Nov. 5, 1929. H. M. FRIENDLY 1,734,083

AUTOMATIC TELEPHONE SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 1

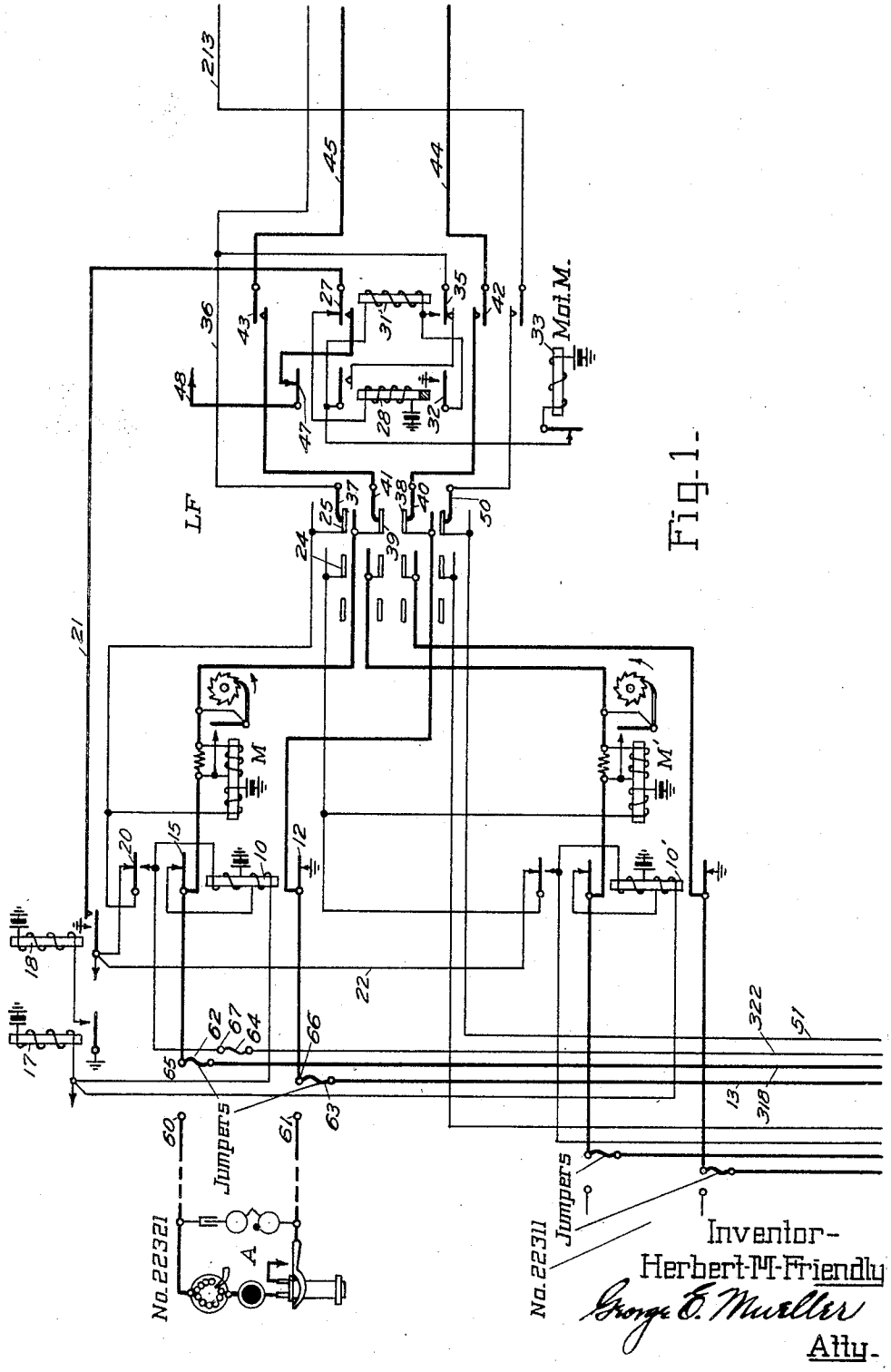


Fig. 1.

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AUTOMATIC TELEPHONE SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 2

