

Dec. 5, 1944.

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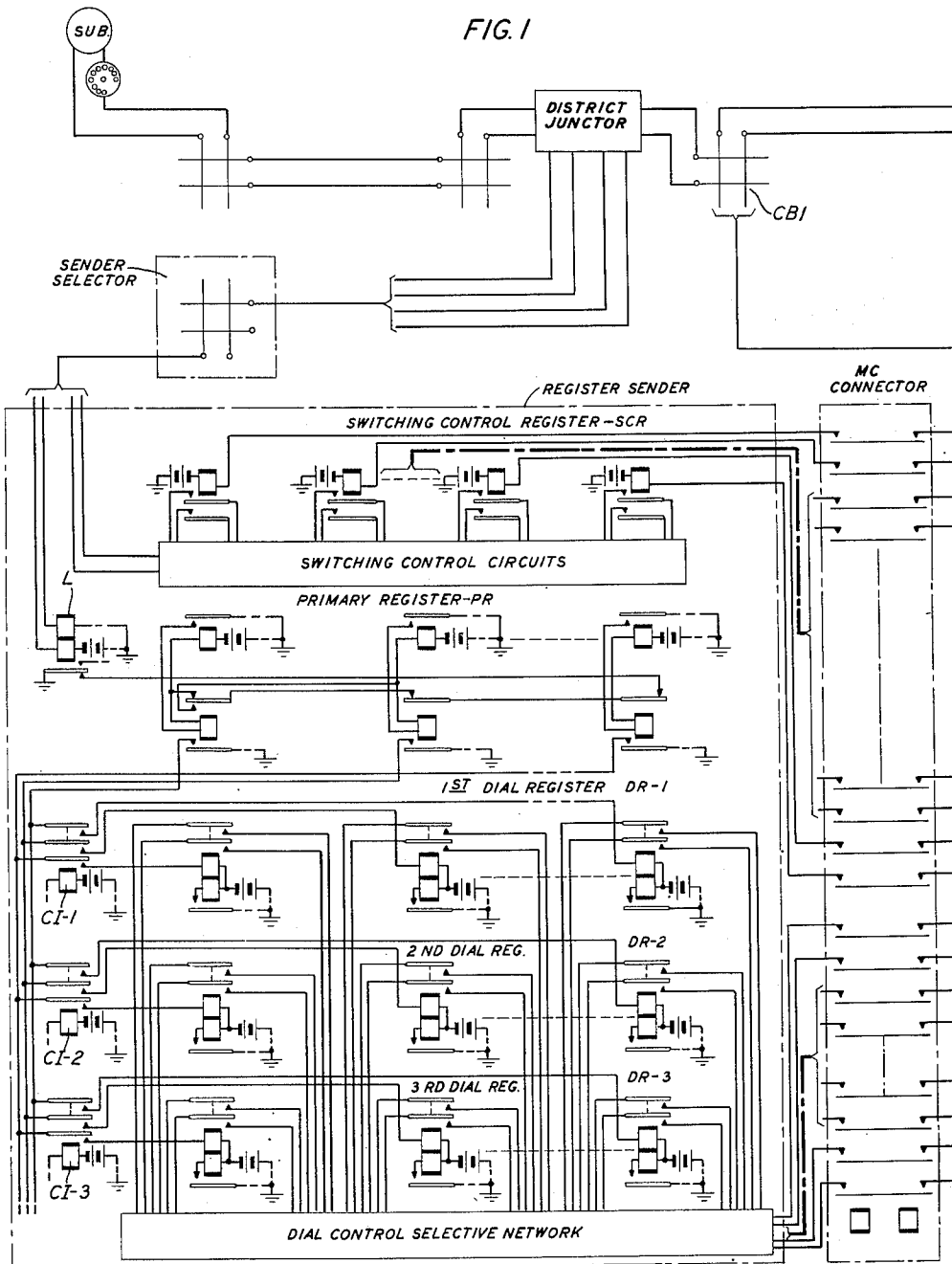
2,364,445

