Feb. 18, 1930. C. E. LOMAX 1,747,478

AUTOMATIC TELEPHONE SYSTEM

Original Filed Sept. 16, 1925 2 Sheets-Sheet 1

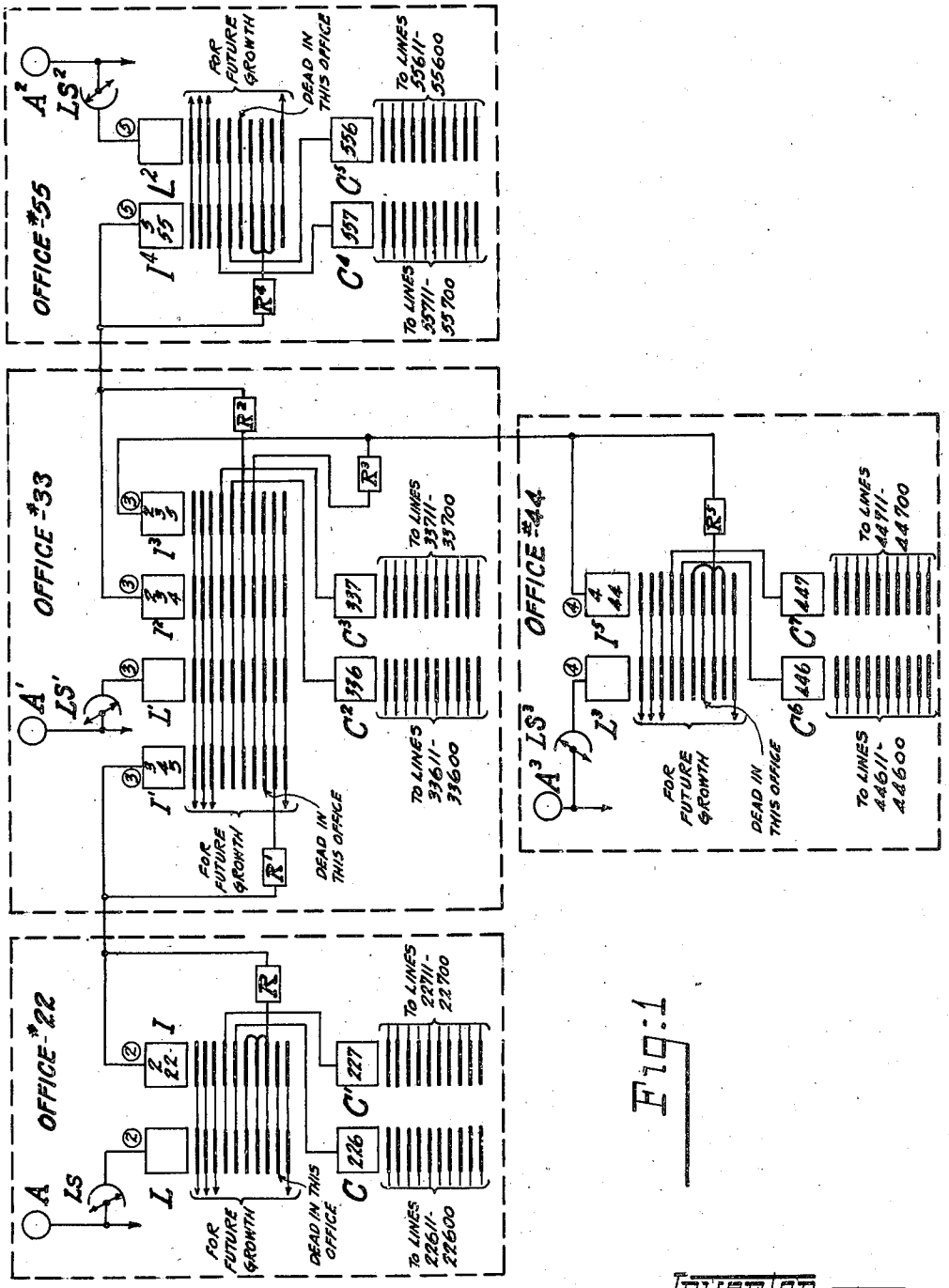

Fig. 1

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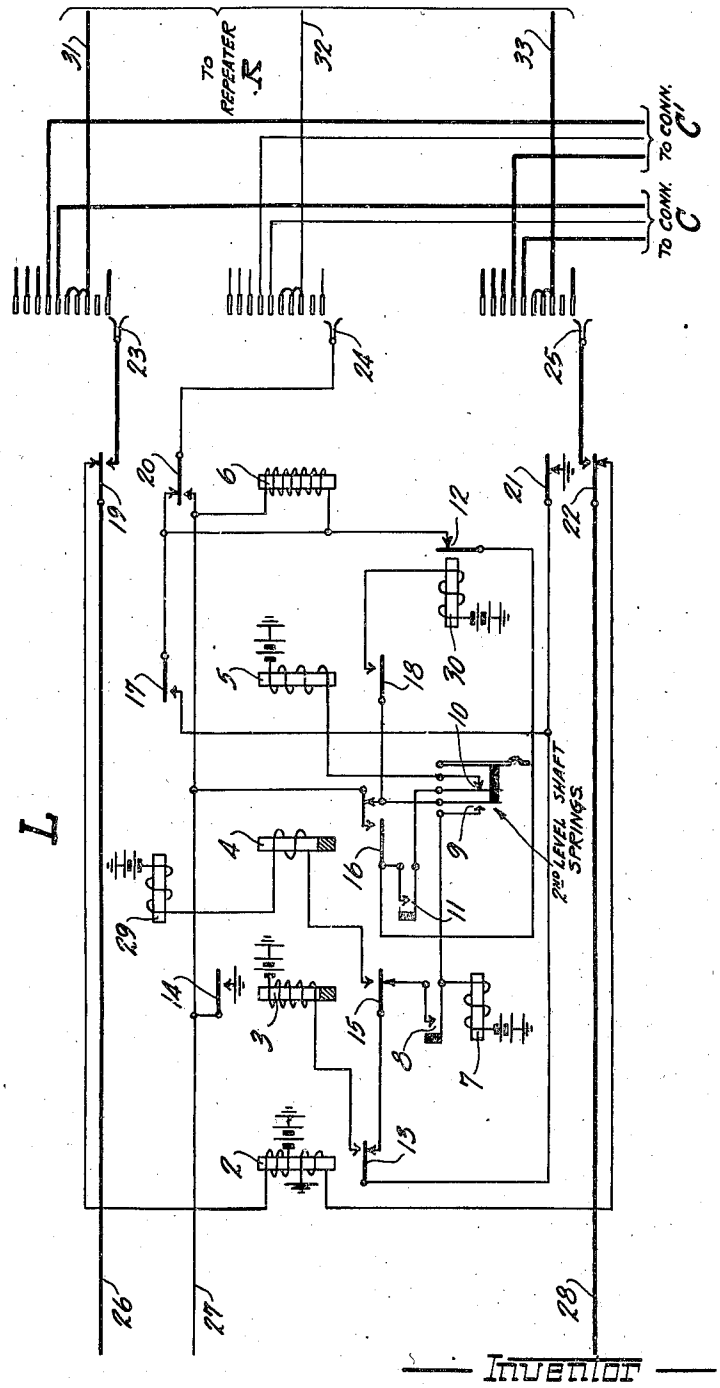

Fig: 2

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Patented Feb. 18, 1930 1,747,478

UNITED STATES PATENT OFFICE

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AUTOMATIC TELEPHONE SYSTEM

Application filed September 16, 1925, Serial No. 56,565. Renewed April 15, 1929.

The present invention relates to multi-office automatic telephone systems, and the broad general object is the production of an economical inter-office trunking arrangement and an economical arrangement of the switches in the various offices concerned while maintaining a uniform and universal numbering arrangement.

Specifically, one object of the invention is the provision of arrangements for providing tandem trunking facilities in connection with certain calls in a system employing universal numbering, together with arrangements whereby the number of switches involved on non-tandem calls is not increased.

Another object is the production of a suitable arrangement whereby a given selector serves the purpose of both an office selector and of a local group selector.

Other objects and features may be learned best from the following description in connection with the accompanying drawings comprising Figs. 1 and 2.