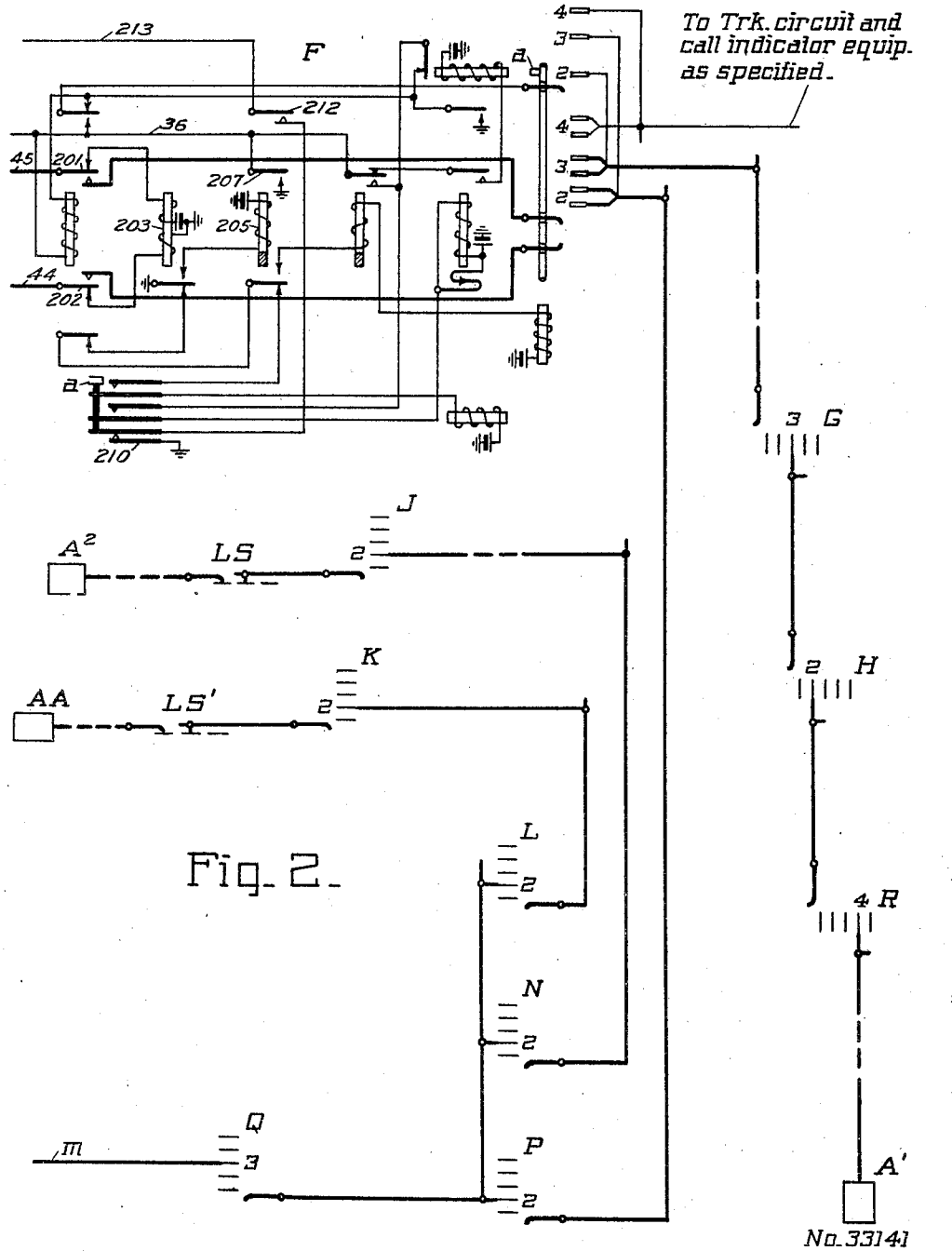


Fig. 2.

No. 33141

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Nov. 5, 1929. H. M. FRIENDLY 1,734,083

AUTOMATIC TELEPHONE SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 3

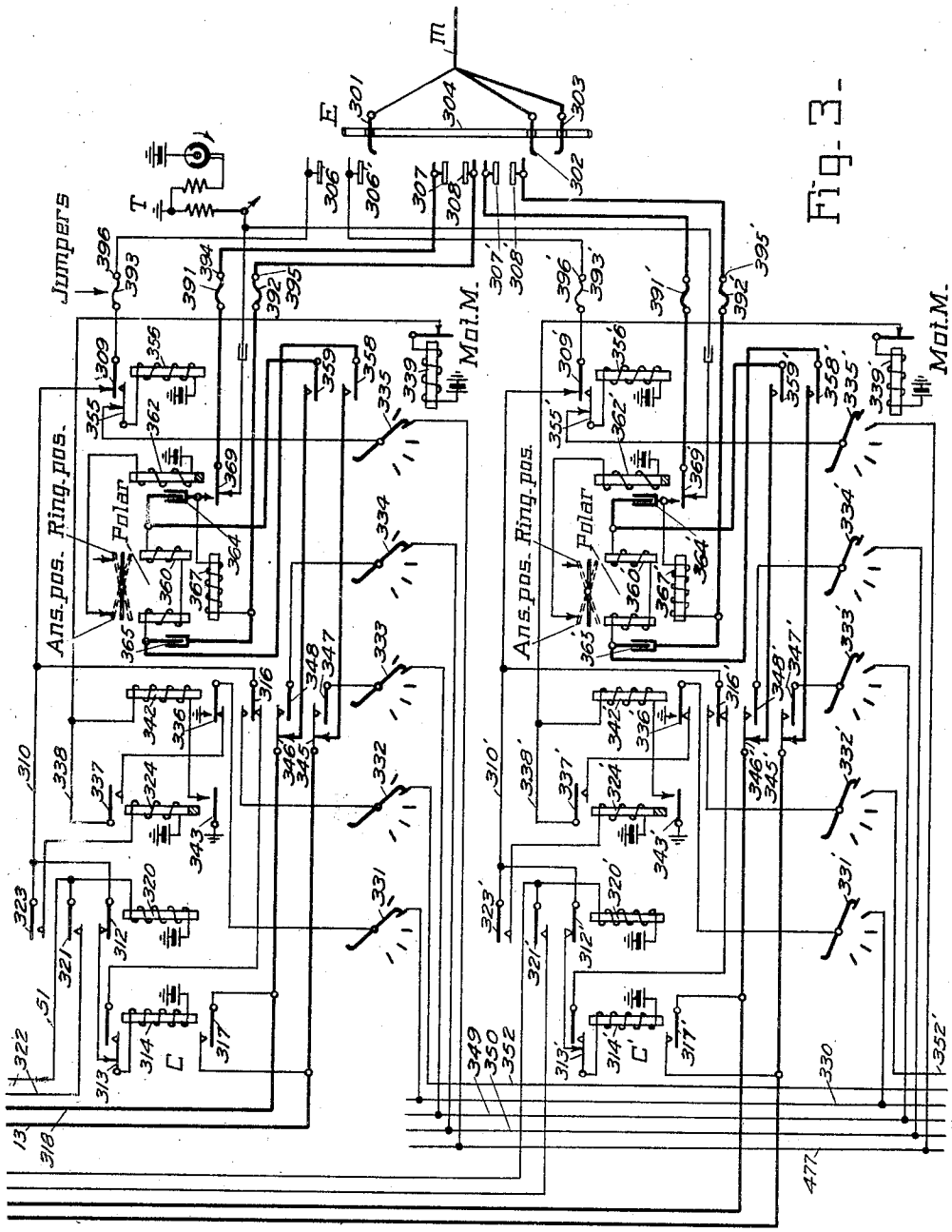


Fig. 3.