TELEPHONE SYSTEM

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2 Sheets-Sheet 1

FIG. 1



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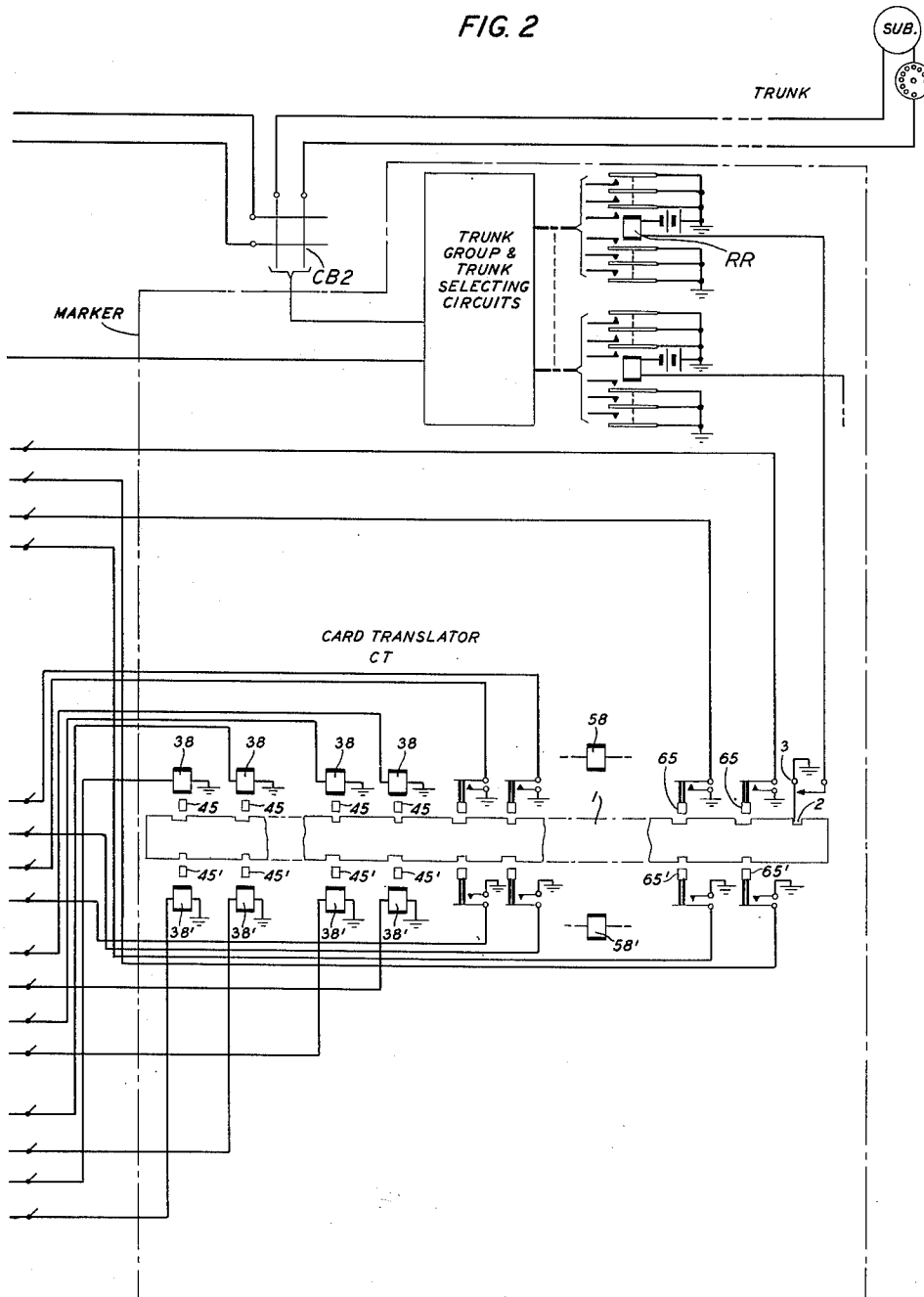
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FIG. 2



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TELEPHONE SYSTEM

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6 Claims. (Cl. 179—22)

This invention relates to telephone systems and more particularly to automatic or semiautomatic telephone systems in which "markers" are used for establishing connections.

As is well known, systems of this kind involve a register sender which receives the wanted designation from the calling subscriber and a marker which, at the appropriate time, is connected to the sender, receives the wanted designation from the latter and, in response to this designation, operates to select a free trunk to the wanted office, causes the connection of this trunk, at a suitable switching frame, with the calling line, and sends back to the sender the information the latter requires to control the completion of the connection at the wanted office over the selected trunk.