Referring now to the drawings, Fig. 1 is a trunking lay-out showing four offices which are numbered 22, 33, 44, and 55, respectively, and which comprise a system embodying the features of the invention; and Fig. 2 shows the local selector L which is also shown diagramatically in office number 22, Fig. 1.

The selector L, Fig. 2, is a standard selector in every respect except for the provision of the second-level shaft springs and the associated circuit connections whereby the selector wipers are restored to their normal position each time the selector responds to the digit 2.

In Fig. 1, the substations A—A^3 are shown in the offices 22, 33, 55, and 44, respectively. The lines of these substations extend to the line switches LS—LS^3 and these line switches have access to the local selectors L—L^3, respectively. In addition to the local selectors the incoming selectors I—I^5 are shown. The trunk lines terminating in the incoming selectors are two way trunk lines, and they are seized through the sections associated with the repeaters R—R^5. This drawing shows also the connectors C—C^7, two of these connectors being shown in each office, each having access to a different hundred-line group.

It will be noted that certain numbers are placed within the squares representing the incoming selectors and the connectors. These numbers it may be pointed out represent the digits and the digit combinations that must be dialled in order to extend a connection to the respective switches.

The selectors in the office number 22 are arranged to drop back when they respond to the digit 2, the selectors in office number 33 are arranged to drop back when they respond to the digit 3, etc. The digit on which each selector drops back is indicated by the number placed within the small circle drawn above each selector. These selectors are arranged to drop back from the critical level repeatedly. That is, if the dialling of the critical digit is followed by the dialling of of the critical digit a second time, the selector drops back the second time also, thus absorbing the critical digit as many times as may be necessary (in the present case two times).

Considering now the trunking arrangement a little more in detail, it will be noted that there are trunk lines directly connecting the office 33 with each of the other offices and that there are no trunk lines directly connecting the other offices with each other. The result is that an inter-office call originating in office 33, goes directly to the called office when the first digit is dialled. Similarly, an inter-office call originated in either of the offices other than office number 33 and intended for office number 33 is trunked to the called office when the first digit is dialled. However, the inter-office calls originating in offices 22, 44 and 55 and intended for offices other than office 33, reach their destination by

way of two trunk lines in tandem, one trunk line extending from the calling office to office number 33 and the other trunk line extending from office number 33 to the called office. It will thus be seen that two office digits are required in the latter type of inter-office call, the first digit being used to extend the connection to office number 33 and the second digit being used to extend the connection from office number 33 to the called office. It will be seen furthermore that on inter-office calls in which office number 33 is a calling office or the called office only one digit is required to trunk the calls to the desired office. Now in order to keep the numbers uniform and universal each office designation contains two digits; namely, 22, 33, 44, and 55. That being the case, arrangements must be provided to absorb or otherwise dispose of the second office digit on non-tandem inter-office calls. This result is accomplished by arranging the incoming selectors, including the incoming selectors I—I^5 so that each will restore its wipers to normal when it is operated responsive to the second digit in the designation of the office to which it is local.

In line with the foregoing remarks, it may for example, be noted that when office number 44 is called through the local selector L in office number 22, the first digit 4 causes the selector L to raise its wipers opposite the fourth level and select an idle outgoing trunk through a repeater, such as R, to an incoming selector, such as I', in office number 33. The incoming selector I' responds to the second office digit 4 and selects an idle outgoing trunk through a repeater, such as R^3, to an incoming selector, such as I^5 in office number 44. The incoming selector I^5 then responds to the next digit, either a 6 or a 7, to extend a connection to one of the connectors, such as C^6 or C^7, which responds to the last two digits in the number to extend the connection to the called line.

It may be seen also that on a call from one of the outlying offices to office number 33, say from office number 22, the dialing of the first office digit 3 results in the local selector raising its wipers opposite the third level and selecting an idle outgoing trunk line through a repeater, such as R, to an incoming selector such as I'. The selector I' responds to the second office digit 3 by raising its wipers opposite the third level. However, as is indicated by the numeral 3 placed inside the circle just above the selector I', the selector I' releases its wipers whenever it is operated in accordance with the digit 3. That being the case, when the second office digit 3 is received it is wiped out by the incoming selector I' when the wipers of this selector are automatically restored to their normal position. The dialling of the next digit, either a 6 or a 7, results in the extension of a connection to a connector, such as C^2 or C^3, which subsequently responds to the remaining two digits in the number to complete the connection to the called line.