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Nov. 5, 1929. H. M. FRIENDLY 1,734,083

AUTOMATIC TELEPHONE SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 4

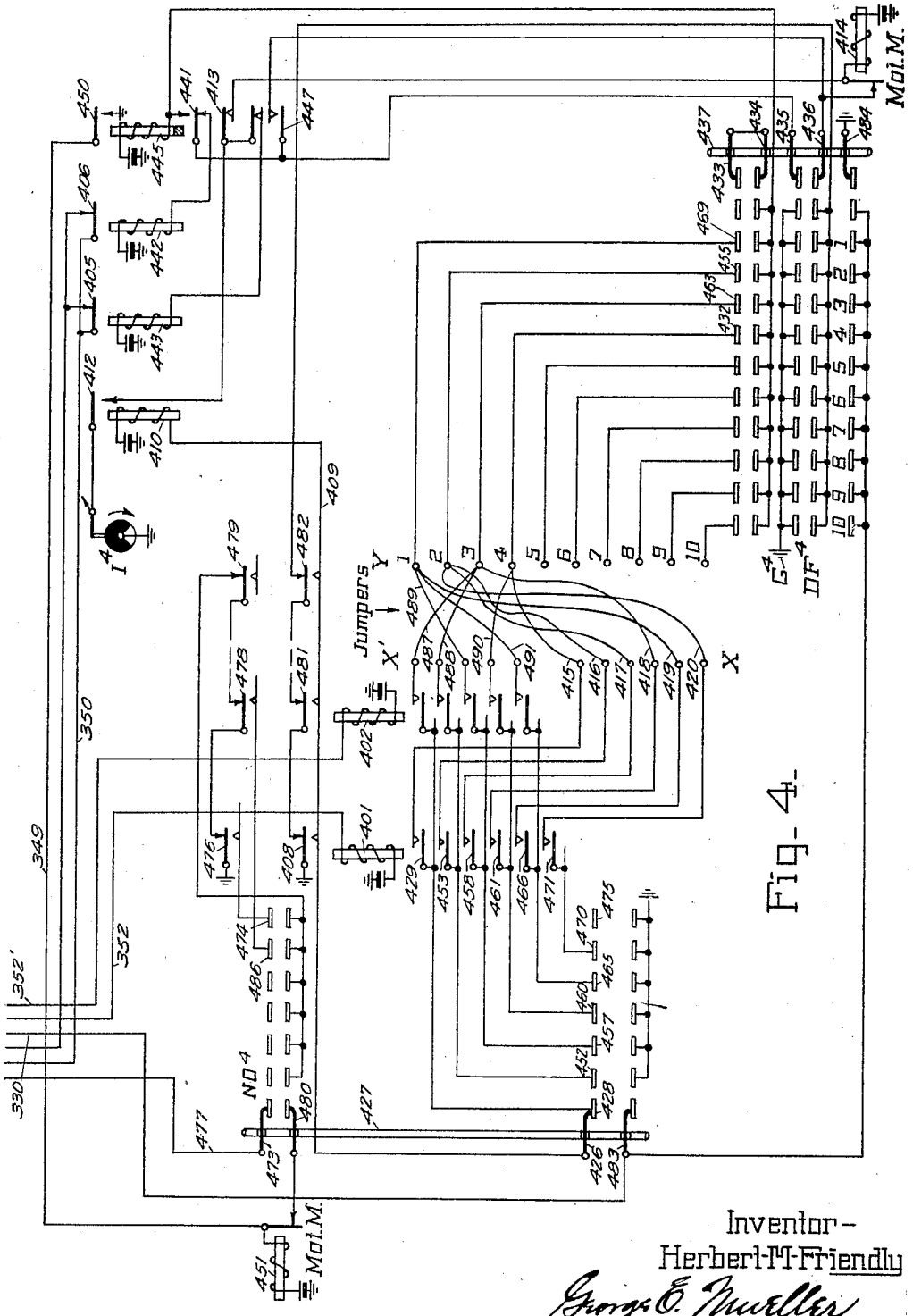


Fig. 4.

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Patented Nov. 5, 1929 1,734,083

UNITED STATES PATENT OFFICE

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AUTOMATIC TELEPHONE SYSTEM

Application filed September 1, 1927. Serial No. 216,862.

The present invention relates to telephone systems; more particularly so-called automatic or machine switching telephone systems.

General objects

An object of the present invention is to enable a subscriber of the automatic telephone system who has changed his telephone number to a random location in the exchange system to be reached over the general trunking system of the exchange at his new number responsive to calling his old telephone number.

Reference is made to my co-pending application for U. S. Patent, Ser. No. 215,034, filed Aug. 24, 1927, which said co-pending application covers a telephone system having objects in certain respects generally similar to the objects set forth in the last foregoing paragraph. However, the present invention is directed to a system having more comprehensive capabilities than disclosed in the said co-pending application, looking towards the economic aspects of commercial embodiments wherein there is a considerable number of subscribers tributary to the same central office of the system who have changed to new telephone numbers, respectively, which are tributary to other random central offices of the system and wherein certain of the mechanism used in forwarding the calls serves the said subscribers commonly. This is to say, only a relatively small portion of the equipment brought into play in forwarding the call is individual to any one subscriber's line. The portion of the mechanism for effectuating the forwarding impulse trains is common to a plurality of lines, the said mechanism adapting itself to send any one of a plurality of specific impulse trains to forward the call to a new telephone number dependent upon what number has been called in seizing the said common mechanism.

As in the case of the said co-pending application, when a number has been called belonging to a subscriber who has moved, so that his new line is tributary to a different central office from that before concerned, or where he has subscribed for a group of lines in the place of a single line, when the connector or final switch seizes the terminals of the old line number, mechanism is brought into play which causes an impulse train to be sent which train corresponds to the new telephone number. The call is thus forwarded over the general exchange trunking system as if it were a new call initiated on the line of the old telephone number. It is intended to claim in the present application only such scope and only such structure as is not claimed or is not disclosed, respectively, in the said co-pending application.

Also, the call may, as in the said co-pending application, be directed to an attendant in the employ of the operating concern, or it may be directed to a random subscriber of the system who has consented to respond to calls for the subscriber (and possibly other subscribers also), perhaps because of the subscriber being absent for a time.

In place of the connector or final switch seizing the forwarding mechanism which is individual to the subscriber, as in the said co-pending application, the present invention comprehends that the connector or final switch will seize a mechanism element constituting as a part thereof a hunting switch which will select an idle impulse sending mechanism of an accessible group of said mechanisms and thereby adapt the latter said mechanism for sending a train of impulses specific to said hunting switch seizing it. Thus, a small plurality of impulse sending mechanisms will serve a larger plurality of said hunting switches, wherein each of the said hunting switches corresponds to a telephone number which has been changed to a new telephone number, or at least some predetermined telephone number of the system. When the impulse train has been sent, the impulse sending mechanism is excluded from the connection responsive to its own operations and is thereupon in readiness for service in a new call while the antecedent call which it forwarded still endures; in fact, may not yet have been responded to by the subscriber or operator called in the forwarding operation.

