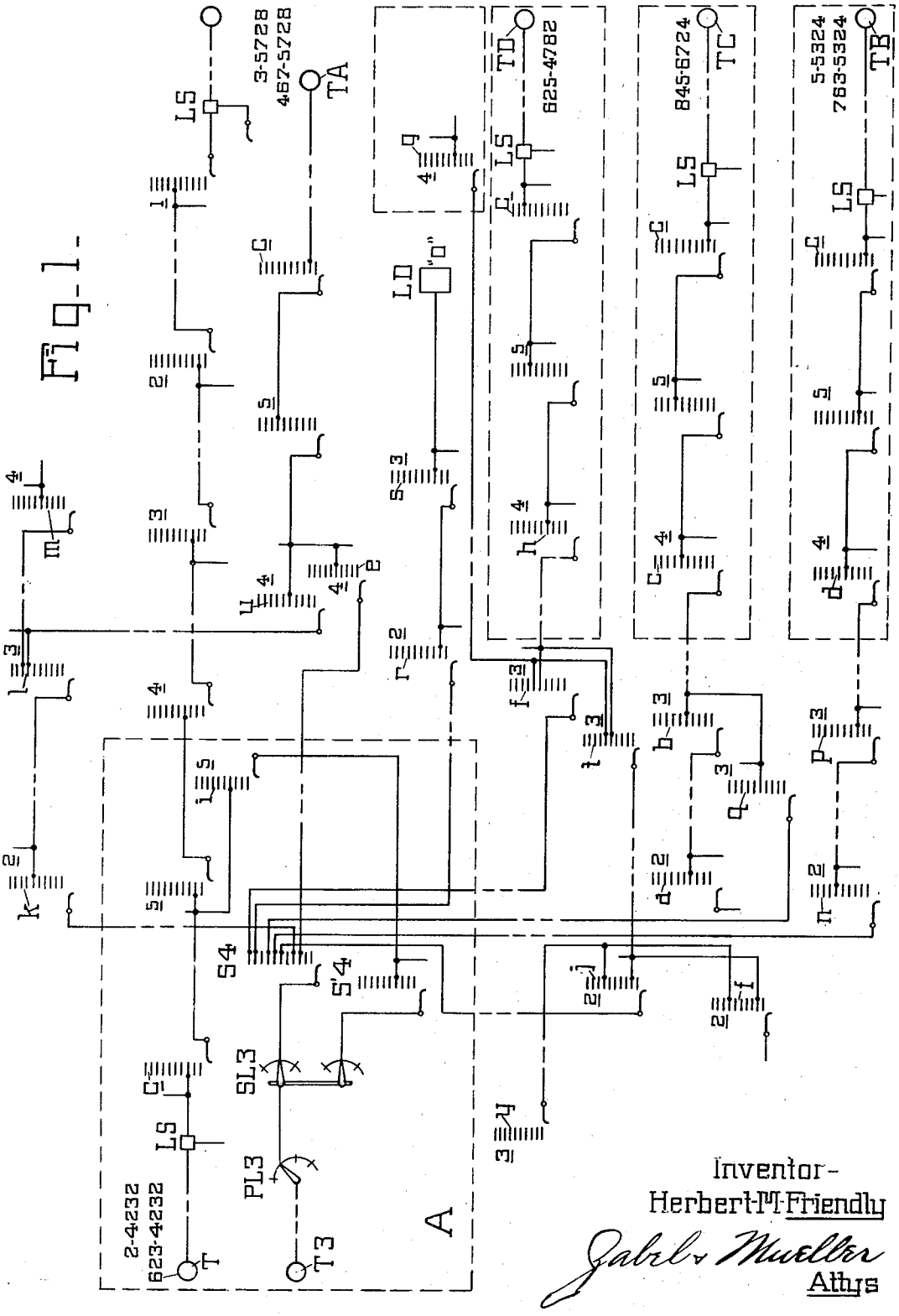
Jan. 30, 1934. H. M. FRIENDLY 1,945,467

TELEPHONE SYSTEM

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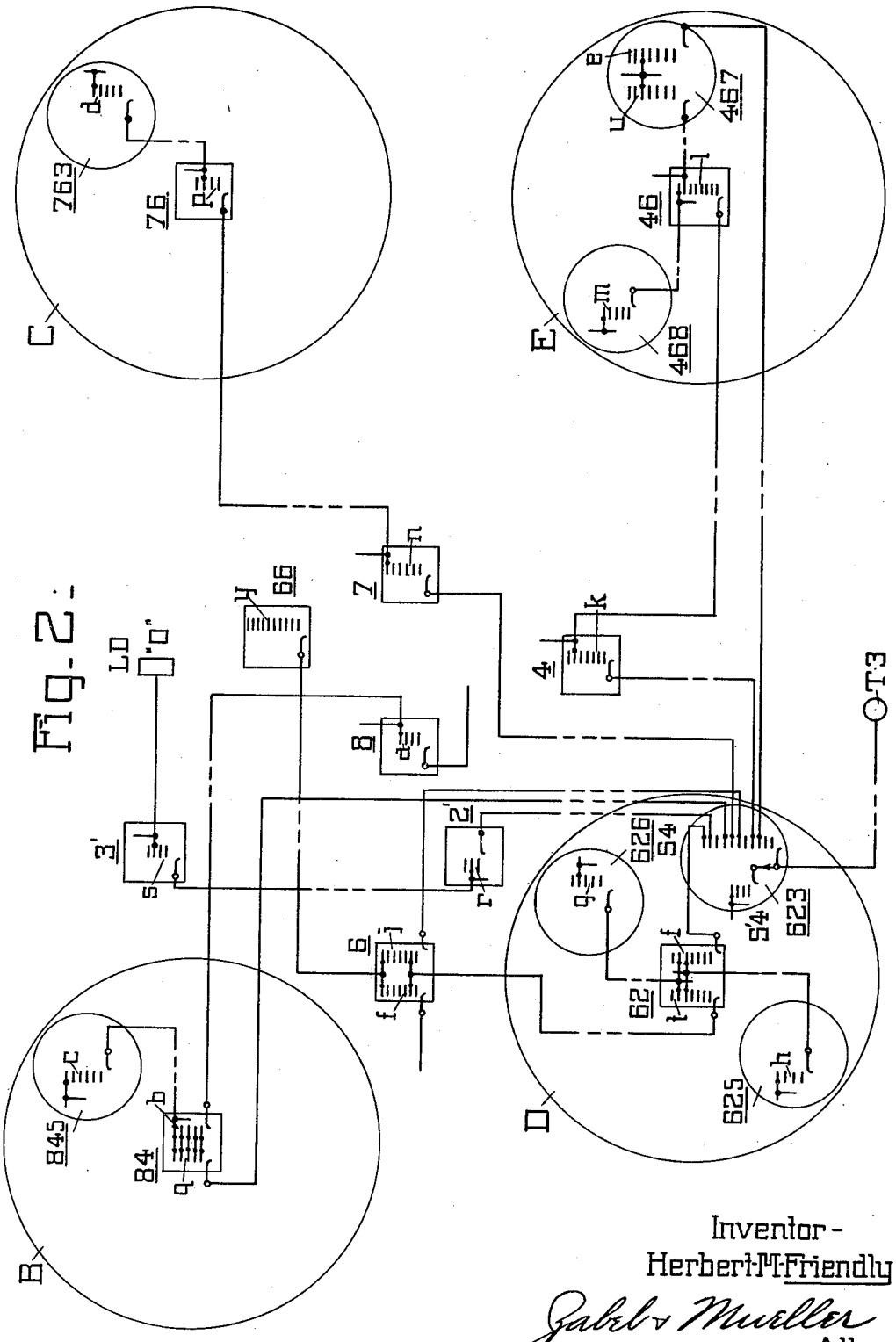


Fig. 2.

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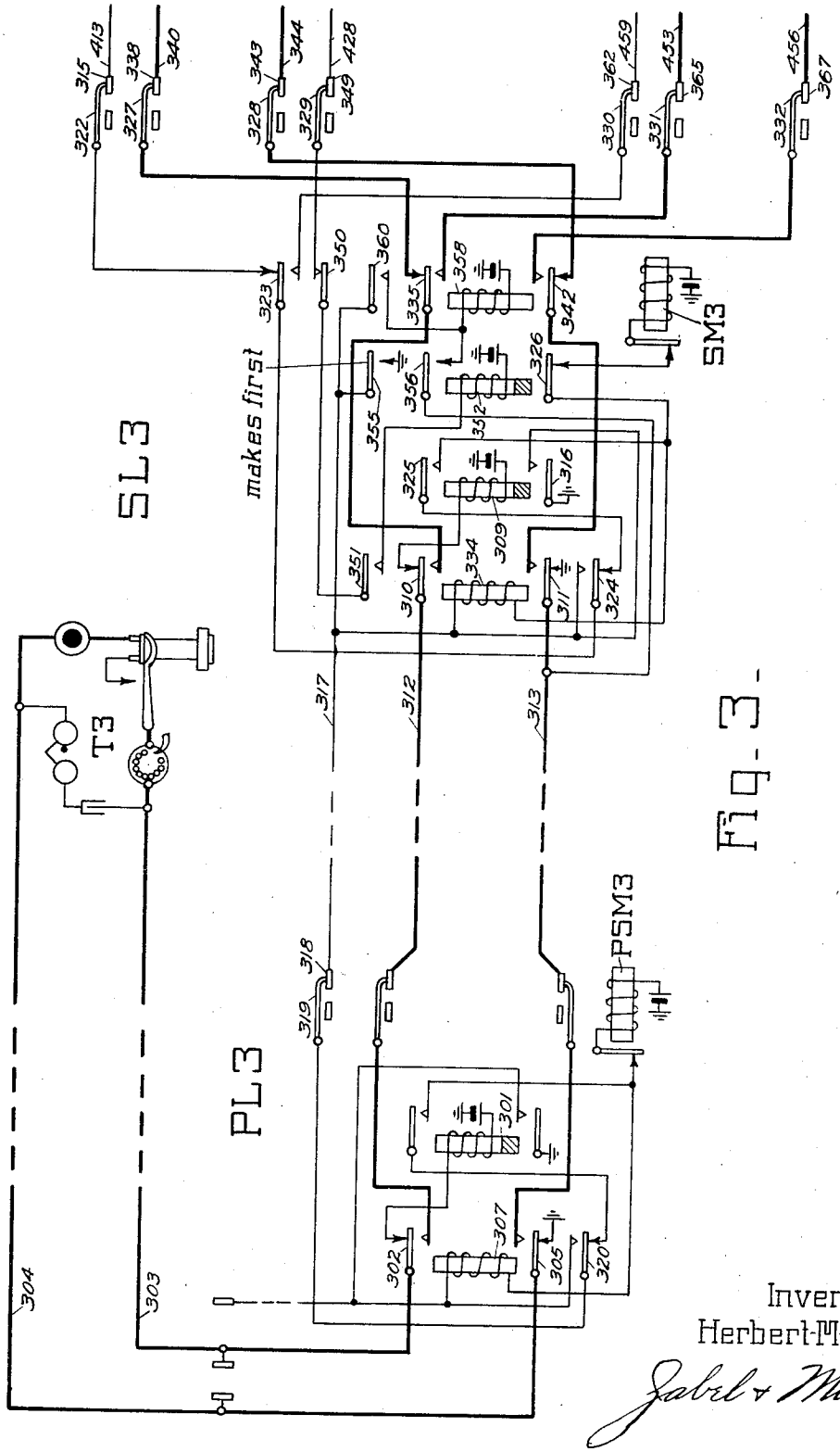


Fig. 3.

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TELEPHONE SYSTEM

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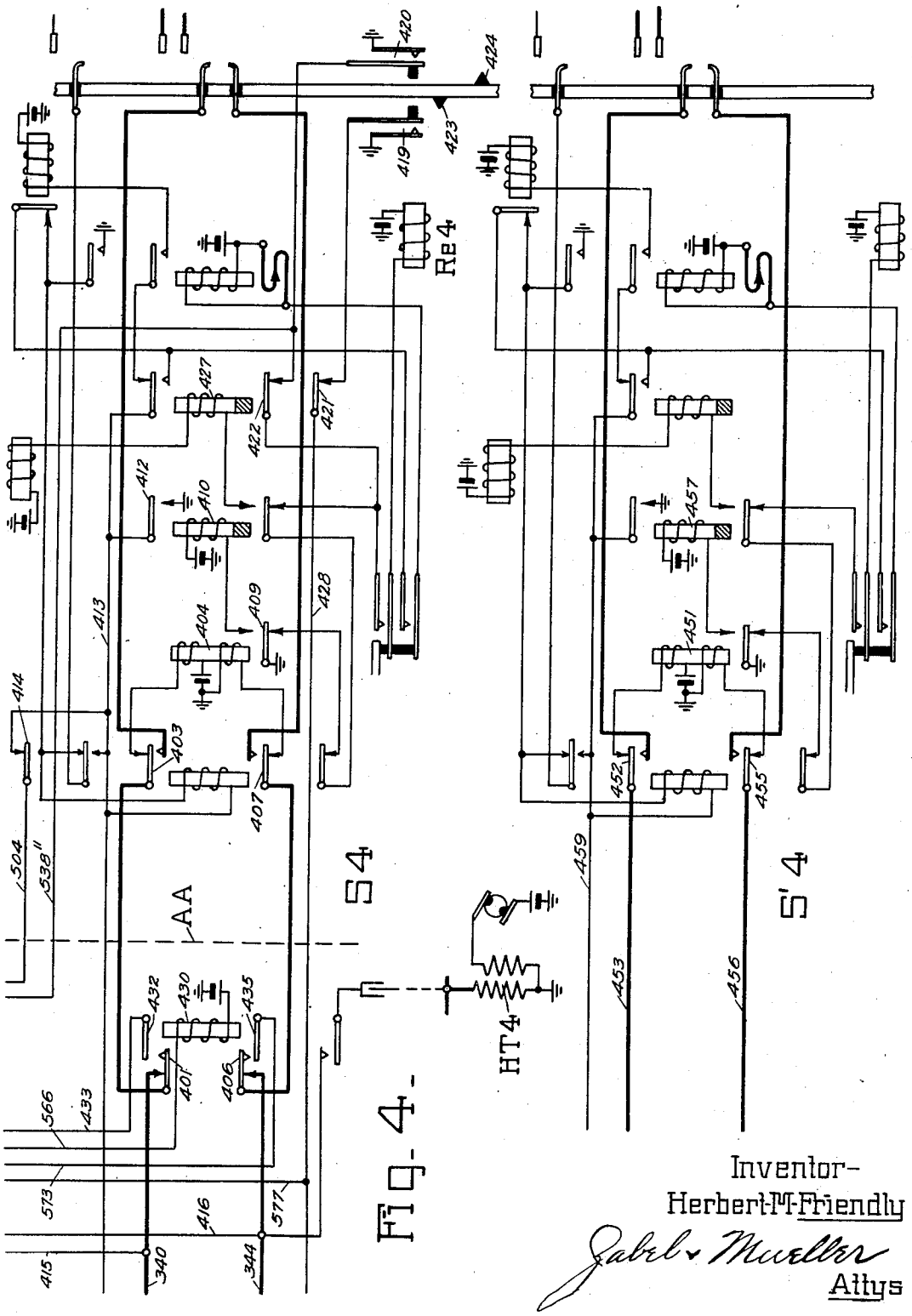


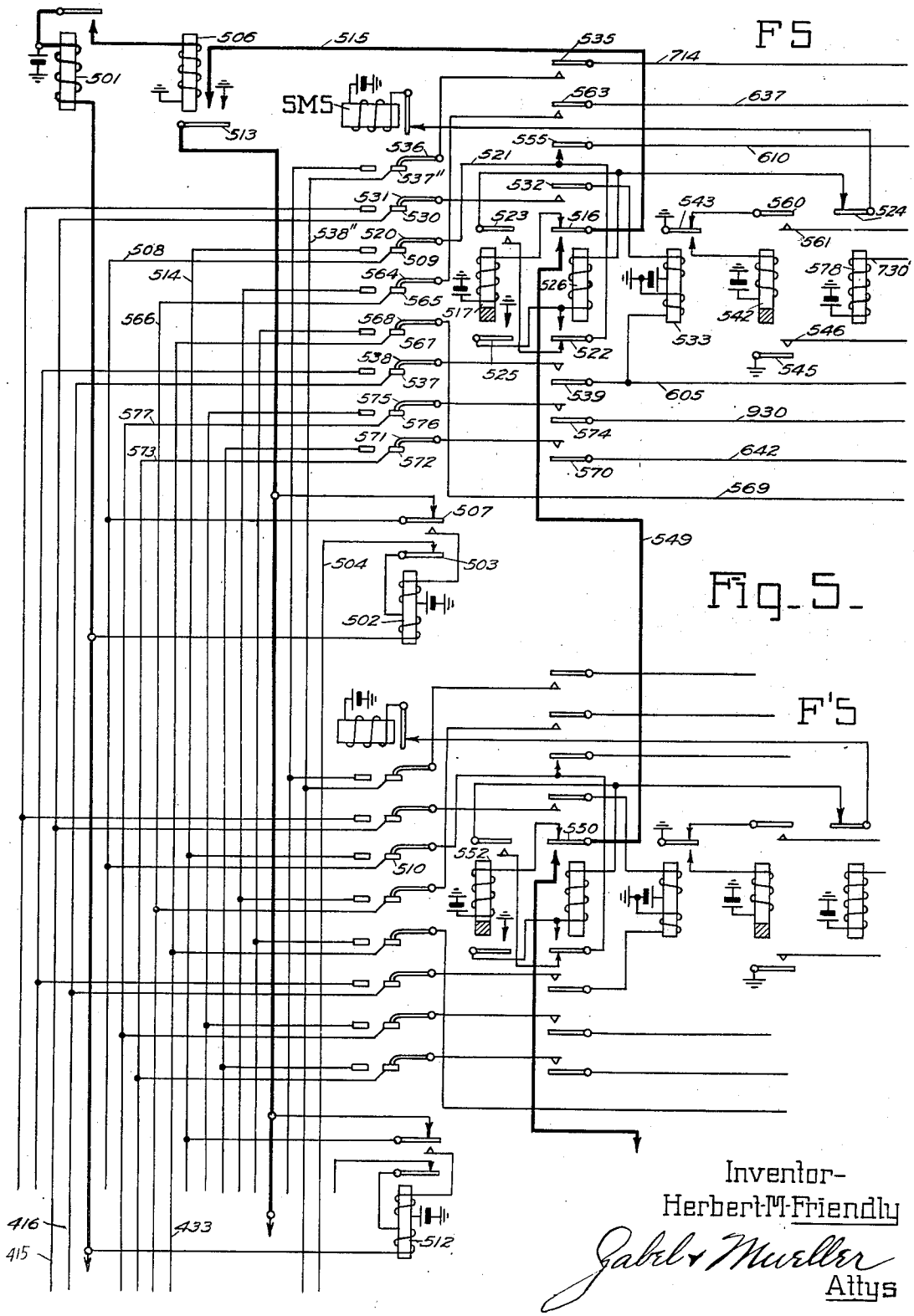
Fig. 4.

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TELEPHONE SYSTEM

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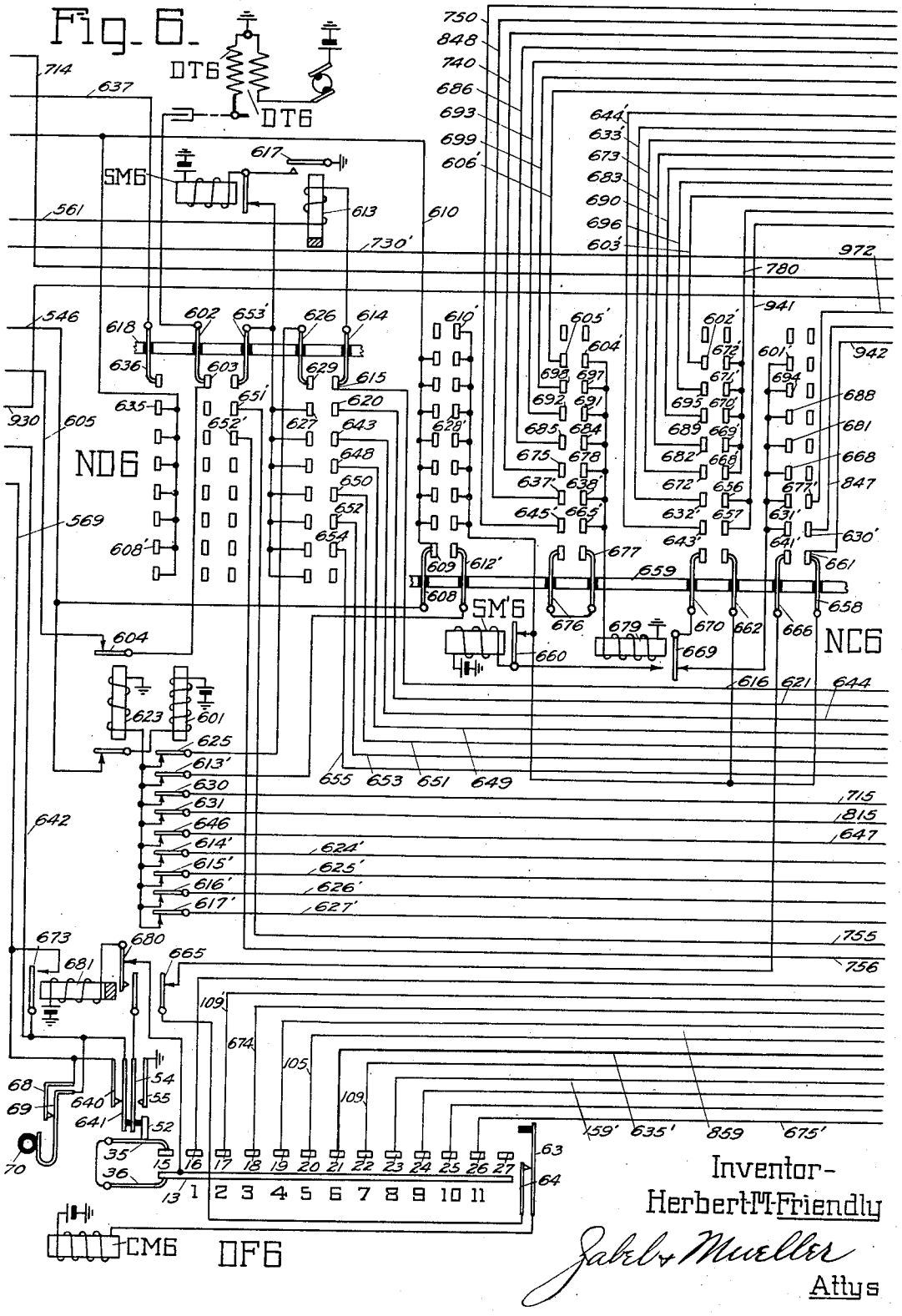


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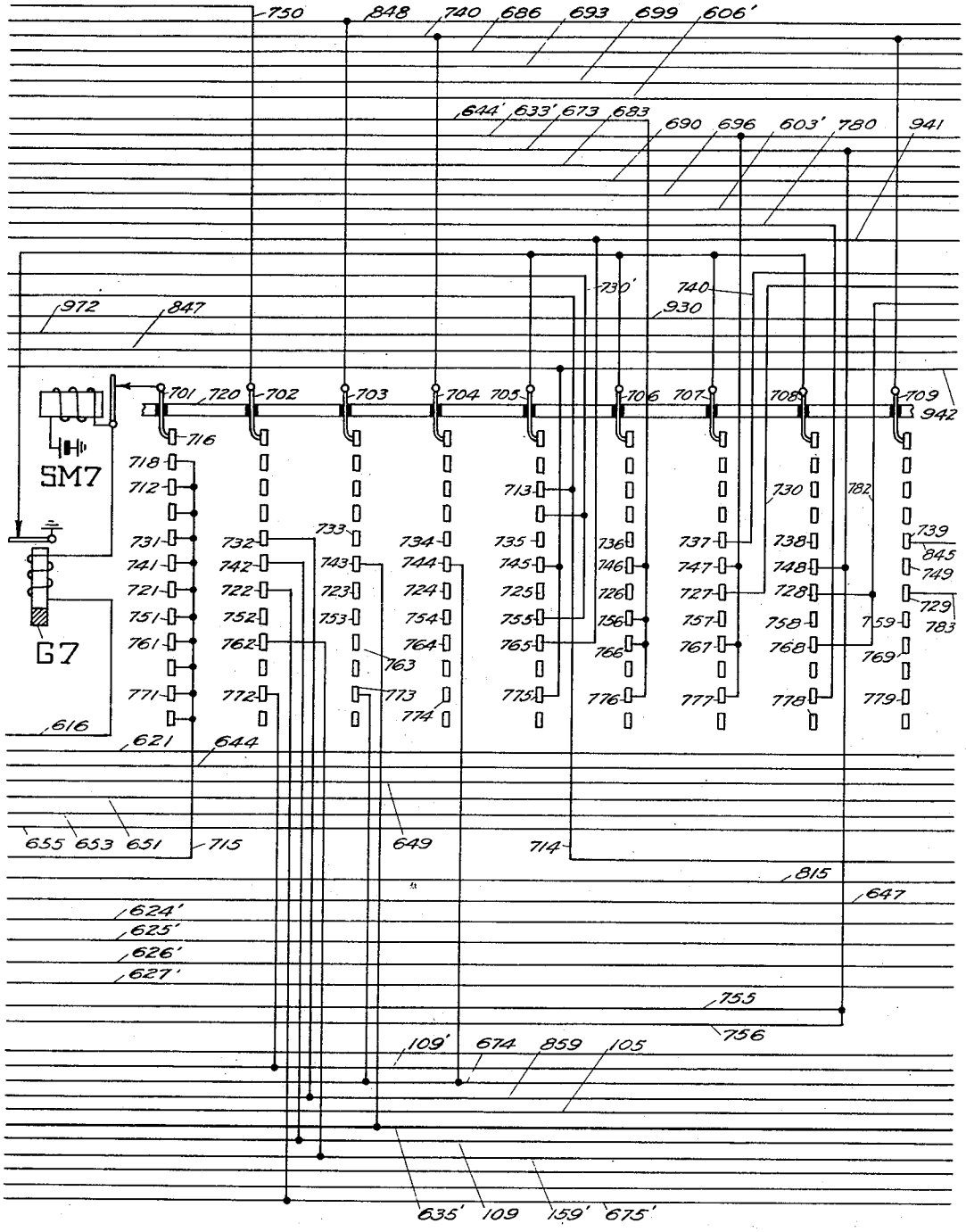


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Fig. 7.