In its most general form, the marker comprises a code register which is settable in response to the called office register of the sender, a "route" relay individual to each terminating office having its circuit, and its own circuit only, completed by the setting of the code register for that office and two common groups of relays each operated directly and selectively from the contacts of each of the route relays, the first group for controlling those operations of the marker which have to do with the selection of an available trunk to the terminating office indicated by the operated route relay, and a second group for transmitting back to the sender certain information needed by the latter to complete the call at the terminating office over the selected trunk. A marker of this kind is shown in Patent 2,235,803, granted to W. W. Carpenter on March 18, 1941.

As is well known, the marker involves the use of considerable relay equipment and related intra-wiring. For example, the office code register usually involves a group of eighteen ordinary and sixteen multicontact relays to produce an individual circuit for each of eight hundred and sixty-three route relays (if the entire local dialing area comprises an office for each usable three-digit code combination of the ten "dial" digits, though in practice the number of such codes is scarcely ever more than two hundred); it involves a group of some seventy "transmitting" relays which are to be selectively operated by each of the route relays to activate a selective combination of thirty-one conductors for transmitting information back to the sender, and it involves a group of several hundred "auxiliary" relays which, through a suitable breaking down process, are selectively operated by the route relay to

gain access to the appropriate trunk group and to select an idle trunk in that group. Each route relay, on the other hand, consists of a multicontact relay having a sufficient number of contact pairs for completing the desired selective circuits to the relays of each of these two groups.

It has been proposed to replace the code register, the route relays, the transmitting relays and the auxiliary relays of the marker by a simple card translator which has as many cards as there are routes or offices, each card being adapted to be selected by a number of code bars selectively set by the code register of the sender, and each card, when selected, determining the selective setting of a number of other bars which, though common to all the cards, may be selectively set in accordance with the unique pattern individual to the selected card and be determinative of the number of separate circuits required to transmit the information back to the sender, to gain access to the trunk group of the desired office and to select an available trunk in the group. A card translator of this type is disclosed in the copending application of G. R. Stibitz, Serial No. 485,734, filed May 5, 1943.

In accordance with the present invention, the card translator described in the above-mentioned copending application is utilized to replace the code register of the marker and the transmitting relays therein by which the information is conveyed back to the sender, but a route relay for each office, operated locally by the selected card individual to the office, is retained, as is also retained the group of common auxiliary relays which are selectively operated by the route relay to gain access to the trunk group and to select an available trunk therein. Thus by utilizing the card translator to replace the code register and the transmitting relays, and by retaining the individual—though now much smaller—route relay and the common auxiliary relays selectively operated by each of the route relays to select a wanted trunk group and an idle trunk therein, the number of "translation" bars in the card translator will be reduced to those necessary to transmit information back to the sender and, on the whole, less equipment will be used in the marker than if a sufficient number of translation bars were used in the card translator also to replace the route relays and the auxiliary relays therein.

In the drawings:

Fig. 1 shows a sender which is indicated as connected to a calling line through the medium of a cross bar sender selector switch. This sender,

as shown, discloses schematically only the primary register, the three dial registers which are set from the primary register in accordance with the called office code, and the switching control register. Fig. 1 also shows, to the right of the sender, a connector by means of which the sender is connected to the marker;

Fig. 2 shows a schematic indication of the marker as modified for use with the card translator in place of the marker code register and the transmitting relays.

It is to be noted that the two figures of the drawings show schematically, among other things, a connection between two telephone subscribers effected through the medium of cross bar switches. The complete equipment and the manner of its operation to establish this type of connection is fully disclosed in Patent 2,235,803, granted to W. W. Carpenter, March 18, 1941, and reference is made to this patent for a full understanding of the "marker" system of establishing such automatic telephone connections, the drawings of the present invention being confined only to a schematic showing of that portion of the sender which includes the primary register responsive to the dial pulses, the three dial registers which are set by the primary register as the latter operates in response to the three trains of dial pulses that designate the three-digit code of a called office, and the switching control register which is selectively operated from the marker; and to a schematic showing of that portion of the marker which, according to this invention, would include the card translator and other parts or elements operated or controlled thereby. Further, no attempt is made herein to show or describe the mechanical structure of the translator itself, the schematic showing thereof in Fig. 2 and the accompanying description of its operation being thought sufficient for the purpose of this invention, reference being made to the above-mentioned copending application to Stibitz for a complete disclosure thereof.

