 130, and 133, are mechanically joined by an operating rod 136. The rod 136 is connected to the respective select bars by levers as illustrated and at its lower end is coupled to an armature which is controlled by two select magnets 137 and 138. One of these magnets when energized moves the bar 136 longitudinally in one direction and rotates all of the individual select bars to prepare the contacts in the No. 0 rows of all ten switches. The other magnet when energized moves the rod 136 in the opposite direction and rotates the individual select bars in the other direction to prepare the contacts in the No. 1 rows of the switches. In like manner four other operating rods, including rods 139 and 140, are provided for operating the remaining four sets of ten select bars. In a similar manner the ten primary office selectors PO—0 to PO—9 are provided with five operating rods, three of which, rods 141, 142 and 143, are shown. The rod 141 operates the individual select bars 144, 145, 146, etc. for preparing the contacts of the No. 0 and No. 1 rows of the corresponding switches. The rod 142 controls the individual select bars associated with the No. 3 and No. 4 rows of contacts, and the rod 143 controls the individual select bars assigned to the No. 8 and No. 9 rows of contacts. In the same manner the secondary office selectors are provided with five operating rods, including the rods 147, 148, and 149. These rods control the corresponding individual select bars of the ten switches in the manner already described in connection with the district secondary and office primary selectors.

It has been suggested for the purpose of illustration that the district and office frames comprise ten primary switches and ten secondary switches per frame. It should be understood, however, that any suitable number of primary and secondary switches may be provided and that the invention is not limited to any particular number of switches. Furthermore, the capacity

of the individual switches may be selected in accordance with the requirements of the system. It is convenient to describe the system in connection with switches having ten rows of contacts in each direction. In some cases, however, it would be desirable to use switches having other capacities, such as those having twenty rows of contacts.

In order to establish a connection through the switches illustrated in Figs. 1 and 2, digit recording and controlling mechanisms are provided which register the designations representing the wanted connections to subscribers' lines and which utilize these designations to determine the proper trunk groups to be used, and to determine the proper links that must be tested and utilized to establish the connection to the chosen idle trunk in the group. One of these mechanisms, which are known as markers, is illustrated briefly in Fig. 3 of the drawings. When a call is received and the designation has been established in the marker, connecting devices, known as frame connectors, are operated to establish connections between the marker and the switches of the district and office frames which are to be used in establishing connections. These frame connecting devices are also illustrated briefly in the lower part of Figs. 1 and 2. For a full and detailed disclosure of a cross-bar system of this general class in which switch controlling markers serve to control the selecting switches to establish the desired connections, reference is made to the copending application of W. W. Carpenter Serial No. 27,305, filed June 19, 1935, granted as Patent 2,093,117, September 14, 1937.

A description will now be given of the operation of the system. Since calls incoming to the district frame appear at random on the district trunks leading to the ten different primary switches, and since an idle outgoing trunk that may subsequently be found in the desired group outgoing from the office frame may have its appearance in any one of the office secondary switches, it is necessary that the marker have information concerning the location of both the calling district trunk and the selected idle outgoing trunk before it can proceed to test the link paths interconnecting these two trunks and to operate the switches to complete the connection. If, for example, the call appears in the group of ten district trunks 100, all of which lead to the primary district switch PD—0, the connection must be extended over some one of the ten links 112. And in order that the marker may test the links 112 to the exclusion of other groups of links, such as groups 113, 114, etc., the test leads from the marker are selectively connected to the group 112 by connecting means 150. Since the ten links 112 extend respectively to the ten district secondary switches, it is possible for the connection to be completed through any one of these secondary switches, provided the corresponding link in the group 112 is idle and there is an idle link outgoing from the secondary switch in the proper direction. The group of links or office trunks 115, 116, 117, etc. outgoing from the district secondary switches to the proper office frame appear respectively in the office primary switches, as explained, and any one of these trunks may be used for the connection, provided it is idle and provided the office primary switch in which it terminates has an idle link extending to the particular office secondary switch in which the determined idle trunk appears. From what has been said it will be seen that the