In a similar manner, when a call is originated in the tandem office 33 and intended for an outlying office, for example office 22, the local selector L' in office number 33 responds to the first office digit 2 and selects an outgoing trunk line through a repeater such as R' to an incoming selector I in office 22. The selector I responds to the second office digit 2 by raising its wipers opposite the second level, but as is indicated by the numeral 2 placed inside the circle just above the selector I the wipers of this selector are released and restored to normal whenever they are brought opposite the second level of bank contact responsive to the dialling of the digit 2. The selector I responds to the next digit, either a 6 or a 7, and extends the connection to a connector, such as the connector C or the connector C', which operates in response to the two remaining digits in the number to complete the connection to the desired line.

At this point it may be mentioned that, whereas the addition of the second office digit to the respective designations of the offices other than office 33 is for the purpose of making the numbers universal so that they will be the same regardless of from what office they are called, the addition of the second digit to the designation of office number 33 is for another purpose; namely, to bring the number of digits in the numbers of lines in office number 33 up to the five digits required in the numbers of the lines in the other office.

Considering now local calls in any office, since the drop-back selectors used are arranged so that they drop back repeatedly from their respective critical levels, the banks of the local first selectors are multipled directly with the banks of the incoming hundred selectors with the result that on a local call the first selector operates twice in response to the two office digits, restoring its wipers to normal following each office digit, after which it operates in accordance with the next digit to seize a local connector. For example, when a local call is made in office number 22 the local selector L, which is arranged to drop back from the second level, operates in response to the first office digit 2 and then restores its wipers to normal. This operation is repeated when the second office digit 2 is dialled. When the third digit in the number (either a 6 or a 7) is dialled, the local selector L raises its wipers to the sixth or to the seventh level and selects an idle connector such as C or C', which connector responds to the next two digits in the number to complete the connection to the desired local line.

The trunking lay-out having been ex-

plained, a more detailed explanation of the operation of the selector L, Fig. 2, will now be given. Assuming that the subscriber at substation A, Fig. 1, desiring to converse with a subscriber whose line terminates in office number 33, removes his receiver, the line switch LS operates in the usual manner to seize an idle local selector, for example, the selector L. The selector L is seized over the conductors 26—28, Fig. 2. When this occurs, line relay 2 energizes over the calling line and closes at armature 13 a circuit for release relay 3. Release relay 3 energizes and at armature 15 opens a point in the circuit of release magnet 7 and prepares a circuit for vertical magnet 29, and at armature 14 places ground upon the release trunk conductor 27 so as to maintain the line switch LS operated in the usual manner.

When the calling subscriber manipulates his calling device in accordance with the first digit 3 in the desired number, line relay 2 of the local selector L falls back three times. Each time it does so, relay 2 closes at armature 13 a circuit through armature 15 and its working contact and the slow acting series relay 4 for vertical magnet 29. By the operation of vertical magnet 29, the wipers 23—25 are raised step by step and come to rest opposite the third level of bank contacts. The slow acting relay 4 is energized in series with vertical magnet 29 and maintains its armature 16 attracted throughout the vertical movement. Off-normal contacts 8 and 11 close as soon as the first vertical step is taken, and off-normal contacts 11 complete a circuit for stepping relay 5 as follows: from ground by way of the grounded release trunk conductor 27, working contact and armature 16, off-normal contacts 11, shaft-spring contacts 10, and relay 5 to battery. Relay 5 energizes and prepares at armature 18 a circuit for rotary magnet 30, and at armature 17 it closes a locking circuit for itself from ground through the resting contact and armature 21, working contact and armature 17, interrupter contacts 12, off-normal contacts 11, and shaft-spring contacts 10.