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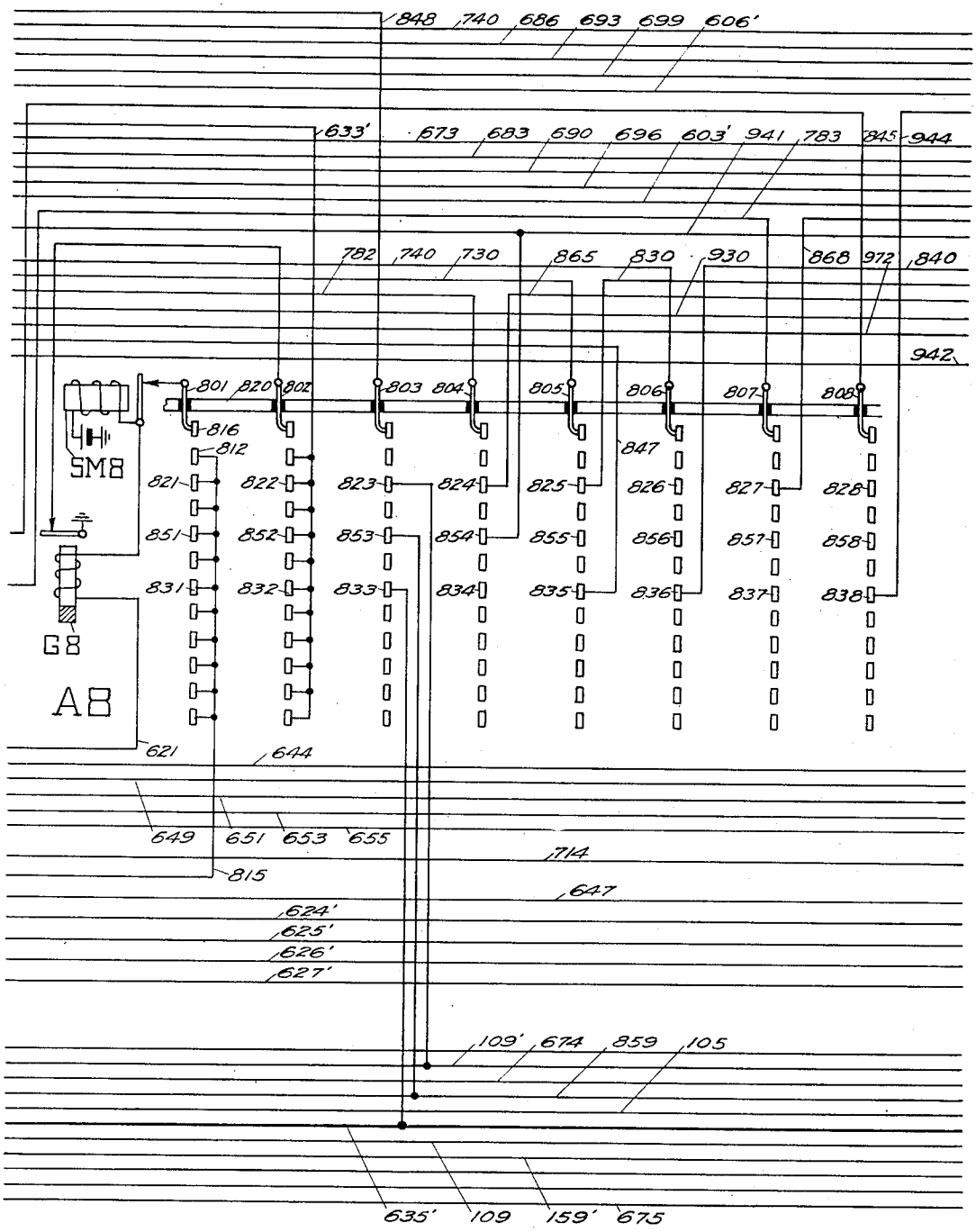


Fig. 8.

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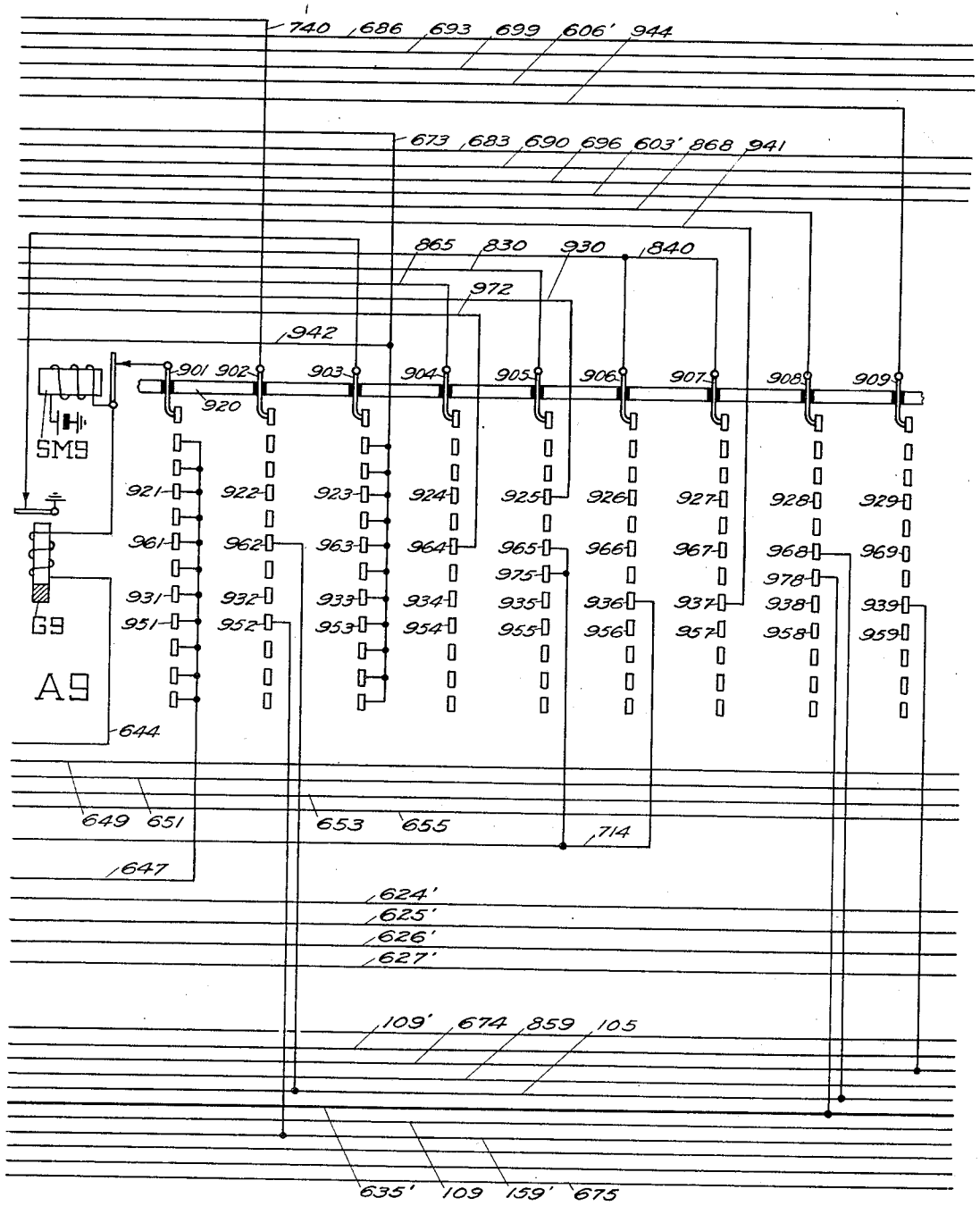


Fig. 9.

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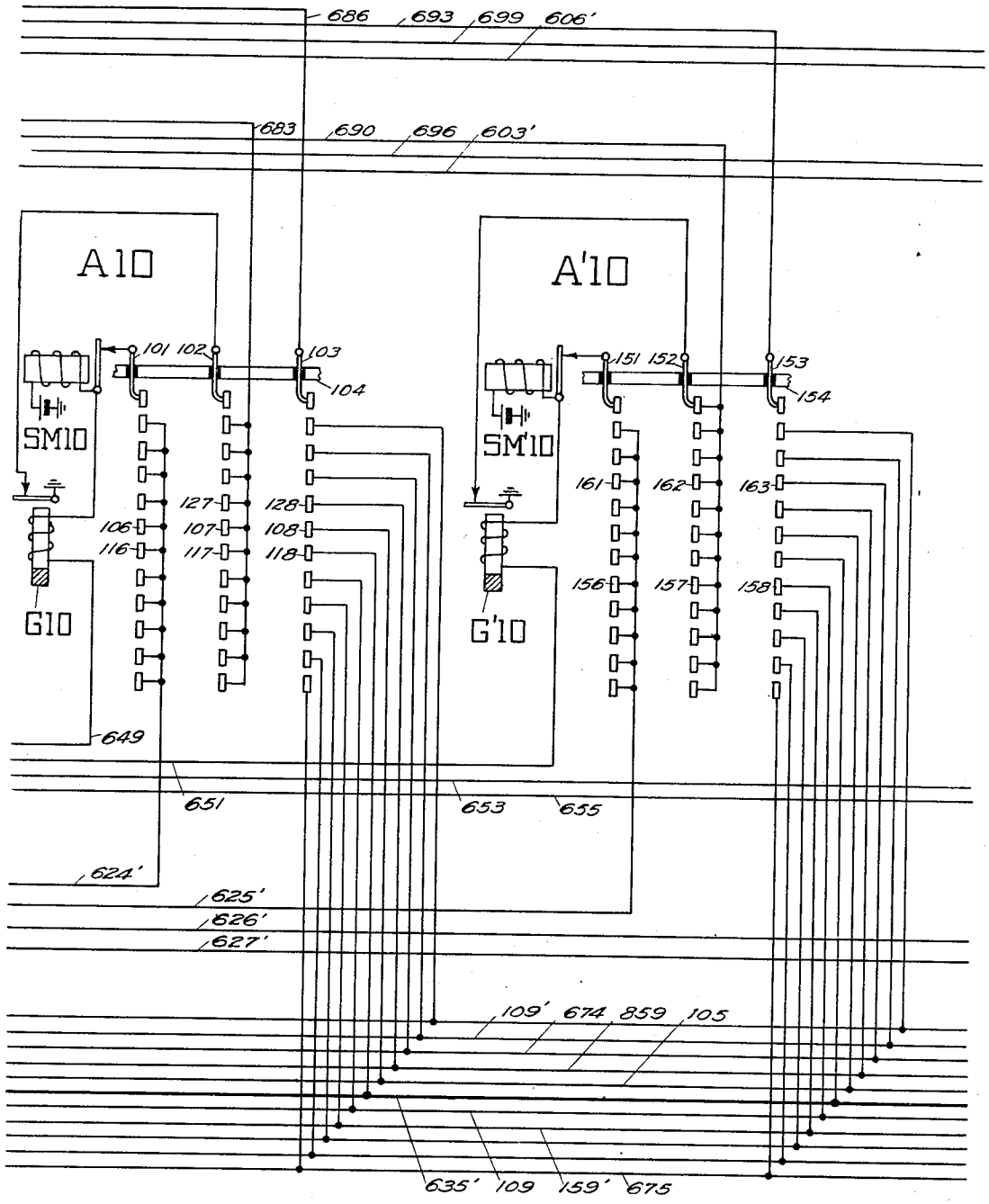


Fig. 10.

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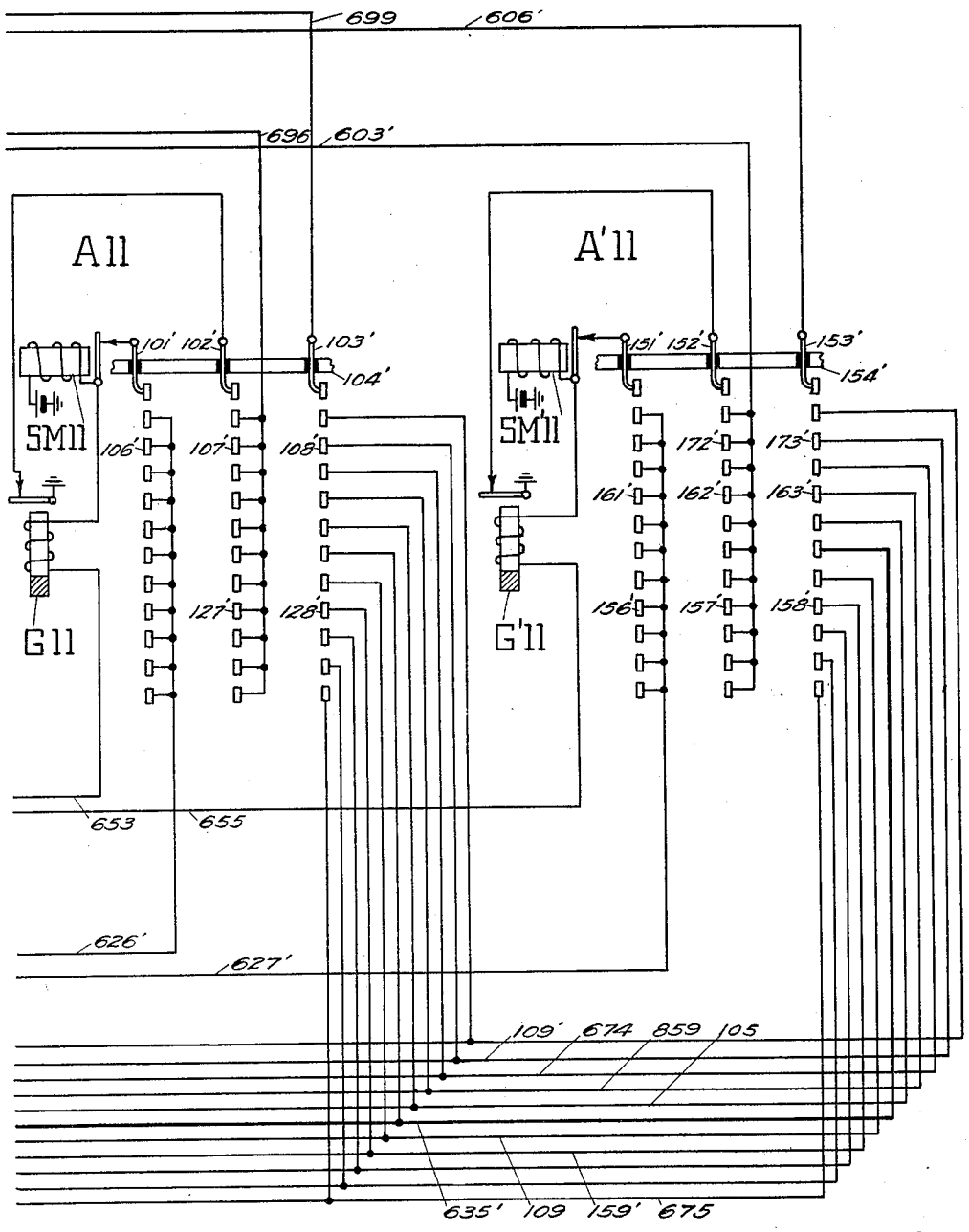


Fig. 11.

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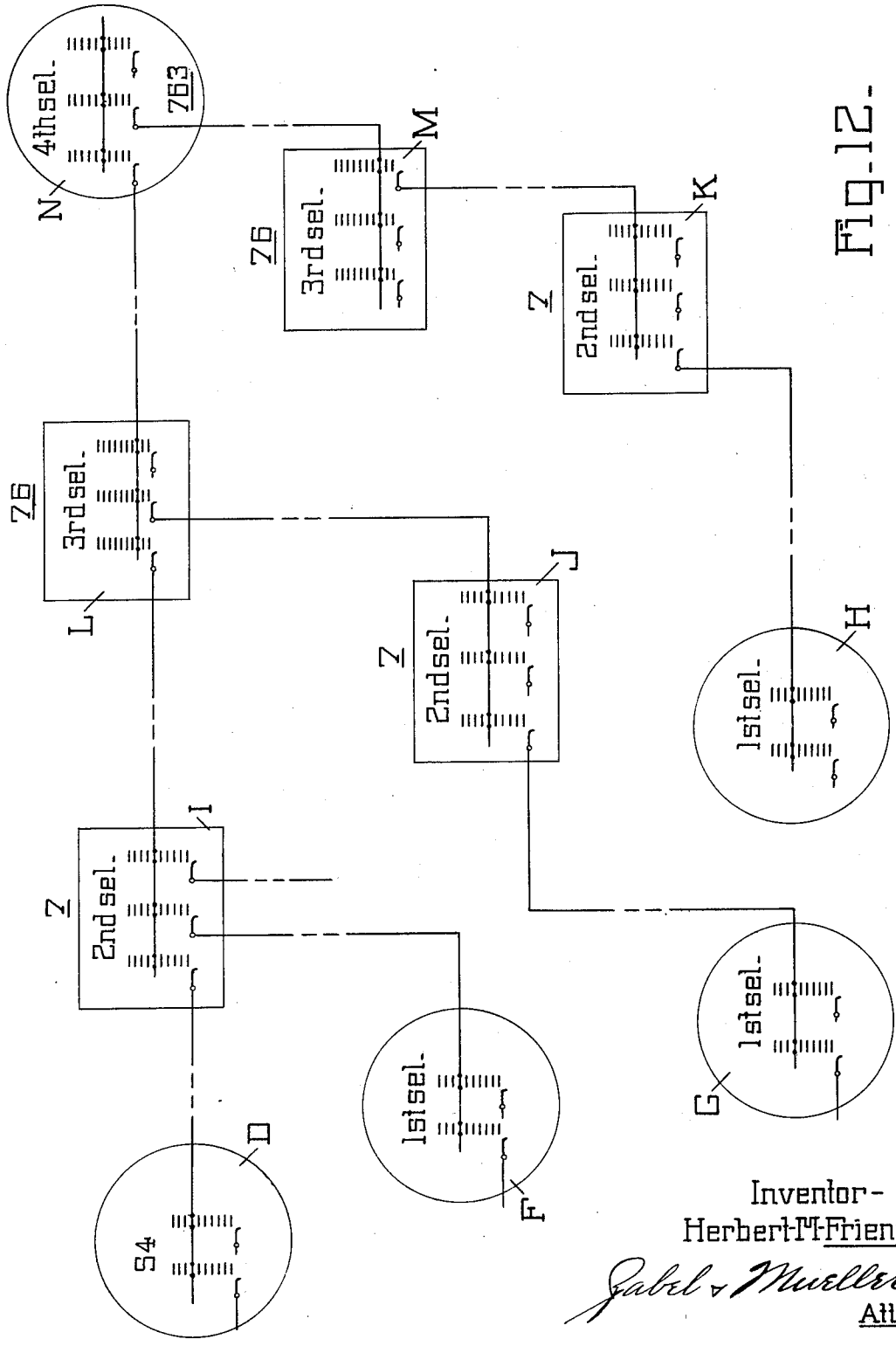


Fig. 12.

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Fig. 14.

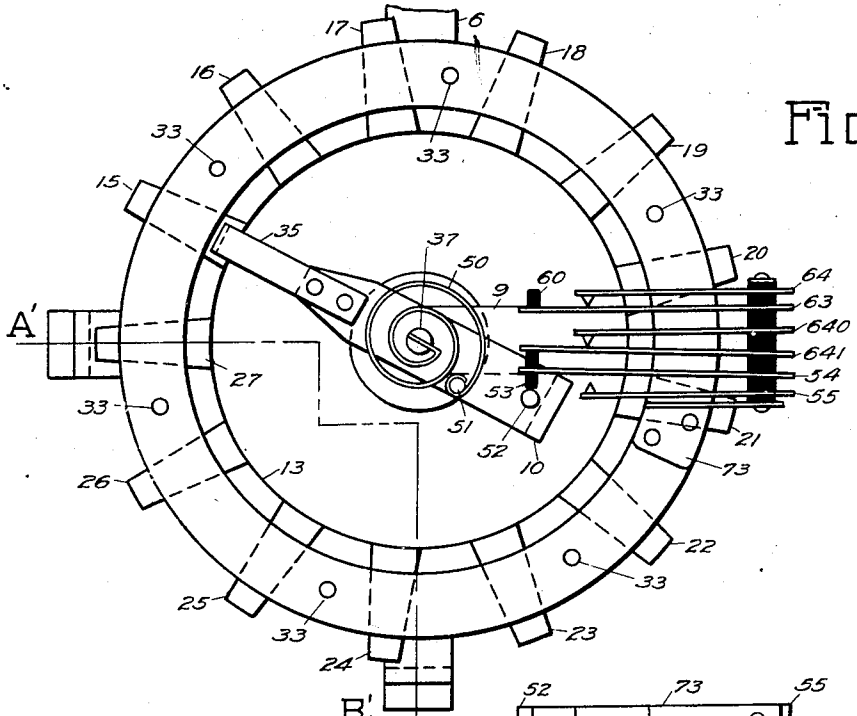
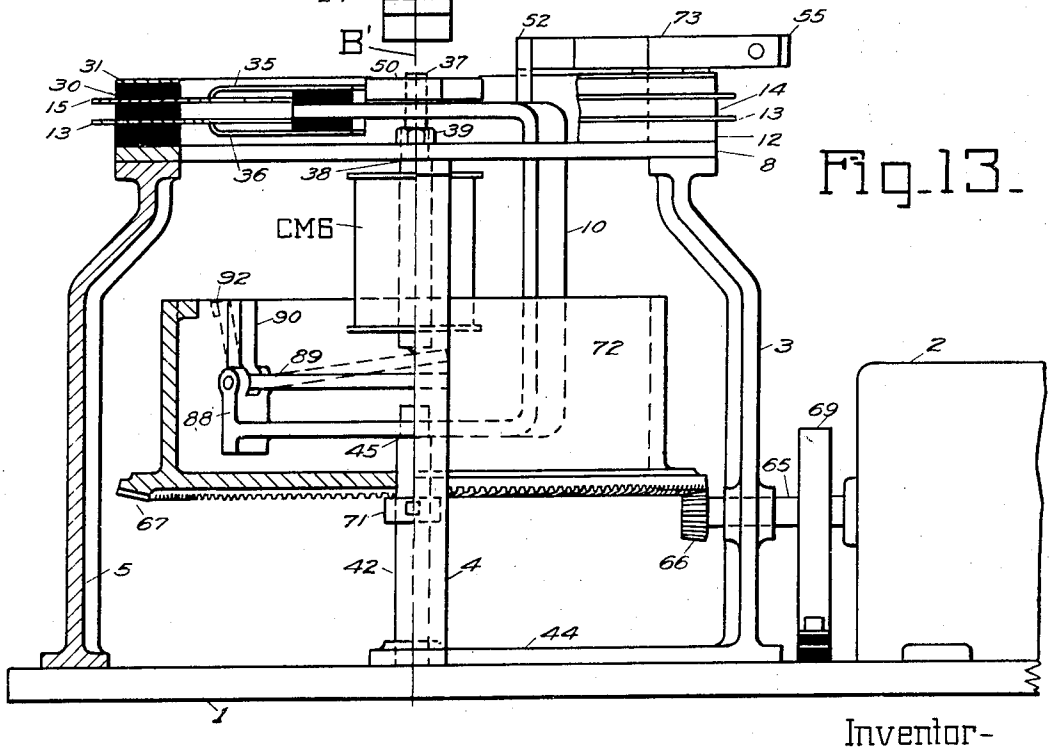


Fig. 13.



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Fig. 16.

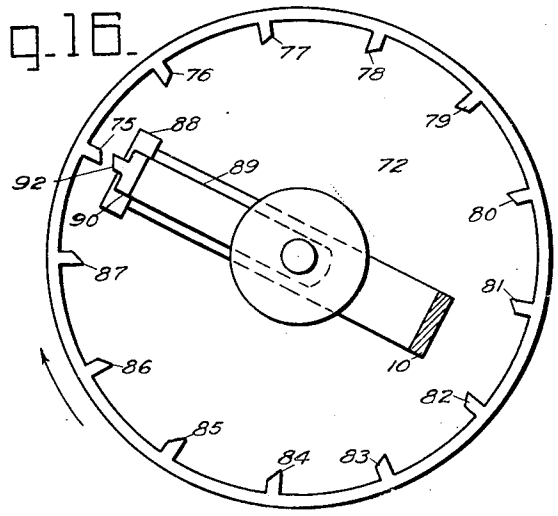


Fig. 20.

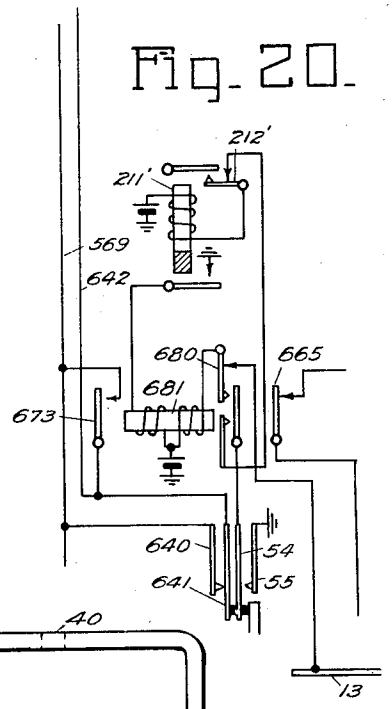


Fig. 19.