particular one of the district secondary switches to be used for the connection is not known until the district links, the office trunks, and the office links have been tested. However, as soon as the position of the calling district is determined the number of the horizontal row of contacts in the district secondary switches through which the connection would be extended is known. That is to say, the connection will be completed through either one of the No. 0 to the No. 9 horizontal rows in the secondary district switches according to whether the calling district trunk appears in the corresponding primary district switches PD-0 to PD-9. For this reason it is possible to prepare all of the district secondary switches by setting the select bars at the outset. Likewise it is not known in the beginning whether the connection will extend through one or another of the ten primary office switches PO-0 to PO-9. But, since the chosen idle outgoing trunk is located in some particular one of the office secondary switches SO-0 to SO-9, it follows that the particular horizontal row of contacts through which the connection must be extended in the office primary switches is known. Accordingly, it is possible to operate at the beginning the proper one of the common operating rods 141, 142, and 143 to prepare all ten of the primary office switches. Again the exact location of the idle outgoing trunk in the group is not known until the trunks have been tested. It may be found on any one of the secondary office switches SO-0 to SO-9. But the horizontal row location of the trunk group is known as soon as the group is identified. For this reason it is possible to proceed at once to operate the proper operating rods 147, 148, 149 to prepare all ten of the secondary switches for extending the connection to any one of the trunks in the desired group that may subsequently be found idle when the test is made.

Assume that the call appears on trunk 151 in the group 100 appearing in primary district switch PD-0. When the call appears on the trunk 151 the individual select magnet 121 is operated to prepare the switch. Also the appearance of the call causes the operation of a connecting relay 155 which is individual to the primary switch PD-0. Relays 156 and 157 are individual to switches PD-4 and PD-8, respectively. Also relays 152, 153 and 154, individual respectively to primary district switches PD-1, PD-5 and PD-9 are illustrated. In a similar manner relays are provided for the remaining primary district switches PD-2, PD-3, PD-6 and PD-7. The purpose of these relays is to close circuits for selectively operating the rods 136, 139, 140, etc. to position the select bars of the secondary district switches. Relay 155 in operating closes the circuit for the magnet 137. The magnet 137 attracts its armature and moves the rod 136 longitudinally to rotate the select bars 127, 130, 133, etc., to prepare the contacts in the horizontal No. 0 rows of all secondary switches SD-0 to SD-9.

As soon as the wanted designation has been received and recorded, an idle marker, such as the one illustrated in Fig. 3, is taken in use, and the wanted designation is transferred thereto. The marker analyzes the designation and determines the desired outgoing trunk group. Assume, for example, that the trunk group over which the connection must be extended includes the trunks 103, 104, 105, etc., appearing in the No. 0 horizontal rows of the office secondary switches. It is now known that the connection must be ex-

tended over the No. 0 horizontal row of some one of the ten office secondary switches SO-0 to SO-9. Accordingly, the marker may now proceed to cause the operation of the common operating rod 147. To do this a circuit is closed from one of the relays 163, 164, etc., to operate the relay 165. The relay 165 is individual to the zero horizontal rows of contacts in the secondary switches, and in operating it closes a circuit for the magnet 166. The magnet 166 operates the rod 147 to rotate the individual select bars 167, 168, 169, etc., to prepare the No. 0 rows of contacts in the switches. If the desired trunk group is located in other horizontal rows of contacts in the switches, the marker causes the operation of the proper one of the relays, such as relays 170, 171, 172, etc., to rotate the corresponding select bars.

