Oct. 18, 1932. H. M. FRIENDLY 1,883,680

AUTOMATIC TELEPHONE SYSTEM

Filed May 14, 1930 2 Sheets-Sheet 1

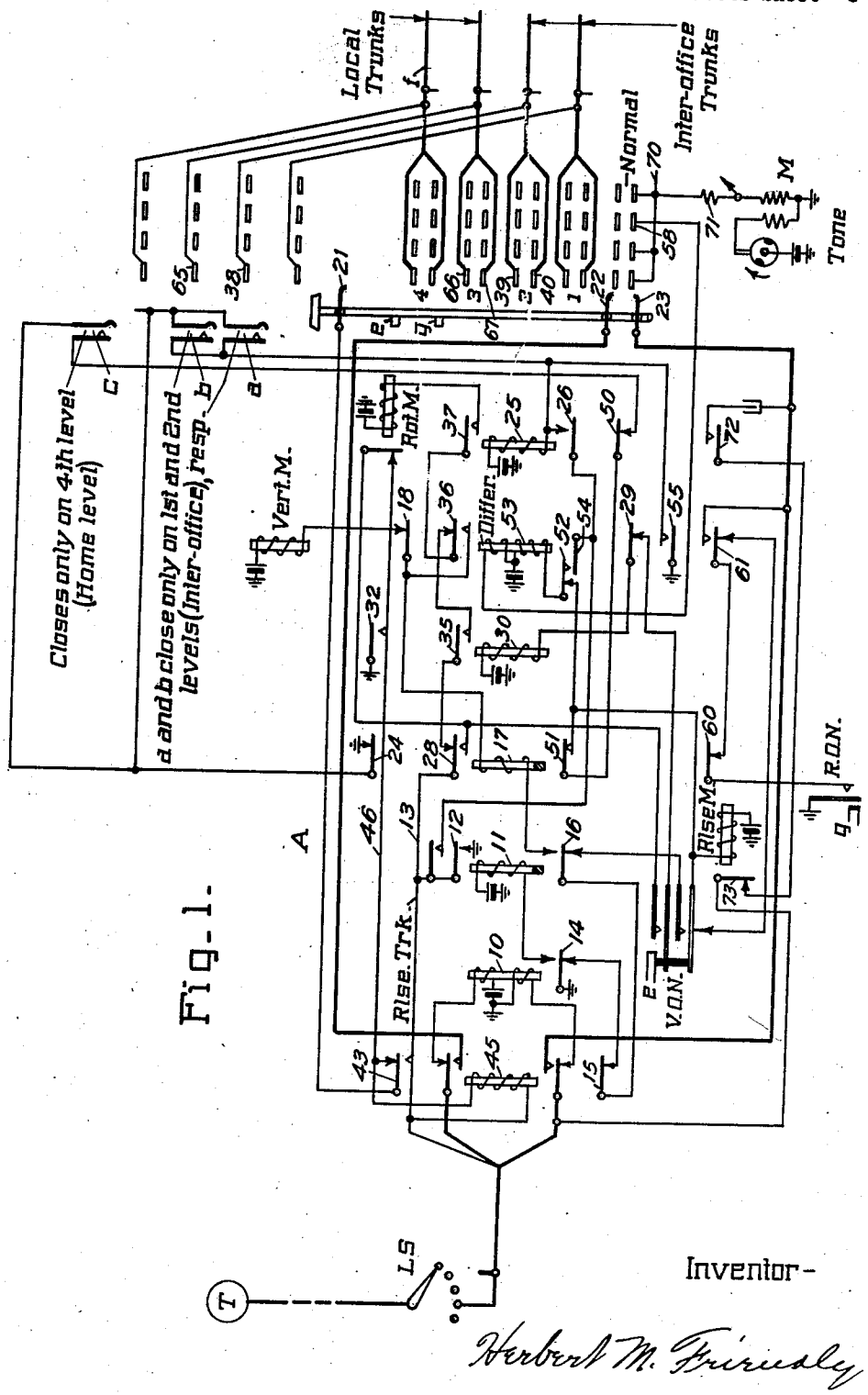


Fig. 1.