As contemplated by the present invention, the function of the marker code register and that of the transmitting relays which control the signals back to the sender are replaced by equivalent functions of a card translator. Referring to Fig. 2, the card translator CT is located in the marker, the office code register of said marker being replaced by the twenty select magnets 38—38' of the translator. These magnets operate associate bars 45—45' disposed over or under the grooves formed by all the "select" notches on the different cards 1 when the latter are arranged in a stack. These notches are wide and narrow, with the wide notch twice the width of the narrow one, and arranged in pairs along opposite edges at one end of the card, one before the other and vice versa to represent each of the two binary digits of the number of such digits required to represent the equivalent of three digits of the office code. Each groove has a minimum width of that of a narrow notch and the bars 45—45' are slightly narrower and adapted to fit, each into its respective groove, upon the operation of its controlling select magnet.

The transmitting relays in the marker which are selectively operated by the route relay to transmit signals back to the sender are replaced by an appropriate number of translation bars 65—65' which are equal to the maximum number of conductors selectively to be activated by the operation of said transmitting relays. As in the

case of the "select" notches, the other two opposite ends of each card 1 contain a series of wide and narrow notches which are identical in dimension to the wide and narrow select notches and similarly arranged in pairs equal to the total number of binary digits required to represent the decimal number which designates the whole of the "translation" code for the card or office designated by the card. These "translation" notches also form oppositely disposed grooves over or under which are disposed the bars 65—65' each of which is slightly narrower than the width of a narrow notch. The upper group of bars 65 is controlled by magnet 58 for the purpose of intruding the bars into the upper grooves while the lower group of bars 65' is controlled by magnet 58' for the purpose of intruding these bars into the lower grooves. Each card 1 in the translator represents, of course, a given route or office and since, according to this invention, the route relay is preserved, a special notch 2 is made at the right end of each card to control a set of springs 3. One of the springs is secured to the frame of the translator with the bottom end of said spring resting against the left edge of the notch. When, upon the selection of the card according to the teaching of the Stibitz application, said card is moved to the right, the spring moves with it to engage the other spring of the set. This latter spring is wired to the winding of the route relay RR individual to the office designated by the card, and appropriate circuit means are provided so that, upon the closure of the two springs, the circuit of the relay RR is completed, causing the latter to operate.

When the sender receives the called office code from calling line in the form of three trains of dial impulses which release and operate the sender line relay L once for each pulse, said relay causes, for each train of pulses, a particular setting of the relays of the primary register PR. During the pause which follows the last pulse of the first train, relay CI—1 is operated to connect the relays of the first dial register DR—1 with those of the primary register PR, whereupon the relays of the first dial register DR—1 are selectively operated by the operated relays of the primary register PR to register, in the first dial register, the digit designated by the first pulse train. Thereafter, the operated relays of the first dial register DR—1 are locked to an off-normal ground, the cut-in relay CI—1 and the operated relays of the primary register PR are released, the latter to be again selectively operated by the pulses in the second pulse train. Upon the operation of the second cut-in relay CI—2, the setting of the primary register relays in response to this pulse train is transferred to the relays of the second dial register DR—2 which are also locked to an off-normal ground. Subsequent to the release of the cut-in relay CI—2, the release of the relays of the primary register PR and the operation of the cut-in relay CI—3, the setting of the primary register PR in response to the third pulse train is effected and this setting is then transferred to the third dial register DR—3 by the selective operation and locking of the relays therein. Thus the three digits of the wanted office code are registered, respectively, in the first three dial registers DR—1, DR—2, DR—3 of the sender.

After the wanted office code is registered in the dial registers of the sender, suitable circuits are completed by which the connector MC is operated to connect the sender with the marker.

If it is assumed that all office codes are three-digit codes, then these codes will necessitate the use of a card translator CT which has twenty select magnets, ten magnets 38 for the top left edge of the cards and ten magnets 38' for the bottom left edge, each office code being designated on the card individual to the office by the binary representation of its three-digit number. In accordance with the teachings of the above-mentioned copending application to Stibitz, each card 1 may then be selected by operating the magnets 38—38' by circuits (not shown) completed by the sender dial registers DR—1, DR—2 and DR—3 in the combination indicated by the wide notches on the card individual to the office. Each of these magnets, upon operating, causes an associated bar 45 or 45' to be intruded into a select groove formed by the aligned notches in the stack of cards, and a mechanism (not shown) then operates to pull out of the stack the card indicated by the operated combination of select magnets 38—38', the amount of movement being limited to the difference between a wide and narrow notch. When the card (say card 1) moves out, an obvious circuit is completed for the route relay RR individual to the office designated by the card, by the closure of the individual set of springs 3, and the operation of the relay RR is followed by the closure over its contacts of circuits (not shown) to the appropriate ones of the auxiliary relays by means which, in accordance with the teachings of the above-mentioned Carpenter patent, the group of trunks extending to the desired office are tested, an idle trunk therein is selected, and appropriate closure of the cross-point contacts at the cross bar switches CB1 and CB2 is effected to cause the trunk to be joined to the calling line extension.