The marker connects itself to the wanted group of trunks through the frame connector shown at the bottom of Fig. 2. To do this the relay 158 individual to the marker is operated, and the relay 159 individual to the trunk group is operated. The test leads 160 are thus extended through to the test conductors of the trunks of the group. These trunks are tested by means of the test relays 161, 162, etc., and an idle one of the trunks is found. Assume that trunk 103 is idle and is selected for use for extending the connection. Since the trunk 103 appears in the switch SO-0, it is now evident that the connection must be completed through the No. 0 level of some one of the ten office primary switches PO-0 to PO-9. Accordingly, the marker causes the operation of the common operating rod 141 to position the select bars 144, 145, 146 associated with the No. 0 rows of contacts in the switches. To accomplish this the marker closes a circuit over the front contact of one of the relays 173, 174, etc., to cause the energization of the relay 179 which is individual to the zero horizontal rows of contacts. Relay 179 operates the magnet 176 which in turn actuates the rod 141. Other relays 175, 177, etc., individual to other rows of contacts in the primary office switches, are illustrated.

The select bars of all switches that can participate in the completion of the desired connection have now been operated, and the system is ready to make a test of the various link paths extending from the calling district trunk 151 to the idle outgoing trunk 103. These link paths are tested by the relay sets 180, 181, 182 in the marker. There are ten test relays in the set 180, and these are connected through a connecting mechanism 150 to the ten respective links in the group 112. The ten test relays in the set 181 are connected through the connecting mechanism 183 to the respective ten office trunks in the group, including trunks 115, 116 and 117. In like manner the ten test relays in the set 182 are connected through the mechanism 184 to the ten links, including links 185, 186, and 187, which appear in the No. 0 horizontal rows of the primary office switches and which extend to the vertical rows of contacts in the secondary office switch SO-0 reaching the trunk 103. The idle paths are indicated by the non-operated condition of all three of the corresponding test relays in the sets 180, 181 and 182. For example, if the first path through the switches is idle, including the link 188, the trunk 115, and the link 185, all three test relays 189, 190, 193 remain deenergized. Finding this idle path through the switches, the marker proceeds to cause the operation of the hold magnet 124 which is individual to the link 188 in the primary dis-

trict switch PD—0, the hold magnet 192 which is individual to the trunk 115 in the secondary district switch SD—0, the hold magnet 193 which is individual to the trunk 115 in the primary office switch PO—0, and the hold magnet 194 individual to the link 185 in the secondary office switch SO—0.

The operation of these hold magnets completes the establishment of the connection through the switches, and the select magnets may now be released. Also the other operated equipment may be restored to normal, and the connection is held in any well-known manner under control of equipment individual to the talking circuits. When the common operating magnets 137, 176 and 166 have released, the corresponding operating rods 136, 141 and 147 permit the individual select bars of the several cross-bar switches to restore to their neutral positions. These switches are now free to be seized by another marker for the establishment of another connection from an incoming district trunk to an outgoing trunk on the office frame. For a more detailed description of the manner in which connections are extended through switches of this kind under the control of a marker and associated equipment reference is made to the above-mentioned application of W. W. Carpenter, Serial No. 27,305, filed June 19, 1935, granted as Patent 2,093,117, September 14, 1937.

It will be noted that the time required for extending a connection through the district and office frames is extremely small. And during this interval only one marker can be associated with the district and office switches. For this reason it is possible to operate select bars of all of the switches, as has been explained herein, to prepare them for the establishment of the connection. And since it is not known at the beginning which switches will be called upon to complete the connection, it is desirable, and it simplifies the circuits to a great extent, to be able to prepare all switches which can possibly take part in the connection prior to the actual determination of the particular switches that are to be used.

What is claimed is:

1. In combination, a switching stage comprising a plurality of cross-bar switches, circuits incoming to said switches, a group of circuits outgoing from said stage, each of said switches having one of said outgoing circuits appearing therein, each of said switches having a cross-bar for the particular one of said outgoing circuits therein and serving to effect connections between the incoming circuits and said particular outgoing circuit, and a common driving device for operating simultaneously all of the cross-bars of said switches which serve the circuits of said outgoing group.