Inventor-

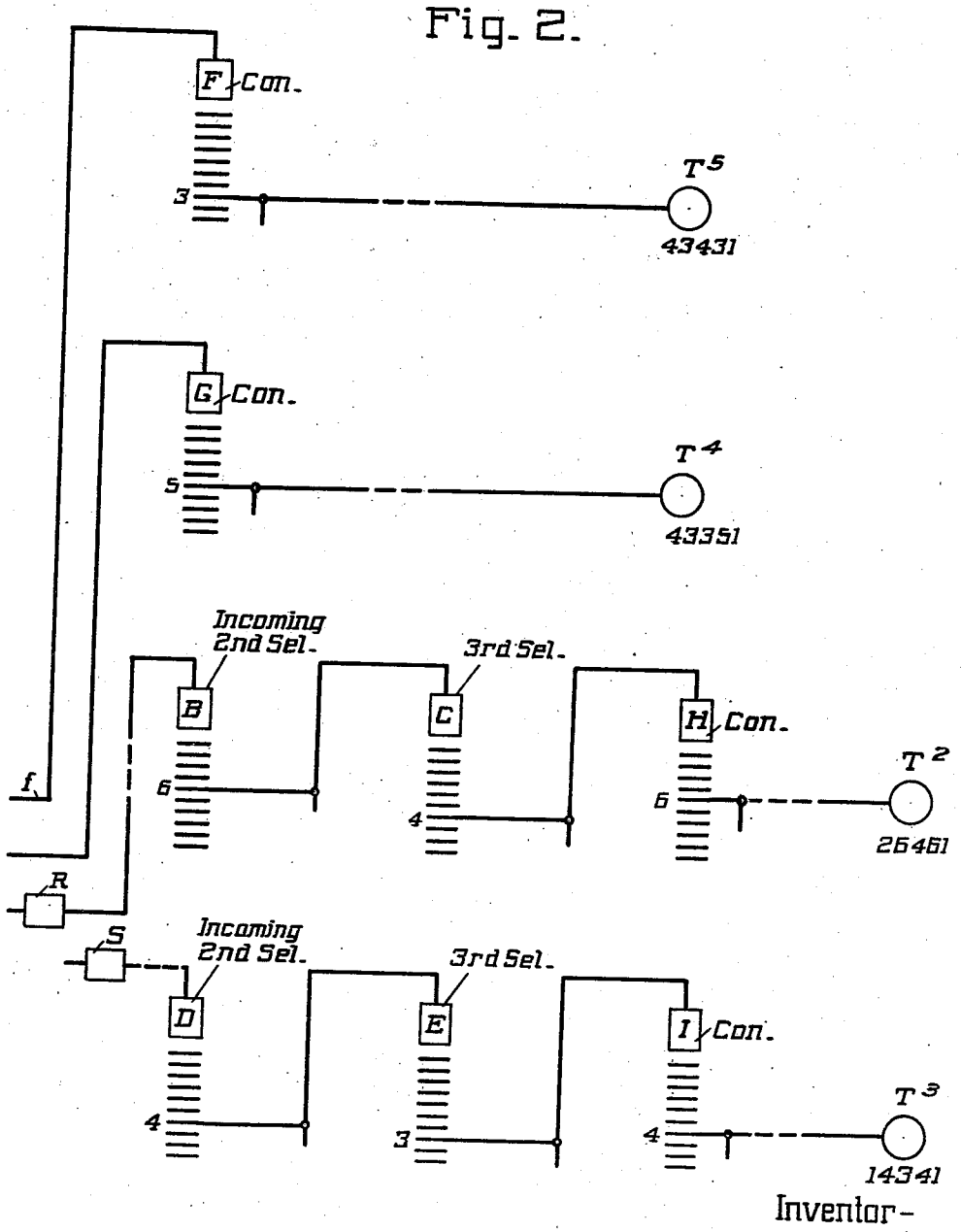
Herbert M. Friendly

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AUTOMATIC TELEPHONE SYSTEM

Filed May 14, 1930 2 Sheets-Sheet 2

Fig. 2.



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Patented Oct. 18, 1932

1,883,680

UNITED STATES PATENT OFFICE

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AUTOMATIC TELEPHONE SYSTEM

Application filed May 14, 1930. Serial No. 452,283.

The object of the present invention is to provide a first numerical switch of the Strowger general class that when used as a first numerical switch of a five-digit multi-office telephone system, will operate its vertical magnet responsive to the first digit series of a telephone number tributary to a remote office of the system to select an inter-office trunk level and a trunk thereof leading to an incoming second selector, located in the remote office. Further, when the said switch is alternatively operated in accordance with the first digit of a telephone number tributary to the office containing said switch, the wipers of the switch will be caused to restore to the normal resting position, disabling the vertical magnet for the time being. The rotary magnet is not capacitated to operate unless the shaft is first operated in accordance with the inter-office trunk level, or has been restored as mentioned.

In the event that the shaft is restored responsive to the first digit, indicative that the call is directed to a telephone number tributary to the office containing the said switch, the second digit will then directively rotate the shaft so that the talking wipers carried thereby will sweep bank terminals of the level aligned with the wipers when in their normal resting position. This latter level will be referred to as the "normal" level of said switch. If the second digit corresponds to the second digit of the numbers tributary to the office containing the said switch, or the originating office, as it will be referred to, when the wipers stop on a bank terminal set of the normal level positioned in accordance with the second digit of the telephone numbers of the originating office the shaft will again restore to the normal resting position; this time capacitating the vertical magnet for next operating directively responsive to the third digit series sent by the calling party. The third digit series will then serve to cause the wipers of the said switch to align with and select on the level leading to the connectors of the originating office. The last two digits will then cause the connector to select the called line.

From the foregoing, it will appear that in calls to telephone lines tributary to remote offices, four switches, the selector A of the present invention, a second selector as B or D, a third selector as C or E, and a connector as H and I, will be employed, while for calls to telephone lines tributary to the originating office only two switches will be employed, the selector A of the present invention, and a connector as F or G, will be employed.