At the end of the vertical movement, relay 4 falls back and completes the rotary magnet circuit and opens the initial circuit of relay 5. Relay 5 remains energized over its locking circuit. Rotary magnet 30 energizes from the grounded release trunk conductor 27 through the normally closed contacts controlled by armature 16 and through armature 18 and its working contact and advances the wipers 23—25 into engagement with the first set of bank contacts in the third level. Near the end of its stroke, magnet 30 opens the interrupter contacts 12, whereupon relay 5 falls back and opens a further point in its own circuit at armatue 17 and opens the circuit of rotary magnet 30 at armature 18. Rotary magnet 30 now falls back and closes its interrupter contacts 12 again.

Further operation depends upon whether the trunk line terminating in the first set of bank contacts is busy or idle. If this trunk line is idle switching relay 6 now energizes, seizing the trunk. If, however, the trunk is busy, there is a ground potential encountered on the busy test contact by test wiper 24, short-circuiting relay 6. In this case relay 5 is again energized by the ground potential on test wiper 24 through armature 20 and its resting contact, and contacts 12, 11, and 10, whereupon the circuit of rotary magnet 30 is again closed at armature 18 and the wipers 23—25 take another step.

This alternate operation of relay 5 and magnet 30 continues as described until an idle trunk line is reached, which trunk line it will be assumed is the one comprising conductors 31—33 and extending to the repeater R, Fig. 1. When this idle trunk line is reached, relay 5 does not energize again on account of the fact that test wiper 24 does not encounter a grounded contact. Therefore, relay 6, being no longer short circuited, energizes from ground on the grounded release trunk conductor 27, and through contacts 12, 11, and 10 and relay 5. Relay 5 does not operate at this time owing to the relatively high resistance of relay 6. Upon energizing, relay 6 removes the ground potential from armature 13 at armature 21; thereby opening the circuit of the slow acting release relay 3; opens a point in the test circuit and prepares the holding circuit at armature 20; and at armatures 19 and 22 disconnects conductors 26 and 28 from the windings of line relay 2 and extends them by way of wipers 23 and 25 to the conductors 31 and 33 of the seized trunk line.

The line and release relays (not shown) of the repeater R now energize over the seized trunk line and the latter relay places ground on release trunk conductor 32, thereby grounding, through wiper 24 and armatures 20 and its working contact, the release trunk conductor 27 before the said conductor 27 is ungrounded by the falling back of the slow acting relay 3.

Responsive to the seizure of the repeater R, the incoming selector I in the calling office is cut off from the two-way inter-office trunk line, and the incoming selector I′ in office number 33 is prepared for operation in the usual manner. An arrangement of repeaters and selectors for a two-way trunk line suitable for use in the present situation is shown in Fig. 2 of the drawings in my prior Patent 1,518,862 issued Dec. 9, 1924, it being merely necessary to substitute incoming selectors with circuits like those of the selector L, Fig. 2, of the present case in place of the selectors shown in the drawing referred to.

When the second digit 3 is dialled, the dis-

tant selector I′ raises its wipers opposite the third level of bank contacts and then restores its wipers to their normal position.

When the next digit in the number is dialled, a connector similar to C^2 or C^3 is seized. The seized connector responds to the next two digits in the number to complete the connection to the desired line.

When the conversation is terminated, the calling subscriber replaces his receiver whereupon the release trunk conductor 32 is ungrounded by the repeater R, Fig. 1. When this occurs the switching relay 6 of the local selector L, Fig. 2, falls back and closes at armature 21 a circuit through armature 13 and its resting contact, armature 15 and its resting contact, and off-normal contacts 8 for release magnet 7. Release magnet 7 thereupon energizes with the result that wipers 23—25 are restored to their normal position in the usual manner. Off-normal contacts 8 open the circuit of release magnet 7 when the wipers reach their normal position.

Assuming now that the subscriber at substation A removes his receiver; that the line switch LS seizes the selector L; and that the calling subscriber desires to converse with a subscriber in his own exchange, the subscriber at substation A dials the first office digit 2, with the result that the wipers 23—25 of the local selector L are raised oposite the second level of bank contacts. When this occurs, the second level shaft springs, which are operated only when the wipers are standing opposite the second level of bank contacts, operate, opening the contacts 10 and closing the contacts 9. The opening of contacts 10 results in the denergization of relay 5, and the closing of contacts 9 results in the preparation of a circuit for release magnet 7.