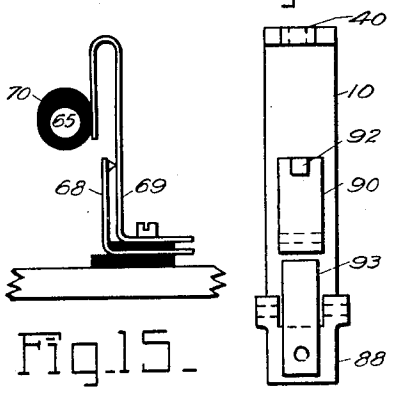


Fig. 15.

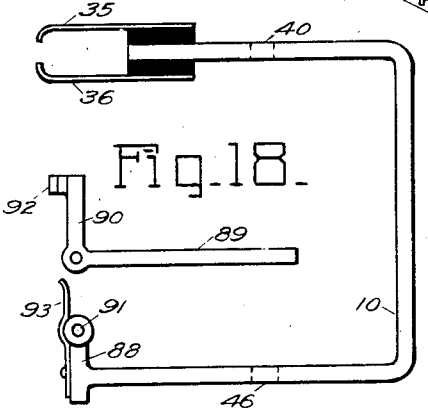


Fig. 18.

Fig. 17.

	5	6	7	8	9	10	11
3	4						

Fig. 21.

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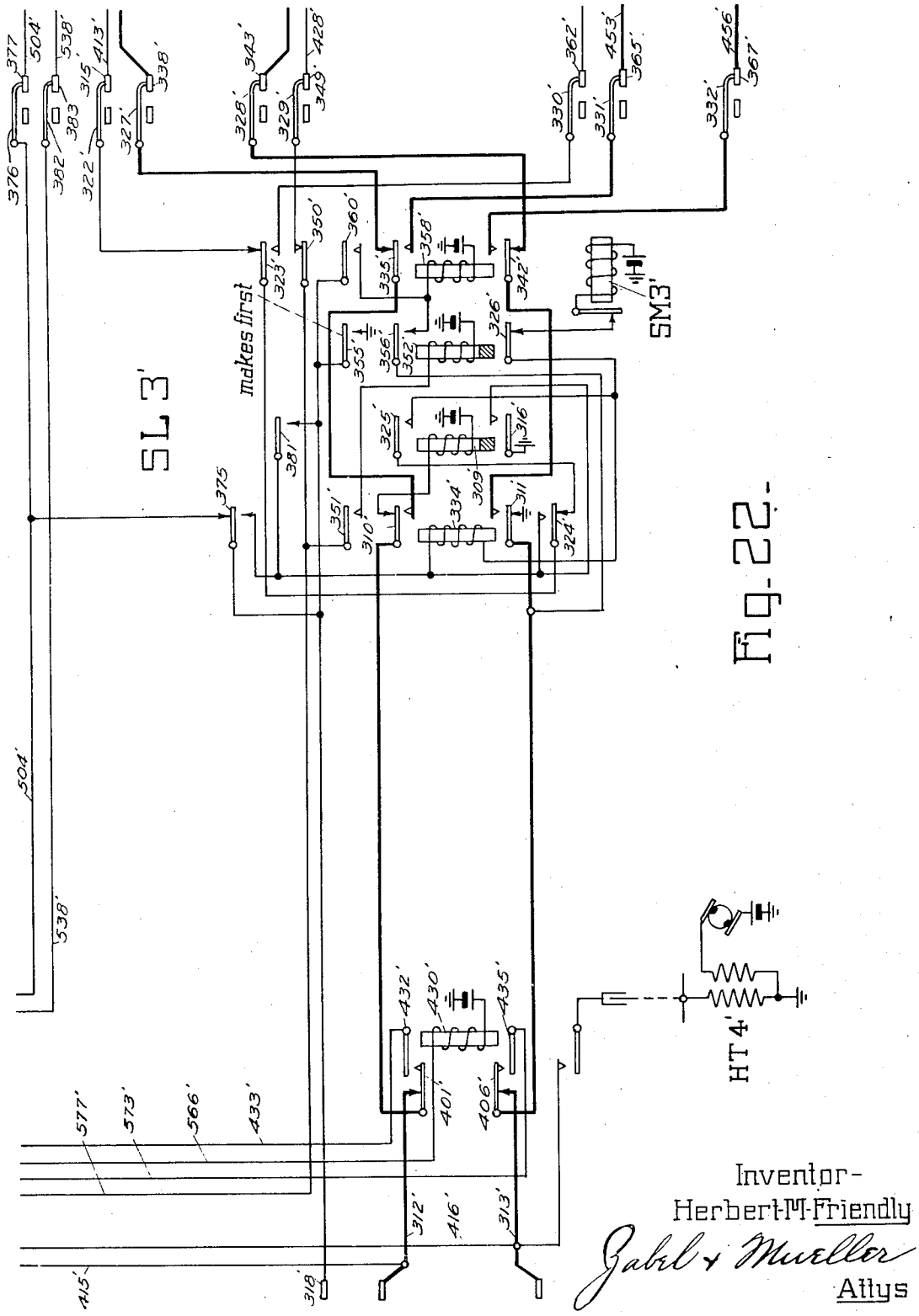


Fig. 22.

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Patented Jan. 30, 1934 1,945,467

UNITED STATES PATENT OFFICE

1,945,467

TELEPHONE SYSTEM

Herbert M. Friendly, Portland, Oreg.; Milton S. Friendly and Central Republic Trust Company executors of said Herbert M. Friendly, deceased

Application October 20, 1922. Serial No. 595,832

58 Claims. (Cl. 179—18)

The present invention is directed to automatic or machine switching telephone systems; more particularly to systems of the stated general type which contemplate directively progressing a call from a calling station, through the agency of a so-called finger-hole dial calling device, to a called station, wherein mechanism is interposed, the purpose of which is to receive and store the directive impulses sent from the calling station, and re-send them self-controlled, effective to link the connection from the calling to the called station.

Devices of the present invention are applicable to variations of the stated system, and in fact, to automatic or machine switching systems wherein intermediate storing of directive impulses is not effected, but where the switching mechanism is directly controlled from the calling station.

The present invention contemplates that, depending upon the destination of the call from any calling station, the directive impulses employed will be effective to setting up the connection positively, or setting up the connection through a storing of all or only certain of the directive impulses. That is to say, in certain calls the linking mechanism units will be positively operated; in other calls, part of the linking mechanism units will be positively operated, and part indirectly operated through the storage of the impulses received from the calling station and the automatically initiated sending of the stored impulses, and in other calls the linking mechanism units will be wholly operated indirectly from the stored impulses. In determining the method of completing calls to the various lines when organizing the system, in view of the last foregoing statements, considerations, such as the location of the called line with respect to the calling station, with reference to the "office" or ten-thousand group wherein the concerned lines terminate or lead from, are taken into account.

Where the calling and the called lines are tributary to the same ten-thousand group, for example, the calling party may be given an alternative calling number or digit train which will not only require a fewer number of digit series to be sent, but which will operate to apply the impulses (constituting the digits) directly to the linking mechanism without storing. Again, where the called line is located in a different ten-thousand group from the one containing the calling line, the latter said method will apply, wherein inter-office trunks will be employed in lieu of local trunks. Moreover, the invention contemplates that the said alternative calling number may be effective to setting up a condition in the storing mechanism whereby a greater number of digit series are re-sent than have been sent from the calling station. In the latter case, the storing mechanism interprets one or more digit series into a larger number of digit series, effective to the linking elements employed in extending the call.

In carrying out the invention in the exampled organization chosen to elucidate it, the calling line leads to a line switch of the well known primary type. The latter switch, in common with other line switches has access to a plurality of secondary line switches of the present invention, there being fewer secondary line switches than primary line switches. The traffic from calling lines is thus converged to a relatively small number of trunks leading to the secondary line switches. The latter stated plan, in general, is not new. However, the secondary line switch of the present invention, is novel, so far as I am aware, in that it has two sets of wipers, which will be referred to as primary and secondary wiper sets. Each said set of wipers has access to a specific group of trunks leading to corresponding groups of selectors. When the call is initiated, the primary line switch of the calling line will function in the well known manner to seize a trunk leading to the secondary line switch of the present invention. The latter said switch will forthwith seize, if its primary wiper set is resting upon bank contacts corresponding to an idle first selector, or it will hunt and seize an idle first selector. This functioning of the secondary line switch is generally similar to the functioning of the primary line switch, or of secondary line switches which are well known.

The trunks leading to the first selectors accessible to the primary wiper sets of the secondary line switches are also selectively accessible to finder switches, each finder switch corresponding to a companion, interlinked mechanism for receiving, storing and re-sending directive impulses in series constituting digits of called numbers, having in mind that the re-sent impulses may be interpreted from received series differing as to number of impulses in each series, and also differing as to the number of series re-sent with respect to the number of series received from the calling station. When a trunk is seized by a secondary line switch, a relay is operated which causes the first available finder switch to forthwith hunt for and seize the concerned trunk, in a manner generally similar

to the operation of finder switches in well known systems wherein finder switches seize calling subscriber lines responsive to a line relay thereof actuating. A tone (which will be termed a dialing tone), is applied audible to the calling party, when the finder switch has seized the trunk, providing the companion equipments are then ready to receive directive impulses which constitute the listed, or the referred-to alternative calling number corresponding to the called line; the latter in view of what switching center the calling line leads into, as will appear, presently.

Coincident with setting up a condition in the storing mechanism companion to the finder switch, responsive to the sending of the first digit series, the first selector will also operate responsive to the said first digit series whereby its wipers will be stepped up into alignment with the level indexed by the said first digit series sent. If the said first digit series sent, and which is that of the nominal first digit of the called number or its prefix, is the actual first digit of the effective calling number, the selector will rotate-in at the level attained and hunt for the first idle trunk leading to the successive linking switch. It will appear, presently, that the latter said switch may be in any of a plurality of numerical orders, depending upon what the first digit is. That is, the call may be destined to a called line requiring the sending of a train of seven digit series, or it may be destined to a called line requiring the sending of a train of but five digit series. In the latter case, as will appear presently, the called line may be reached by the calling party effectuating a train of seven digit series, alternatively, or in other words, sending two distinct digit trains from a specific calling line may, for example, be effective to setting up a condition in the storing mechanism specific to each digit train sent, but resultant to progress the call to the same called line. Thus, two distinctively different set-up conditions in the storing mechanism may actually constitute similar stored conditions.

An object of the said alternative calling numbers referring to the same called line from a specific calling station, and also other certain stations of the system, possibly, is to enable five pulls of the finger-hole calling device dial to effectuate a complete connection, in lieu of requiring seven, where the nominal capacity and organization of the exchange system contemplates seven numerical orders of digits. Where seven numerical orders are employed, the first three thereof may refer to the first three letters of exchange office name prefixes. These letters correspond to and are the equivalent of digits, since letters and digits will appear as separate designations of the same finger-hole on the dial calling device, used by general subscribers, and on keys of pre-setting devices, where switchboard operators are concerned as the calling party. The letters are employed for psychological reasons, since a number made up of seven digits would be difficult to retain in the mind, and would therefore lead to annoyance due to transposing digits. Finger-hole calling devices having auxiliary letter designations to the numerical designations of the finger-holes have been used heretofore, and are well known. However, the present invention contemplates supplementing the latter referred to method with a name or office prefix with regard to certain finger-holes, so in the event a call is to be made to the ten-thousand group corresponding to the indicated name, the corresponding finger-hole may be pulled, followed by the last four digits of the wanted line number. The latter will mean that five pulls of the dial will transmit the complete call, though the nominal organization of the system contemplates seven pulls of the dial, and that the latter number may be alternatively employed in the latter exampled call, by pulling the dial three times with reference to lettered holes in lieu of one time with reference to the said named hole. The named hole may also be indicated by a letter or letters, and it would, in any event, be indicated by a numeral. Thus, the named hole may be designated by two supplemental letters and a numeral; four designations having the same numerical value.

With regard to the name designations on the dial, it will appear, presently, that the dials of the different ten-thousand groups may have different names at the same numerical position. Moreover, this difference may refer to divisions of the same ten-thousand group. Thus, a certain prefix name, such as "Main", for example, may be placed radial with the "2" hole of the dial with relation to a certain ten-thousand group of subscribers' telephones, while with relation to another said group, the prefix name "Central", for example, may be placed radial with the "2" hole. The pulling of "2" in one case will trunk the initiated call to the "Main" ten-thousand district, and to the "Central" ten-thousand district in the other. The last four digits of the listed number will be sent to complete its transmission bearing in mind that the "2" sent may, in each said instance, cause the storing mechanism to interpret the said "2" into one or more predetermined digits, and transmit them, or the said "2" may be directly effective (irrespective of the storing mechanism) to extend the initiated call to the point contemplated, as if the listed first three pulls had been sent in lieu thereof. It will appear, presently, that the location of each office district and the traffic and other factors, will determine by what method an initiated call will be extended responsive to the calling dial, whether the listed or the alternative calling number (if an alternative calling number is provided for), is sent by the calling party.

In a large exchange, such as would require seven-digit numbers, ten-thousand or other line-group units, will be centered in various parts of the exchange territory, as determined from economic and other well known considerations. Direct and indirect (tandemed) trunk lines will serve as links in connections between calling and called lines which do not belong to the same said line group. One or more of the first digits of the listed calling number of a called line are representative of the trunk line links. That is to say, if the line group units are assumed to comprise ten thousand lines each, the first three digits of the seven will be effective to progress the call through the auxiliary switching links to the line group unit containing the called line.

From the last foregoing, it will be manifest that where a call is from one to another line of the same group unit, three of the digits sent will be idle digits, in that should the said unit be the only one, but four calling digits would be required. The seven digits will usually be required in the listed calling numbers to avoid confusion and the necessity of supplying special telephone directories for each ten-thousand group, if the latter were practical. Where a subscriber calls

lines of his own group from the listed number of seven digits, it thus means that seven digits must be called in each instance. The latter requires more time and effort on the part of the subscriber, and a longer equipment holding time is entailed in completely progressing a call than would be the case were a less number of digits necessary on calls within his unit, or on local calls, as it will be termed. The present invention contemplates that where the call is destined to a local line, but five pulls of the calling device dial will be required through the use of the alternative calling number, though seven pulls will ordinarily be required where the call is destined to a remote group. It will appear presently, that calls may be likewise completed to called lines in certain remote units by five pulls of the dial. The latter would be employed where a considerable percentage of calls from a particular district or districts are destined to a certain remote district or districts, having in mind that it is possible to divide ten-thousand groups so that pulling the same nominal hole first will refer to a different district, the holes being designated correspondingly on the dials of the said divisions of a ten-thousand group. It is thus manifest that where the subscriber's dial has the special designation or designations thereon, the subscriber can progress a call to lines of the corresponding ten-thousand group with five pulls of the dial, or he may also do this by pulling the listed number of seven pulls. In this case, the subscriber may pull three times as a prefix, or he may pull one time as an equivalent prefix.

Other objects of the invention, and the invention itself will be understood from the following description, having reference to the accompanying drawings in which:—

Fig. 1 is a diagrammatic circuit layout showing the trunk routes and the various corelated equipment elements.

Fig. 2 is a diagrammatic layout of a portion of the system contemplated in the invention, in view of Fig. 1.

Fig. 3 shows a subscriber's telephone leading to a line switch PL3. The said line switch, in common with other line switches of its group, has access to secondary line switch SL3, and other secondary line switches of the group containing switch SL3. The secondary line switch SL3, in common with other secondary line switches of its group, has access to alternative groups of selectors, S4 and S'4 in Fig. 4 being selectors of each of two groups, respectively.

Fig. 4 shows the said selectors S4 and S'4. These selectors each have access to selectors of a successive numerical order as shown in Fig. 1.

Fig. 5 shows the first two of a group of finder switches F5 and F'5 having access to selector S4 and other selectors of its group.

Fig. 6 shows a numerical order distributer switch ND6, a numerical order commutator switch NC6 and a digit finder switch DF6. The latter said switches are interlinked with and companion to finder switch F5.

Fig. 7 is the first numerical order storing switch A7, arranged to store the first digit sent. It is also arranged to store the second and third digits sent under special conditions.

Fig. 8 is the second numerical order storing switch A8.

Fig. 9 is the third numerical order storing switch A9.

Fig. 10 shows the fourth and fifth numerical order storing switches A10 and A'10.

Fig. 11 shows the sixth and seventh numerical order storing switches A11 and A'11. Switches in Figs. 6 to 11 are companion to finder switch F5.

Fig. 12 is a diagrammatic layout of the system, showing the method of sub-dividing tandeming centers.

Fig. 13 is an elevation of the digit finder switch DF6 of the present invention.

Fig. 14 is a plan view of the digit finder switch DF6.

Fig. 15 is a detail of the directive impulse springs of the digit finder switch DF6.

Fig. 16 is a plan view of the clutch and cooperating clutch-claw and the supporting yoke, sectioned on line with the top of the clutch of the digit finder switch DF6.

Fig. 17 is an elevation of the said yoke of switch DF6.

Fig. 18 is the clutch-claw and armature of the yoke.

Fig. 19 is an end elevation of the yoke and clutch-claw (shown in Figs. 17 and 18) assembled.

Fig. 20 shows the preferred means of modifying Fig. 6 to insure that the interval between digit series will be more nearly equal, regardless of the number of impulses in the various series.

Fig. 21 is a diagram showing the way of assembling the circuit drawing figures to display the exampled system, disclosing the present invention.

Fig. 22 shows a modification applied to Figs. 3 and 4.

It will be clear, presently, that where the first digits sent from the subscriber's calling device is that listed in the general subscriber directory, and that it also indexes the level the first selector will rotate-in at in the progression of the call, the storing mechanism will not re-send this first digit, nor will the first selector automatically restore forthwith. The storing mechanism will receive all digits sent by the calling party under the condition of storing any of the digits, but the second digit will, in this case, be the first one effective to being re-sent to the second selector through the operated first selector by way of progressing the call. If the first digit sent by the calling party is not numerically indicative of the bank level accessible to the first selector which will be concerned in the call, the first selector will forthwith restore, after which it will be forthwith re-operated from the storing mechanism, so it will be caused to rotate-in at the proper level. This will be followed by the remainder of the digit train pertinent to the called line, as interpreted by the storing mechanism from the digits received by it, having in mind that in many instances all digits following the first will correspond numerically with the digits sent from the subscriber's station. Where the first digit sent by the calling party is the one which in itself designates the ten-thousand group containing the wanted line, the first selector will rotate-in at the numerically corresponding level and progress the call over the first idle trunk to the fourth selector in the latter said group. Succeeding digits sent by the calling party will be directly effective in progressing the call in the latter said group, the storing device becoming released from the connection and subject to other use incidental to the sending of the said first digit by the calling party. It will therefore be understood that where an alternative digit train of five digits is employed by the calling party for his convenience, and the first digit sent by the subscriber is directly effective to the first selector

by way of progressing the call, the finder switch and storing mechanism converted consequent to the primary initiation of the call, will be released from the connection without its effective employment in the linking of the connection.

The releasing of the finder switch and the storing mechanism under the stated condition operates to reduce the number of finder switches and companion storing equipments necessary for a given installation, since the converted latter said equipments will be forthwith available for use in a subsequent call, though the former call may not yet be completed to the wanted line. Again, where the call is progressed directly from the calling device at the subscriber's station, the time of completing the connection will be coincident with the termination of the last digit of the called number, whereas, where the directive impulses are first stored and then re-sent, a very noticeable delay occurs after the calling party has finished his sending, before the connection becomes established. The latter has the effect of delaying the calling party and of holding converted storing and linking equipments. In a large exchange system the latter idleness factor may aggregate a considerable equivalent holding period, and therefore necessitate an appreciable percentage of additional storing and linking equipments to offset the said idleness factor.

Where the calling party employs the alternative calling number consisting of five digits, and the first digit is not directly effective, the storing mechanism will interpret the first digit into the digit or digits and then send them by way of linking the call, having in mind that under the stated condition the first selector will automatically restore consequent to the sending of the first digit, to be forthwith re-operated from the storing mechanism in accordance with the first digit of the interpreted digit train. In this connection, it will be understood that the first digit (of five) sent by the subscriber, under the condition will either be directly effective in progressing the call, or a plurality of digits will be interpreted from the first digit wherein the first digit re-sent will not be the same as sent by the calling party, but this latter statement does not positively hold. That is to say, it will possibly occur that the first digit will be effective to directly progress the call through the first selector (which remains set) and at the same time set up a condition in the storing mechanism whereby one or a plurality of successive digits will be sent through the first selector effective to linking successive switches. In the latter case, the successive digits sent by the calling party, following the first, will be re-sent by the storing mechanism.

A modification of the stated arrangement is shown, whereby when the calling party sends the listed seven digits in lieu of the alternative five digits, the storing mechanism will operate to disconnect the secondary line switch primary wipers and connect the secondary wipers thereof, causing the said secondary line switch to then hunt and seize the first idle trunk leading to a fourth selector, the call being thereafter directly progressed from the calling telephone, the storing mechanism being released from the connection consequent to the sending of the third digit. The latter stated modification will apply where the secondary line switch will re-hunt consequent to the sending of a corresponding digit, where five digits constitute the alternative calling number.

A feature of the storing mechanism of the present invention is that when a digit train is sent from the storing device, the intervals between the digit series thereof will be practically equal, regardless of the number of impulses constituted of each digit series. This condition operates to shorten the period of re-sending by the storing mechanism to the possible minimum. The storing mechanism is released at once upon its sending the last digit series, so that it may be forthwith converted to the uses of another call.

Referring to Fig. 1, the dotted enclosure denotes that the enclosed equipment elements are located in or are subordinately tributary to the same ten-thousand group. In the present exampled instance, the storing mechanism is located in enclosure A, though it will be understood that the other groups may be likewise equipped with storing mechanisms. That is, the specific descriptions will be applicable to other groups of the exchange system, possibly modified. Connections linked within the said dotted enclosure will involve so-called local trunks only, while connections extending to remote groups will involve so-called inter-office trunk lines. The latter may comprise a plurality of trunk line sections interlinked at so-called tandeming centers.

The various equipment elements will be comprehended in view of the following references to the third edition of "Automatic Telephone Practice" by Harry E. Hershey. The subscribers' telephones or sub-stations are the usual common battery series type including a dial calling device as described on pages 16 to 19; the primary line switch PL3 is as described on pages 53 to 55; the finder switches F5 and F'5 are of the general type as the finder switch described on pages 56 and 57, though modified to operate in accordance with the present invention; the various selectors are as described on pages 59 to 62, having in mind that the selector S4 is modified to operate in accordance with the present invention; the connectors are as described on pages 36 to 40; the secondary line switch SL3 is of the same general type as PL3, though modified to operate in accordance with the present invention; the rotary elements of the impulse storing mechanism, wherein a stepping magnet is employed, are of the general type as PL2 as to mechanical structure, having in mind that the said elements operate both directively and selectively.

The detailed operation of the system will be comprehended in view of the calls which will be exampled. It will be understood, of course, that the descriptions and the illustrations do not purport to be exhaustive; only enough of the system contemplated in the invention being shown and described as has been thought necessary to a full and complete disclosure of its operating principles and structure, since each commercial embodiment of the invention will incorporate detailed modifications or amplifications to the system exampled, in order to meet the traffic and service peculiarities to be satisfied in the community to be served.

With further reference to Fig. 1, the indicated selectors have their numerical order designated by an under-scored numeral. The telephones are indicated by small circles; the line switches (primary and secondary, combined) by small squares, and the connectors by the letter C underscored. Where a trunk link has a dotted portion, it indicates the trunk is an inter-office one, perhaps leading to or from a tandeming center, or a ten-thousand group. The calling telephone

T3; the primary line switch PL3; secondary line switch SL3; first selector S4, and first selector S'4 are correspondingly designated specifically.

With reference to Fig. 2, it will be understood that the seven-digit system contemplated, will have a potential capacity of one hundred ten-thousand line-groups for each of the ten holes of the dial calling devices employed on the telephones of the subscribers, or a total of one thousand ten-thousand line-groups. The latter may be divided into one hundred hundred-thousand line groups, each latter said group being made up of its component ten ten-thousand groups. The large circles designated B, C, D and E each indicate a hundred-thousand group. The small circles within the large circles designate a component ten-thousand group. The squares designated 4, 6, 7 and 8 (all under-scored) each indicate a so-called primary tandeming center. The squares 46, 62, 76 and 84 (all under-scored) each indicate a so-called secondary tandeming center. The squares 2' and 3' (both under-scored) each indicate a tandeming center in a route to a special switchboard LD, which may perhaps be the toll recording switchboard.

It will thus appear, in view of the last foregoing, that if a call is initiated at telephone T3, the first selector S4 will be automatically reached through the primary and secondary line switches. The selector S4 has eleven levels (or more, perhaps), each said level having a group of trunks which may extend to a tandeming center. For example, trunks from the fourth, sixth, seventh and eighth levels lead to the "4", "6", "7" and "8" tandeming centers, respectively. The latter said trunks terminate in second selectors in the latter said tandeming centers. The said second selectors have ten levels (or more, perhaps), each said group having a group of trunks which extend to a secondary tandeming center. For example, trunks from the fourth level of the second selector *a* in the "8" center lead to a third selector *b* in the "84" secondary tandeming center. The said third selector *b* has ten levels (or more, perhaps), each said level having a group of trunks which lead to so-called "incoming" fourth selectors *c* in a ten-thousand group. For example, the fifth level of the said third selector *b* has trunks which lead to the selectors *c* of the "845" (under-scored) ten-thousand group of the "84" hundred-thousand group B. The said fourth selector *c* has ten levels, each of which has a group of trunks which lead to so-called "local" fifth selectors in the "845" ten-thousand group.