In the event that the second digit is not one that is pertinent to the originating office, wherein the first digit was pertinent to the originating office, the first numerical switch (A) will be disabled from thereafter operating its wipers until the calling party abandons the call by replacing his receiver on the switchhook. Under the latter condition of disabling the operation of the wipers, a tone from source M will be applied audible to the calling party to apprise him of the condition, so that he will abandon the call which he improperly made.

Drawings

With reference to the accompanying drawings:—

Fig. 1 shows the first numerical switch A of the present invention.

Fig. 2, which attaches on the right of Fig. 1, so that the lines extending to the margins register, shows the arrangement of switches succeeding the switch A in exemplary connections to called telephone lines.

Equipment

The telephones T, T^2, T^3, T^4 and T^5 are of any suitable well known or other type of automatic telephone as used in so-termed two-wire Strowger operation.

The line switch LS may be any suitable type of line switch as used in Strowger operation. Thus it may be of the so-called Keith plunger class, or so-called rotary class, or it may be a so-called finder switch.

The first numerical switch or selector A is of the well known general class sometimes called a Powell selector, such as is illustrated in Fig. 63 of the Fourth edition of Hershey's book Automatic Telephone Practice, how-

ever, modified in accordance with the present invention; this modification concerning the normal bank level aligned with the talking wipers when in their normal resting position. It also concerns other features which are believed to be novel.

The selectors B, C, D and E may be of the said Powell type.

The connectors F, G, H and I may be of the type shown in Fig. 62 of the said Hershey book.

The repeaters R and S may be the one shown in Fig. 75 in the said Hershey book.

It will appear presently that the first selector A will operate as a first selector and also as a third selector. That is, it will seize a second selector as B or D responsive to the first digit of a telephone number, or will not seize until the third digit is sent, when it will seize a connector as F or G. The present invention is thus directed to a novel switch A and to the trunking arrangement incorporating the said switch A into a multi-office telephone system. However, the switch A has uses in single office systems, as will appear presently.

Operation

When the calling party at telephone T removes his receiver from the switchhook, the line switch LS will operate to extend the calling line to the first idle first selector A. The line relay 10 will now have its windings energized through the telephone T and will actuate. The slow-releasing release relay 11 will now be energized in a local circuit of the relay 10, ground being applied back through armature 12 to the release trunk 13 to maintain the line switch LS in seizure. The circuits are now in readiness for receiving the first digit of the called number.

Calling telephone T²

Let it be assumed that the calling party desires to call telephone T², the telephone number of which is 26461. Responsive to sending the first digit 2 from the telephone dial, the relay 10 will retract its armature two times, the relay 11 sustaining its armatures over the current lapses. Two ground impulses are thus applied from armature 14, through armatures 15 and 16, winding of slow-releasing series relay 17, armature 18 to the vertical magnet, the said vertical magnet (designated Vert. M.) operating to step the shaft so that the wipers 21 to 23 will align with the designated 2 level.

Before detailing the operation further, it will be pointed out that the telephone T and the switches LS and A belong to the 4 office of the system; that is, the telephone numbers of the lines tributary to this office will have telephone numbers starting with digit 4. Also, the off-normal shaft operated spring-sets *a*, *b* and *c*, are set to operate when the shaft is aligned with the 1, 2 and 4 levels of bank terminals, respectively.

Going back to the condition when the wipers 21 to 23 aligned with the 2 level, the springs of the set *b* will be engaged, so that upon relay 17 deactuating, following the last impulse, ground is thereupon applied from armature 24 to the winding of relay 25, causing the latter said relay to actuate and lock through its armature 26 to the release trunk conductor 13. At the time the relay 17 actuated responsive to the sending of the impulses to the vertical magnet, ground from the release trunk 13 is applied through armature 28, vertical off-normal springs (designated V. O. N.), armature 29 to the winding of the relay 30, the latter said relay actuating and locking through the armature of the rotary magnet (designated Rot. M.) to grounded armature 32. Relays 25 and 30 are thus locked actuated, and the spring-set *b* is closed with the wipers aligned with the 2 level. At the time the relay 17 deactuated, and after relay 25 actuated, ground from the release trunk 13 is applied through armatures 28, 35, 36 and 37 to the winding of the rotary magnet, the latter said magnet operating to step the wipers in to the first set of bank terminals.

The wipers 21 to 23 are now resting upon bank terminals 38 to 40, respectively. When the rotary magnet operated, it opened the locking circuit for relay 30. However, if the wiper 21 had encountered busy ground on the bank terminal 38, this ground would have been applied through armature 43, armature on the rotary magnet, off-normal springs, armature 29 to the winding of relay 30, at the time the armature on the rotary magnet retracts. Relay 30 will therefore lock as before and cause the rotary magnet to advance the wipers another step, this operation continuing as long as the wiper 21 encounters busy grounds.

However, when wiper 21 fails to receive ground when advanced under the driving power of the rotary magnet, the relay 30 will not be caused to actuate and lock, so that the wipers will not be driven further. That is, if wiper 21 fails to receive ground on bank terminal 38, the relay 30 will not reactuate. On the other hand, the windings of relay 30 and relay 45 will then be in series, since there is no ground applied to conductor 46 from the wiper 21 or the armature 32. Relay 45 will actuate, while relay 30 will not, due to the marginal adjustment of the relay 30. The said actuation of relay 45 effects the seizure of the trunk leading from the first bank terminal set to the incoming second selector B. Relays 10, 11 and 25 will now deactuate.