A plurality of so-termed set relays is provided for each impulse sending mechanism for

forwarding the calls, each said set relay being specific to one of the hunting switches having access to the said mechanism. The corresponding set relay will operate when a hunting switch seizes the said mechanism and thus sets up a stored condition in the said mechanism in accordance with the predetermined telephone number to which the call is to be forwarded, and also starts the transmission of the impulse series train, excluding the said mechanism when the last impulse of the train has been sent.

A salient feature of the present invention is that feature which provides for enabling a call made to a random line to be forwarded over a trunk to an operator's position or switchboard. The position may be located in a random one of the exchange central office buildings where an operator employed by the operating concern is in attendance, or this switchboard may be located at any other point where an operator employed by a subscriber is in attendance. A so-called call indicator equipment of well known or suitable type is associated with the said trunk or trunks leading to the said operator's position, so that when a call is directed to a trunk leading to this operator's position a train of impulses will be thereupon applied over the trunk from the forwarding mechanism to set up signals on the call indicator indicative of the telephone number primarily called. That is to say, the operator will receive a visual indication of the number of the called line as primarily called by the calling party. When the call is responded to by the operator she is in a position to inform the calling party regarding the subscriber he primarily called without making enquiry as to what telephone number the calling party called. The subscriber under primary call may have gone away on a prolonged trip, for example, and desires those calling his telephone line to be given an intelligent response by the operator acting as his agent, as it were, perhaps without the calling party knowing that the operator responding is not at the telephone of the party primarily called. Of course, it is optional whether the forwarding mechanism annexes the number called primarily, so that this will depend upon prearranged jumpering relating to the random lines served by the forwarding mechanism, respectively.

The same line relay as 10 of the primarily called subscriber's line is used as was formerly used when the call was initiated on its corresponding line from telephone A, which telephone A is now disconnected.

In carrying out the present invention, the operating concern will provide a sufficient number of units of equipment mechanisms as C and C′, together with a lesser number of mechanisms as shown in Fig. 4 for common cooperation with random ones of said mechanisms as C and C′. The operating concern will then introduce these mechanisms as C and C′ into the desired lines as required, perhaps contingent upon a specific rental payment. To introduce the said equipments, connections between certain terminals are opened, and certain terminals are jumpered to a unit as C or C′, for example. The designated jumpers in Fig. 4 are then run with respect to the armatures of the corresponding relay 401 or 402, respectively, in accordance with the conditions of forwarding the call. That is, whether the call is to be forwarded to a random other subscriber's line of the system, or is to be forwarded to an attendant operator and there indicate on her call indicator equipment the number of the line primarily called. Of course, any other suitable kind of line finder switch and associated equipments may be substituted for the line finder switch LF and associated equipments; in fact a so-called line switch of suitable type may be employed in place of the line finder switch LF and associated equipments. Using the same line relay as 10 and finder switch arrangement involving switch LF as formerly used by the subscriber of telephone as A insures the same class rating to the forwarded calls as existed for the calls initiated at telephone A, with the least clerical work, and it also facilitates returning the line leading to telephone as A to former service by the same subscriber, if desired in case the change was occasioned by a temporary absence.

There are additional operative features of the present invention which will be described in the specifications relating to the exemplary embodiment of the invention chosen to explain it, having in mind that other features not specifically mentioned will be apparent from the descriptions. The invention is capable of varied modification without departing from its scope as defined by the subjoined claims.

Drawings

With reference to the accompanying drawings:—

Fig. 1 shows a line finder switch LF individual to a first selector F in Fig. 2, there being a plurality of line finder switches in the group containing switch LF. Fig. 1 also shows two line relays 10 and 10′.

Fig. 2 shows a first selector F of well known type and other indicated switches and telephones in an exchange layout.

Fig. 3 shows two elements C and C′ introduced into two subscribers' lines numbers 22311 and 22321, for forwarding calls made to the respective said lines. These elements cooperate with the impulse sending mechanism shown in Fig. 4.

Fig. 4 shows an impulse sending mechanism which is common to elements C and C′ and other said elements of the same type, not shown.

The various figures of the drawings are assembled so that correspondingly designated lines extending towards the margins of the sheets containing them register.

Equipment

The telephones A, AA, A^2 and A′ are of the well known common-battery series automatic type.

The first selector F is of the well known type sometimes designated as the Powell selector, and described in the third edition of Hershey's Automatic Telephone Practice, pages 59 to 61. However, spring 210 and armature 212 are specific to the present invention. The selectors C, H, J, K, L, N, P and Q indicated in Fig. 2 are similar to selector F, excepting that they do not have said spring 210 and armature 212.

The connector E indicated in Fig. 3 is of the well known type as shown in Fig. 73 of the fourth edition of the said Hershey book. It is also shown as E in the said co-pending application for patent mentioned at the outset. Connector R is similar to connector E.

The finder switch LF in Fig. 1 is the type shown and described on pages 55 to 57 of the third edition of the said Hershey book.

The line switches LS and LS′ are of the type illustrated and described on pages 53 to 55 in the third edition of the said Hershey book.

The hunting switch elements of the mechanisms C and C′ have the same mechanical structure as the switch LF, the circuits being modified in accordance with the objects of the present invention.

The switch elements NO^4 and DF^4 in Fig. 4 have the same general mechanical structure as the switch LF, the circuits being modified in accordance with the objects of the present invention.

Of course, the specific switches may be substituted for by any switch meeting the requirements, without departing from the spirit of the present invention. The present invention resides in Figs. 3 and 4, cooperated with elements of a well known telephone system illustrated in Figs. 1 and 2.

Call from telephone A^2 to telephone line 22321 under the condition that the subscriber of the latter said line has arranged with the operating concern for having his calls answered by its operator

In view of the well known operation of the line switch LS, first selector J, including second selector N, third selector Q and connector E, and in view of the third and fourth editions of the said Hershey book and the reference to the said co-pending application for patent mentioned at the outset, it is thought that it is unnecessary to recite the detailed operation of the said switches responsive to the directive operations of the calling party at telephone A^2 in initiating a call and for operating the calling device of his telephone for causing wipers 301 to 303 on shaft 304 of connector E to be set upon the bank terminals 306 to 308, respectively, of the line number 22321.