It is thus clear that the incoming fourth selectors *c* in the "845" ten-thousand group are reached responsive to three digit series, wherein antecedent first, second and third selectors have correspondingly functioned responsive to a train of successive series. The fourth digit series is effective to the local fourth selector *c*, determining the thousands group in the "845" ten-thousands group to which the called line belongs. The fifth digit series will then operate the fifth selector to determine the hundreds group of the selected thousands group to which the called line belongs, terminating the extended connection in a connector accessible to one hundred lines in the selected hundreds group. The last two of the seven digit series will serve to set the wipers of the connector on the bank contacts of the wanted line and signal thereon.

In view of the foregoing, it will be clear that sending digits "763" will progress the call to an incoming fourth selector *d* in the "763" ten-thousand group of the "76" hundreds thousand group C. However, as adverted to, certain ten-thousand groups may be reached by five pulls of the dial, and moreover, by including but three selectors antecedent to the connector, for example, the third level of selector S4 has trunks leading directly to incoming selectors *e* having access to the trunks common with the fourth selectors *u* in the "467" ten-thousand group of the "46" hundred-thousand group E. Also, the eleventh level of selector S4 leads to selectors *f* in the "62" secondary tandeming center, from whence trunks are accessible through the fifth and sixth levels to fourth selectors *h* and *g* in the "625" and "626" ten-thousand groups thereof. The latter implies but six digit series (re-sent, in the present instance, from seven sent by the calling party) to complete the call from the calling line to the called line. In this instance, the calling and called lines are in the same hundred-thousand group, though it will be manifest that the trunks leading from the eleventh level of selector S4 may extend to incoming selectors in any other secondary tandeming center with reference to any other hundred-thousand group. Similarly, the trunks leading from the third level of selector S4 may extend to any other ten-thousand group of the system other than the "467" of the "46" hundred-thousand group E.

The alternative selector S'4, which it will appear, presently, is attained upon the calling party sending impulses corresponding to digit "2", may be alternatively located in any ten-thousand group of the system other than the "623" ten-thousand group containing the calling line, as shown. The levels of the selector S'4 (reached directly from the secondary line switch SL3), extend to thousands (fifth) local selectors *i*, thus entailing but four pulls of the dial to progress the call from the selector S'4 to the wanted line. It will be manifest, presently, that a single selector (or a plurality) may be introduced intermediate of the selector S'4 and the thousands selector *i* of the ten-thousand group to which the wanted line belongs. Under the latter condition, the completion of the call will involve six (or more) digit series, the said selector (or selectors) introduced intermediate of the selector S'4 and the thousands selector *i* will be located in a tandeming center, or centers. Where the selector S'4 is involved in a call, the storing mechanism, which is then associated with the selector S4 will not be concerned, since it will be vacated with its companion selector S4 upon the digit or digits being sent to cause the secondary line switch SL3 to seize the selector S'4.

With further reference to Fig. 4, the trunks leading from the bank contacts accessible to the wipers of the selectors S4 and S'4 are not shown connected. In view of the citations, and descriptions to follow, it is deemed that the disclosure with relation to the said trunks will be ample, since the trunks outgoing from the latter said selectors are indicated in Figs. 1, 2 and 12. It will be understood, in this connection, that the inter-office trunks will have impulse repeaters interposed, as has been a well known practice in systems of the general class, in order to translate from three-wire to two-wire operation, and for other reasons.

Assume that party at telephone T3 removes the receiver by way of initiating a call destined to telephone T, tributary to the same ten-thousand group, the listed calling number of which is

"623—4232", but which has an alternative calling number of "2—4232". A circuit path can be traced from the winding of slow-releasing line relay 301, armature 302, conductor 303, telephone T3, conductor 304, armature 305 to grounded resting contact, the relay 301 actuating, followed by switching relay 307, in the well known manner, the connection now including ground and slow-releasing line relay 309 of secondary line switch SL3, armatures 310 and 311 and conductors 312 and 313. Bank contact 315 being ungrounded due to the corresponding selector S4 being idle, no short-circuit will be applied to the winding of the stepping magnet SM3. Relay 309 will actuate, energized in series with telephone T3, and apply ground from armature 316, conductor 317, bank contact 318, wiper 319, armature 320, winding of relay 307 to the winding of stepping magnet PSM3. The latter said application of ground from armature 316 occurs before relay 301 has had time to deactuate, so no lapse of ground for maintaining relay 307 occurs.

If it is for the present assumed that bank contact 315 is grounded, due to the selector S4 being busy, this ground will be applied through wiper 322, armatures 323, 324, 325 and 326 to the winding of the stepping magnet SM3. The latter said magnet will operate, preparatory to causing the wipers 322, 327 to 332 (inclusive) to be advanced one step upon its deenergization, due to its armature interrupting its energizing path. This latter functioning will continue to re-occur as long as wiper 322 receives ground from an engaged bank contact.

In the case of wiper 322 not receiving ground from an engaged bank contact, which may be assumed in this instance to be the one (315) upon which it is resting when the primary line switch PL3 seizes the secondary line switch SL3, wherein relay 309 actuates, the winding of the switching relay 334 is not short-circuited. Thus under the latter condition the windings of the stepping magnet SM3 and the relay 334 become energized in the *a* series path, relay 334 only, actuating, due to the marginal adjustments. The secondary line switch SL3 has thus seized the trunk leading to the first selector S4.

A circuit path can now be traced from armature 310, armature 335, wiper 327, bank contact 338, conductor 340, make-before-break spring 401, armature 403 to the battery winding of line relay 404 of the selector S4, and from armature 311, armature 342, wiper 328, bank contact 343, conductor 344, make-before-break spring 406, armature 407 to the ground winding of relay 404, the latter said relay actuating. Grounded armature 409 operatively energizes slow-releasing relay 410. Armature 412 applies ground to private conductor 413 before armature 316 retracts, due to armature 310 having attracted, so the said ground on conductor 413 is applied through bank contact 315, wiper 322, armatures 323 and 324, conductor 317 to maintain the line switches PL3 and SL3 in seizure. The relay 404 being energized in the path including the telephone T3, should the receiver at the latter said telephone be restored, the relays 404 and 410 would deactuate, followed by relays 334 and 307, the circuits then being normal.

Consequent to conductor 413 becoming grounded, an operative circuit can be traced from the winding of common relay 501, lower winding of relay 502, armature 503, conductor 504, armature 414 to said 413. Relay 501 will actuate, followed by its local relay 506. Armature 507 will fully operate, but due to adjustments, armature 503 will not disengage its resting contact. Thus, conductor 508 attached to the private bank contacts 509 and 510, and others similarly accessible to finder switches, is applied to the upper winding of relay 502. Due to the attraction of the armature 513, all other private conductors, such as 514, will be grounded, so a hunting finder switch will not seize a bank contact attached thereto. Of course, should a second first selector companion to the relay 512, for example, become seized by a secondary line switch in lieu of seizing the selector S4, relay 512 will actuate and unguard (by ungrounding) its corresponding private bank contacts accessible to the finder switches. Under the latter condition, the hunting finder switch will seize at the first ungrounded private bank contact encountered. This will be the one corresponding to relay 512.

The wipers of the finder switches rest upon the last bank contact set seized when at normal, the two finder switches F5 and F'5 being shown resting upon corresponding bank contacts of different sets, which sets happen to be the sets corresponding to selector S4. In a commercial system, the sets of wipers of the various finder switches of a group would thus normally be deployed over the entire group of contacts, though obviously, such a condition as shown in the drawings is possible. That is to say, while the finder switch may have its wipers resting upon the bank contact set corresponding to the trunk requisitioning it, it will in most instances hunt over a plurality of guarded idle or busy bank contact sets before finding the said trunk.

Relays 501 and 506 being actuated due to the said grounding of conductor 413, a circuit path can be traced from grounded working contact, armature 513, common conductor 515, armature 516 to the winding of slow-releasing relay 517, the latter relay actuating. Assume for the present that bank contact 509 is grounded from conductor 508, because some other relay than 502 (possibly relay 512) has actuated, under which condition the conductor 508 will receive ground from armature 513 and armature 507. Relay 517 being actuated, a circuit path can be traced from ground assumed to be on bank contact 509, wiper 520, conductor 521, armatures 522, 523 and 524 to the winding of the stepping magnet SM5, the latter said magnet operating to interrupt its energizing circuit, whereby the set of wipers will be advanced to the successive set of bank contacts. If the wiper 520 again encounters ground, or in fact remains grounded, the said magnet SM5 will function as before, the said functioning continuing as long as wiper 520 receives ground from an engaged bank contact. When the wiper 520 fails to receive ground from an engaged bank contact, or if the one it is shown resting upon does not constitute ground when relay 517 actuates, the magnet SM5 will not be energized direct to ground, but a ground path from armature 525 through the winding of relay 526, armature 524 will energize both relay 526 and the magnet SM5. Due to marginal adjustments, relay 526 only, will operate under the latter condition. In this connection, it will be noted that while ground was assumed applied directly to the magnet SM5, armature 525 was attracted so that the winding of relay 526 is grounded at both its winding terminals and therefore is short-circuited.

When relay 526 actuates, as stated, the finder switch F5 thus seizes the set of bank contacts

its wipers are then resting upon. That is, the finder switch F5 has seized the trunk leading to selector S4. A circuit path now exists from the line conductor 340, conductor 415, bank contact 530, wiper 531, armature 532 to the battery winding of relay 533, and from line conductor 344, conductor 416, bank contact 537, wiper 538, armature 539 to the ground winding of relay 533, the latter said relay actuating, followed by the local slow-releasing relay 542 and relay 601, the attraction of grounded armature 543 energizing relay 542 and the attraction of grounded armature 545 grounding conductor 546, which leads to the winding of relay 601.

Tone from grounded source DT6 is applied through wiper 602, bank contact 603, armature 604, conductor 605, armature 539, wiper 538, bank contact 537, conductor 416 to conductor 344, audible to the party at telephone T3, indicating that the circuits and associated equipments are in readiness to receive the directive calling impulses. It will be noted that due to the attracted condition of armature 516, conductor 515 is disconnected from the winding of relay 517 and is applied over conductor 549, armature 550 of finder switch F'5 to the winding of slow-releasing relay 552, corresponding to relay 517. Thus, if relay 501 is again caused to actuate because of a new call being extended to a first selector of the group containing S4, relay 552 will actuate to cause the finder switch F'5 to function as described with relation to finder switch F5. Then, when armature 550 attracts, because of finder switch F'5 seizing, the next chained finder switch (not shown) will be connected to the conductor 515. That is, the finder switches wil have an order of operativeness, determined by the chaining of conductor 515.

Armature 545 being attracted, a locking ground path can be traced from conductor 546, wiper 608, bank contact 609, conductor 610, armature 555, armature 522 to the winding of relay 526, so there will be no lapse of ground at the lower winding terminal of relay 526 consequent to armature 525 retracting consistent with its retracting period. The latter said ground is also applied through wiper 520, bank contact 509, conductor 508, armature 507 to the upper winding of relay 502, causing the said latter relay to fully energize, whereby armature 503 is disassociated from its resting contact to unground the winding of relay 501 so far as conductor 413 is concerned. Conductor 508 being now grounded through the agency of the finder switch F5, the trunk corresponding thereto is permanently guarded against seizure by a hunting finder switch.

It is clear that the battery and ground windings of both relays 533 and 404 are in bridge of the talking conductors 340 and 344, so if the calling party manipulates the dial (calling device) at telephone T3, both the said relays 533 and 404 will vibrate their armatures correspondingly. The operation of the selector S4 responsive to the relay 404 will be understood in view of the citations, having in mind the added off-normal spring sets 419 and 420, together with their respectively associated armatures 421 and 422, and the added armature 414, constitute the only modification from the citation. The shaft of selector S4 has cams 423 and 424, which operate the spring sets 419 and 420 at the second and fifth levels, respectively.

It will be assumed that the calling party pulls the dial to send the impulses corresponding to digit "2", the dial being possibly designated with a ten-thousand group name prefix radial with the "2" finger-hole, the latter said hole being the one pulled. In the present instance, the "2" refers to the ten-thousand group containing the calling line, though it will appear, presently, that this "2" may refer to any ten-thousand group, and moreover, the "2" finger-hole of the calling device of the telephones tributary to the various ten-thousand groups may refer to various ten-thousand groups irrespectively, depending upon traffic characteristics. That is, if the "2" finger-hole is reserved for alternative calling for any ten-thousand group, the "2" hole will not be employed elsewhere in the system as a first calling finger-hole, unless said first calling refers to a calling number of five digits. In the exampled system, the "2" finger-hole of all the telephones tributary to all the ten-thousand groups may be designated for alternative calling to lines of the containing ten-thousand group, or to some other of various ten-thousand groups of the exchange. Of course, a plurality of finger-holes may be reserved for alternative, or for five-digit calling; in fact, the "3" and the "5" finger-holes of the exampled system are reserved for alternative calling, as will appear, presently.

The wipers of selector S4 will be stepped into alignment with the second level of bank contacts, the spring set 419 operating. The armature 543, upon its retracing two times (coincident with the retracting of armature 409) will apply two ground impulses through armature 560, conductor 561, winding of slow-releasing relay 613, wiper 614, bank contacts 615, conductor 616, series winding of slow-releasing relay G7 to stepping magnet SM7 of the "millions" numerical order storing switch A7. The magnet SM7 will thus actuate and deactuate two times, the relay G7 sustaining its armature over the lapse to temporarily disconnect ground from wipers 705 to 708, the wipers 701 to 709 advancing two steps responsive to the two deactuations of SM7. Wipers 701 and 705 will thus rest upon bank contacts 712 and 713, respectively; the other said wipers resting upon operatively dead bank contacts. Consequent to the attraction of armature 617 on relay 613, the stepping magnet SM6 will be energized, preparatory to advancing the wipers on shaft 618 (and incidentally disconnecting the tone source DT6), consequent to its deactuation, upon armature 617 retracting, following the second impulse applied through the winding of relay 613, the armature 617 sustaining over the brief lapses of a digit series. The functioning of the switch ND6 will be detailed presently.

Having in mind that the spring set 419 in selector S4 is operated, when the slow-releasing series relay 427 deactuates (practically coincident with the deactuation of relay 613), an operative circuit path is closed from ground, spring set 419, armature 421, conductor 428, bank contact 349, wiper 329, armatures 350 and 351 to the winding of slow-releasing relay 352, the latter said relay actuating. Armature 326 opens the energizing path for relay 334 to unseize the switch SL3, though ground is maintained on conductor 317 from conductor 413 until armature 355 has had time to attract, to ground said 317, so the primary line switch PL3 will not unseize. Consequent to the retraction of armatures 310 and 311, relay 309 will actuate, armature 316 applying ground to conductor 317 before armature 355 has had time to retract. At the time armature 311 retracts, ground on its resting contact is applied

from conductor 313, armature 356 to the winding of relay 358, the latter occuring before armature 356 has had time to retract. The relay 358 becomes locked through its armature 360 to conductor 317. Armatures 323, 335 and 342 being attracted, the secondary wipers 330, 331 and 332 are now operatively associated with circuits of said SL3, and the said switch is in a state of hunting with respect to the trunk leading to selector S'4 and to trunks leading to other selectors of its group, the armature 326 being retracted. The relay 309 being actuated, as primarily, the magnet SM3 will be operatively energized as long as wiper 330 receives ground from an engaged bank contact, so the wipers will be selectively advanced incidental to each retraction of the armature of the magnet SM3 due to its energizing path becoming opened by its interrupter armature. The wipers 322, 327, 328 and 329 will now have no operative effect on passed-over contacts, or on contacts they may be resting upon when the wipers 330 to 332 seize a trunk, due to armatures 323, 350, 335 and 342 being locked attracted until conductor 317 becomes ungrounded. Under the condition of armatures 335 and 342 attracting, relays 404 and 533, and their dependent relays, deactuate. When armature on relay G7 retracts, it applies its ground to wiper 705, bank contact 713, conductor 714, armature 535, wiper 536, bank contact 537'', conductor 538'', armature 422, off-normal springs to the release magnet Re4, operative to restore the selector S4 before relay 410 deactuates to energize the release magnet Re4.

Assume selector S'4 is idle when relay 358 actuates, bank contact 362 will be unguarded, therefore the winding of relay 334 will not be short-circuited, so the switch SL3 will seize. A circuit can be traced from the battery winding of line relay 451, armature 452, line conductor 453, bank contact 365, wiper 331, armatures 335 and 310, over the traced path including the telephone T3 to armatures 311, 342, wiper 332, bank contact 367, conductor 456, armature 455 to the ground winding of relay 451, the latter said relay actuating, followed by the slow-releasing relay 457. The actuation of relay 457 causes ground to be applied over conductor 459, bank contact 362, wiper 330, armatures 323 and 324, conductor 317, winding of relay 334, armature 326 to the winding of magnet SM3. Relays 334 and 358 are thus sustained dependent on ground being maintained on conductor 459 from ahead. At the present juncture, the ground on conductor 317 is dependent upon maintaining the closure of the seriesed path including the telephone T3 and the windings of relay 451. The call can now be progressed by the calling party annexing the last four digits of the number. The latter four digits correspond in both the listed number and the alternative calling number. By referring to Fig. 1, it will be clear that the fourth level of selector S'4 has access to a fifth selector *i*, and the latter said fifth selector, in turn, has access to a connector. The connector has access to the wanted line leading to telephone T. The operation of the equipments involved in the call from the time selector S'4 is seized, will be clearly understood in view of the citations.

Due to relays 533 and 542 deactuating, ground will be removed from conductor 546 by armature 545, relay 601 deactuating. It will be noted here that when armature 543 retracted, the armature 560 is briefly sustained, so a false ground impulse is applied from armature 543, armature 560, conductor 561, winding of relay 613, wiper 614, bank contact 620, conductor 621 to the winding of stepping magnet SM8 of the "hundred-thousand" numerical order storing switch A8, energizing said SM8 preparatory to advancing the wipers of switch A8 one step consequent to its deenergization, when armature 560 retracts.

At the time ground is removed from conductor 546, this ground is removed from conductor 610 and armature 555, unlocking relay 526, to unseize the finder switch F5, whereupon it is then normal. The relay 601 being normal, a circuit path can be traced from ground, winding of relay 623, armature 625, wiper 626, bank contact 627 to the winding of magnet SM6, the latter said magnet operating to advance the wipers on the shaft 618 upon its interrupter armature opening its energizing path, the latter functioning continuing until the wipers have been driven over the bank contact sets and have arrived back at normal position, at which latter position wiper 626 engages a dead bank contact 629. In this connection, it will be understood that in all the stepping switches shown in Figs. 6 to 11, the remotest bank contacts with reference to the wipers as drawn are to be understood as located one step from the normally resting position as shown in the drawings. That is, for example, when the wipers on shaft 618 of switch ND6 step from the lowermost bank contacts, they engage the topmost bank contacts upon which they normally rest as shown in the drawings. Also, it will be understood that all the wipers of each said switch shown are rigidly attached to a driving shaft of the respective switch, so all wipers of a switch will occupy corresponding bank contact positions. The switch ND6 will function in a like manner if the armature 625 retracts when the wipers are resting at any off-normal position, as the wiper 626 will then apply ground to the winding of magnet SM6, since it will rest upon a bank contact tied to bank contact 627 at all off-normal positions. A generally similar arrangement exists in all the stepping switch elements shown in Figs. 6 to 11, in view of the last foregoing statements.

A circuit path can also be traced from the winding of stepping magnet SM7, interrupter armature, wiper 701, bank contact 712, conductor 715, retracted armature 630, winding of relay 623 to ground. In view of all the bank contacts engageable to wiper 701, excepting the bank contact 716 upon which wiper 701 rests being tied to conductor 715, the magnet SM7 will function to restore the wipers of switch A7.

It was set forth how switch A8 functioned falsely to step its wipers one step consequent to the retraction of armature 543, at the time finder switch F5 restored. So a circuit path can now be traced from the winding of magnet SM8, interrupter armature, wiper 801, bank contact 812, conductor 815, retracted armature 631, winding of relay 623 to ground, the magnet SM8 functioning to step the wipers of switch A8 over all the bank contact sets and back to normal position, at which latter position wiper 801 engages a dead bank contact 816. The storing mechanism and its companion finder switch F5 are now at normal, and is therefore subject to being again converted consequent to a new call being initiated from any telephone embraced by it, in the manner before described. However, the relay 623 will remain

actuated as long as ground is being derived through its winding, as set forth, or as will appear in subsequent descriptions herein, thus opening the traced path to the winding of relay 601 and also the tone from source DT6. Thus, the finder switch F5 will function normally to seize the calling line extended to a first selector, and relays 533 and 542 actuate, though the "dialing" tone from source DT6 will not be heard by the calling party, nor will the winding of relay 601 be normally applied to conductor 546 until all switches dependent thereon have returned their respective wiper sets to normal position. The deactuation of relay 623 causes the tone source DT6 to be applied audible to the calling party, as set forth, and also causes relay 601 to actuate due to conductor 546 being grounded at armature 545. The initiated call may now be progressed.

Returning to the condition of the circuits after the finder switch F5 seized the trunk leading to selector S4, if it is assumed that the calling party replaces the receiver without having sent impulses from the dial, it will be clear that the relays 404 and 410 will deactuate, causing the selector S4 to restore, in the well known manner. Also, the relay 533 will deactuate, causing a ground impulse to be applied from its armature 543, armature 560, conductor 561, winding of relay 613, wiper 614, bank contact 615, conductor 616 to the winding of magnet SM7. Upon armature 560 retracting, the wipers of switch A7 will be advanced one step. Armature 545 having retracted coincident with armature 560, the relay 601 will deactuate, so that a circuit path can be traced from ground, through the winding of relay 623, armature 630, conductor 715, bank contact 718, wiper 701, interrupter armature, to the winding of magnet SM7. The latter said magnet will operate in the manner before described to advance the wiper 701 over all the bank contacts tied to conductor 715 to return the wipers of switch A7 to their normal position. Of course, while the wipers of switch A7 are thus automaticaly rotating, the relay 623 will be actuated, effective to disconnect the tone source DT6 and to disconnect the winding of relay 601, so that in the event the trunk leading to selector S4 is seized by the finder switch F5, responsive to the trunk leading to the selector S4 becoming again seized, the calling party will not perceive the dialing tone and the armature 630 will remain retracted until the wipers of switch A7 have become restored to their normal position. If the new call is not initiated from the telephone calling until the wipers of switch A7 have had time to restore, the newly calling party will perceive the dialing tone forthwith upon the finder switch F5 seizing, since the relay 623 will have deactuated. It will be recognized that the finder switch F5 is the first one of the chain, and therefore, if it is assumed the latter said switch is at an intermediate or remote position in the chain, the new call will most probably involve a finder switch of the chain antecedent to the one last released. In the latter case, the dialing tone would be perceived upon the finder switch concerned seizing, unless the latter said finder switch had just been released and its companion switches of the storing mechanism have not had time to restore before the last said seizure.

If it is assumed that when the call from telephone T3 destined to telephone T is initiated, the listed number "623—4232" is sent in place of the alternative number "2—4232", the selector S4 will be operated so that its wipers will step into alignment with the sixth level of bank contacts and there rotate-in and seize the first idle trunk leading to selector *j* at the "6" primary tandeming center. In this connection, it will be borne in mind that a comprehensive system of the contemplated magnitude, the first digit "6" may refer to calls destined to any one of one hundred ten-thousand groups, the particular hundred-thousand group being determined by the second pull of the dial, where seven calling digits are employed, as in the last assumed case. It is thus necessary to convert a trunk to the "6" primary tandeming center, preparatory to the further extension of the call therefrom, in the event the succeeding digit or digits are consistent with such extending. It will appear, presently, that while the following two digits (second and third) may be consistent with advancing the call beyond the said converted trunk to the "6" primary tandeming center, the call will not be advanced over successive trunk sections unless the successive digit or digits have been sent determining that the call is positively destined to a line reachable over the first said converted trunk to the "6" primary tandeming center. That is, the storing mechanism will receive the first three digits, and thereafter initiate its functioning to cause the call to be further progressed consistent therewith. Thus, in the present instance, the selector S4 will be released consequent to the sending of the third digit "3", and the selector S'4 will be converted, through the secondary wipers of the secondary line switch SL3, as if the digit "2" had been sent in lieu of digits "623", the selector S4 thus restoring and releasing the trunk seized by it, and also the finder switch F5. The call is then progressed directly responsive to the sending of the last four digits, as was described with reference to the sending of the alternative calling number "2—4232". It will be noted in this connection, that the release magnet Re4 is not energized over conductor 538 from armature of relay G7, as when digit "2" was the first digit sent. However, when the secondary line switch SL3 functions to disconnect from selector S4, relay 404 in the latter said selector will deactuate to cause the restoration.

It will appear, presently, that where the first three digits of a called number are "625" and "626", for example, the selector S4 will be restored upon the third digit being sent. It will also appear, presently, that had the call been destined to a line in a group "667", for example, the storing mechanism will receive and store all the digit series, and then send the last six digit series while maintaining the selector S4, which was operated responsive to the first digit series. That is, the connection will be progressed through the "6" tandeming center from the selector terminating the trunk seized by selector S4 at its sixth bank level.

Having in mind that the last described call to telephone T, the selector S4 converted a trunk leading to the "6" primary tandeming center, and held this trunk until the third digit was sent by the calling party, it will be remembered that practically all of the calls destined to lines of its own group from any of the lines of the group containing the line leading to telephone T3, will be extended by employing the alternative calling number "2—4232", wherein the selector S4 is disengaged and the selector S'4 is thereupon engaged by the secondary line switch SL3 consequent to the first digit being sent. So it will be manifest that the idle holding of trunks

to the latter said "6" tandeming center on calls destined to the "623" group from a calling line of the same group will not aggregate a considerable period in commercial operation. Of course, it will be possible to arrange the storing mechanism, as will be detailed presently, so that the first selector will be restored consequent to the sending of the first digit series, and then reoperated from the storing mechanism, provided the call is to be extended through the selector S4 in lieu of through selector S'4. If the first three digits are consistent with extending the call through selector S'4, the secondary line switch SL3 will be caused to function as set forth to disconnect from selector S4 and seize selector S'4, preparatory to progressing the call directly responsive to the last four digit series sent direct from the calling telephone. Of course, if an intermediate selector is introduced at a tandeming center succeedent to selector S'4, an extra digit will need to be sent consistent with progressing the call therethrough. Since four digit series are required to progress the call through the last two selectors and the connector, five digits will then be required to effectuate the connection under call, after selector S'4 becomes seized.