The conductor 13 in switch A will now receive ground from the repeater R over wiper 21. The calling telephone T is now in series with the line relay of the repeater R.

The line relay of the incoming second selector B is now energized through contacts controlled by the line relay in the repeater R. Therefore, annexing the last four digits 6—4—6—1 of the telephone number will complete the connection to telephone T^2. Hanging up the receiver at telephone T will cause ground to be removed from the conductor 13, whereupon relay 45 will deactuate and close a circuit from grounded armature 14, armatures 15, 16, vertical off-normal springs to the release magnet, the release magnet operating to restore the shaft of switch A to normal resting position.

Calling telephone T^3

Had the call been to telephone T^3, the telephone number of which is 14341, the operation would be the same as described for calling telephone T^2, only in this case the spring-set *a* will be operated responsive to digit 1, in place of spring-set *b*, responsive to digit 2.

Calling telephone T^4

Assume that the call is to telephone T^4, the telephone number of which is 43351. Remembering that the calling telephone T is tributary to the 4 office, it will be clear that there will be no inter-office trunks used in the connection. In fact, local trunks running direct from the 4 level of switch A will extend direct to the connectors as G in the same office, and the latter have access to the called lines as T^5.

Sending the first digit series

The operation responsive to the calling party removing his receiver from the switchhook has been described. The first digit in the present instance will be 4, indicative that the called line is tributary to the office to which the calling line is tributary. The shaft of switch A will then be aligned with the 4 level responsive to sending the first digit 4. This will cause the spring-set *c* to be operated. When the relay 17 deactuates, following the last impulse of the series of four, ground applied from armature 24, through spring-set *c*, armatures 50, 51, make-before-break spring 52, lower winding of differentially wound relay 53 to grounded battery, the latter said relay actuating and locking through armature 54 to the release trunk conductor 13, which latter conductor is grounded through armature 12. The ground applied from through the spring-set *c* will also be applied to the winding of the release magnet, causing it to operate to restore the wipers 21 to 23 to their normal resting position. Armature 55, in attracting, will operatively energize the winding of relay 25, so that it will actuate and lock in the manner before described to disable the spring-set *c*, and to prepare a circuit path for the rotary magnet. The vertical magnet is disconnected at armature 18.

Sending the second digit series

When the calling party now sends the second digit 3, it causes three ground impulses to be sent from armature 14, through armatures 15, 16, winding of relay 17, armatures 36 and 37 to the winding of the rotary magnet. The rotary magnet will thus drive the wipers 22 and 23 along the normally aligned level, designated "normal", three steps, so that the wiper 23 will then rest on bank terminal 58. The rotary off-normal spring-set R. O. N. will be operated, under this condition, so that when relay 17 deactuates following the last impulse, ground through this spring-set will be applied through armatures 60 and 61, wiper 23, bank terminal 58, upper winding of relay 53 to grounded battery, the two windings of the latter said relay neutralizing the energizing effect of each other, so that the armatures thereof will retract, unlocking the lower winding. The core of relay 53 may be slugged to retard its attraction after energization, in order to make the unlocking more easily adjusted for. The retraction of armatures 18 and 36 will cause the impulse circuit including the winding of relay 17 to be disconnected from the winding of the rotary magnet and reconnected to the winding of the vertical magnet. The retraction of the armature 61 closes a circuit from ground, rotary off-normal spring-set, armatures 60 and 61, lower vertical off-normal spring to the winding of the release magnet, the release magnet operating to restore the wipers to normal resting position. The relay 25 is sustained locked.

The first two digits 4—3 have been sent and the wipers of the switch A are in the same position as after the calling party initiated the call, but before any digit impulse series were sent. There is this difference in the condition of the switch A; the relay 25 is now locked actuated.

Sending the third digit series

Responsive to the third digit 3 being sent, relay 10 will correspondingly operate to send three ground impulses from its armature 14 through the winding of relay 17 and armature 18 to the winding of the vertical magnet, stepping the wipers up into alignment with the 3 level. At the time the wipers stepped vertically, the vertical off-normal springs operate and a circuit path can be traced as when the first digit 4 was sent, from the grounded release trunk 13, attracted armature 28, upper off-normal springs, armature 29 to the winding of relay 30, the latter said relay operating and locking to armature 32 as before described. The latter said armature 32 also maintains ground on the upper terminal of the winding of relay 45 to keep it short-cir-

cuited, so it cannot be energized in series with the winding of relay 30, which is energized through this same armature 32.

At the termination of the three directive impulses constituting the third digit 3, and consistent with the slow-releasing characteristic of relay 17, armature 28 will retract. Ground from the release trunk 13 will now be applied through armatures 28, 25 and 37 to the winding of the rotary magnet, causing the rotary magnet to operate to step the wipers 21 to 23 into engagement with the first set of bank terminals 65 to 67, respectively.