When relay 4 falls back, the release magnet circuit is completed at the normally closed contacts controlled by armature 16 from the grounded release trunk conductor 27 through the shaft-spring contacts 9. Release magnet 7 energizes with the result that the wipers 23—25 are restored to their normal position in the usual manner. The circuit of release magnet 7 is opened at contacts 9 responsive to the dropping of the shaft. The releasing operation, however, is not stopped responsive to the deenergization of release magnet 7 because of the usual so-called release link which maintains the so-called double dog in its normal position.

As another result of the dropping of the shaft, the usual circuit of switching relay 6 is completed at contacts 10 and it remains closed until the off-normal contacts 11 open. Relay 6 does not energize at this time on account of the short time taken for the shaft to complete its restoration to normal and open the contacts 11.

Referring now again to the trunking layout shown in Fig. 1, certain modifications will be described. It will be noted that the addition of the second 3 to the designation of office number 33 has no utility in the present layout other than to make the telephone numbers of the lines terminating in office number 33 of the same length as the telephone numbers of lines terminating in the other offices. In certain instances it may be permissible, or even desirable, to have the telephone numbers shorter in office number 33, in which case the second "3" is merely omitted and the office becomes instead office number 3. In the modified arrangement, the drop-back feature is eliminated in the incoming selectors I′, I^2, and I^3 as it is the second office digit 3 that these incoming selectors absorb in the layout as shown. The local selector L′ still contains the drop-back feature and drops back on local calls only once, the designation of the connectors C^2 and C^3 in this case being 36 and 37, respectively.

A still further modification may be had by going a step further. Trunk lines may be run directly from office number 22 to the offices 44 and 55, in which case the second digit in the designation of office number 22 may be eliminated. In this further modification the third level of the selectors in office number 22 still leads to office number 33 as shown in the drawings. However the ties between the third and fourth levels and between the fourth and fifth levels are cut. Trunks from the fourth level are taken directly through outgoing repeaters to trunk lines leading to incoming selectors in office number 44, and trunks from the fifth level are similarly extended to office number 55.

In office number 44, the tie between the second and third levels is now removed and the second level trunks lead directly to office number 22. The same is true in office number 55.

In order to obtain direct trunking throughout, it is only necessary in the offices 44 and 55 to now remove the ties between the third and fifth and the third and fourth levels respectively, and to join the two offices by direct trunk lines. When this is accomplished all the office designations may consist of one digit each and the office designations become merely 2, 3, 4, and 5 respectively; none of the incoming selectors are of the drop back type; and the local selectors in the various offices each absorb one digit only.

It will be noted that only two levels of the selectors in the layout shown leads to connectors. That means that ultimate capacity of the various offices with the equipment indicated is 200 lines each. However, the first, eighth, ninth, and tenth levels of the selectors in each office are available for future growth. Therefore, the capacity of any office may be increased in 100 line steps up to 600 lines by merely adding connector groups to each of the selector levels above named.

In addition to the sixth and seventh levels which now lead to connectors and in addition to the levels available for future growth, there are in each office three outgoing levels and one dead level, the latter corresponding to the local office. Obviously, connector groups cannot be assigned to those levels leading to outgoing trunks, but an arrangement will now be described whereby the levels indicated as dead levels in the various offices may each be used to trunk to an additional connector group.

Considering the above described situation in which direct trunks are run between each office and every other office and in which each office designation consists of a single digit, it will be remembered that the local selectors only are of the drop back type in this case and that they drop back on only one digit as there is only one office digit to be absorbed on local calls. Accordingly, the local selectors are merely converted into the type shown and described in the copending application of Martin, Serial No. 392,943, filed June 30, 1920. The drop back selector shown in the Martin application restores its shaft and wipers to normal when the critical digit is dialled the first time, but when this digit is repeated the wipers are again brought to the same level and are rotated in search of an idle trunk line in the usual manner. The connection is thus extended to an idle connector which may be operated to complete the connection to a desired line.

This same arrangement as regards the local selectors, may be applied to the tandem trunking layout as shown in Fig. 1 by merely modifying the selector shown in the above Martin application so that it releases twice from the critical level and then hunts on the critical level when the critical digit is dialled the third time. In connection with the incoming selectors, however, it is merely necessary to make them of the type shown in the above Martin application as they are never called upon to absorb more than one digit each.