The various primary tandeming centers indicated in Figs. 2 and 12 will be located where found most economical from engineering and other considerations. These centers will contain a main group of second selectors having the corresponding bank contacts of the respective levels tied in multiple, so the same outgoing trunk therefrom will be correspondingly reached through all said selectors. The said main group is then subdivided into as many sub-groups as there are groups of trunks leading in from tributary ten-thousand or other line groups, it being borne in mind that while all the ten-thousand groups of a hundred-thousand group may have outgoing trunks from the various first selectors thereof, respectively, corresponding to S4, leading to the same tandeming center main group of second selectors, this will not necessarily follow. That is, there may be a plurality of tandeming centers located diversely in the exchange territory reached by the same numerical first pull of the dial of a calling telephone. Trunks will lead from the various levels of all the selectors of the said diversely located primary tandeming centers reached by the same numerical first pull, to incoming second selectors located in the corresponding secondary tandeming centers. Also, there may be a plurality of the latter centers with respect to a single hundred-thousand group. It will thus be manifest that any one of a plurality of primary tandeming centers may be reached by the pulling of the same first digit, depending upon which group contains the calling telephone. Further, that any one of a plurality of secondary tandeming centers may be reached by the pulling of the same first and second digits, depending upon what group contains the calling telephone. Of course, a plurality of primary and secondary tandeming centers may be located contiguously under the same roof, for example, in a commercial installation. The arrangement alluded to will be understood with reference to Fig. 12, wherein the enclosures I, J and K indicate the "7" primary tandeming center, the secondary group of which is located diversely, the in-coming selector groups in each said enclosure being reached from the seventh level of first selectors. For example, the selectors in the I enclosure are reached from the seventh level of the first selectors of the groups D and F. The selector group of enclosure J shown connected is reached from the seventh level of the first selectors of the group G, and the selector group of enclosure K shown connected is reached from the seventh level of the first selectors of group H. The third selector group in enclosure L, being that of a division of the "76" secondary tandeming center, is reached from the sixth level of the second selectors of subdivisions of the "7" primary group in the enclosures I and J. The third selector group in enclosure M, being that of a division of the "76" secondary tandeming center, is reached from the sixth level of the second selectors of the subdivisions of the "7" primary group in the enclosure K. The ten-thousand tandeming center of the group "763" is reached from the third level of the third selector groups in enclosures L and M.

With further reference to the call to telephone T, upon the calling party sending digit "6", wherein the selector seized a trunk at its sixth level, the relay 533 will vibrate six times, causing six ground impulses to be applied to magnet SM7, in the manner before described. The armature 617 will energize the magnet SM6 consequent to the first impulse being sent to magnet SM7, preparatory to deenergizing it to advance the wipers on the shaft 618 following the last impulse constituting the digit. The magnet SM7 advances the wipers on shaft 720 resultant to each deenergization of the magnet SM7, so the wipers 701 to 709 (inclusive) will rest on bank contacts 721 to 729, respectively, at the termination of the first said digit series. The wipers on the shaft 618 then automatically advance to the second position, as referred to. A circuit can now be traced from grounded armature 545, conductor 546, wiper 608, bank contact 609, conductor 610, bank contact 635, wiper 636, conductor 637, armature 563, wiper 564, bank contact 565, conductor 566 to the winding of relay 430, the latter said relay actuating. The make-before-break springs of relay 430 are now disassociated from their resting contacts, so that the talking conductors 340 and 344 are not now in the seriesed path energizing the windings of relay 404. However, the latter said relay is now energized over the path including the spring 401, armature 432, conductor 433, bank contact 567, wiper 568, conductor 569, off-normal springs 640 and 641 in switch DF6, conductor 642, armature 570, wiper 571, bank contact 572, conductor 573, armature 435 to spring 406. The relays 404 and 410 are thus maintained actuated, preventing a lapse of ground occurring to conductor 413 so that the switches PL3 and SL3 will remain in a seized state, as well as preventing the selector S4 from restoring. Since the conductors 340 and 344 have not been disturbed as to their seriesed relation with the calling line and the windings of relay 533, the second series of two impulses constituting the second digit "2" sent by the calling party will cause the armature of relay 533 to vibrate two times, resultant to applying two ground impulses from armature 543, armature 560, conductor 561, winding of relay 613, wiper 614, bank contact 620, conductor 621, series winding of slow-releasing relay G8 to stepping magnet SM8 of "hundred-thousand" numerical storing switch A8, the wipers 801 to 808 on shaft 820 being stepped two steps into engagement with bank contacts 821 to 828, respectively. The armature 617 will energize the magnet SM6 as before described, consequent to the first impulse and the latter said magnet will deenergize following the

second (last) impulse, so the wipers on shaft 618 will be driven an additional step.

Upon the calling party sending the third digit "3", constituting three open impulses, the armature of relay 533 will vibrate three times and apply three ground impulses through the winding of relay 613 in the manner before set forth, effective to energize the magnet SM6 and effective to apply the said impulses through wiper 614, bank contact 643, conductor 644, series winding of slow-releasing relay G9 to the stepping magnet SM9 of "ten-thousandths" numerical storing switch A9, the wipers 901 to 909 on shaft 920 being stepped three steps into engagement with bank contacts 921 to 929, respectively. The retraction of armature 617 will cause magnet SM6 to advance the wipers on the shaft 618 a step. However, the latter will be to no operative purpose, since a circuit path can now be traced from grounded armature on relay G7, wiper 707, bank contact 727, conductor 730, wiper 805, bank contact 825, conductor 830, wiper 905, bank contact 925, conductor 930, armature 574, wiper 575, bank contact 576, conductor 577, conductor 428 and over the before traced path to the winding of relay 352, effective to disassociating the primary wipers from operative relation with the circuits of the switch SL3 and substituting the corresponding secondary wipers therefor, whereupon the switch SL3 will hunt for and seize the first disengaged selector S'4 accessible to the secondary wiper set, in the manner described wherein the digit "2" caused the conductor 428 to be grounded from the off-normal spring set 419. In the present instance, selector S4 is indirectly restored, due to relay 404 deactuating when relay 334 deactuates, and not by a ground application over conductor 538, as ensued in previous descriptions. The energizing path for the relay 533 will be opened at armatures 335 and 342, so that relay 601 will deactuate, causing switches ND6, A7, A8 and A9 to restore their wipers to normal position in the manner described, the magnet A9 being energized from grounded armature 646, conductor 647, bank contacts engageable to wiper 901, interrupter armature to the winding of magnet SM9. The finder switch F5 will restore consequent to armature 545 retracting, thereby opening the ground to armature 555. That is to say, the selector S4 and the finder switch F5 will be forthwith subject to seizure, and the dialing tone will be subject to audition upon relay 623 retracting upon the operated said switches of the storing mechanism restoring by automatically completing the restoration from the stated respective off-normal positions. In view of the last foregoing descriptions, it will be clear that whether the calling party sends digits "623" as a prefix, or sends "2" as a prefix, will cause the same operative call progression.

It will be manifest that the trunk leading to the "6" primary tandeming center will be released consequent to the restoration of the selector S4, as set forth in the last foregoing descriptions. Also, that this trunk would not have been seized had the alternative prefix "2" been sent in lieu of digits "623". Obviously, subscribers will generally pull the alternative prefix (as indicated on the dial, perhaps), in lieu of the listed number, because the call will then be effectuated with fewer pulls and in a shorter time. As adverted to, the selector S'4 may be installed in any ten-thousand group of the exchange system. If the place of installation is remote from the switch SL3, an impulse repeater will be interposed in the trunk, contiguous to the said switch SL3, in order to obviate carrying the private conductor 459 beyond the location of the said repeater. It will thus be clear that the said pulling of digit "2" may refer to any ten-thousand group of the exchange system, and not necessarily the "623" ten-thousand group, as exampled. In commercial operation, the characteristics of the traffic will determine what ten-thousand group it will refer to. For example, if the business portion of an exchange territory comprises a largely called ten-thousand group, it will usually be found advantageous to have telephones of such group reached by all subscribers with five pulls of the dial, in lieu of seven. Where it is found convenient to have all subscribers thus arranged with respect to the said group, it obviously will not then be necessary to have a seven-digit number for the subscribers of said business group, so the said alternative number would be the one listed, and in addition, perhaps, designating the dials of all the telephones with the name prefix of the said group, radial with the digit "2" hole. Of course, any digit hole may be used in place of the exampled "2" hole, generally or in part only. If the latter, the dials of the exchange will not be uniformly designated numerically, with relation to the name prefix of the concerned ten-thousand group. Moreover, a portion or sub-group of a ten-thousand group may be arranged with specific secondary line switch groups wherein their secondary wipers will refer to a specific group of alternative selectors (corresponding to S'4), the latter groups having access to specific ten-thousand groups. That is to say, if digit "2" is sent from the calling device of a telephone, it will depend from what sub-group of telephones of the main group the call emanates as to what ten-thousand group will be thereby reached. In this connection, it will be understood, that the listed number has a three-digit prefix, for example, and that the storing mechanism switches will be wired consistent with the sub-divisions, in that for one division the pulling of "623" will be equivalent to the pulling of "2" simply, and the pulling of said "623" at a telephone of another sub-division will mean that the call will be progressed by some other method as will be described with reference to calls to other groups wherein the secondary set of wipers of the switch corresponding to SL3 will not be concerned. This method of subdividing a ten-thousand group may be found desirable where certain of the subscribers thereof have a considerable percentage of calls to certain ten-thousand groups. In this arrangement, the outgoing traffic for each sub-group will be considered as if emanating from a main or ten-thousand group, the secondary line switches and the selectors and finder switches and companion storing mechanisms being wired accordingly into independent sets, though the connectors and local selectors will be common to all the subscriber lines of the component sub-groups of the ten-thousand group. It will be further understood, in this connection, that where the prefix digits "623" last referred to does not refer to the same ten-thousand group as the "2" hole of the dial, the "2" hole of the dial of such telephone may refer to some other ten-thousand group. Furthermore, there will be an equivalent prefix of three digits which may be pulled to cause the same effective progression of the call as if the digit "2" simply, has been sent. That is to say, for example, the digit "2" sent from telephones of two sub-divisions of a ten-thousand group will

progress the call to an incoming selector of each of two specific ten-thousand groups, respectively, and also that each latter said incoming selector of a ten-thousand group will be equivalently reachable responsive to sending the listed three-digit prefixes specific to the ten-thousand group containing the subscriber line under call.

The last foregoing plan would ordinarily be widely applied in an exchange, whereby the digit "2" prefix may refer to a different ten-thousand group when pulled from telephones of the various ten-thousand groups, as well as any plurality of sub-divisions thereof. Under this plan, a different name prefix would be placed radial with the digit "2" hole of the telephones of the various ten-thousand (or sub-divisions thereof) groups, respectively, and employed as an alternative prefix in acordance with the prefix name. There would be a generally listed number common to all calling telephones of the exchange system which may be pulled from any said telephone of the system by way of progressing the call therefrom to the telephone line specifically indexed thereby, regardless of what ten-thousand group, or sub-division thereof, the line under call may be tributary to. It will appear, presently, how an alternative calling number of five digits may be employed in lieu of the listed calling number of seven digits, wherein the secondary line switch will not be affected; the latter method being capable of employment in a plurality of ways, independent of the last described method wherein the secondary line switch is concerned.

Assume that the party at telephone T3 desires to extend a connection to telephone TA, the listed calling number of which is "467—5728", having an alternative calling number "3—5728". The call will be initiated as before, wherein the connection will be automatically extended through the secondary line switch SL3 (or one of its group), and the latter said switch will seize selector S4 (or one of its group), and the finder switch F5 (or one of its group), will seize the trunk leading to selector S4. Thus, the dialing tone will be perceived as before described. It will be first assumed that the calling party chooses to employ the alternative calling number "3—5728", the first digit "3" benig perhaps indicated by a name prefix radial with the "3" hole of the dial, so the alternative calling number (as in all cases of alternative calling numbers), will in reality be an "office" name prefix, followed by four digits. That is, where the first three digits of the listed calling number constitutes the three first letters of a listed name prefix, the alternative calling number may comprise one pull of the dial from the hole corresponding to the said listed name prefix placed radial with the hole. In the present instance, the hole will be that of digit "3".

Upon the calling party pulling "3", the selector S4 will step its wipers into alignment with the third bank level, and there rotate-in and seize the first idle trunk leading to a fourth selector *e*, as indicated in Figs. 1 and 2. As before described, the relay 533 will operate responsive to the dial while the wipers of selector S4 is stepping-up, so that switch A7 will cause the wipers on shaft 720 to rotate three steps. Upon the retraction of the armature on relay G7, a circuit can be traced from ground thereon, wiper 705, fourth bank contact, conductor 730' to the winding of relay 578, the latter said relay actuating. The energizing path of relay 526 is thus opened at armature 524, whereupon the finder switch F5 will unseize and the locking ground for relay 502 will be opened at armature 555, the latter said relay deactuating. Relay 533, and dependent relays thereof will deactuate, causing the wipers of switch A7 to restore to normal upon the retraction of armature 630. Of course, the retraction of the armature of magnet SM6 will cause the wipers on shaft 618 to advance one step, but these wipers will be also caused to restore upon the retraction of armature 625. In this connection, it will be noted that the selector S4 has remained in seizure of the trunk selected by it leading to selector *e*, and that conductor 413 has remained grounded to maintain the antecedent switches. However, due to the armature 414 being attracted, the relay 502 will not be falsely energized upon armature 503 retracting consequent to the unseizing of the finder switch F5. The relay 502 is individual to the selector S4, and the switch F5 is normally responsive to being requisitioned by any one of a plurality of such relays as 502. The sending of the first digit "3" thus served to directively progress the call through the selector S4 and to incidentally disengage the finder switch F5, together with its associated storing mechanism. The sending of the last four digits "5728" will operate to progress the call through the fourth selector C and the fifth selector to the connector, and through the connector to the called line leading to telephone TA.

If it is assumed that the calling party had chosen to employ the listed calling number "467—5728" in the last described initiated call, the first digit (or letter equivalent) "4" will cause the selector S4 to step its wipers into alignment with the fourth bank level and rotate-in and seize the first idle trunk leading to second selector *k* of the "4" primary tandeming center, preparatory to the further extension of the call therethrough, since the said "4", as a first sent digit, may mean that the call may be destined to any one of one hundred hundred-thousand units. The switch A7 will operate in the manner before described, to step its wipers 701 to 709 into engagement with bank contacts 731 to 739, respectively, followed by the wipers on the shaft 618 being rotated one step. The sending of the second digit "6" will cause the switch A8 to operate in the manner before described, to step the wipers 801 to 808 into engagement with bank contacts 831 to 838, respectively, followed by the wipers on the shaft 618 being rotated one step. The sending of the third digit "7" will cause the switch A9 to operate in the manner before described, to step the wipers 901 to 909 into engagement with bank contacts 931 to 939, respectively, followed by the wipers on the shaft 618 being rotated one step. The sending of the fourth digit "5" will cause five ground impulses to be applied through wiper 614, bank contact 648, conductor 649, winding of slow-releasing relay G10 to the stepping magnet SM10 of the "thousands" storing switch A10, causing the wipers 101 to 103 on the shaft 104 to step into engagement with bank contacts 106 to 108, respectively, followed by the wipers on the shaft 618 being rotated one step. The sending of the fifth digit "7" will cause seven ground impulses to be applied through wiper 614, bank contact 650, conductor 651, winding of slow-releasing relay G'10 to the stepping magnet SM'10 of the "hundreds" storing switch A'10, causing the wipers 151 to 153 on the shaft 154 to step into engagement with the bank contacts 156 to 158, respectively, followed by the wipers on the shaft 618 being rotated one step. The sending of the sixth digit "2" will cause two ground impulses to

be applied through wiper 614, bank contact 652, conductor 653, winding of slow-releasing relay G11 to the stepping magnet SM11 of the "tens" storing switch A11, causing the wipers 101' to 103' on the shaft 104' to step into engagement with the bank contacts 106' to 108', respectively, followed by the wipers on the shaft 618 being rotated one step. The sending of the seventh digit "8" will cause eight ground impulses to be applied through wiper 614, bank contact 654, conductor 655, winding of slow-releasing relay G'11 to the stepping magnet SM'11 of the "units" storing switch A'11, causing the wipers 151' on shaft 154' to step into engagement with bank contacts 156' to 158', respectively, followed by the wipers on the shaft 618 being rotated one step to the bank contact set first antecedent to the set upon which the wipers are shown normally resting. That is, the latter said wipers are now resting upon the lowermost set of bank contacts.

At the time of completing the sending of the third digit "7", a circuit path can be traced from armature on relay G7 (which retracts its period after the last impulse is applied), wiper 707, bank contact 737, conductor 740, wiper 806, bank contact 836, conductor 840, wiper 906, bank contact 936, conductor 714, and over the traced path to the release magnet Re4, operative to restore the wipers of selector S4, the relays 404 and 410 remaining actuated, so no lapse of ground occurs to conductor 413. Also, a circuit path exists from grounded conductor 840, wiper 907, bank contact 937, conductor 941 to multipled bank contacts 656 and 657. Also, a circuit path exists from grounded armature on relay G9, wiper 903, bank contact 933, conductor 942, bank contact 661, wiper 658 to the stepping magnet SM'6, the latter said magnet operating, preparatory to advancing the wipers on the shaft 659 one step upon its armature 660 interrupting its energizing path. Due to bank contacts 656 and 657 being grounded, the magnet SM'6 will receive ground over wiper 662 to advance the wipers on the shaft 659 two additional steps. The object of the latter function is in view of digits "467" sent from the dial being resolved or interpreted into the digit "3", simply, will mean that but five numerical orders of digits will be re-sent in extending the call. The first two numerical orders will thus be evaded, since the numerical order commutating switch NC6 now has its wipers in the position to effect the re-sending of the effective third numerical order digit "3." A circuit path can now be traced from the clutch magnet CM6 of the digit finder switch DF6, off-normal spring set 63—64, armature 665, wiper 666, bank contact 668, armature 669, wiper 670, bank contact 672, conductor 673, bank contact 933, wiper 903 to grounded armature on relay G9, the magnet CM6 energizing to operatively attract its clutch armature, as will appear, presently.

Before proceeding with the general operative functions, at this juncture, the digit finding switch DF6 shown in working detail in Figs. 14 to 19, will be described, having in mind that parts in the mechanism drawings will correspond with similar designated parts of the schematic drawing DF6, in Fig. 6. In Figs. 13 to 19, 1 is a suitable base upon which is mounted the driving motor 2, shown in part, and the four standards, 3, 4, 5 and 6. A section or quadrant defined by the radial lines A'—B' in Fig. 14 is shown removed in Fig. 13. The said standards support the attached annular contact holder consisting of a metallic base-ring 8 having a radial inwardly projecting support-arm 9. The support-arm 9 forms the upper bearing support for the pivoted yoke 10, and also carries the depending electro-magnet CM6. An insulating washer 12, a metallic bank contact ring 13 and an insulating washer 14 surmounts the said ring 8 concentrically in the order named. Metallic bank contact segments 15 to 27 (thirteen) are spaced uniformly radially upon the washer 14 and covered with an imbedded insulating washer 30, a metallic ring 31 surmounting the assembly of rings, washers and segments. Clamp-screws 33 hold the said assembly in rigidity as a unit. The yoke 10 carries a pair of wipers 35 and 36, insulated from the yoke, but electrically tied together. The electro-magnet CM6 has its iron core projecting at its upper end as a spindle 37. The said spindle is threaded next to the helix portion so when it is fitted into the hole 38 of the support-arm 9, the nut 39 may be set to secure the spindle 37 (carrying the helix on the lower portion thereof) to the support-arm 9. The electro-magnet CM6 will thus occupy a depending position with respect to the support-arm 9 at the geometric center of the ring structure supported by the standards 3 to 6.

The upper portion of the spindle 37 is machined to form an arbor for the upper alignment bearing-hole 40 of the yoke 10. A spindle 42 is rigidly secured to the base-arm 44 projected from the standard 3. The center-lines of the spindles 37 and 42 align. A shoulder 45 on spindle 42 serves as a thrust bearing for the lower bearing-hole 46 of the yoke 10, the yoke 10 thus being pivoted on the spindle 42, supported vertically by the shoulder 45 on the spindle 42. The center-line of the holes 40 and 46 align. The wiper 35 is adapted to successively engage the said bank contacts 15 to 27, and the wiper 36 is adapted to engage ring 13 constantly, regardless of the radial angular position thereof. A retracting coil spring 50 has one of its ends secured through a slot at the top portion of the rigidly secured spindle 37, and the other end of the said spring is secured to a bracket 51 integral with the yoke 10. When the yoke 10 is rotated about its spindles, as arbors, in a clock-wise direction from the normal position shown in the drawings, and then released, the residual resilience provided in the spring 50 and the resilience of the said spring stored incidental to the said rotating, the yoke will restore to its normal position. A stud 52 on the yoke 10 normally rests upon an insulating bushing 53 to maintain the springs 641 and 54 flexed from their free position from tension exerted from spring 50. That is, springs 640—641 will be engaged and springs 54—55 will be disengaged. When the yoke 10 is rotated about its axis from normal position, the off-normal spring sets 640—641 and 54—55 are thus operated, for an object which will appear presently. Should the yoke 10 be rotated clockwise (the only way it may be rotated from normal), to its extreme position, the stud 52 will engage the insulating bushing 60 and flex the off-normal spring 63 from its companion spring 64, for an object which will appear, presently.

It will be clear that since the wipers 35 and 36 are electrically tied, as shown in Fig. 6, the bank contact ring 13 and the bank contact 15 will be electrically tied when the yoke 10 is at its normal position shown. Similarly, as when the yoke 10 is revolved about its arbors or spindles 37 and 42, the bank contacts will be successively elec-

trically tied to the ring 13. It will appear, presently, that while the bank contacts will be correspondingly tied to the ring 13 as the wipers are rotated over the said bank contacts, there will be no operative effect or object in the said tieing during the time the wipers are retracting over the said bank contacts under the influence of the spring 50.

The motor drive-shaft 65 has a beveled pinion 66 driving the beveled gear-wheel 67. The tooth ratio between said pinion 66 and said gear-wheel being one to thirteen, the shaft 65 will make thirteen revolutions to one of the wheel 67. A pair of normally closed contact springs 68—69 are operated by the cam 70 attached to the shaft 65 with a set screw, not shown. Thus, the springs 68—69 open their contact with each revolution of the shaft 65, due to the cam 70 flexing springs 69 away from spring 68.

The motor 2 may be continuously driven, or it may be energized from the closure of a set of contacts on relay 542, in order that the motor will operate only while relay 542 is actuated, or, moreover, the shaft 65 may be driven in plurality with other similar shafts from a common drive source.

The gear-wheel 67 revolves about the spindle 42 as an arbor, the collar 71 serving as a thrust bearing. The said gear-wheel 67 has a recessed portion or clutch 72 having the form of an open top cylinder. Around the upper edge of the inside periphery of the portion 72 are placed thirteen projections or clutch teeth 75 to 87 shown in Fig. 16 and also a part thereof in Fig. 13. The yoke 10, carries an armature hinge support 88, integral with the yoke 10, for armature 89, having a right-angle clutch-claw 90 on the said armature 89 which is adapted to assume its shown dotted position. The armature 89 is hinged on pin 91, so the clutch-claw 90 will be thrust outwardly as indicated by the said dotted lines, when the magnet CM6 is operatively energized. The clutch-claw 90 has a lateraly oblique beveled face 92, and this face is tilted or obtruded outwardly due to the attraction of its rigidly attached armature portion 89, so its said face 92 registers in circumferential alignment with the corresponding oblique faces of the thirteen tooth projections 75 to 87. A flat retractile spring 93 serves to aid gravity to restore the armature 89 and its clutch-claw 90 when the magnet CM6 becomes deenergized.

Having in mind that the gear-wheel 67 is constantly revolving (under the condition of use), it will appear that the clutch tooth projections 75 to 87 are constantly successively passing the retracted clutch-claw 90. In fact, one said tooth projection will pass the clutch-claw 90 for each revolution of the shaft 65. Or a given projection 75, for example, will be completely revolved during the time the shaft 65 has turned thirteen revolutions. If the cam 70 is secured to the shaft 65 so it will disengage the springs 68—69 when the tooth projection 75 has progressed one twenty-sixth of a revolution from the drawn position, for example, the cam 70 will thus cause the springs 68—69 to disengage eight times and be re-engaged while the said projection 75 is moving from the drawn position to the angular position occupied by tooth projection 83, as drawn, the tooth projection 83, of course, having rotated an equal angular distance. It will also be clear that if the tooth projection 75 revolves to the angular position occupied by the tooth projection 76 as drawn, the springs 68—69 will be disengaged one time and re-engaged. The said springs 68—69 are directive impulse springs, as will appear, so they will be potentially capable of oening a circuit path thirteen times during each revolution of the gear-wheel 67.

It will appear, presently (as shown in Fig. 6), that there is means provided to normally negate the effect of the springs 68—69 under all but specific conditions. This means consists of the off-normal springs 640—641, which normally short-circuit springs 68—69 together with armature 673 and its normally disengaged cooperative contact.