At the time the rotary magnet operated as last described, its armature opened the locking circuit for relay 30, so that it therefore deactuated responsive to stepping the wipers in to the first set of bank terminals of the 3 level. However, if it is assumed that the wiper 21 encountered busy ground on bank terminal 65, this ground will be applied through armature 43, conductor 46, armature of the rotary magnet, upper vertical off-normal springs, armature 29 to the winding of relay 30, the latter said relay actuating and again locking through armature 32. The attracting of armature 35 will again close the traced energizing path to the winding of the rotary magnet, so that the rotary magnet will operate to advance the wipers 21 to 23 to the next (second) set of bank terminals of the 3 level. If the wiper 21 again encounters ground on its cooperating bank terminal, the relay 30 which unlocked when the rotary magnet operated, will again actuate and lock and the wipers 21 to 23 will thereupon be further advanced to the third set of bank terminals, the operation continuing as long as the wiper 21 finds busy ground.

However, if when the wipers 21 to 23 engaged bank terminals 65 to 67, the wiper 21 did not receive busy ground from bank terminal 65, the relay 30 will not be caused to reactuate to cause the wipers to further advance off the first set of bank terminals. Moreover, when armature 32 retracts while there is no ground applied back from the wiper 21, the windings of the relays 30 and 45 energize in series from battery derived through the winding of relay 30, the relay 30 being marginally adjusted to not actuate under this condition, although the relay 45 will actuate to effect the seizure of the local trunk leading from bank terminals 65 to 67 to the connector G. Relays 10, 11 and 25 will deactuate under the condition of relay 45 actuating.

Sending last two digit series

The calling party will now annex the last two digits 5—1, and thereby operate the connector G in the well known manner to select the called line leading to telephone T^1. The release trunk 13 will receive its ground from connector G over the wiper 21, in the well known manner. The called line will be rung upon and the response thereon will operate the back-bridge relay in the connector in the well known manner.

Abandoning the call

Should the calling party abandon the call by hanging up his receiver, the connector will release and the ground will be removed from the bank terminal 65, so that the relay 45 will deactuate and cause the release magnet in the switch A to operate as before described to restore the wipers of the switch A to their normal resting position.

Should the calling party have abandoned the call following the sending of the first digit 4 while the wipers are in the restored condition, before sending the second digit 3, the relays 10, 11, 53 and 25 will restore. And should the calling party have abandoned the call following the sending of the second digit 3 while the wipers are in the restored condition before sending the third digit 3, the relays 10, 11 and 25 will restore, the relay 53 having already restored responsive to the second digit 3.

Applying tone if wrong digit is sent

It will be noted that should the second digit have been any other digit than 3, the wiper 23 would not have come to final rest on bank terminal 58, so that the release magnet would not be operated to restore the wipers 21 to 25 to their normal resting position, because relay 53 would then remain actuated and hold the circuit of the release magnet open at attracted armature 61. On the other hand, the wiper 23 would have come to rest upon a bank terminal tied to tone conductor 70 which constitutes tone applied through current-limiting resistor 71 from tone source M. Remembering that relay 25 is actuated and locked under the condition that the shaft rotates on its normal level, it will be clear that the wiper 23 will derive current constituting tone from any bank terminal it rests upon, excepting the bank terminal 58, which occupies the third rotary position. This tone will be applied through wiper 23, armature 72, armature 73 on the release magnet to the lower talking conductor leading to the line switch LS and telephone T, to apprise the calling party that the second digit sent is not pertinent to the office of the system indexed by the first digit 4. The calling party will understand that he must hang up his receiver and make a new call, in order to unlock relay 25 and thereby close the energizing path at armature 61 for operating the release magnet.

In this connection, it will be noted that when the wiper 23 comes to rest on only bank terminal 58, the relay 53 will unlock and relay 17 will thereupon deactuate consistent with its slow-releasing characteristic, and thereupon by its armature 60 close a circuit path from ground, rotary off-normal spring-set, said

armature 60, armature 61, lower vertical off-normal spring to the release magnet, the latter said magnet operating to restore the wipers to normal resting position. The armature 73 being attracted while the wipers are retracting and wiper is passing over bank terminals constituting tone, the false application of tone audible to the calling party is precluded.

In the event the wiper 23 comes to rest on a bank terminal of the normal level other than bank terminal 58, the relay 53 will not be unlocked, so that the release magnet will not operate and the tone will be applied until the calling party hangs up his receiver to remove the ground from the release trunk conductor 13 to unlock the relay 53.

From the descriptions, it will appear that unless the first two digit series are both pertinent to the telephone numbers belonging to the office to which the calling line belongs, it will be impossible to effect a connection to one of these lines. This thus insures that if an error has been made by way of omitting a digit series, or sending the wrong train of series, the call will not be progressed to a telephone of the office to which the calling line belongs.

Calling telephone T^5

Should the last call to telephone T^4 have been directed to telephone T^5, the telephone number of which is 43431, the operation of the switch A will be the same as when telephone T^4 was called, with the exception that the wipers are caused to be aligned with the 4 level in place of the 3 level responsive to sending the third digit series.