If it is assumed that the bank terminal 306 constitutes battery potential, due to no other connector of the group containing connector E being in seizure with any multiple of said terminals 306 to 308 at the time the said terminals are selected by the connector E, the wiper closing relay of the connector E will actuate and lock to effect the seizure of the latter said terminals, changing the battery potential previously existing on bank terminal 306 to ground potential to guard the multiples of the seized line terminals against seizure by another connector, should some other party call for the line number 22321. The telephone A^2 may be considered a random telephone tributary to a central office other than the "2" office, the selector N being an in-coming second selector, of the "2" office containing the line number 22321, denoted by the first digit of the said number.

Ground applied to bank terminal 306 is continued through armature 309, conductor 310, armature 312, made-before-break spring 313 to the winding of relay 314, the latter said relay actuating and locking through armature 316 to conductor 310. A circuit can now be traced from ground, armature 12, conductor 13, armature 317, conductor 318, armature 15, lower winding of relay 10, winding of common relay 17 to grounded battery, relay 17 actuating to energize its dependent common relay 18, relay 10 only operatively attracting its armature 20. The actuation of relay 18 causes ground to be applied to common conductor 21 and all conductors as 22 to apply ground to all idle private bank terminals as 24.

It will be noted that the bank terminal 25 corresponding to relay 10, individual to the line number 22321 is applied to battery potential through the upper winding of relay 10 and is thus the only bank terminal accessible to the line finder switches of the group containing switch LF which is unguarded.

Ground on conductor 21 is applied through armature 27 to the winding of slow-releasing line relay 28, the latter said relay actuating. Relay 31 is now in a series path from ground, armature 32, winding of motor magnet 33 to grounded battery, the relay 31 actuating while the armature of the motor magnet remains retracted due to the marginal adjustment and because of the resistance of the winding of relay 31. Ground applied through armatures 32 and 35, release trunk 36 and private wiper 37 places a busy guard on the bank terminal 25 and multiples thereof

and energizes the upper winding of relay 10 so that all the armatures on the latter said relay operatively attract. Unless some other line as that corresponding to relay 10′ has a call initiated thereon the relays 17 and 18 will deactuate responsive to the attraction of armature 15.

The conductors 13—318 are now continued to bank terminals 38—39, wipers 40—41, armatures 42—43, conductors 44—45, armatures 202—201 to the lower and upper winding of line relay 203 in first selector F, respectively. The armature of relay 203 attracting, operatively energizes the slow-releasing release relay 205 and armature 207 applies ground to the release trunk 36. The latter said ground is applied to conductor 36 by armature 207 before 32 retracts, because relay 28 is deenergized by the attraction of armature 27, so that no lapse of guarding ground potential occurs on the release trunk 36. Conductor 21 is now continued through armatures 27 and 47 to conductor 48 leading to the next following line finder switch, not shown.

In this connection, it will be noted that had the bank terminal 25 constituted busy ground potential at the time relay 28 actuated, this ground would have short-circuited the winding of relay 31, so that the motor magnet 33 would then be operatively energized to drive the wipers including wiper 37 to the next set of bank terminals in a hunting operation, the motor magnet 33 continuing the advancing operations as long as wiper 37 encounters busy ground.

When the relay 205 actuated, ground from spring 210 is applied through the armature 212, conductor 213, wiper 50, conductor 51 to the winding of relay 320, the latter said relay actuating and locking through its armature 321, conductor 322, armature 20, bank terminal 25, wiper 37 to the release trunk 36. It will be noted that the first off-normal movement of the shaft of selector F will cause the ground applied from spring 210 to be opened. However, the relay 320 will remain locked as long as ground remains on the release trunk 36. The relay 320 therefore actuates and locks responsive to the first selector F being seized, and before which time the selector F is not responsive to impulses over its leading-in trunk.

Responsive to the actuation of relay 320, ground is applied from conductor 310, through armature 323 to the winding of slow-releasing relay 324, the latter said relay actuating. If it is for the present assumed that the impulse sending mechanism in Fig. 4 is engaged by a mechanism as C′, for example, private conductor 330 will constitute ground potential, as will appear presently, and therefore ground from conductor 330 will be applied through the wiper 331, armatures 336, 337, conductor 338 to the winding of the motor magnet 339. The motor magnet 339 will operate under the stated condition, interrupting its energizing circuit and advancing the wipers 331 to 335 to the next position corresponding to the next impulse sending mechanism (not shown) like shown in Fig. 4, the motor magnet 339 continuing to advance the wipers until the wipers 331 fail to encounter ground potential, indicating an idle impulse sending mechanism has been found.

It will be assumed that the wipers 331 to 335 are in the drawn position when wiper 331 fails to encounter ground potential. Under the latter condition, the conductor 338 is not grounded and therefore, the winding of relay 342 becomes in a series path between grounded armature 343, conductor 338, winding of motor magnet 339 to grounded battery. Relay 342 will actuate, but motor magnet 339 will not operate under the latter said condition, due to the resistance of the winding of relay 342 and the adjustment of the motor magnet 339. Ground is forthwith applied through armature 336, wiper 331 to common conductor 330 to guard the impulse mechanism in Fig. 4 against seizure by another hunting switch as is associated with element C′, there being a number of such elements having selective access to the impulse sending mechanism in Fig. 4 and other similar impulse sending mechanisms, not shown.

Under the condition of relay 342 being actuated, armature 316 unlocks relay 314 and conductors 13—318 are continued through make-before-break springs 345—346, armatures 347—348, wipers 333—334, common conductors 349—350, armatures 405 and 406 in multiple. The armatures 405 and 406 in multiple are therefore substituted for the armature 317 in the path maintaining the relay 203 energized. Ground from conductor 310 is applied through armature 316, wiper 332, conductor 352 to the winding of relay 401, the latter said relay actuating. This starts the operation of the impulse sending mechanism in Fig. 4, ground from armature 408 being applied over conductor 409 to the winding of relay 410, the latter said relay operating to close the circuit path from the brush of the interrupter device I^4, armatures 412, 413 to the winding of motor magnet 414.