If it is assumed that the magnet CM6 becomes energized, wherein the clutch-claw 90 tilts outwardly, the first tooth projection 85, for example, to reach the obtruding face 92 will register therewith and rotate the carrying yoke 10 with it, revolvably about its arbors 37 and 42. The wipers 35 and 36 will successively electrically connect the encountered bank contacts to the ring 13. Incidental to the off-normal movement of the yoke 10, the off-normal spring sets 640—641 and 54—55 (carried with springs 63—64 on the bracket 73, rigidly attached to and surmounting the ring 31), will be operated. When the magnet CM6 is deenergized, the spring 93 aiding the gravity of armature 89, together with the deflecting beveled faces of the clutch-claw 90 and the registering cooperating tooth projection 85, will cause the said clutch-claw 90 to disengage and restore. The latter function will free the yoke 10 so that it will revolvably retract to normal to flex the off-normal springs 641 and 54 into the position shown in the drawings. It will appear, presently, that the magnet CM6 will always be caused to deenergize while the wiper 35 is in engagement with a bank contact, and not while the wiper 35 occupies an intermediate position with reference to consecutive bank contacts. Under the provided condition, the springs 68—69 will be engaged, due to the said timing of the cam 70. In operative functioning, the wiper 35 will be caused to be drawn over a predetermined number of bank contacts and then released to restore, a predetermined number of times, corresponding with the set-up condition in the switch NC6 and the switches shown in Figs. 7 to 11.

The mechanical details of the switch DF6 having been set forth, and remembering the magnet CM6 is energized and its armature 89 is attracted wherein the first projection 75 to 87 registering with the clutch-claw face 92 will cause the wiper 35 to be rotated over the cooperative bank contacts, the descriptions will be continued. A circuit path can be traced from bank contact 18, conductor 674, bank contact 939, wiper 909, conductor 944, bank contact 838, wiper 808, conductor 845, bank contact 739, wiper 709, conductor 740, bank contact 675, wipers 676—677, bank contact 678, winding of relay 679 to ground. A circuit path can also be traced from ring 13, make-before-break spring 630, winding of slow-releasing relay 631 to grounded battery.

It is clear that as the wiper 35 is progressed, the springs 68—69 disengage, timed intermediate of the bank contacts passed over, so when wiper 35 has engaged bank contact 17, two disengagements of springs 68—69 have occurred, for example. Under the condition of springs 640—641 being disengaged at this juncture, the springs 68—69 are not short-circuited. Thus, the traced path involving the conductors 569—642 will be opened two times. When the wiper 35 has pro-

gressed into engagement with bank contact 18, three openings of the latter said traced path will have occurred, the said impulses effective to operating the selector S4, so the wipers of the latter said selector will then align with the third level of bank contacts where, as will appear, presently, they will rotate-in and select the first idle trunk leading to incoming second selector *e* in group "467." When the wiper 35 engages bank contact 18, the circuit path traced from the winding of relay 679 to bank contact 18 and the path traced from ring 13 to the winding of relay 681 are joined by wipers 35—36. Relays 679 and 681 will actuate. Relay 681 will lock through its right-hand inside armature to spring 55. A path can be traced from ground on bank contact 672, wiper 670, attracted armature 669 to the winding of magnet SM'6, the latter said magnet attracting its armature preparatory to advancing the wipers on shaft 659 one step upon the retraction of armature 669, consequent to the energizing circuit of relay 679 opening due to the wipers 35—36 retracting because of the opening of the energizing path of the magnet CM6 at armature 665. Relay 681 will unlock, consistent with its slow-releasing period, consequent to the spring 55 disengaging upon the yoke 10 restoring to normal.

At the time relay 681 actuated, armature 673 will short-circuit the springs 68—69, and hold this short-circuit condition until supplanted by the corresponding short-circuit condition introduced by the springs 640—641 upon the yoke 10 restoring. That is, when the three open impulses have been applied to the traced path including conductors 569 and 642 from the springs 68—69, the relay 681 actuates whereby its armature 673 prevents further open impulses being applied effective to selector S4. Had the wiper not found ground on bank contact 18, the relay 681 would not have actuated at that juncture, so open impulses will be applied, one for each bank position in the switch DF6, until a grounded bank contact is encountered by wiper 35. If through any reason no grounded bank contact is encountered, the yoke 10 will operate the off-normal spring set 63–64 to open the energizing path of magnet CM6 to cause the said yoke to retract without encountering the rigid arm 9.

A circuit path can be traced from the magnet CM6, over the before traced path to wiper 666, bank contact 681, armature 669, wiper 670, bank contact 682, conductor 683, bank contact 107, wiper 102 to grounded armature on relay G10, the magnet CM6 attracting its armature 89 for the objects before set forth. A circuit path can be traced from the winding of relay 679, bank contact 684, wipers 677—676, bank contact 685, conductor 686, wiper 103, bank contact 108, conductor 105 to bank contact 20. Having in mind the functioning of the switch DF6, the impulse springs 68—69 will apply open impulses to the circuit path including conductors 569 and 642, which now include the line relay in fourth incoming selector *e* in the "467" group, until the wiper 35 encounters bank contact 20, meaning that the springs 68—69 will apply five open impulses to the latter said selector *e*. The relays 679 and 681 and the magnet SM'6 will actuate when the wiper 35 encounters bank contact 20, for the objects before set forth. The selector *e* will seize the fifth local selector in the "467" group.

The wipers on shaft 659 have been advanced a further step due to the relay 679 deactuating consequent to the actuation of relay 681. A circuit can be traced from the magnet CM6, over the before traced path to wiper 666, bank contact 688, armature 669, wiper 670, bank contact 689, conductor 690, bank contact 157, wiper 152 to grounded armature on relay G'10, the magnet CM6 attracting its armature 89. A circuit path can be traced from the winding of relay 679, bank contact 691, wipers 677—676, bank contact 692, conductor 693, wiper 153, bank contact 158, conductor 109 to bank contact 22. The impulse springs 68—69 will apply open impulses to the circuit extended therefrom and including the windings of the line relay in the said fifth selector in the "467" group, forthwith followed by the actuation of relays 679 and 681 and the magnet SM'6 when the wiper 35 engages bank contact 22. The latter said selector will seize a connector having access to the line under call.

The wipers on the shaft 659 have been advanced a further step due to the relay 679 deactuating consequent to the actuation of relay 681. A circuit can be traced from the magnet CM6, over the before traced path to wiper 666, bank contact 694, armature 669, wiper 670, bank contact 695, conductor 696, bank contact 107', wiper 102' to grounded armature on relay G11, the magnet CM6 attracting its armature 89. A circuit path can be traced from the winding of relay 679, bank contact 697, wipers 677—676, bank contact 698, conductor 699, wiper 103', bank contact 108', conductor 109' to bank contact 17. The impulse springs 68—69 will apply open impulses to the circuit extended therefrom and including the windings of the line relay of the latter said connector, causing the wipers of the connector to be stepped into alignment with the second bank level. The relays 679 and 681 and the magnet SM'6 will actuate when the wiper 35 engages bank contact 17.

The wipers on the shaft 659 have been advanced a further step consequent to the relay 679 deactuating due to the actuation of relay 681. A circuit path can be traced from the magnet CM6, over the before traced path to wiper 666, bank contact 601', armature 669, wiper 670, bank contact 602', conductor 603', bank contact 157', wiper 152' to grounded armature on relay G'11, the magnet CM6 attracting its armature 89. A circuit path can be traced from the winding of relay 679, bank contact 604', wipers 677—676, bank contact 605', conductor 606', wiper 153', bank contact 158', conductor 159' to bank contact 23. The impulse springs 68—69 will apply open impulses to the circuit extended to the line relay of the latter said connector, causing the wipers of the connector to be stepped to and set upon the eighth set of bank contacts leading to the line under call, the connector applying signaling current thereto. The relays 679 and 681 and the magnet SM'6 will actuate when the wiper 35 engages bank contact 23.

The wipers on the shaft 659 have been advanced a further step due to the relay 679 deactuating consequent to the actuation of relay 681. The latter said wipers are therefore resting on the uppermost bank contact set shown in the drawings, which is one step back from their normal position, as has been referred to. Under this condition, the wiper 608 does not apply ground received from armature 545 to armature 555, so the finder switch will unseize. This will open the traced energizing circuit from the winding of relay 430 to wiper 636, now resting on bank contact 608' where set following the sending

of the seventh digit series from the dial, so the relay 430 will deactuate. This will establish the connection from the calling line through the springs 401 and 406 to the called line. The windings of relay 533 will be disassociated from the calling line at retracted armatures 532 and 539. The relay 502, individual to the selector S4 will deactuate, due to its locking ground being opened at armature 555, however, it cannot again operate until selector S4 has restored, since armature 414 is attracted. The finder switch F5 is now subject to being converted by any associated relay, such as 512, for example, and in such event it will rotate its wipers one step before seizing, because under the latter assumed condition, there will be ground potential applied as a guard from armature 513, armature 507, conductor 508 to bank contact 509. It will be noted, in this connection, that while relay 430 remained actuated from the time the first digit was sent completely from the dial until the connector has set its wipers upon the bank contacts corresponding to the called line, the grounded holding tone source HT4 will be applied through the lower armature of relay 430 to talking conductor 344, audible to the calling party to indicate that the call is being progressed under the self-functioning agency of the storing mechanism in the present instance, it being borne in mind that the first effective digit "3" was resolved by the storing mechanism from the first three digits sent, after the said three digits were transmitted from the dial. Thus, it will be possible to send the remaining four digits from the dial before the said "3" has been sent and the last four digits of the call have been re-sent and the called line reached. In any event, the audition of the tone from source HT4 will indicate that the relay 430 is actuated and that the connection is therefore not yet completed.

Relay 601 will deactuate following the deactuation of relay 542, whereupon the magnets SM6, SM7, SM8 and SM9 will operate in the manner described to return their respective wiper sets to normal position. The magnet SM'6 will be energized through its interrupter armature 660, bank contact 610', wiper 612', armature 613', winding of relay 623 to ground, causing the wipers on the shaft 559 to be rotated one step to normal position, as shown. It will be manifest that had the wiper 612' been resting on back contact 628', when the armature 613' retracted, for example, the magnet SM'6 would be successively energized through its self-functioning interrupter armature, whereby the set of wipers on the shaft 659 will be step-rotated to the normal position. The armatures 614' to 617' will ground conductors 624' to 627', respectively, upon the deactuation of relay 601. This will cause the bank contacts engaged by wipers 101, 151, 101' and 151 at off-normal positions to receive ground from the said armatures over the said conductors, respectively. It will operate to energize the magnets SM10, SM'10, SM11 and SM'11 through their respective interrupter armatures, whereby the wipers on the shafts 104, 154, 104' and 154', respectively, will be step-rotated to their normal position shown in the drawings. Thus, the storing mechanism will automatically initiate its self-functioning to restore its switch elements to normal position forthwith after a resent call has been effectuated, or if the service is terminated; the latter in view of the fact that if at any state of the operation the calling party replaces his receiver, the relay 533 will deactuate and cause the relay 601 to deactuate.

In view of relay 430 being normal, and there being no way of re-operating it after the unseizing of the finder switch F5, the established connection involves the same circuit relations as if the relay 430 had not operated and that the call had been progressed to the called line under direct control of the dial. The connection will be destroyed by the calling party restoring the receiver, whereby the selectors will restore, and the ground will be removed from conductor 413 to unseize the line switches PL3 and SL3, in view of the citations.

If it is assumed that the call last detailed is to line "468—5728", in lieu of to "467—5728", the call will be progressed in a different manner to that described, and moreover, there is no alternative calling number provided for the present assumed call. Having in mind that in the last described call, the selector S4 restored its wipers consequent to the sending of the third digit "7", and that sending the specific digits "467" caused the storing mechanism to set-up a condition corresponding to digit "3", it will be noted that in the present call no circuit path is established whereby the selector S4 will restore its wipers when the third digit is sent. The sending of the digits constituting the present call, from the dial, will cause the various switches of the storing mechanism to be set like when the digits of the last described call were sent from the dial, with the exception that the wipers 901 to 909 of switch A9 will now rest upon bank contacts 951 to 959, respectively. This will mean that ground will not be applied over conductor 941 to bank contacts 656 and 657, so that when wiper 903 applies ground over conductor 942 to bank contact 661 the wiper 662 will not receive ground from bank contacts 656 and 657 to cause the magnet SM'6 to advance the wipers on the shaft 659 two steps, out of engagement with them. However, ground received from armature on relay G7 is applied over wiper 707, bank contact 727, conductor 730, wiper 805, bank contact 835, conductor 847 to bank contact 630'. The wiper 658 will apply this ground through the armature 660 to cause the magnet SM'6 to advance the wipers on shaft 659 one step.

Having in mind that the relay 430 will actuate consequent to the wiper 636 advancing to bank contact 635 when the first digit series sent from the dial is ended, it will be clear that the second and third digits, as well as the remaining digits of the call, will not be directly effective to progressing the call through the second selector *k* primarily seized by the selector S4. A circuit path can be traced from the magnet CM6, springs 63—64, armature 665, wiper 666, bank contact 631', armature 669, wiper 670, bank contact 632', conductor 633', bank contact 832, wiper 802 to grounded armature on relay G8, the magnet CM6 thus attracting its armature 89. A circuit can be traced from bank contact 21, conductor 635', bank contact 833, wiper 803, conductor 848, bank contact 637', wipers 676—677, bank contact 638' to the winding of relay 679. When the wiper 35 has engaged bank contact 21, the relays 679 and 681 will actuate in the manner as before described. The springs 68—69 will have re-sent six open impulses, effective to stepping the wipers of the second selector *k* into alignment with the sixth bank level, where they will rotate-in and seize the first idle trunk leading to incoming third selector *l*. The wipers on the

shaft 659 will be caused to advance one step, in the manner before described. The magnet CM6 will now be energized over the before described path from wiper 666, bank contact 668, armature 669, wiper 670, bank contact 672, conductor 673 bank contact 953 (in lieu of 933 in the previous description) wiper 903 to armature on relay G9, the magnet CM6 thus attracting its armature 89. A circuit can be traced from bank contact 23 conductor 159', bank contact 952, wiper 902, conductor 740, bank contact 675, wipers 676—677, bank contact 678 to the winding of relay 679. When the wiper 35 has engaged bank contact 23, the relays 679 and 681 will actuate in the manner before described. The springs 68—69 will have sent eight open impulses, effective to stepping the wipers of third selector *m* into alignment with the eighth bank level, where they will rotate-in and seize the first idle trunk line, leading to local fourth selector, not shown, in the "468" group. The last four digits will be sent from the dial, and then re-sent forthwith in the manner before described to complete the connection to the called line, after which the finder switch F5 will unseize. The relay 430 will deactuate resultant therefrom, together with other functioning including the restoring of the switch elements of the storing mechanism, in the manner before described. It is thus clear that the first switch was effectually linked directly from the dial, and that the successive switches were linked responsive to re-sent directive impulses. The resending was initiated incidental to the completion of the sending of the third digit from the dial. It continued independent of the primary sending from the dial. However, it will be understood that if the primary sending ceases for a prolonged period before all the digit series have been re-sent, the storing mechanism will not restore its switch elements until the seventh digit has been stored and re-sent, unless the calling party terminates the service as has been referred to. Where any digits sent from the dial are stored, the last digit re-sent must correspond to the seventh or the last listed digit of the line under call, so far as the numerical order distributer NC6 is concerned. That is to say, the wipers on the shaft 659 will be in the position attained at the seventh step from normal position, wherein wiper 670 will be in engagement with bank contact 602'. If the calling number contains less than seven re-sent digits, the wipers on the shaft 659 will be falsely stepped over the bank contact sets corresponding to the numerical order or orders of the omitted digits. Thus, the grounding of the conductor 941 caused the second and third numerical order digits to be evaded, and the grounding of conductor 847 caused the second numerical order digit to be evaded. It, of course, will be understood that in the exampled system all calling numbers to subscriber lines constitute seven digits in fact. Where fewer digits are sent, one or more of the digits in fact, constitute a plurality of digits. For example, it will appear, presently, that the digit "5", when sent as a first digit, refers to the first three numerical orders, when re-sent. Where the alternative calling number consists of but five digits, and the first digit and following digits are not re-sent in linking the connection, the second and third numerical order linking switches are by-passed or evaded.

Assume that the initiated call from telephone T3 is destined to the line leading to telephone TB, having listed number "763—5324", and an alternative calling number "5—5324". The finder switch F5 will function and relay 542 will actuate as before described when the selector S4 became seized by the secondary line switch SL3. When the first digit "7" is sent from the dial, the wipers of the selector S4 will step up into alignment with the seventh bank level, and there rotate-in and seize the first idle trunk, leading to second seceltor *n*. The armature of relay 533 will vibrate seven times responsive to the sending of the latter said digit, so that the switch element A7 will advance its wipers 701 to 709 into engagement with bank contacts 731 to 739, respectively. Ground from armature on relay G7 is applied through wiper 705, bank contact 755, conductor 730' to the winding of relay 578, the latter said relay actuating to cause the finder switch F5 to unseize, as before described. When the armature 617 retracts, the wipers on shaft 618 will advance one step, so that the relay 430 will be operatively energized over the traced path to ground, including wiper 636. However, this latter function will be to no operative purpose, because the armature 563 will retract following the attraction of armature 524, wherein it causes the unseizing of the finder switch F5. The relay 601 will deactuate and the switch element A7 will function to restore its wipers to normal, in the manner described. The finder switch F5 and its companion storing mechanism will now be subject to use in a new call. The call will be progressed through the second, third, fourth and fifth selectors and the connector to the called line, controlled directly from the dial.

If, in the last assumed call, the alternative calling number "5—5324" is employed, the sending of the first digit "5" will set the wipers 701 to 709 of switch element A7 into engagement with bank contacts 741 to 749, respectively. Also, the selector S4 will operate to step its wipers into alignment with the fifth level of bank contacts. Following the last impulse of the latter said digit, the armature 422 will retract and close a path from operated spring set 420, off-normal springs to the release magnet Re4, effective to restoring the wipers of the selector S4, but maintaining ground on conductor 413 from armature 412, so the antecedent switches will not unseize. Ground from armature on relay G7 will be applied through wiper 705, bank contact 745, conductor 942 to the bank contact 661, to cause the wipers on the shaft 659 to be advanced one step, in the manner before described. The circuit path traced from the magnet CM6 to the wiper 666 will be continued through bank contact 641', armature 669, wiper 670, bank contact 643', conductor 644', bank contact 746, wiper 706 to armature on relay G7, the magnet CM6 attracting its armature 89. A circuit path can be traced from bank contact 22, conductor 109, bank contact 742, wiper 702, conductor 750, bank contact 645', wipers 676—677, bank contact 665' to the winding of relay 679. When the wiper 35 engages bank contact 22, the relays 679 and 681 will actuate in the manner before described. The springs 68—69 will have sent seven open impulses, effective to stepping the wipers of selector S4 into alignment with the seventh level of bank contacts, where they will rotate-in and seize the first idle trunk leading to a second selector *n*. At the time relay 679 actuated, a circuit path is completed from the magnet SM'6, armature 669, wiper 670, bank contact 643', conductor 644', bank contact 746, wiper 706 to armature on relay G7, the magnet SM'6 actuating preparatory to ad-

vancing the wipers on the shaft 659 one step upon the retraction of armature 669, in the manner before described. Upon the deactuation of relay 681, a circuit path can be traced from the magnet CM6, wiper 666, bank contact 631', armature 669, wiper 670, bank contact 632', conductor 633', bank contact 747, wiper 707 to armature on relay G7, the magnet CM6 attracting its armature 89. A circuit path can be traced from bank contact 21, conductor 635', bank contact 743, wiper 703, conductor 843, bank contact 637', wipers 676—677, bank contact 638' to the winding of relay 679. When the wiper 35 has engaged bank contact 21, the relays 679 and 781 will actuate in the manner as before described. The springs 68—69 will have sent six open impulses, effective to stepping the wipers of second selector *n* into alignment with the sixth bank level, where they will rotate-in and seize the first idle trunk line leading to third selector *p*. At the time relay 679 actuates, a circuit path is completed from the magnet SM'6, armature 669, wiper 670, bank contact 632', conductor 633', bank contact 747, wiper 707 to armature on relay G7, the magnet SM'6 actuating, preparatory to advancing the wipers on the shaft 659 one step upon the retraction of armature 669, in the manner before described. Upon the deactuation of relay 681, a circuit path can be traced from the magnet CM6, wiper 666, bank contact 668, armature 669, wiper 670, bank contact 672, conductor 673, bank contact 743, wiper 703 to grounded armature on relay G7, the magnet CM6 attracting its armature 89. A circuit path can be traced from bank contact 18, conductor 674, bank contact 744, wiper 704, conductor 740, bank contact 675, wipers 676—677, bank contact 678 to the winding of relay 679. When the wiper 35 has engaged bank contact 18, the relays 679 and 681 will actuate in the manner before described. The springs 68—69 will have sent three open impulses effective to stepping the wipers of the third selector *p* into alignment with the third level of bank contacts, where they will rotate-in and seize the first idle trunk line leading to an incoming selector *d* of the group "763".

In this connection, it will be understood that while storing mechanism has been sending the first three digits of the listed calling number, interpreted from the first digit sent from the dial, the dial is perhaps being operated in sending the last four digits of the calling number and setting-up a condition in the storing mechanism corresponding therewith, so when the first three digits of the listed calling number have been sent from the storing mechanism, the last four digits of the calling number will be forthwith consecutively annexed. That is, wipers 101 to 103 on shaft 104 will be in engagement with bank contacts 106 to 108, respectively; wipers 151 to 153 on shaft 154 will be in engagement with bank contacts 161 to 163, respectively; wipers 101' to 103' on shaft 104' will be in engagement with bank contacts 106' to 108', respectively; wipers 151' to 153' on shaft 154' will be in engagement with bank contacts 161' to 163', respectively. It is to be noted, in this connection, that the storing mechanism switch elements A8 and A9 were not set. This is because the numerical orders represented by the latter said switch elements were set by the switch element A7. In order to cause the numerical order distributing switch ND6 to evade the "hundred-thousands" and "ten-thousands" numerical orders so that the digit series corresponding to the "thousands" numerical order, which will be the second digit series sent, in the present instance, ground will be applied from armature on relay G7, wiper 708, bank contact 748, conductors 755 and 756 in parallel, to bank contacts 651' and 652', respectively. In view of the latter condition, when armature 617 retracts at the termination of the first digit series of five impulses, and the magnet SM6 deenergizes, advancing wipers on the shaft 618 one step wherein wiper 653' will engage grounded bank contact 651', the magnet SM6 will be energized through its interrupter armature, thus causing it to advance the latter said wipers an additional step upon the energizing path becoming interrupted. This functioning will re-occur when the wiper 653 advances into engagement with bank contact 652'. That is, wiper 614 is caused to be automatically stepped from bank contact 615 to bank contact 648, preparatory to directing the second digit series applied to wiper 614 through engaged bank contact 648 over conductor 649 to magnet SM10.

An alternative method of progressing the connection wherein the alternative calling number is employed, may be accomplished by disconnecting the off-normal spring set 420, so that the selector S4 will not be caused to restore its wipers consequent to the sending of the first series of five impulses to effectuate the digit "5". The conductor 730' will be attached to bank contact 746, in lieu of the conductor shown there attached. This will cause the relay 578 to be energized to unseize the finder switch F5, upon the armature on relay G7 retracing at the termination of the said first digit series. Of course, conductors in switch A7 pertinent to the sending of digits "763" may be disconnected, under this method of operation. There will be trunks leading from the bank contacts of the fifth level of selector S4 in multiple with the third level trunks leading from third selector *p*. In lieu of the latter multiple relation, the trunks from the fifth level of selector S4 may lead direct to independent incoming selectors in the "763" group, the latter selectors having their corresponding bank contacts in multiple with the bank contacts of the incoming fourth selector *d* shown as reached from the third level of selector *p*. The last four digits of the called number will be directly effective from the dial to progress the call. This latter method of operation will correspond to the described method of calling alternative number "3—5728".

Assume that after initiating a call from telephone T3, it is desired to extend the connection to the line leading to telephone TC having listed calling number "845—6724", wherein the "84" secondary tandeming center is located advantageous to direct trunking from the "623" group first selector S4, though other groups of the exchange system may obtain connection to the said "84" center by routing through the primary tandeming center "8". Thus, in the present call emanating from the specific "623" group, the effective calling number will be "85—6724", wherein the second digit sent from the dial is eliminated by the storing mechanism when re-sending.

It will be clear, in view of the foregoing descriptions, that the storing mechanism will start re-sending when three digits have been set-up, though, perhaps, the said three digits may have been set-up by the sending of one digit series from the dial. It will also be clear that the re-sending functioning of the storing mechanism is independent of the functioning of receiving and storing of digit series sent from the dial. So it will simplify the succeeding disclosure by assuming that the calling party has sent the

seven series of digit impulses "845—6724" from the dial and that the following physical condition exists in the switch elements of the storing mechanism: The wipers on the shaft 618 will rest upon the lowermost set of cooperative bank contacts; wipers 701 to 709 will rest upon bank contacts 761 to 769, respectively; wipers 801 to 808 will rest upon bank contacts 851 to 858, respectively; wipers 901 to 909 will rest upon bank contacts 961 to 969, respectively; wipers 101 to 103 will rest upon bank contacts 116 to 118, respectively; wipers 151 to 153 will rest upon bank contacts 156 to 158, respectively; wipers 101′ to 103′ will rest upon bank contacts 106′ to 108′, respectively; wipers 151′ to 153′ will rest upon bank contacts 161′ to 163′, respectively. The selector S4 operated responsive to the sending of the first digit series from the dial, its wipers rotating-in at the eighth level and selecting the first idle trunk leading to a third selector *q* in the "84" secondary tandeming center, relay 430 being maintained actuated, in the manner before described.