It is noted, that while when the first digit series constituted the digit 4, the spring-set *c* operated to energize the lower winding of relay 53, when the armature 51 retracts, when the spring-set *c* is again operated responsive to sending the third digit 4 when calling telephone T^5, it will be to no operative effect since the armature 50 is attracted, due to the locked condition of relay 25.

Capacity of the switch A

It will thus be seen that should the exchange system be made up of three offices, as exampled, two levels of a ten off-normal level selector will correspond to remotely located offices, while the remaining off-normal levels may be used for trunks to connectors. That is, there may be eight hundred lines reached through eight levels of the switch A, employed as a third selector, wherein this switch A and a connector will be the only numerical switches in a connection from a calling line to a called line. This is against employing the switch A as a first selector wherein there will be a second selector and a third selector intermediate of the switch A and the connector in calls to lines in remote offices. The 1 level is shown used for inter-office trunks. This level may be used for local trunks to connectors and therefore represent one hundred lines capacity of the office containing the switch A. The 3 level as well as other levels may be used for inter-office trunks. Then, if a false impulse constituting digit 1 is accidentally prefixed, the wipers will not be capacitated to rotate in. This latter having in mind that under the condition of the 1 level not being an inter-office trunk level, the spring-set *a* will be adjusted to not operate at the 1 level position of the shaft, but to be adjusted at some other level used for inter-office trunks, the 3 level, for example, if the inter-office trunks are assumed transferred from the 1 level to the 3 level.

In further explanation of the latter referred to operation, unless the relay 25 is in its actuated condition, the circuit to the winding of the rotary magnet will be open, as would be the case if the shaft is first operated with reference to a level that does not cause the relay 25 to actuate and lock. In the drawings, there is no spring-set operated when the shaft is operated with reference to the 3 level, and therefore, should an impulse series corresponding to digit 3 be sent first, either by accident or intent, the shaft will remain aligned with the 3 level (without rotating in) until the calling party hangs up his telephone. This arrangement thus insures that unless the full range of five digits is sent, it will not be possible to complete a call to a called line, regardless of the fact than when calling certain telephone numbers, as those extending to telephones T^4 and T^5, but three digit series are actually effective in extending the call by a progressive advancement of the call extension, this being the last three of the five sent, although the first two series have a preparatory purpose.

Reference is made to my U. S. Patent No. 1,711,311, granted April 30, 1929. Reference is also made to my pending applications for U. S. Patents, Ser. No. 171,637, filed May 29, 1917; Ser. No. 362,321, filed March 1, 1920; Ser. No. 481,259, originally filed June 29, 1921. It is intended to claim only such specific structure in the instant application as is not claimed in these listed references.

I claim:—

1. In a telephone system, means including a plurality of serially related directively controlled automatic switches for connecting a calling and called subscriber's line, two less similar switches for connecting the said calling line with another called subscriber's line, a uniform numbering system in which all the said subscriber's lines have the same number of digits in their telephone numbers, and means included in one of the switches used in calling said second called line and dependent upon the extent of selective movement of the

switch effective to cancel any two of the digits of the number including dissimilar digits.

2. In a telephone system, means including a plurality of serially related directively controlled automatic wiper switches for connecting a calling and called subscriber's line, two less similar switches for connecting the said calling line with another called subscriber's line, a uniform numbering system in which all the said subscriber's lines have the same number of digits in their telephone numbers, and means for operating one of the switches used in calling said second called line so as to cancel any two of the digits of the number including dissimilar digits, whereby responsive to directively applying the third digit to said one of the switches its wiper will be operated from normal resting position.

3. In a telephone system, means including a plurality of serially related directvely controlled automatc switches for connecting a calling and called subscriber's line, two less similar switches for connecting the said calling line with another called subscriber's line, a uniform numbering system in which all the said subscriber's lines have the same number of digits in their telephone numbers, means included in one of the switches used in calling said second called line and dependent upon the extent of selective movement of the switch effective to cancel any two of the digits of the number including dissimilar digits, and means whereby one of the switches used in the series relationship in extending connection to the first said called line is subject to use in the connection to said another called line.

4. In a telephone system, means including a plurality of serially related directively controlled automatic switches for connecting a calling and called subscriber's line, two less similar switches for connecting the said calling line with another called subscriber's line wherein one of said switches is common to said connections, a uniform numbering system in which all the said subscriber's lines have the same number of digits in their telephone numbers, and means in said common switch for canceling any two of the digits of the number including dissimilar digits of said another called line when it is being called.

5. In a telephone system, a calling line, a directive device on the calling line for sending digit series of control impulses, first and second called lines, a uniform numbering system wherein each called line has the same number of digits, a first selector, a second selector, a third selector and a connector adapted to be connected in tandem comprising the numerical automatic switches used in linking a call from the calling line to said first called line, said first selector and another connector adapted to be connected in tandem comprising the numerical automatic switches used in linking a call from the calling line to said second called line, a connective terminal for said first selector, means whereby the connective terminal will be moved from normal resting position to seize said second selector responsive to the first series of control impulses sent over the calling line from the directive device only under the condition that this first series has a predetermined number of impulses, and means whereby the connective terminal will be moved from normal to seize said another connector responsive to the third series of control impulses sent over the calling line from the directive device only under a condition wherein said first series is not said predetermined series.