Forwarding the call to telephone number 22321 to the operator attendant and indicating to the said operator by call indicator equipment that line number 22321 was called primarily by the calling party

From the fourth level of first selector F trunks extend to an operator's position, the operator thereat responding for the subscribers primarily called. The service of these subscribers may be discontinued at the time and it is desired to have the calls for such subscribers responded to.

The trunks to the said operator's position from the fourth level of selector F may be of the exact circuit arrangement as disclosed in Fig. 55 of the fourth edition of the said book of Hershey's. Moreover, they may alternatively be the exact circuit arrangement disclosed for the trunks in the patents to Willis Nos. 1,539,925 and 1,542,649 of June 2nd and June 16th, 1925, respectively. In fact, any suitable call indicator circuit arrangement may be employed for the trunks leading from the fourth level of the first selector F which will set up an indication to the operator of the trunk of what train of impulse series have been sent over the seized trunk.

Attention is called to the fact that the call indicator circuits referred to have associated therewith a plug individual to the trunk so that the plug may be inserted into the jack of the line called as indicated to the operator. Employing the said circuit as a cooperative element of the present invention necessitates that the operator's telephone be connected to a jack cooperative with the said trunk plugs so that when the operator observes the indication she may insert the concerned plug into the jack for her telephone set and orally communicate with the calling party, the closure of the conductive circuit through her telephone serving to operate relays which will effect a current reversal back over the trunk to operate the call meter, if any, on the line calling, and also call meter M on the line primarily called. It will be clear that a key may be provided for each trunk terminating plug, so that this key may be operated after the indication is set up which will connect the trunk to the operator's telephone and operate relays of the trunk as if the plug were inserted into the operator's telephone jack, or other accessible line jack and a response made thereon. The line jacks enable the operator to further extend the call, if desired. It is thought that the foregoing will make clear the operator's switchboard equipment for receiving and indicating to her the train of impulses sent by the impulse sending mechanism in Fig. 4 indicative of the line number primarily called by the calling party.

Impulse sending mechanism

Relay 401 corresponds to line number 22321, there being a relay similar to this with similarly disposed jumpers from its corresponding armature make contact terminals for each impulse sending mechanism like shown in Fig. 4, there being as many relays as 401 and 402 in each said impulse sending mechanism as there are lines arranged for having calls made thereto forwarded therefrom. That is to say, if there are fifty mechanisms corresponding to each element as C and C′ for random lines in the central office there will be fifty relays corresponding to the latter said elements in each of the impulse sending mechanisms as shown in Fig. 4.

In view of the fact that the impulse sending mechanism as shown in Fig. 4 would be occupied on the average less than ten seconds, it will be clear that three such mechanisms would be nominally capable of handling eighteen calls per minute, so that there will be a relatively small number of such mechanisms as shown in Fig. 4 used cooperative with the elements C and C′, the number depending upon the number of calls to be handled. The lines corresponding to the elements as C and C′ are shown accessible from the same connector group containing connector E, and they also correspond to the same group of line finder switches containing switch LF. This arrangement has seemed the simplest in disclosing the invention. However, it will be understood that the lines corresponding to elements C and C′ may be accessible from random connector groups and random line finder switch groups.

The operation of the element C individual to line number 22321 in causing the terminals 306 to 307 of the said line to be extended to first selector F and the first idle impulse sending mechanism as shown in Fig. 4 to be operatively associated has been detailed, relays 401 and 410 being described as actuated.

The jumpers 415 to 420 refer to the first to the sixth impulse series of the train prearranged to be sent responsive to the actuation of relay 401. The train is constituted of the series 422321, wherein the first series 4 corresponds to the fourth level of trunks leading from the first selector F to the answering operator's switchboard, and the remaining series numerically correspond to the number of the line of telephone A selected by connector E.

Sending first impulse series

Ground from armature 408 is applied over conductor 409, wiper 426 on shaft 427 of element NO^4, bank terminal 428, armature 429, jumper 415 to terminal 4 of Y to bank terminal 432 of element DF^4. It will be noted, in this connection, that the terminal group X is specific to the relay 401 of line number 22321, served by element C. Also, that the terminal group X′ is specific to the relay 402 of line number 22311, served by element C′. Also, that the terminal group Y refers to the digits 1 to 0 of the digit finder switch DF^4. There will be as many terminal groups X and X′ as there are lines served by elements as C and C′, while there will be a single terminal group Y common to all the former mentioned groups.

The ground interrupter I^4 revolves at a speed of approximately 12 times per second. The first ground application from the interrupter I^4 applied through attracted arma-

ture 412, armature 413 to the motor magnet 414 causes the wipers 433 to 436 and 484 on shaft 437 to advance, wherein wipers 433 and 434 rest upon unconnected bank terminals. Ground G^4 on bank terminal 440 is now applied over wiper 435, armature 441 to the winding of relay 442, the latter said relay actuating to attract armature 406 so that the armature 405 now alone governs the relay 203 in selector F, having in mind that the relay 443 actuated coincident with the energization of the motor magnet 414, but to no operative purpose, since when the armature 405 attracted the armature 406 was retracted. However, as the series of impulses following are applied through armature 412 to the relay 443 and the motor magnet 414, the armature 405 will transmit open impulses effective to retracting the armature of relay 203. This will continue until the wiper 433 encounters the grounded bank terminal 432, at which time four open impulses have been sent by armature 405, the relay 442 having been maintained actuated.

Ground received from bank terminal 432 is applied through wipers 433 and 434 to the winding of slow-releasing relay 445, the latter said relay actuating to cause relay 442 to deactuate and disconnect the winding of impulsing relay 443, the relay 445 locking through armature 441, wiper 435 to ground G^4. This ground is also applied through armature 447 and the interrupter armature of the motor magnet 414 to cause the wipers on the shaft 437 to restore to the drawn position, the relay 445 thereupon unlocking consistent with the slow-releasing characteristic.

At the time relay 445 actuated, ground was applied through armature 450 to the winding of motor magnet 451, so that when the relay 445 unlocks, the motor magnet 451 drives the wipers on shaft 427 one step so that wiper 426 rests upon bank terminal 452. Ground from armature 408 is now applied through wiper 426, bank terminal 452, armature 453, jumper 416 to terminal 2 of numerical terminals Y to bank terminal 455.