At the same time that the route relay RR is operated, a circuit is also completed in any suitable manner for the two magnets 58 and 58'. As previously stated, these magnets each control a group of bars 65 and 65' respectively, which are normally disposed in engageable relation with the grooves on the "translation" edges of the different cards, which grooves are made up of wide and narrow notches of the binary digits that represent the maximum number of conductors extending between the marker and the relays in the switching control register SCR of the sender over which said relays are to be selectively operated in accordance with a selected card, said card determining which of the conductors are to be electrically activated and, therefore, which of the relays in the control register SCR are to be operated. Since the wide and narrow notches in the "translation" edges of a card are identical in dimension to those on the "select" edges of the card, it follows that when, by the selection of a card, said card is withdrawn from the stack by the difference between a wide and narrow notch, those translation grooves which include the narrow notches of the selected card will be blocked while those which include the wide notches will remain unaffected. Hence, when magnets 58 and 58' are operated to force the bars 65—65' into their associated grooves, only those grooves will be penetrated by their associated bars that include only the wide notches on the selected card, the other grooves blocking the entry of their own associated bars. Since the bars 65—65' each control an individual set of springs which are closed when the bars penetrate their respective grooves,

and since one spring of each set is grounded and the other is extended to the winding of a relay in the switching control register SCR of the sender via a connecting path through the connector MC, it follows the selection of each card in the manner above set forth will cause a combination of bars 65—65' to enter the translation grooves of the card stack which is unique to the selected card. This combination, for each card, determines which of the relays in the switching control register SCR of the sender will be operated, thereby to provide the sender with the required information for it to control the establishment of the connection over the selected trunk at the terminating office, all in accordance with the operation set forth in the above-mentioned Carpenter patent.

As previously stated, the route relay RR, when operated, functions in the well-known manner to control the operation of marker circuits by which an idle trunk leading to the desired office is selected. However, once the switching control register SCR is operated, the marker is disconnected from the sender in the manner disclosed in said above-mentioned patent and the marker, when finished with the selection of the trunk and the connection thereof to the extension of the calling line in the cross bar switches CB1 and CB2, restores to normal in readiness for another call.

What is claimed is:

1. In a telephone system, the combination with a plurality of groups of trunks, of a first register, a second register and a marker, said marker comprising a card translator having a card for each one of said groups of trunks and means settable by said first register to select a card, means responsive to the selection of said card for setting said second register and other means locally controlled by said selected card for selecting the one group of trunks in said plurality of groups of trunks which is designated by said card.

2. In a telephone system, the combination with a plurality of groups of trunks, of a first register, a second register and a marker, said marker comprising a card translator having a group of cards arranged in a stack, each of said cards being notched to designate a particular trunk group and further notched to designate a setting of said second register specific to said trunk group, means settable by said first register in accordance with the notches that designate a particular trunk group for selecting the card individual to said trunk group, means operative through the grooves formed in the card stack by the notches designating the settings of said second register and left unblocked by the selected card for setting said second register in accordance with the notches in said selected card that designate the setting of said second register, and means locally controlled by said selected card for selecting the one group of trunks in said plurality of groups of trunks which is designated by said card.