6. In a telephone system, a calling line, first and second called lines, a uniform numbering system wherein each called line has the same number of digits, a first selector, a second selector, a third selector and a connector adapted to be connected in tandem comprising the numerical automatic switches used in linking a call from the calling line to said first called line, said first selector and another connector adapted to be connected in tandem comprising the numerical automatic switches used in linking a call from the calling line to said second called line, and means in said first selector for canceling two of the digits in the telephone number of said second called line while not canceling any of the digits in the telephone number of the said first called line.

7. In a telephone system, a calling line, first and second called lines, a uniform numbering system wherein each called line has the same number of digits, a first selector having a wiper for linking connections ahead, a second selector, a third selector and a connector adapted to be connected in tandem comprising the numerical automatic switches used in linking a call from the calling line to said first called line, said first selector and another connector adapted to be connected in tandem comprising the numerical automatic switches used in linking a call from the calling line to said second called line, and means in said first selector for canceling two of the digits in the telephone number of the said second called line by operating and restoring said wiper while not canceling any of the digits in the telephone number of said first called line.

8. In a telephone system, means including a plurality of serially related directively controlled automatic switches for connecting a calling line to a desired one of a plurality of called subscriber's lines, two less similar switches for connecting the calling line with a said called line wherein one of said switches is common to said connections, said common switch having a shaft and a wiper carried by the shaft which has a normal resting position, the wiper for linking connections ahead in tandem to the next successive one of

said switches involving moving the wiper off-normal, a uniform numbering system in which all the said called lines have the same number of digits in their telephone numbers, and means in said common switch for canceling any two of the digits of the number including dissimilar digits of a certain one of the said lines when it is being called, each said digit cancellation involving restoring the wiper from an off-normal position to normal position and thereafter, when the two digits have been thus canceled, reoperating said wiper off-normal responsive to an annexed digit of the telephone number of said certain called line in effecting a linking ahead towards said certain called line.

9. In a telephone system, an automatic switch having a wiper in normal resting position, a level of bank terminals aligned with the normal position of the wiper and cooperative with the wiper, off-normal positioned levels of bank terminals cooperative with the wiper, means for operating the wiper directly from normal to select a predetermined off-normal level and a bank terminal in the selected level responsive to a single automatic directive operation in selecting the off-normal level by the wiper, and means for operating the wiper from normal three times responsive to three automatic directive operations in order to select another of said levels, one of said operations of the wiper from normal being along said normal level and two other said operations being in intersecting plane to said normal level.

10. In a telephone system, an automatic switch having a wiper in normal resting position, a level of bank terminals aligned with the normal position of the wipers and cooperative with the wiper, off-normal positioned levels of bank terminals cooperative with the wiper, means for operating the wiper directly from normal to select a predetermined off-normal level and a bank terminal in the selected level responsive to a single automatic directive operation in selecting the off-normal level by the wiper, and means for operating the wiper from normal three times responsive to three automatic directive operations in order to select another of said levels, the first and third said operations of the wiper from normal being in intersecting plane to said normal level and the second of said operations being along said normal level.

11. In a telephone system, an automatic wiper switch, trunk lines of two different non-consecutive numerical orders leading out from said switch commonly accessible from the wiper, a calling line leading-in to said switch, a calling device for directively operating the switch over the calling line by sending numerical order digit impulse series from the calling device in order to connect the wiper of the switch to a desired numerical order trunk line, means for causing the switch to operate its wiper from normal resting position responsive to each impulse series sent from the calling device until a trunk has been connected to by the wiper, and means governed by the number of impulses of a digit series sent to operate the switch which will determine to which numerical order the trunk which may be connected to must belong.

12. In a telephone system, an automatic wiper switch, trunk lines of two different non-consecutive numerical orders leading out from said switch commonly accessible from the wiper, a calling line leading-in to said switch, a calling device for directively operating the switch over the calling line by sending numerical order digit impulse series from the calling device in order to connect the wiper of the switch to a desired numerical order trunk line, means for causing the switch to operate its wiper from normal resting position responsive to each impulse series sent from the calling device until a trunk has been connected to by the wiper, and means governed by the number of impulses of the first digit series sent to operate the switch which will determine to which numerical order the trunk which may be connected to must belong.

13. In a telephone system, an automatic wiper switch, trunk lines of two different non-consecutive numerical orders leading out from said switch commonly accessible from the wiper, a calling line leading-in to said switch, a calling device for directively operating the switch over the calling line by sending numerical order digit impulse series from the calling device in order to connect the wiper of the switch to a desired numerical order trunk line, means for causing the switch to operate its wiper from normal resting position responsive to each impulse series sent from the calling device until a trunk has been connected to by the wiper, and means governed by the number of impulses in the first series sent to operate the wiper which will determine if this first series of impulses will select the trunk to be employed, or whether two more impulse series must be annexed to effect the selection of the trunk to be employed.