Preparatory circuit paths, established by the storing mechanism switch elements, may be traced as follows: Bank contact 645′, conductor 750, wiper 702 to bank contact 762; bank contact 637′, conductor 848, tap to wiper 703 and engaged bank contact 763, wiper 803, bank contact 853, conductor 859 to bank contact 19; bank contact 675, conductor 740, wipers 704 and 709 resting upon bank contacts 764 and 769, respectively, wiper 902, bank contact 962, conductor 105 to bank contact 20; bank contact 685, conductor 686, wiper 103, bank contact 118, conductor 635′ to bank contact 21; bank contact 692, conductor 693, wiper 153, bank contact 158, conductor 109 to bank contact 22; bank contact 698, conductor 699, wiper 103′, bank contact 108′, conductor 109′, bank contact 17; bank contact 605′, conductor 606′, wiper 153′, bank contact 163′, conductor 859 to bank contact 19. Also, bank contact 643′, conductor 644′, bank contact 766, wiper 706 to armature on relay G7; bank contact 632′, conductor 633′, bank contact 767, wiper 707 to armature on relay G7; bank contact 672, conductor 673, bank contact 963, wiper 903 to armature on relay G9; bank contact 682, conductor 683, bank contact 117, wiper 102 to armature on relay G10; bank contact 689, conductor 690, bank contact 162, wiper 152 to armature on relay G′10; bank contact 602′, conductor 603′, bank contact 157′, wiper 152′ to armature on relay G′11. Also, bank contacts 656 and 657, conductor 941, bank contact 765, wiper 705 to armature on relay G7.

At the time armature on relay G9 retracts, following the sending of the third digit "5", ground is applied therefrom to wiper 903, bank contact 963, conductor 942 to bank contact 661. This will cause the wipers on the shaft 659 to be stepped from their normal position to the first successive set of bank contacts. Due to bank contacts 656 and 657 being grounded, the magnet SM′6 will operate in the manner before described, to advance the wipers two further steps, automatically. Wiper 670 now rests upon grounded bank contact 672, so magnet CM6 will energize in the manner before described. When the wiper 35 encounters bank contact 20, the windings of relays 679 and 681 will become in series, including the traced path between bank contacts 20 and 675, wipers 676—677 and bank contact 678. The relays 679 and 681 will actuate and magnet SM′6 will energize from grounded bank contact 772, effective to advance the wipers on shaft 659 one step upon armature 665 attracting. The winding of relay 679 will now be in a path including bank contact 685 to bank contact 21, and magnet CM6 will be energized from ground on bank contact 682. The relays 679 and 681 will actuate upon wiper 35 engaging bank contact 21, effective to advance the wipers on shaft 659 one step upon armature 665 attracting. The winding of relay 679 will now be in a path including bank contact 692 to bank contact 22, and magnet CM6 will be energized from ground on bank contact 689. The relays 679 and 681 will actuate upon wiper 35 engaging bank contact 22, effective to advance the wipers on shaft 659 one step upon armature 665 attracting. The winding of relay 679 will now be in a path including bank contact 698 to bank contact 17, and magnet CM6 will be energized from ground on bank contact 695. The relays 679 and 681 will actuate upon wiper 35 engaging bank contact 17, effective to advance the wipers on shaft 659 one step, upon armature 665 attracting. The winding of relay 679 will now be in a path including bank contact 605′ to bank contact 19, the magnet CM6 will be energized from ground on bank contact 602′. The relays 679 and 681 will actuate upon wiper 35 engaging bank contact 19, effective to advancing the wipers on shaft 659 one step upon armature 665 attracting, the said wipers now engaging the topmost set of bank contacts. Ground applied from conductor 546 through wiper 608, conductor 610, wiper 636, conductor 637 to maintain relay 430 actuated becomes opened because the bank contact wiper 608 is resting upon is dead. The finder switch F5 will unseize because of the removal of ground from conductor 610, as has been referred to.

It has been clear throughout the foregoing descriptions that the contact springs 68—69 controlled the sending of open impulse series in numerical correspondence with the number of bank contacts or bank contact positions traversed by the wiper 35 during the periods the magnet CM6 was energized. Also, due to the circuit relations, the selector *q* responded to the first series of five impulses re-sent, to progress the call over the first idle trunk of the fifth level thereof to the incoming fourth selector *c* in the "845" ten-thousand group, from whence the call is advanced in accordance with the last four digit series re-sent corresponding with the last four digit series sent from the dial. The first digit "8" in the present exampled call determined that the selector S4 will remain in seizure of the trunk leading to third selector *q*. It also determined that the second digit of the listed number sent from the dial will be evaded when re-sending. Under this assumed condition, the first digit "8" refers to but one-hundred thousand lines, because the selector *q* seized by selector S4 has access to but ten ten-thousand groups. Should it be desired to expand the accessibility of the eighth level of selector S4 ten times to comport with the potential capacity of the exchange system, it will be necessary to make the following circuit changes at such time: Tie bank contact 768 to bank contact 728, the latter being tied to wiper 804; tie bank contact 854 to conductor 941, which leads to bank contacts 656 and 657. So far, the arrangement conforms with the drawings. Disconnect the tap from conductor 941 to bank contact 765. The latter changes will insure that the bank con-

tacts 656 and 657 will constitute ground as when the digit "8" was the first digit sent from the dial. It will be manifest that if the first two digits are other than "84", or moreover, if the second digit is other than "4", the conductor 941 will not be grounded. That is, the sending the first two digits "84" under the latter assumed condition will operate to cause the numerical order commutating switch NC6 to evade the first two numerical orders. Attention is called to the fact that if digits "62", "64" or "82" are the first two digits of the called number, the conductor 941 will likewise become grounded to cause the first two numerical orders to be evaded. However, if the first three digits are "623", as was an assumed instance, this would not operate to vitiate the call, because the digit "3" will cause the selector S'4 to be seized, disconnecting selector S4. Of course, the numbers employed in the exchange system may not include the exampled interfering first two digits. If it does, in place of tieing bank contact 768 in multiple with wiper 804, it will be tied to an introduced wiper on shaft 820, which latter will cooperate with bank contact 854. The latter bank contact would not then be cooperative with wiper 804, there being a substituted bank contact for 854 cooperative with wiper 804, perhaps, depending upon its requirement.

In this connection, it will be understood that where a wiper attached to conductor leading to the armature on relay G7, for example, is accessible to a bank contact at any set position which has an operative conductor attached, the said operative conductor may be detached and re-attached to any bank contact cooperative with a wiper attached to the said conductor. That is, the drawings indicate that certain conductors are to be attached (through bank contacts) to the conductor leading to the armature on relay G7 when the shaft of a specific element has rotated a predetermined number of steps, and the armature on relay G7 has retracted, and it is immaterial that wiper accomplishes this. Also, certain of the wipers are shown as engaging off-normal bank contacts attached to a common operative conductor. It is manifest a pair of off-normal springs, operated by a shaft cam may be substituted therefor. And it will be understood that where commoned bank contacts occur consecutively, as in the case of commoned bank contacts engageable to wiper 608, for example, the wipers will be of such design as to span adjacent bank contacts while passing from one to another, so no open circuit path condition will occur under this condition. Obviously, this would not be necessary in the case of wipers 701 and 705, for example.

If it is assumed that after initiating a call from telephone T3, it is desired to extend the connection to the line having listed calling number "0", which may, perhaps, be the toll recording operator's switchboard LD, the calling party will pull digit "0", wherein the selector S4 will respond to step its wipers into alignment with the tenth bank level, and there rotate-in and seize the first idle trunk leading to second selector *r*. The finder switch F5 functions incidental to the initiation of the call, in the manner before described, so the switch element A7 functions coincident with selector S4 to set its wiper 701 to 709 into engagement with bank contacts 771 to 779, respectively. When armature 617 retracts, following the last impulse of the "0" digit series, the wipers on the shaft 618 will be rotated one step, closing the before traced circuit path energizing relay 430. Circuit paths can be traced as follows: From bank contacts 643', conductor 644', bank contact 776, wiper 706 to armature on relay G7; bank contact 632', conductor 633', bank contact 777, wiper 707 to armature on relay G7; ground from armature on relay G7, wiper 708, bank contact 778, conductor 780 to multipled bank contacts 668', 669', 670', 671' and 672'; bank contact 661, conductor 942, bank contact 775, wiper 705 to armature on relay G7; bank contact 645', conductor 750, wiper 702, bank contact 772, conductor 109' to bank contact 17; bank contact 637', conductor 848, wiper 703, bank contact 773, conductor 674 to bank contact 18. Due to bank contact 661 being grounded, the magnet SM'6 will operate to rotate the wipers on shaft 659 one step. The magnet CM6 will energize over the traced path therefrom to wiper 666, and thence to contact 641', armature 669, wiper 670, bank contact 643, conductor 644', bank contact 766, wiper 706 to armature on relay G7. This will cause wiper 35 to be drawn to bank contact 17 to complete the operative circuit path including the windings of relays 679 and 681, in the manner before described, having in mind that wipers 676—677 tie bank contacts 645—665'. The deactuation of relay 679 will cause wipers on shaft 659 to be advanced a step, as magnet SM'6 was energized to grounded bank contact 643'. Magnet CM6 will energize over the traced path therefrom to wiper 666, bank contact 631', armature 669, wiper 670, bank contact 632' to armature on relay G7. Wiper 35 will now be drawn to bank contact 18 to complete the operative circuit path including the windings of relays 679 and 681, in the manner before described, having in mind that wipers 676—677 tie bank contacts 637'—638'. The deactuation of relay 679 will cause wipers on shaft 659 to be advanced a step, as magnet SM'6 was energized to grounded bank contact 632'. No energizing path for the magnet CM6 will now exist. However, wiper 662 will find ground on bank contacts 668' to 672' as the magnet SM'6 operates its interrupter contacts in advancing the wipers on the shaft 659 so they will engage the uppermost set of bank contacts. The wipers on shaft 618 have not advanced beyond the first step wherein wiper 636 is in engagement with bank contact 635. When wiper 608 assumed its position on the uppermost bank contact, the energizing path for relays 430 and 526 opened, causing the talking path to be completed through selector S4, and causing the finder switch F5 to unseize. The latter function will cause the switch elements of the storing mechanism to restore in the manner described.

It is clear that the contact springs 68—69 controlled the sending of open impulses in series corresponding to the train of digits "23", which latter digits were successively effective to step the wipers of the second selector *r* into alignment with the second bank level thereof, where it rotated-in and seized the first idle trunk leading to third selector *s*. The latter said selector then steps its wipers into alignment with the third bank level to select the first idle trunk line leading to the switchboard LD. The latter trunk line may involve any of the well known circuit means for linking final selectors to a responding switchboard. A suitable circuit for this is shown in Fig. 3 of my pending application for U. S. Patent, Serial No. 362,321, filed March 1, 1920.

In the last exampled call, the second and third

digits where automatically annexed through the agency of the storing mechanism, forthwith following the first digit sent from the dial, resultant from a condition set-up in the storing mechanism. This set-up condition was effectuated coincident with setting the selector S4, responsive to sending the digit "0" from the dial. After the relay 430 deactuated, the linked connection is the same as would have ensued had the conductors 566 and 504 been disconnected before initiating the call, and the calling party had sent digits "023" from the dial, in lieu of "0", simply.

If it is assumed that after initiating the call from telephone T3, it is desired to extend the connection to the line leading to telephone TD, having the listed calling number "625—4782", for example, the called party, after perceiving the dialing tone, will pull the corresponding holes of the dial to set the various switch elements of the storing mechanism, in the manner before described. The selector S4 will step its wipers into alignment with the sixth level and rotate-in and seize the first idle trunk leading to selector *j*, responsive to the first digit "6". Consequent to the sending of the third digit "5", the wipers of the selector S4 are restored, and the storing mechanism initiates its functioning to apply directive impulses to the selector S4 to re-operate it and the succeeding selectors and the connector, successively. Having in mind the stated functioning, and the fact that the storing mechanism may receive and store responsive to the dial while at the same time it is re-sending stored impulses, it will appear that the re-sending will be self-initiated consequent to the sending of the third digit "5", and that a series of eleven and a series of five impulses will be re-sent in lieu of the "625" sent from the dial, the following circuit paths may be traced from set-up conditions: Armature on relay G7, wiper 707, bank contact 727, conductor 730', wiper 805, bank contact 825, conductor 830, wiper 905, bank contact 965, conductor 714, and over the traced path to the release magnet Re4; armature on relay G7, wiper 708, bank contact 728, conductor 782, wiper 804, bank contact 824, conductor 865, wiper 904, bank contact 964, conductor 972 to bank contact 677'; bank contact 645', conductor 750, wiper 702, bank contact 722, conductor 675' to bank contact 26; bank contact 637', conductor 848, wiper 803, bank contact 823, conductor 109' to bank contact 17; bank contact 675, conductor 740, wiper 709, bank contact 729, conductor 783, wiper 807, bank contact 827, conductor 868, wiper 908, bank contact 968, conductor 105 to bank contact 20; bank contact 685, conductor 686, wiper 103, bank contact 128, conductor 859, bank contact 19; bank contact 692, conductor 693, wiper 153, bank contact 158, conductor 109 to bank contact 22; bank contact 698, conductor 699, wiper 103', bank contact 128', conductor 159' to bank contact 23; bank contact 605', conductor 606', wiper 153', bank contact 173', conductor 109' to bank contact 17; bank contact 643', conductor 644' to free bank contacts 746, 766 and 776; bank contact 632', conductor 633', bank contact 822, wiper 802 to armature on relay G8; bank contact 672, conductor 673, bank contact 693, wiper 903 to armature on relay G9; bank contact 682, conductor 683, bank contact 127, wiper 102 to armature on relay G10; bank contact 689, conductor 690, bank contact 157, wiper 152 to armature on relay G'10; bank contact 695, conductor 696, bank contact 127', wiper 102' to armature on relay G11; bank contact 602', conductor 603', bank contact 172' to armature on relay G'11; bank contact 661, conductor 942, bank contact 963, wiper 903 to armature on relay G9. The latter traced path is established consequent to the sending of the third digit "5", and causes the re-sending to be initiated whereby the wipers on the shaft 659 will be rotated one step. The magnet CM6 will energize over the path previously traced to wiper 666 and thence to bank contact 641', armature 669, wiper 670 to grounded bank contact 643'.

In view of previous descriptions, it will be clear that due to bank contact 677' being grounded, the second digit "2" will be evaded, and therefore, but six digit series will be sent. Due to the set-up condition, the first and second series re-sent will be "11" and "5", respectively, since the wiper 35 will first rotate to bank contact 26, and then to bank contact 20. The last four digit series re-sent will correspond numerically with the last four digits sent from the dial. The first digit series "6" sent from the dial set-up digit series "11"; the second digit series "2" sent from the dial set-up digit series "2" and the third digit series "5" sent from the dial set-up digit series "5". However, the set-up condition due to the sending of the second digit "2" is ignored, due to the ground on bank contact 677' causing the switch NC6 to falsely rotate from the corresponding numerical order bank contact set without causing the corresponding functioning of the digit finder switch DF6. In this connection, it will be understood that the armature 669 will always retract a sufficient period in advance of the retraction of armature 665 to insure that the said false rotation due to the grounded condition of bank contact 677', for example, will have occurred before the magnet CM6 will energize, at least before sufficient time has elapsed for the wiper 35 to have reached a grounded bank contact corresponding to the numerical order (or orders) which is to be ignored. The successive operation of the wiper 35 in finding the bank contacts grounded through the agency of the switch NC6 as it successively progresses over the bank contacts of the six numerical orders and the unseizing of the finder switch F5 and the deactuation of relay 430 after the connector has set its wipers upon the bank contact set corresponding to the called line will be manifest, in view of previous descriptions.

If it is assumed that in lieu of sending digits "625—4782" in the last exampled call, digits "626—4782" are sent, wherein the third digit is "6" in lieu of "5", the circuit path from bank contact 675, conductor 740 will continue over the last before traced path to wiper 908, thence to bank contact 978, conductor 635' to bank contact 21, in lieu of from conductor 740, bank contact 968, conductor 108 to bank contact 20. The wiper 905 will engage bank contact 975 in lieu of 965, conductor 714 to the release magnet Re4, as before. This will cause the same functioning as before, only that the third digit re-sent will now be "6" in lieu of "5" because bank contact 21 is concerned now in lieu of 20. That is, fourth selector *g* will be seized at the sixth level of third selector *f* in lieu of fourth selector *h* at the fifth level of said selector *f*.

If it is assumed that in lieu of sending digits "625—4728" in the last exampled call, digits "667—4782" are sent, wherein the second and third digits are "67" in lieu of "26", the circuit

paths with relation to bank contacts 645', 637', 675, 643', 632' and 672 will be altered, though the circuit paths with relation to the last four digits will be the same as in the last two exampled calls. Circuit paths can be traced as follows: Bank contact 645', conductor 750, wiper 702, bank contact 722, conductor 675', bank contact 26; bank contact 637', conductor 848, wiper 803, bank contact 833, conductor 635', bank contact 21; bank contact 675, conductor 740, wiper 902, conductor 109 to bank contact 22; bank contact 643, conductor 644, bank contact 756, wiper 706 to armature on relay G7; bank contact 632', conductor 633', bank contact 832, wiper 802 to armature on relay G8; bank contact 672, conductor 673, bank contact 933, wiper 903 to armature on relay G9; bank contact 630', conductor 847, bank contact 835, wiper 805, conductor 730, bank contact 727, wiper 707, to armature on relay G7; bank contact 657, conductor 942, bank contact 933, wiper 903 to armature on relay G9. The bank contact 661 is thus grounded consequent to the sending of the third digit from the dial. Bank contact 630' being grounded, the wiper 658 (and companion wipers) will be caused to rotate to the second set of bank contacts corresponding to the second digit "6". Thus, while the storing mechanism is set-up to re-send "6" as the first digit, and "6" as the second digit also, but one of the latter said digits, the second, will be re-sent. The selector S4 having remained where set under direct control of the dial will be in the position as if the wipers thereof had been at normal and the first digit "6" had been re-sent effective to operating it. Of course, since the wipers of the switch NC6 moved from normal to the second set of bank contacts to re-send the second digit of the number sent from the dial, there will be no delay while the selector S4 is being operated. The last four digits of the number under call will be annexed in the manner referred to in the call to telephone TB.

It will be understood that while the re-sending of the primarily sent digits have been initiated consequent to the third digit being sent, this function may be varied to suit conditions, it being only necessary to ground conductor 942 to cause the said initiation. This latter can be done by the corresponding wiper and cooperating bank contact of any of the storing switch elements. Of course, in some instances the route of the call is not determined until the third digit has been sent, and in such case the initiation of the re-sending will be necessarily held until the required number of digits have been primarily sent from the dial in accordance with the specific call. Thus, it is practicable to initiate the re-sending coincident with the completion of the primary sending of the first digit, where the first digit indexes that the call will be stored and sent in its entirety.

Under the condition of sending from the dial while the storing mechanism is re-sending, if the latter has sent all stored digits, while some are still to be stored, the re-sending will be arrested until another digit has been stored, when the re-sending will ensue. Thus, a very prolonged interval may be made between digits sent from the dial without vitiating the call or releasing the storing mechanism and finder switch prematurely. The wiper 670 must receive ground from an engaged bank contact in order to energize the magnet CM6, so if the latter said wiper is advanced to a numerical order which has not been set-up, the functioning of the switch DF6 will not occur until the set-up condition subsequently ensues.

Fig. 20 is a preferred modification of a portion of Fig. 6, affecting relay 681. A fast relay 681' having two windings is substituted for relay 680. When relay 681 actuates, added slow-releasing relay 211' will actuate to energize the left-hand winding of relay 681' to hold it locked for a predetermined period. The make-before-break spring 212' on relay 211' serves to disconnect the windings of relay 211' and to maintain it until after the yoke 10 has had time to retract and flex spring 54. This will insure relay 681' being held actuated a predetermined length of time after the last impulse of a series has been sent, irrespective of the time the yoke is required to retract, so the period between digit series will be practically constant, regardless of the time taken for the yoke to retract. A possible variation of the said period occurs wherein there may be a variable angular distance for a clutch tooth to progress before encountering the obtruded clutch-claw.

It will be manifest that the secondary line switch SL3 may be displaced by a line switch of the type disclosed in D3 of Fig. 3, my pending application for U. S. Patent, Serial No. 535,430, filed February 10, 1922, Patent No. 1,776,022, granted Sept. 16, 1930.

By introducing Fig. 22 so the lines thereof extending to the right-hand margin register with the lines extending to the right from section line AA in Fig. 4, and applying Fig. 5 to Fig. 22 so the lines extending to the lower margin of Fig. 5 will register with the lines of Fig. 22 extending to the upper margin, the functioning of the system will be changed. It will be manifest that the said introduction of Fig. 22 will mean that the finder switches shown in Fig. 5 will be related to the trunks leading to the secondary line switches, as SL3', in lieu of first selector as S4. That is, the finder switch requisitioned will initiate its hunting operation forthwith upon the primary line switch PL3 seizing.

In order to avoid confusion the designations in Fig. 22 will have a prime added wherein they correspond to designations of parts in Figs. 3 and 4.

The relay 430' (corresponding to relay 430) is now interposed in the trunk leading to the secondary line switch SL3' in essentially the same relation to the group of finder switches, as F5 and F'5, as when the said relay 430 was described interposed in the trunk leading-in to the first selector S4.

The secondary line switch SL3' is modified from the switch SL3 by the addition of the upper armatures 375 and 381 on relays 334' and 309', respectively, and the two upper wipers 376 and 382 are also added. The bank contacts at the left in Fig. 22 are those the wipers of the switch PL3 are shown resting upon in Fig. 3.

When the primary line switch PL3 seizes and thereby applies ground to bank contact 318' from the lower armature of relay 301, this ground will be applied through armature 375, conductors 504' and 504, armature 503 to the lower winding of relay 502, to initiate the hunting of the finder switch in the manner before described. Should the relay 334' actuate forthwith upon the switch PL5 seizing due to the fact the selector S4 is idle, the armature 375 will open the energizing circuit of relay 502, perhaps, before the finder switch converted has found the trunk leading to switch SL3'. Wiper 376 will complete a circuit

path from conductor 504', bank contact 377, conductor 504, armature 414 to conductor 413. The latter said conductor will be grounded at armature 412, though a brief lapse of ground to conductor 504 may occur. The relay 502 may be made slightly slow-releasing to bridge the latter said lapse. Thus, after armature 375 attracts, the relay 502 is maintained from ground applied through wiper 376 until armature 507 fully attracts when the finder switch seizes. Armature 381 applies ground from armature 316' to bank contact 318' before relay 301 deactuates, so no lapse of ground occurs to the winding of relay 307. When armature 375 attracts, bank contact 318' is tied and locked to the upper winding terminal of relay 334'. Conductor 538' is applied through wiper 382, bank contact 383 to conductor 538'', so that conductors 504 and 538'' now have the same operative function as where the finder switches are directly related to the trunks leading to the first selectors as S4, fully described.

It will thus appear that the finder switch will initiate its functioning and perhaps seize the requisitioning trunk by the time the secondary line switch SL3' seizes; at least so briefly thereafter that the calling party will not be required to await a further time. In commercial operation, the storing mechanism will be ready to receive the first digit series sent from the calling dial when the calling party is ready to initiate the sending therefrom. In view of previous descriptions, the detailed operation of switch SL3' with relation to the system will be manifest.

The introduction of armature 381 insures that ground from bank contact 318' cannot energize relay 334' until after relay 309' has first actuated. This insures that the relay 334' will not falsely actuate; even if wiper 322' is resting upon a grounded bank contact when switch SL3 is seized. The line switch SL3 may have an armature corresponding to 375 introduced between conductor 317 and the upper winding terminal of relay 334, in lieu of the permanent tie conductor, for the object last referred to thus obviating adjustments to forestall the said false actuation of relay 334.

In the exampled system, the impulses re-sent from the storing mechanism have been of the same open character as those primarily sent from the dial. It will be understood that in carrying out the invention into its possible modifications that all or only a part of the impulse series may be of a character to correspond to the impulses primarily sent. That is, the series re-sent to set the first switch corresponding to the first numerical order, for example, may be of the same character as the impulses primarily sent, while the impulse series following may be of a different character, and moreover, may be of a complex character constituted of a combination of impulses of different characters.

The scope of the invention will be understood and defined by the subjoined claims.

I claim:—

1. In a telephone system, calling and called lines, a directive calling device on the calling line, a common storing mechanism for receiving and storing series of directive impulses sent from the said calling device, directively controlled switches for extending a connection from the calling line to a called line, means for applying directive impulses from the said calling device directly effective to part of the said switches concerned in extending a call from the calling line, and means whereby part of the series of directive impulses concerned in the said call are first stored by the said storing mechanism and then resent therefrom effective to other of said switches to complete the extension of the call to the called line.

2. In a telephone system, calling and called lines, a directive calling device on the calling line, a common storing mechanism for receiving and storing series of directive impulses sent from the said calling device, a train of directively controlled switches for extending a connection from the calling line to a called line, means for applying directive impulses from the said calling device directly effective to the first switch of the said train in extending a call from the calling line towards the called line and means whereby the remaining directive impulses sent from the calling device concerned in the said call are first stored in the said storing mechanism and then resent therefrom effective to other said switches to complete the extension of the call to the called line.

3. In a telephone system, calling and called lines, a directive calling device on the calling line, a switch terminating the far end of the calling line, a storing mechanism for receiving and storing directive impulses sent from the said calling device, a train of directively controlled switches including the first said switch as the first switch of the train for extending a connection from the calling line to a called line, an other switch accessible from the first switch of the said train, means for applying directive impulses from the said calling device directly effective to the said first switch of the said train to extend the call to said other switch, means whereby all the directive impulses are effective to setting-up a stored condition in the said storing mechanism, and means made operative dependent upon what line is being called, to restore the said first switch and to then reoperate the said first switch and other switches of its train, controlled automatically from the storing mechanism to extend the call from the calling line to the called line.

4. In a telephone system, calling and called lines, a directive calling device on the calling line, a storing mechanism for receiving and storing series of directive impulses sent from the said calling device, a train of directively controlled switches for extending a connection from the calling to a called line, an other switch accessible from the first switch of the said train, means for applying directive impulses from the said calling device directly effective to the said first switch of the said train to extend the call to the said other switch or alternatively to the succeedent switch of the said train dependent upon the first series of directive impulses sent from the calling device, means whereby all the directive impulses are effective to setting-up a stored condition in the said storing mechanism, and means made operative dependent upon what line is being called to restore the said first switch and then reoperate the said first switch and other switches of its train controlled automatically from the said storing mechanism, or to retain the said first switch where operated.