The relay 455 having deactuated, the motor magnet 414 and the relay 443 will respond to the next ground impulse transmitted from the interrupter I^4 through the armature 412. However, before proceeding with the sending of the second series of two open impulses by armature 405, the operation of the first selector F responsive to the first series of four open impulses from said armature 405 will be discussed.

In view of the well known operation of the first selector F, its wipers will be aligned with the fourth level of bank terminals and there rotate-in and select the first idle trunk leading to the operator's call indicating equipment. The next five series of open impulses to be sent by the armature 405 will be effective to set up an indication on the call indicator denoting the number 22321, in accordance with the train of the said five series.

Sending second impulse series—First digit of number primarily called

Returning the condition of the circuit at the time the wipers on the shaft 437 restored to their drawn positions, following the sending of the first series of four open impulses by the armature 405, the wipers on shaft 437 will start forward under the influence of interrupter I^4 until wiper 433 encounters grounded bank terminal 455, at which time two open impulses have been sent by armature 405 effective to the call indicating equipment of the operator's position to indicate first digit 2. At the termination of the sending of the first digit 2 the relay 445 will actuate and lock and the wipers on the shaft 437 will restore to the drawn position and the wipers on the shaft 427 will advance another step so that wiper 426 is resting on bank terminal 457. Ground from armature 408 is now applied through wiper 426, bank terminal 457, armature 458, jumper 417 to terminal 2 of numeral terminals Y to the bank terminal 455.

Sending third impulse series—second digit of number primary called

Returning to the condition of the circuits at the time the wipers on the shaft 437 last restored to their drawn position following the sending of the second series of two open impulses by armature 405, the wipers on the shaft 437 will start forward until wiper 433 encounters grounded bank terminals 455, at which time two open impulses will have been sent by armature 405 effective to the call indicating equipment of the operator's position to indicate second digit 2. At the termination of the sending of the second digit 2 the relay 445 will actuate and lock and the wipers on shaft 437 wll restore to the drawn position and the wipers on the shaft 427 will advance another step so that wiper 426 is resting on bank terminal 460. Ground from armature 408 is now applied through wiper 426, bank terminal 460, armature 461, jumper 418 to terminal 3 of numeral terminals Y to the bank terminal 463.

Sending fourth impulse series—third digit of number primarily called

Returning to the condition of the circuits at the time the wipers on the shaft 437 last restored to their drawn position, following the sending of the third series of two open impulses by armature 405, the wipers on shaft 437 will start forward until wiper 433 encounters grounded bank terminal 463, at which time three open impulses will have been sent by armature 405 effective to the call indicating equipment of the operator's position to indicate third digit 3. At the

termination of the sending of the third digit 3 the relay 445 will actuate and lock and the wipers on shaft 437 will restore to the drawn position and the wipers on the shaft 427 will advance another step, so that wiper 426 is resting on bank terminal 465. Ground from armature 408 is now applied through wiper 426, bank terminal 465, armature 466, jumper 419 to terminal 2 of numeral terminals Y to the bank terminal 455.

Sending fifth impulse series—fourth digit of number primarily called

Returning to the condition of the circuits at the time the wipers on the shaft 437 last restored to their drawn position, following the sending of the fourth series of three open impulses by the armature 405, the wipers on the shaft 437 will start forward until the wiper 433 encounters grounded bank terminal 469, at which time one open impulse will have been sent by armature 405, effective to the call indicating equipment of the operator's position to indicate the fourth digit 2. At the termination of the sending of the fourth digit 2, the relay 445 will actuate and lock and the wipers on the shaft 437 will restore to the drawn position and the wipers on the shaft 427 will advance another step so that wiper 426 is resting on bank terminal 470. Ground from armature 408 is now applied through wiper 426, bank terminal 470, armature 471, jumper 420, to terminal 2 of numeral terminals Y to the bank terminal 455.

Sending sixth impulse series—fifth (last) digit of number primarily called

Returning to the condition of the circuits at the time the wipers on the shaft 437 last returned to their drawn position following the sending of the series of two open impulses by armature 405, the wipers on the shaft 437 will start forward until wiper 433 encounters grounded bank terminal 469, at which time one open impulse has been sent by armature 405 effective to the call indicating equipment of the operator's position to indicate the last (fifth) digit 1. At the termination of sending the fifth digit 1, the relay 445 will actuate and lock and the wipers on the shaft 437 will restore to the drawn position and the wipers on the shaft 427 will advance another step so that wiper 473 is resting on bank terminal 474, the wiper 426 resting upon dead bank terminal 475. The call indicator at the operator's position now indicates number 22321 has been called by the party calling. The operator may now respond, knowing that telephone number 22321 was under call.

Excluding the impulse sending mechanism shown in Fig. 4

Ground from armature 476 is applied to bank terminal 474, so that when the wiper 473 engages the latter said bank terminal following the sending of the last (fifth) digit 1, this ground is applied over wiper 473, common conductor 477, wiper 335, make-before-break spring 355 to the winding of relay 356, the latter said relay actuating and locking to the ground on the private bank terminal 306. Due to the attraction of armature 309, relays 324 and 342 will deactuate in sequence.

Restoration of impulse sending mechanism in Fig. 4

Responsive to relay 442 deactuating, the relay 401 deactuates, so that ground on armature 476 is applied through armatures 478 and 479, wiper 480 to the winding of motor magnet 451, the interrupter of the latter said magnet causing the wipers on shaft 427 to restore to the drawn position. Ground from armature 408 is applied through armatures 481 and 482, wiper 436 to the winding of the motor magnet 414, the interrupter armature of the latter said magnet causing the wipers on the shaft 437 to restore to the drawn position. It will be noted, in this connection, that the private conductor 330 is maintained grounded, although relay 342 deactuates, until both wipers 483 and 484 have been restored to their respective drawn positions, after which time the impulse sending mechanism shown in Fig. 4 may be seized by an accessible element as C'.

It will be noted that conductors 13—318, springs 345—346, armatures 358—359 and the winding of the polarized relay 360 are in series with and energized through the windings of the line relay of the call indicator equipment terminating the concerned trunk of the fourth level of first selector F. The armature of the polarized relay 360 is tilted clock-wise into the dotted position designated "Ring pos.", since the connector E is in the ringing condition.