3. In a telephone system, the combination with a plurality of groups of trunks extending to different offices, of a first register settable to designate the code of any one of said offices, a second register settable to control the extension of a connection over a trunk in that group of said groups of trunks which extends to any one of said offices, means for selecting the group of trunks extending to said office and a free trunk in said group, and a translator responsive to the setting of said first register for setting said second register and for operating said trunk group and trunk selecting means, said translator comprising a plurality

of cards arranged in a stack, each of said cards having wide and narrow notches to record the code of an office and a correlated switching code indicative of the setting of said second register for controlling the extension of a connection over a trunk extending to said office, said notches forming grooves of varying widths when the cards are stacked, a bar for each groove adapted for intrusion into the narrow portion of the groove, means responsive to the setting of said first register according to the code of one of said offices for causing bars to be selectively intruded into those grooves formed by the office code notches which are indicated by the wide notches on the card individual to said office, means for withdrawing said card partially from the stack whereby the narrow notches of the notches indicating the switching codes on the cards in front and in back of the card withdrawn from the stack are blocked by the corresponding notches in the card partially withdrawn and the wide notches on said card are reduced to the width of narrow notches, means for intruding other of said bars in the unblocked grooves, circuits completed by said last-mentioned intruded bars for selectively setting said second register in accordance with the switching code on the card partially withdrawn from the stack, and circuit closing means individual to said selected card and operative after its selection for operating said trunk group and trunk selecting means for the one of said offices.

4. In a telephone system, the combination with a plurality of trunk groups extending to different offices, of a first register setttable to designate the code of any one of said offices, the second register setttable to control the extension of a connection over a trunk in one of said groups of trunks extending to said office, means individual to each office and common means operated thereby for selecting the one of said trunk groups and an idle trunk in that group which extends to any office, and a translator responsive to the setting of said first register for setting said second register, said translator comprising a plurality of cards arranged in a stack, each of said cards being individual to one of said offices and notched to record the code of the office and a correlated code indicative of the setting required by said second register for controlling the extension of the connection over an idle trunk in the one of said trunk groups which extends to said office, means responsive to the setting of said first register and controlled by the office code notches for selecting the card individual to the office indicated by the setting of said first register, means operative after the selection of said card and controlled by the notches that record correlated codes for setting said second register according to the correlated code recorded on said selected card, and circuit closing means individual to said selected card and operative upon its selection for operating said means individual to the office designated by the selected card, whereby the trunk group to the office and an idle trunk therein are selected.

5. In a telephone system, the combination with a plurality of trunk groups extending to different offices, of a first register setttable to designate the code of any one of said offices and a second register setttable to control the extension of a connection over a trunk in that group

of trunks which extends to any one of said offices, means individual to each office and common means operated by each of said individual means for selecting the one of said trunk groups and an idle trunk in that group which extends to any one of said offices, and a translator responsive to the setting of said first register for setting said second register, said translator comprising a plurality of cards arranged in a stack, each of said cards being individual to an office and provided with wide and narrow notches to record the code of the office and a correlated code indicative of the setting required by said second register for the extension of the connection over an idle trunk in the one of said groups of trunks which extends to said office, all of said notches forming a plurality of grooves of varying widths when the cards are stacked, a bar for each groove adapted for intrusion into the narrow width thereof, a magnet for each bar individual to each groove formed by the notches that indicate office codes, means responsive to the setting of said first register for selectively operating said magnets to cause the intrusion of their associated bars into the grooves which include only the wide notches of the office code notches on the card individual to the office, means for withdrawing said card out of the stack a distance equal to the difference between a wide and a narrow notch, whereby the narrow notches indicating the correlated codes on the card immediately in front and in back of the card moved out of the stack are blocked by the narrow notches of the notches indicating the correlated code on said card, electromagnetic means operative to cause the intrusion of other bars in the unblocked grooves, means controlled by said last-mentioned intruded bars for setting said second register according to the correlated code recorded on the selected card, and circuit closing means individual to said selected card and operative upon its selection for operating said means individual to the office designated by the selected card, whereby the trunk group to the office and idle trunk therein are selected.

6. A translating device comprising a plurality of stackable strips each having a series of wide and narrow notches that form grooves when said strips are stacked, said notches on each strip designating an item of information and a translation of a part thereof, bars adapted for selective insertion into said grooves to designate an item of information whereby all of said strips except the one designating such item of information are stackably locked, said latter strip being free to move lengthwise out of the stack by an amount equal to the difference between a wide and narrow notch, and whereby the lengthwise movement of said strip blocks the grooves made by the notches that designate partial translation which include the narrow notches of the displaced card, means for passing other bars through the unblocked grooves whereby such bars designate the partial translation recorded on the notches of the selected card, and relay means individual to each strip and operative upon a strip being selected by lengthwise movement as aforesaid for providing the remainder of the translation of the item of information individual to the selected strip.

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