5. In a telephone system, calling and called lines, a directive calling device on the calling line, a storing mechanism for receiving and storing a train of series of directive impulses sent from the said calling device, a first switch terminating the calling line having access to two trains of directively controlled selective switches

to extend a connection from the calling line to either said train and to respective called lines, means for directively operating the first said switch by a series of directive impulses while also operating the storing mechanism to store the latter said directive impulse series to progress the call from the said first switch to one or the other said train, automatically applied means for restoring the said first switch and for thereafter reoperating it automatically applied from the storing mechanism to advance the call to the called line over one said train of switches, or to advance the call to the called line over the other said train of switches under automatically applied control of the storing mechanism while retaining the said first switch where primarily operated, the said automatic restoring of the first said switch depending upon what line is called.

6. In a telephone system, calling and called lines, a directive calling device on the calling line, a storing mechanism for receiving and storing a train of series of directive impulses sent from the said calling device, a first switch terminating the calling line having access to two trains of directively controlled selective switches to extend a connection from the calling line to either said train and to respective called lines, means for directively operating the first said switch by a series of directive impulses to progress the call from the said first switch to one or the other said train, automatically applied means for restoring the said first switch and for thereafter reoperating it to advance the call to the called line over one said train of switches, or to advance the call to the called line over the other said train of switches while retaining the said first switch where primarily operated, the said automatic restoring of the said first switch depending upon what line is called.

7. In a telephone system, calling and called lines, the calling line leading to a line switch, a directive calling device on the calling line, directive switches in a first and in a second group accessible from the line switch, a first selective switch of said first group being automatically selected consequent to the call being initiated on the calling line, a storing mechanism for receiving and storing a directive series of impulses sent from the said calling line effective to the said first directive switch, means for applying directive impulses from the said calling device directly effective to the said first directive switch and to the storing mechanism, and means made operative responsive to a predetermined directive series of impulses sent from the calling device to cause the line switch to disconnect from the switch primarily seized and thereupon select and seize a switch of the said second group.

8. In a telephone system, calling and called lines, the calling line leading to a line switch, a directive calling device on the calling line, directive switches in a first and in a second group accessible from the line switch, a first selective switch of said first group being automatically selected consequent to the call being initiated on the calling line, a storing mechanism for receiving and storing a directive series of impulses sent from the said calling line effective to the said first directive switch, means for applying directive impulses from the said calling device directly effective to the said first directive switch and to the storing mechanism, means made operative responsive to a predetermined directive series of impulses sent from the calling device to cause the line switch to disconnect from the switch primarily seized and thereupon select and seize a switch of the said second group, and means whereby annexing the remaining series of impulses of the train constituting the number of the called line will complete the connection from the calling to the called line including the said directive switches of the said second group as links of the connection.

9. In a telephone system, calling and called lines, the calling line leading to a line switch, a directive calling device on the calling line, directive switches in a first and in a second group accessible from the line switch, a first directive switch of said first group being automatically selected consequent to the call being initiated on the calling line, other directive switches, a storing mechanism for receiving and storing a train of series of directive impulses sent from the said calling line effective to the said first directive switch and other of the said other directive switches, means for applying directive impulses from the said calling device directly effective to extend the connection through a plurality of the said directive switches including the said first directive switch, and means made operative upon a predetermined number of links being annexed for destroying the connection linked and for then automatically progressing the call responsive to the storing mechanism wherein a switch of the said second group will be the first switch linked.

10. In a telephone system, calling and called lines, the calling line leading to a line switch, a directive calling device on the calling line, directive switches in a first and in a second group accessible from the line switch, a first directive switch of said first group being automatically selected consequent to the call being initiated on the calling line, other directive switches, a storing mechanism associated with the said first directive switch for receiving and storing a train of series of directive impulses sent from the said calling line effective to the said first directive switch and other of the said other directive switches, alternative trains of impulses effective to progress the call through the same switches to the same called line, and means depending upon what train of impulses is sent from the calling line determining if the call will be directly progressed responsive to the calling device on the called line, or first stored by the storing mechanism and then made effective to automatically progress the call to the line called directed by the storing mechanism.

11. In a telephone system, calling and called lines, a directive calling device on the calling line, directive switches, a first one of said directive switches being attained consequent to the initiation of the call on the calling line, a storing mechanism associated with the said first one of the directive switches for receiving and storing a train of series of directive impulses sent from the said calling line primarily effective to certain ones of the said directive switches in progressing the call, and means made operative upon a predetermined number of series of impulses having been sent from the calling line in extending the connection towards the called line to disconnect the said storing mechanism from the connection or to disable the primary control of the directive switches against the calling device and to thereafter place the control of the switches in secondary automatically applied control of the storing mechanism to progress the call to the called

line, but primarily controlled from the calling device, depending upon what line is being called.

12. In a telephone system, a calling line and a called line, automatic directive switches of different numerical orders, a directive impulse calling device on the calling line, and means whereby sending either of two trains of impulse series will progress a call from the said calling line through all or only a part of the said switches to the said called line depending upon which train of impulse series is sent from the calling device.

13. In a telephone system, calling and called lines, automatic directive switches of different numerical orders, a directive impulse device on a calling line, a storing mechanism associated with the calling line responsive to the calling device for storing the train of impulse series sent from the calling device and resending the said train effective to the directive switches to extend the call from the calling line to the called line, a tone source, and means for applying the said tone source audible along the calling line only during the time the impulses are being resent.

14. In a telephone system, a calling line leading to a line switch having two sets of wipers each having access to a specific group of switches, the said switch automatically functioning to seize a switch of one group responsive to the initiation of a call on the calling line, and means whereby when a predetermined series of impulses is sent from the calling device effective to the terminating switch the said line switch will unseize and hunt for and seize the first idle switch of the alternative group through the alternative wiper set.

15. In an impulse storing and sending mechanism, a continuously rotating member, a reciprocating member driven from normal by the rotating member, a resilient member for retracting the reciprocating member to normal, digit setting elements, a digit numerical order distributor, a digit commutator, a digit finder, an impulse sending contact device driven by the said rotating member, means including the digit numerical order distributer for setting the said setting elements in accordance with the digit series to be sent, means including the digit commutator for successively driving and retracting the reciprocating member over spaces of the digit finder in accordance with the digits set and with the order in which the digits are to be sent, and means for causing the said contact device to effect digit series of circuit interruptions in correspondence with only the driven movements of the reciprocating member.

16. In an impulse storing and sending mechanism, a continuously rotating member, a reciprocating member driven from normal by the rotating member, a resilient member for retracting the reciprocating member to normal, digit setting elements, a digit numerical order distributer, a digit commutator, a digit finder, an impulse sending contact device driven by the said rotating member, means including the digit numerical order distributer for setting the said setting elements in accordance with the digit series to be sent, means including the digit commutator for successively driving and retracting the reciprocating member over spaces of the digit finder in accordance with the digits set and with the order in which the digits are to be sent, means for causing the said contact device to effect digit series of circuit interruptions in correspondence with only the driven movements of the reciprocating member, and means for causing equal spacing of the said digit series sent.

17. In an impulse storing and sending mechanism, a continuously rotating member, a reciprocating member driven from normal by the rotating member, a resilient member for retracting the reciprocating member to normal, digit setting elements, a digit commutator, a digit finder, an impulse sending contact device driven by the said rotating member, means for setting the said setting elements in accordance with the digit series to be sent, means for successively driving and retracting the reciprocating member over spaces of the digit finder in accordance with the digits set and with the order in which the digits are to be sent, and means for causing the said contact device to effect digit series of circuit interruptions in correspondence with only the driven movements of the reciprocating member.

18. In an impulse storing and sending mechanism, a continuously rotating member, a reciprocating member driven from normal by the rotating member, a resilient member for retracting the reciprocating member to normal, digit setting elements, a digit commutator, a digit finder, an impulse sending contact device driven by the said rotating member, means for setting said setting elements in accordance with the digit series of different digits to be sent, means for successively driving and retracting the reciprocating member over spaces of the digit finder in accordance with the digits set and with the order in which the digits are to be sent, means for causing said contact device to effect digit series of circuit interruptions in correspondence with only the driven movements of the reciprocating member, and means for causing equal spacing of said digit series sent.

19. In an impulse storing and sending mechanism, a continuously rotating member, a reciprocating digit designating member, a setting device, means for manually operating the setting device in accordance with a train of different digits, means for directly driving said reciprocating member by said rotating member, means including the reciprocating member for transmitting a train of impulse series corresponding with the setting of the setting device, means for restoring the reciprocating member after each impulse series of a train.

20. In an impulse storing and sending mechanism, a continuously rotating shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, means for manually operating the setting device in accordance with a train of different digits, and automatically applied means including the reciprocating member for transmitting a train of impulse series in correspondence with said operation of said setting device wherein an equal pause is made between each series of the train.

21. In an impulse storing and sending mechanism, a continuously rotating shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, means for manually operating the setting device in accordance with a train of different digits, and automatically applied means including the reciprocating member for transmitting a train of impulse series in correspondence with said operation of said setting device wherein an equal pause is made between each series of the train regardless of unequal pause in the manual setting.

22. In an impulse storing and sending mechanism, a continuously rotating driving shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, means for manually operating the setting device in accordance with a train of different digits, automatically applied means for successively operating said reciprocating member to initiate the transmission of the respective digit series of the train by the impulse transmitter, automatically applied means for transmitting each digit series in correspondence with the extent of travel of said reciprocating member during the transmission of the specific series of the train, and means for determining said travel by the said operation of the setting device.

23. In an impulse storing and sending mechanism, a continually rotating driving shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, manual control means for operating the setting device in accordance with a train of digits, a pawl operating magnet, a relay, means for operating the pawl to initiate the travel of the reciprocating member, means for rendering the impulse transmitter effective consequent to the off-normal travel of the reciprocating member, automatically applied means for operating the relay to restore the reciprocating member and to terminate the digit series being sent in correspondence with the first digit of the train, automatically applied means including the magnet and the relay for successively operating and restoring the reciprocating member to effectively transmit digit series in accordance with the succeeding digits of the train, and means for disabling the magnet consequent to the termination of the final series of the train.

24. In an impulse storing and sending mechanism, a continually rotating driving shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, manual control means for operating the setting device in accordance with a train of digits, a pawl operating magnet, a relay, means for operating the pawl to initiate the travel of the reciprocating member, means for rendering the impulse transmitter effective consequent to the off-normal travel of the reciprocating member, automatically applied means for operating the relay to restore the reciprocating member and to terminate the digit series bent sent in correspondence with the first digit of the train, and automatically applied means including the magnet and the relay for successively operating and restoring the reciprocating member to effectively transmit digit series in accordance with the succeeding digits of the train.

25. In an impulse storing and sending mechanism, a continually rotating driving shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, manual control means for operating the setting device in accordance with a train of digits, a pawl operating magnet, a relay, means for operating the pawl to initiate the travel of the reciprocating member, means for rendering the impulse transmitter effective consequent to the off-normal travel of the reciprocating member, automatically applied means for operating the relay to restore the reciprocating member and to terminate the digit series being sent in correspondence with the first digit of the train, automatically applied means including the magnet and the relay for successively operating and restoring the reciprocating member to effectively transmit digit series in accordance with the succeeding digits of the train, and means for equally spacing the digit series.

26. In an impulse storing and sending mechanism, a continually rotating driving shaft, an impulse transmitter operated by the shaft, a reciprocating digit designating member driven by the shaft, a setting device, manual control means for operating the setting device in accordance with a train of digits, a pawl operating magnet, a relay, automatically applied means responsive to the said operation of the setting device for operating the pawl to initiate the travel of the reciprocating member, means for rendering the impulse transmitter effective consequent to the off-normal travel of the reciprocating member, automatically applied means for operating the relay to restore the reciprocating member and to terminate the digit series being sent in correspondence with the first digit of the train, and automatically applied means including the magnet and the relay for successively operating and restoring the reciprocating member to effectively transmit digit series in accordance with the succeeding digits of the train.

27. In a telephone system, a calling and a called line, a directive calling device on the calling line, directive switches, a first one of said directive switches being attained consequent to the initiation of the call on the calling line, a storing mechanism associated with the calling line for receiving and storing a train of series of directive impulses sent from the said calling line for resending impulses to control the directive switches to extend the call to the called line, and means whereby sending either of two trains involving a different number of series of impulses from the calling line will set-up a condition in the storing mechanism whereby the storing mechanism will send like trains of impulses to progress the call between said lines regardless of which series has been sent from the calling line.

28. In a telephone system, a calling and a called line, a directive calling device on the calling line, directive switches, a storing mechanism for receiving and storing directive impulses sent from said calling device for causing the directive switches to extend the calling line to the called line, and means responsive to the sending of any one of a plurality of trains of a different number of series of impulses from the calling device for causing the storing device to effect like operations of the said switches in effecting the completion of a call between the said lines.

29. In a telephone system, a calling and a called line, a directive calling device, directive switches, a storing mechanism for receiving and storing directive impulses sent from said calling device for causing the directive switches to extend the call from the calling to the called line, and means responsive to the sending of any of a plurality of trains of a different number of series of impulses from the calling device for causing the storing device to effect like operations of the said switches in effecting the completion of a call between the said lines.

30. In an impulse mechanism, a digit setting device, an impulse storing device, means for operating the storing device by the setting device, means for causing the storing device to effect a train of impulse series in predetermined correspondence with the operation of the setting device, and means responsive to each one of a plu-

rality of different digit settings of the setting device wherein each setting is constituted of a different number of digits for a train to cause the storing device to effect like trains of impulse series.

31. In an impulse mechanism, a digit setting device, an impulse storing device, means for operating the storing device by the setting device, means for causing the storing device to effect a train of impulses in predetermined correspondence with the operation of the setting device, and means responsive to each one of a plurality of different digit settings of the setting device wherein each setting is constituted of a different number of digits for a train to cause the storing device to effect like trains of impulse series.

32. In an impulse mechanism, a digit setting device, an impulse storing device, means for operating the storing device by the setting device, means for causing the storing device to effect a train of impulse series in predetermined correspondence with the operation of the setting device, and means responsive to each one of a plurality of different digit settings of the setting device wherein each setting is constituted of a different number of different digits for a train to cause the storing device to effect like trains of impulse series.

33. In a telephone system, a calling and a called line, a directive impulse calling device, directive switches, and means whereby sending either of two different trains constituted of unlike number of series of impulses from the calling device alternatively will cause like operation of the said switches in effecting the completion of a connection from the said calling to the said called line.

34. In a telephone system, a calling and a called line, a directive impulse calling device, directive switches, and means whereby sending either of two different trains constituted of unlike number of unlike series of impulses from the calling device alternatively will cause like operation of the said switches in effecting the completion of a connection from the said calling to the said called line.

35. In a telephone system, a calling and a called line, a directive impulse calling device, directive switches, and means whereby sending any one of a plurality of different trains constituted of unlike number of unlike series of impulses from the calling device at will will cause like operation of the said switches in effecting the completion of a connection from the said calling to the said called line.

36. In an automatic telephone system, a calling line, a switch, groups of line connecting terminals accessible from the switch, a directive device on the calling line for operating the switch, means responsive to the operation of the directive device for operating the switch into selective relation to a corresponding said group, and automatically applied means depending upon what group has been selected for restoring and reoperating the switch into selective relation with another of said groups.

37. In an automatic telephone system, a calling line, a switch, groups of line connecting terminals accessible from the switch, a directive device on the calling line for operating the switch, means responsive to the operation of the directive device for operating the switch into selective relation to a corresponding said group, and automatically applied means depending upon what group has been selected for restoring and reoperating the switch into selective relation with another of said groups and for connecting with terminals of a line of the last said group by a hunting operation.

38. In an automatic telephone system, a calling line, a switch, groups of line connecting terminals accessible from the switch, a directive device on the calling line for operating the switch, means responsive to the operation of the directive device for operating the switch into selective relation to one or another said groups, and automatically applied means depending upon what group has been directively selected for restoring and reoperating the switch into selective relation with another of said groups with predetermined correspondence to the said directive operation.

39. In an automatic telephone system, a calling line, a switch, groups of line connecting terminals accessible from the switch, a directive device on the calling line for operating the switch, means responsive to the operation of the directive device for operating the switch into selective relation to one or another said groups, and automatically applied means depending upon what group has been directively selected for restoring and reoperating the switch into selective relation with another of said groups with predetermined correspondence to the said directive operation and for connecting with the terminals of a line of the last said group by a hunting operation.

40. In an automatic telephone system, a calling line, a called line, an automatic directive control device, a storing device, automatic switches, trunk line links for extending connections from the calling line, means responsive to the operation of the control device in accordance with the call digits of the called line to operate certain of said switches for selectively extending the calling line over certain of the trunk line links, means responsive to the said operation of the control device for also operating the storing device, automatically applied means responsive to predetermined said operation of the control device for causing the said extended connection to be destroyed and to then operate certain of said switches directed by the storing device to extend the calling line over certain of said trunk links toward the called line.

41. In an automatic telephone system, a switch, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to a predetermined impulse series respectively, and automatically applied means whereby if the switch is operated into selective relation to certain said groups will cause the switch to thereupon operate into selective relation to a predetermined different said group respectively regardless of the busy or idle state of the lines of the first selected group.

42. In an automatic telephone system, a switch, a storing device, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to predetermined impulse series respectively, means for operating the storing device by the impulse device when operating the switch, and automatically applied means including the storing device whereby if the switch is operated into selective relation to certain said groups will cause the switch to thereupon operate into selective relation to a predetermined different said group respectively.

43. In an automatic telephone system, a switch, a storing device, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to predetermined impulse series respectively, means for simultaneously operating the storing device by the impulse device when operating the switch, and automatically applied means including the storing device whereby if the switch is operated into selective relation to a certain said group will cause the switch to thereupon operate into selective relation to a predetermined different said group regardless of the condition of the said certain group.

44. In an automatic telephone system, a switch, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to a predetermined impulse series respectively, and automatically applied means whereby if the switch is operated into selective relation to a group of certain of said groups will cause the switch to thereupon operate into selective relation to a predetermined different one of first said groups respectively regardless of the condition of the selected one of said certain groups.

45. In an automatic telephone system, a switch, a storing device, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to predetermined impulse series respectively, means for simultaneously operating the storing device by the impulse device when operating the switch, and automatically applied means including the storing device whereby if the switch is operated into selective relation to a group of certain said groups will cause the switch to thereupon operate into selective relation to a predetermined different one of first said groups respectively regardless of the condition of the selected one of said certain groups.

46. In an automatic telephone system, a switch, a storing device, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to predetermined impulse series respectively, means for simultaneously operating the storing device by the impulse device when operating the switch, and automatically applied means including the storing device whereby if the switch is operated into selective relation to a certain said group will cause the switch to thereupon operate into selective relation to a predetermined different one of first said groups regardless of the condition of the said certain group and connect with the terminals of a line of the said different group.

47. In an automatic telephone system, a switch, a storing device, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to predetermined impulse series respectively, means for simultaneously operating the storing device by the impulse device when operating the switch, automatically applied means including the storing device whereby if the switch is operated into selective relation to a certain said group will cause the switch to thereupon operate into selective relation to a predetermined different one of first said groups regardless of the condition of said certain group and connect with the terminals of a line of the said different group, and means whereby the switch can be directively operated into selective relation to any first said groups and connect with the terminals of a line of said selected group.

43. In an automatic telephone system, a switch, a storing device, groups of line terminals accessible from the switch, an impulse device for directively operating the switch with selective relation to said groups responsive to predetermined impulse series respectively, means for simultaneously operating the storing device by the impulse device when operating the switch, automatically applied means including the storing device whereby if the switch is operated into selective relation to a certain said group will cause the switch to thereupon operate into selective relation to a predetermined different one of first said groups regardless of the condition of the said certain group and connect with terminals of a line of the said different group by a hunting operation, and means whereby the switch can be directively operated into selective relation to said certain group and connect with the terminals of a line of the last said group by a hunting operation.

49. In an automatic telephone system, a calling line, a called line, a directive calling device, a selective switch, other selective switches, a finder switch, means on the calling line for causing the said calling line to be extended to the selective switch, means responsive to the said extension to cause the finder switch to operate to effect its connection with the calling line, means for thereafter operating the directive device to operate the first said selective switch, means responsive to the directive device to disconnect the finder switch without restoring the selective switch and for thereupon rendering the finder switch available for a new connection, and means for then operating the said other selective switches by the calling device to complete the first said extension to the called line.

50. In an automatic telephone system, a calling line, a first and a second switch, first and second wiper sets of the said first switch, leading-in terminals of the said second switch accessible from the said first switch, other connecting terminals of lines specifically accessible from the said switches respectively, means on the calling line for causing the operation of the said first switch to extend the calling line through said first wiper set to the said leading-in terminals of the said second switch, means for directively operating the said second switch from the calling line to thereby cause the said second switch to extend the calling line to a said accessible one of the specific said other line terminals, and means for directively operating the said second switch from the calling line to disconnect the said extension and to thereupon cause the said first switch to extend the calling line through said second wiper set to a said accessible one of the specific said other line terminals without effacing the call.

51. In an automatic telephone system, a calling line, a first and a second switch, first and second wiper sets of the said first switch, leading-in terminals of the said second switch accessible from the said first switch, a first group of trunk lines accessible from the said first switch, a second group of trunk lines accessible from the said second switch, means on the calling line for causing the operation of the said first switch to extend the calling line through said first wiper set to the said leading-in terminals of the said

second switch, and means for directively operating said second switch from the calling line to thereby at will cause the said calling line to be thereupon extended through the said second wiper set to a trunk of said first group or through the said second switch to a trunk of said second group.

52. In an automatic telephone system, a calling line, a first and a second switch, first and second wiper sets of the said first switch, leading-in terminals of the said second switch accessible from the said first switch by a hunting operation, a first group of trunk lines accessible from the said first switch by a hunting operation, a second group of trunks accessible from the said second switch by a hunting operation, means on the calling line for causing the operation of the said first switch to extend the calling line through said first wiper set to the said leading-in terminals of the said second switch by a hunting operation, and means for directively operating the said second switch from the calling line to thereby at will cause the said calling line to be thereupon extended through the said second wiper set to a trunk of the said first group or through the said second switch to a trunk of said second group by a hunting operation.

53. In an automatic telephone system, a calling line, a first and a second switch, first and second wiper sets of the said first switch, leading-in terminals of the said second switch accessible from the said first switch, a first group of trunk lines accessible from the said first switch, a second group of trunk lines accessible from the said second switch, means on the calling line for causing the operation of the said first switch to extend the calling line through said first wiper set to the said leading-in terminals of the said second switch, means for directively operating the said second switch to thereby at will further extend the calling line through the said second switch to a trunk of said second group or to thereby cause the said first switch to destroy the said extension to the said leading-in terminals and thereupon alternatively extend the calling line through said second wiper set to a trunk of said first group without effacing the call.

54. In an automatic telephone system, a calling line, a first and a second switch, first and second wiper sets of the said first switch, leading-in terminals of the said second switch accessible from the said first switch, a first group of trunk lines accessible from the said first switch, a second group of trunk lines accessible from the said second switch, means on the calling line for causing the operation of the said first switch to extend the calling line through said first wiper set to the said leading-in terminals of the said second switch, and means including the second switch directively controlled from the calling line for causing the calling line to be thereby extended through the said second set of wipers to a trunk of the first group or through said second switch to the second group at will.

55. In an automatic telephone system, a calling line, a called line, an automatic directive control device, a storing device, a first automatic switch, other automatic switches, trunk line links for extending connections from the calling line, means responsive to the operation of the control device in accordance with the call digits of the called line to operate the first switch and certain of said other switches for selectively extending the calling line over certain of the trunk line links, means responsive to said operation of the control device for also operating the storing device, automatically applied means including the storing device responsive to predetermined said operation of the control device for causing said extended connection to be destroyed and then differently re-operate said first switch and initially operate certain of said other switches to extend the calling line toward the called line over certain of said trunk links other than employed in first said extension.

56. In an automatic telephone system, a calling line, a called line, an automatic directive control device, a storing device, a first automatic switch, other automatic switches, trunk line links for extending connections from the calling line, means responsive to the operation of the control device in accordance with the call digits of the called line to operate the first switch for selectively extending the calling line over a certain one of said trunk links, means responsive to said operation of the control device for also operating the storing device, automatically applied means including the storing device responsive to predetermined said operation of the control device for causing said extended connection to be destroyed and to then differently re-operate said first switch and initially operate certain of said other switches to extend the calling line toward the called line over certain of said trunk links other than employed in first said extension.

57. In an automatic telephone system, a calling line, a manually operated impulse sending device on the calling line, a second impulse sending device, automatic linking switches, a setting switch having a movable element variably operable to correspondingly set said second impulse device to in turn directively operate certain of said automatic switches to link an extension from said calling line, and means responsive to only a single operation of first said impulse sending device to step-by-step directively set said movable element of the setting switch in accordance with only the step-by-step directed operation of said movable element for thereby causing said second sending device to thereupon start its operation to direct the operation of certain of said automatic switches to extend a connection from the calling line with correspondence to the setting of said second impulse device by said movement.

58. In an automatic telephone system, a calling line, a manually operated impulse sending device on the calling line, a second impulse sending device, automatic linking switches, a setting switch having a shaft and wipers carried thereby variably operable to correspondingly set said second impulse device to in turn directively operate certain of said switches to link an extension from said calling line, and means responsive to only a single operation of first said impulse sending device to step-by-step directively set said wipers of the setting switch in accordance with only the step-by-step directed operation of said wipers for thereby causing said second sending device to thereupon start its operation to direct the operation of certain of said automatic switches to extend a connection from the calling line with correspondence to the setting of said second impulse device by said wipers.

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