What is claimed is:

1. In a telephone system, an automatic switch, a terminal of a given order accessible thereto, another terminal accessible thereto of a numerical order two orders removed from the first named terminal, means for seizing said switch and for transmitting series of impulses thereto, said switch being responsive to a series of impulses of one value to select the first named terminal and responsive to a series of impulses of another value to select said other terminal, and means in said switch operative subsequent to the seizure thereof and prior to the receipt of the last named series of impulses for cancelling two series of impulses.

2. In a telephone system, an automatic switch, a terminal of a given numerical order accessible thereto, another terminal accessible thereto of a different numerical order, means for seizing said switch and for transmitting series of impulses thereto, said switch being responsive to a series of impulses representing a given digit for seizing the first named terminal and responsive to impulses representing a different digit for seizing said other terminal, and means in said switch operative responsive to the receipt of impulses representing a still different digit for cancelling such digit prior to the receipt of the second named series of impulses.

3. In a telephone system, a first office, a second office, and a third office, switching mechanism in the first office responsive to one digit, for trunking a call from the first office to the second office, switching mechanism in the second office responsive to a second digit for extending the connection from the second office to the third office, and means associated with the switching mechanism in the second office for absorbing one digit on calls from the first office and intended for a line terminating in the second office.

4. In a telephone system, a first office, a second office, and a third office, switching mechanism in the first office responsive to one digit for trunking a call from the first office to the second office, switching mechanism in the second office responsive to a second digit for extending the connection from the second office to the third office, means associated with the switching mechanism in the second office for absorbing one digit on calls from the first office and intended for a line terminating in the second office, and means associated with the switching mechanism in the first office for absorbing two digits on calls local to the first office.

5. In a telephone system, a first office, a second office, and a third office, the third office being designated by means of two digits, switching mechanism in the first office responsive to the first of the two said digits to extend a connection to the second office, switching mechanism in the second office responsive to the second of said digits for extending said connection to the third office, other switching mechanism in the second office responsive in a second call to the first digit in said office designation for extending a connection to the third office, switching mechanism in the third office, and means associated with the said switching mechanism in the third office for cancelling the second digit in the office designation in the latter case.

6. In a telephone system, a first office, a second office, and a third office, the third office being designated by means of two digits, switching mechanism in the first office responsive to the first of the two said digits to extend a connection to the second office, switching mechanism in the second office responsive to the second of said digits for ex-

tending said connection to the third office, other switching mechanism in the second office responsive in a second call to the first digit in said office designation for extending a connection to the third office, switching mechanism in the third office, and means associated with said switching mechanism in the third office for cancelling the second digit in the office designation in the latter case and for cancelling both digits in the office designation in a local call within the third office.

7. In a telephone system, a first office and a second office, the second office being designated by a given digit, switching mechanism in the first office responsive to such digit to extend a connection to the second office, and switching mechanism in the second office responsive in local calls in the second office to cancel the said digit.

8. In a telephone system, a first office and a second office, a given digit being assigned to designate the first office and another digit being assigned to designate the second office, a first selector in the first office, a terminal located in the bank of said selector and corresponding to said other digit, another terminal located in the bank of said selector and corresponding to local switches, said selector being responsive to the digit designating the second office to extend a connection to the second office through the corresponding terminal, said selector being responsive to the digit designating the local office to cancel such digit whereby it is enabled to respond to the following digit to extend the connection through said other terminal.

9. In a telephone system comprising three offices, subscribers' lines designated by numbers all having the same number of digits, means comprising only two directive switches directly controlled from the calling line for connecting two lines in the first office, means comprising only three directive switches similarly controlled for connecting a line in the first office with a line in the second office, and means comprising four directive switches for connecting a line in the first office with a line in the third office.

10. In a telephone system comprising three offices, subscribers' lines designated by numbers all having the same number of digits, and three switch trains each comprising a different number of switches controlled directly from the calling line in accordance with the proper telephone numbers for connecting a line in the first office with lines in the first, second and third offices, respectively.