2. In combination, a switching stage comprising a plurality of cross-bar switches, circuits incoming to said switches, a group of circuits outgoing from said stage, each of said switches having one of said outgoing circuits appearing therein, each of said switches having a select bar for the particular one of said outgoing circuits therein, a common operating device mechanically coupled to all of the select bars of said switches which serve the circuits of said outgoing group, and means for energizing said operating device to position all of the select bars to which it is coupled.

3. In combination, a switching stage comprising a plurality of cross-bar switches, circuits incoming to said switches, a group of circuits out-

going from said stage, each of said switches having one of said outgoing circuits appearing therein, each of said switches having a select bar for the particular one of said outgoing circuits therein, a common operating device mechanically coupled to all of the select bars of said switches which serve the circuits of said outgoing group, means for energizing said operating device to position all the select bars coupled thereto to prepare all of the corresponding switches for the establishment of a connection to said group of outgoing circuits, and further means for operating a particular one of the prepared switches to complete the establishment therethrough of the connection to the corresponding one of the circuits of the outgoing group.

4. The combination in a switching stage of a plurality of cross-bar switches having rows of contacts, circuits incoming to said stage, a group of trunks outgoing from said stage and distributed among said switches, each outgoing trunk appearing in a contact row of some one of said switches, select bars for said switches, each select bar serving to prepare a particular row of contacts for operation, a common actuating mechanism coupled to all select bars serving the contact rows in which said trunks appear, means for operating said mechanism to position said select bars, operate bars for said switches cooperating with the select bars to close said contacts, and means for actuating an operate bar of some one of said switches to close the contacts of the row prepared by the positioned select bar and establish a connection from an incoming circuit to the corresponding trunk of said group.

5. The combination in a switching stage of a plurality of cross-bar switches having rows of contacts, circuits incoming to said stage, a group of trunks outgoing from said stage and distributed among said switches, each outgoing trunk appearing in a contact row of some one of said switches, select bars for said switches, each select bar serving to prepare a particular row of contacts for operation, a common actuating mechanism coupled to all select bars serving the contact rows in which said trunks appear, means for operating said mechanism to position said select bars, operate bars for said switches cooperating with the select bars to close said contacts, means for testing the trunks of said group to determine an idle one, and means for actuating an operate bar in the particular switch in which appears the idle trunk to establish a connection from an incoming circuit to said idle trunk.

6. The combination in a switching stage of a plurality of cross-bar switches, a plurality of sets of select bars, each set including a bar in each of the several switches, mechanical means for linking together all bars in each set, circuits appearing in said stage, there being one circuit for each of the several select bars, operating devices for said sets of bars, means for operating any one of said devices to position all bars of the corresponding set, and means cooperating with any one of the select bars of the positioned set for establishing a connection through the corresponding switch with the corresponding one of said circuits.

7. The combination in a switching stage of a plurality of cross-bar switches, a plurality of sets of select bars, each set including a bar in each of the several switches, mechanical means for linking together all bars in each set, trunks outgoing from said stage, there being one trunk for each of the several select bars, operating devices for

said sets of bars, means for operating any one of said devices to position all bars of the corresponding set, operate bars for each of said switches, means for selectively operating an operate bar of any one of said switches to coact with the positioned select bar to establish a connection to the particular trunk associated with said select bar.

8. The combination in a switching stage of a plurality of switches, select bars, one for each switch, a plurality of trunks arranged in pairs, each pair being served by a different one of said bars, a common operating device mechanically coupled to all of said bars, means for causing said device to position all of said bars to select one or the other of the trunks of each of the respective pairs, and means cooperating with the positioned bar of any one of said switches to

effect connection with the corresponding one of the trunks.

9. The combination in a switching stage of a plurality of switches, select bars, one for each switch, a plurality of trunks arranged in pairs, each pair being served by a different one of said bars, a common operating device mechanically coupled to all of said bars, means for rendering said device effective to rotate all of said bars in one direction to select one of the trunks of each of the respective pairs and effective to rotate all of said bars in the opposite direction to select the other trunk of each of the respective pairs, and means cooperating with the rotated bar of any one of said switches to effect connection with the corresponding one of the trunks.

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