14. In a telephone system, an automatic wiper switch, trunk lines of two different non-consecutive numerical orders leading out from said switch commonly accessible from the wiper, a calling line leading-in to said switch, a calling device for directively operating the switch over the calling line by sending numerical order digit impulse series from the calling device in order to connect the wiper of the switch to a desired numerical order trunk line, means for causing the switch to operate its wiper from nor-

mal resting position responsive to each impulse series sent from the calling device until a trunk has been connected to by the wiper, means governed by the number of impulses of digit series sent to operate the switch which will determine to which numerical order the trunk which may be connected to must belong, and means whereby if a trunk is not selected responsive to the first series sent, the second series sent must have a predetermined number of impulses to render possible the selection of a trunk responsive to the third series.

15. In a telephone system, an automatic wiper switch, trunk lines of two different non-consecutive numerical orders leading out from said switch commonly accessible from the wiper, a calling line leading-in to said switch, a calling device for directly operating the switch over the calling line by sending numerical order digit impulse series from the calling device in order to connect the wiper of the switch to a desired numerical order trunk line, means for causing the switch to operate its wiper from normal resting position responsive to each impulse series sent from the calling device until a trunk has been connected to by the wiper, means governed by the number of impulses of digit series sent to operate the switch which will determine to which numerical order the trunk which may be connected to must belong, means whereby if a trunk is not selected responsive to the first series sent, the second series sent must have a predetermined number of impulses to render possible the selection of a trunk responsive to the third series, and means for applying a signal to the calling line responsive to the second series being sent, provided that the second series is not said predetermined series.

16. In a telephone system, an automatic wiper switch, trunk lines of two different non-consecutive numerical orders leading out from said switch commonly accessible from the wiper, a calling line leading-in to said switch, a calling device for directively operating the switch over the calling line by sending numerical order digit impulse series from the calling device in order to connect the wiper of the switch to a desired numerical order trunk line, means for causing the switch to operate its wiper from normal resting position responsive to each impulse series sent from the calling device until a trunk has been connected to by the wiper, means governed by the number of impulses of a digit series sent to operate the switch which will determine to which numerical order the trunk which may be connected to must belong, means whereby if a trunk is not selected responsive to the first series sent, the second series sent must have a predetermined number of impulses to render possible the selection of a trunk responsive to the third series, and means for applying a signal to the calling line responsive to the second series being sent, provided that the second series is not said predetermined series, last said means including a means for moving the wiper in a plane intersecting the plane the wiper operated in responsive to the first series sent.

17. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, means for selecting a trunk of said first group responsive to a single directed movement of the wiper from said normal resting position, and means whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from said normal resting position whether said first two movements are similar or not.

18. In a telephone system, an automatic switch having a wiper in normal resting position and having a vertical and rotary movement, a first group of trunks and a second group of trunks accessible from said wiper, means for selecting a trunk of said first group responsive to a single directed movement of said wiper from said normal positoin in a vertical direction and an automatic hunting movement responsive to the directed movement, and means whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from said normal position one of said movements being rotary and an automatic hunting movement responsive to the last one of said three directed movements.

19. In a telephone system, an automatic switch having a wiper in normal resting postion, a first group of trunks and a second group of trunks accessible from said wiper, means for selecting a trunk of said first group responsive to a single digit directed movement of said wiper from said normal position, and means whereby a trunk of said second group can be selected only responsive to three digit directed movements of said wiper from normal position, wherein said wiper is restored to normal position after the first two of said directed movements whether responding to like or dissimilar directive digits.

20. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, means for selecting a trunk of said first group responsive to a single directed movement of said wiper from said normal position, and means whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from normal position, wherein said wiper is restored to normal position after the first two of said directed movements and wherein the

second directed movement of said wiper is in a plane intersecting its first directed movement.

21. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, a first relay, means including said relay for selecting a trunk of said first group responsive to a single directed movement of said wiper from said normal position, a second relay, and means including said second relay whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from normal position.

22. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, a first relay, means including said relay for selecting a trunk of said first group responsive to a single directed movement of said wiper from said normal position, a second relay, and means including said second relay whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from normal position, and means including the actuation and the deactuation of said second relay whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from normal position.

23. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, a first and second relay, means including the actuation of said first relay while said second relay remains deactuated for selecting a trunk of said first group responsive to a single directed movement of said wiper from normal position, and means including the actuation of said second relay whereby a trunk of said second group can be selected only responsive to three directed movements of said wiper from normal position.

24. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, means for selecting a trunk of said first group responsive to a single digit directed movement of said wiper from said normal position, and means whereby a trunk of said second group may be selected responsive to three digit directed movements of said wiper from normal position wherein two like or dissimilar directive digits are canceled by drop-back action of the wipers of the switch.

25. In a telephone system, an automatic switch having a wiper in normal resting position, a first group of trunks and a second group of trunks accessible from said wiper, means for selecting a trunk of said first group responsive to a single digit directed movement of said wiper from said normal position, and means whereby a trunk of said second group may be selected responsive to three digit directed movements of said wiper from normal position wherein two dissimilar directive digits are canceled by drop-back action of the wipers of the switch.

In witness whereof, I hereunto subscribe my name this twelfth day of May, 1930.

HERBERT M. FRIENDLY.