11. In a telephone trunking system, three offices, a selector in the first office, a trunk line extending from the bank of said selector to an incoming selector in the second office, a trunk line extending from the bank of said incoming selector to an incoming selector in the third office, and trunk lines extending from the bank of each of said selectors to local connectors.

12. In a telephone trunking system, three offices, a selector in the first office, a trunk line extending from the bank of said selector to an incoming selector in the second office, a trunk line extending from the bank of said incoming selector to an incoming selector in the third office, and local switches of the same numerical order directly accessible from the bank of each of said selectors.

13. In an automatic selector switch, means for restoring said switch to normal whenever it is operated in accordance with a given digit in a telephone number, and means for maintaining the switch in operated position whenever it is operated in accordance with a different digit.

14. In an automatic selector switch, means for repeatedly operating and automatically releasing the switch responsive to successive digits of the same value, and means for maintaining the switch in operated position the first time it is operated responsive to a digit of a different value.

15. In an automatic telephone system in which the subscribers' telephone numbers all contain the same number of digits, a plurality of offices, one of which is a tandem office, trunking arrangements and automatic switches directly responsive to the subscribers' calling devices for establishing local office connections, inter-office connections over direct trunks, and tandem inter-office connections, there being a different number of switches involved in each type of connection, and means associated with certain of the said switches for absorbing the unnecessary digits in calls which require less than the maximum number of switches.

16. In a telephone system of the type in which automatic switches are arranged in a plurality of switching stages corresponding to the successive digits of telephone numbers, a selective switch equipped with a single set of wipers for extending a connection, and means in said switch for adapting the same to extend a connection either as a switch of the first switching stage or as a switch of the third switching stage.

17. In a telephone system of the type in which automatic switches are arranged in a plurality of switching stages corresponding to the successive digits of telephone numbers, a selective switch equipped with a single set of wipers for extending a connection, and means for operating said switch in each of the first three switching stages.

18. In a switching mechanism having directive primary and automatic secondary operations, a relay for controlling the secondary operation, an energizing and locking circuit for said relay, and mechanically operated contacts operated responsive to the primary movement of the switching mechanism

to open said circuit and to close another circuit for initiating the release of the switching mechanism.

19. In a switching mechanism having directive primary and automatic secondary operations, a relay energized responsive to the primary operation of the switching mechanism and locked in operated position responsive to its own operation, said relay controlling the secondary operation of the switching mechanism, a release magnet, and mechanically operated contacts operated responsive only to the primary operation of the switching mechanism for opening the circuit of said relay and for closing the circuit of said release magnet.

20. In a telephone system of the type in which automatic switches are used to effect connections, a calling line and a called line terminating in the same exchange, a calling device for sending series of digit impulses corresponding to the digits of a called telephone number, and means whereby sending any one of a plurality of series comprising differing numbers of digits will operate a train of automatic switches to extend a connection between said calling line and said called line, said train comprising the same switches in each case.

21. In a telephone system of the type in which connections are completed responsive to the calling of a series of digits corresponding to a called telephone number, a calling line and a called line terminating in the same exchange, automatic switches, and means whereby a connection may be completed between said calling line and said called line via the same automatic switches responsive to the calling of any one of a plurality of series of digits, each series comprising a different number of digits.

22. In a telephone system of the type in which connections are completed responsive to the calling of a series of digits corresponding to a called telephone number, a first office and a second office, a called line in each office, means whereby a local connection to a called line in either office may be completed responsive to the calling of any one of three differing series of digits, and means whereby an inter-office connection to a called line in either office may be completed responsive to the calling of either of two differing series of digits.

23. In a telephone system, a line which can be called from other lines in the same exchange by a plurality of call numbers each consisting of a different number of directive digits, automatic switches responsive to said digits, and means whereby the same switches may be operated responsive to any one of said call numbers to extend a connection to said line.

24. In a telephone system, a line which can be called by a plurality of call numbers each comprising a different number of directive digits, said line terminating in an automatic exchange, automatic switches in the exchange responsive to said digits, and means whereby a call to said line may be completed via the same number of switches responsive to any one of said call numbers.

In witness whereof, I hereunto subscribe my name this 12th day of September, A. D. 1925.

CLARENCE E. LOMAX.