Operator responds

When the operator responds to the call, thereby causing the reversing relay in the call indicator equipment to reverse the direction of current traversing the winding of the polarized relay 360, the latter said relay will be tilted counter-clock-wise into the dotted position designated "Ans. pos.". Under the latter said condition, slow-releasing relay 362 will actuate, operatively attracting its armature 369 to complete a talking circuit from the selected trunk line leading out from the fourth level of selector F back to bank terminals 307—308, wherein the condensers 364—365 are interposed. The armature 369 incidentally connects the winding of the retardation coil 367 across the conductors leading from the bank terminals 307—308. In view of the well known operation of the connector E, this will operate the ring-cut-off relay therein, and also the back-bridge relay therein to reverse the direction of current traversing the calling telephone A^2, the call-

ing party at said telephone A^2 being now in talking relation with the operator responding to the call. The responding operator knowing from the call indicator indication what number was being called need not question the calling party as to that.

Terminating the call—calling party acting first

Upon the calling party first replacing his receiver on the switch-hook while the operator still maintains the responded condition, will have no effect so far as restoring the connector E, since the retardation coil 367 is still maintained across the talking conductors leading from bank terminals 307—308. However, upon the operator terminating the responded condition, the polarized relay 360 will operate to deenergize relay 362 and thereby remove the retardation coil 367 from the bridge across terminals 307—308, so that the back-bridge relay in connector E will deactuate to cause the connector E to restore, the element C becoming in condition for a new call, and the ungrounding of the release trunk 36, in the well known manner, in view of the references causing the restoration of the relays maintained by its ground.

Terminating the call—called party (operator) acting first

Had the operator first acted by effacing the responded state, thereby causing the polarized relay 360 to operate to deenergize relay 362, the retardation coil 367 would be thereby removed from the bridge so that the back-bridge relay in the connector E would deactuate to restore the direction of current traversing the calling telephone A^2, but without restoring the connector E. However, when the calling party at telephone A^2 replaces his telephone on the switch-hook, the line relay in the connector E will deactuate and cause the said connector E to restore. The ground will thus be removed from the release trunk 36 in the well known manner, in view of the references.

Abandoning the call

If the calling party at telephone A^2 abandons the call at any time after the wipers 301 to 303 seize bank terminals 306 to 307, and before the impulse sending mechanism has completed its operations of sending impulses, ground will thereby be removed from conductor 310 responsive to the restoration of connector E, causing relays 324 and 342 to deactuate in sequence. Relay 320 being locked to the release trunk extension, conductor 322 will maintain relay 314 disabled, so that when relay 342 deactuates there will be no conductive path between conductors 13—318 to maintain the call extension. Relay 401 will deactuate and restore the wipers on the shafts 427 and 437 of elements NO^4 and DF^4, respectively. The ground will be removed from the conductor 322, in the well known manner, in view of the references, so that relay 320 will unlock. The element C is thus in readiness for new seizure.

An arbitrary number may be set up on the operator's call indicator in place of the called telephone number

In foregoing descriptions the number set-up on the operator's call indicator was the number 22321 of the line primarily called. In order to avoid sending the train of five digit series, the lines primarily called may each be given an arbitrary number designation unknown to the calling party. These numbers may range from 1 to 100, depending upon the number of lines to be served by the call forwarding mechanism. Then, when a line arranged for forwarding calls to an operator's position is primarily called, the forwarding mechanism will cause this arbitrary number to be set-up on her call indicator, The operator, by consulting her record will find what telephone number was primarily called. While the latter indication of an arbitrary, assigned number entails extra work for the operator in consulting records, it will be noted that it enables the jumpers between the terminals X and Y to be permanently run to constitute the arbitrary number, the line being simply cross-connected to the element as C or C' as desired. The said element, carrying its number, will serve any desired line without jumper change between the terminals corresponding to X and Y, the operator being constantly informed through the records as to the actual line number corresponding to the indicated number.

In this connection, it is pointed out that where the impulse series train constitutes less than six digit series, as where a train of series constituting an arbitrary number containing from one to four digits is sent in place of the actual called telephone number, the conductor leading from the make contact of armature 476 which is shown connected to bank terminal 474 will be changed from said terminal 476 to an antecedent terminal cooperative with wiper 473. Then when the latter said wiper steps forward following the termination of the last series of the train sent, this wiper will receive ground from armature 476 to cause the relay corresponding to 356 in element C to actuate so that the impulse sending mechanism concerned will be excluded from the circuits and thereupon subject to use in a new call.

Calling telephone number 22311 in place of telephone number 22321

Let it be assumed that the calling party at telephone A^2 called telephone line number 22311, in place of telephone line number 22321. The wipers 301 to 303 will be set

upon bank terminals 306′ to 307′, respectively. This will seize the element C′, causing it to operate in the manner of element C, as when connector E seized terminals 307 to 308. The line relay 10′ is individual to the element C′. Parts of the element C′ correspond to the similarly designated parts in element C, there being a prime added to the designated parts in the element C′. In view of the latter explanation, it will be unnecessary to minutely detail the operation of element C′ in imparting a comprehensive disclosure of its operation. However, it is pointed out that in place of the impulse sending mechanism in Fig. 4 now sending the train of impulse series corresponding to digits 422321, under control of relay 401, it will operate under control of relay 402. The latter said relay has jumpers disposed to send the train of impulse series corresponding to digits 33141, which is the telephone number of telephone A′. It will thus be noted that while the elements C and C′ are alike, the relay 401 is individual to the element C, while the relay 402 is individual to the element C′.

It will be noted, in this connection, that the actuation of relay 402 will cause a train of five impulse series to be sent, whereas the relay 401 causes a train of six impulse series to be sent. That is to say, under the condition of relay 402 actuating, the wiper 473 must receive ground from bank terminal 486, following the sending of the fifth impulse series, in place of receiving ground from bank terminal 474 following the sending of the sixth impulse series. This is accommodated by grounding the bank terminal 474 by the armature 476 on relay 401 and the grounding of bank terminal 486 by armature 478 on relay 402.

The jumpers 487 to 491 correspond to digits 33141. In view of the described operation of the element C, the line relay 10 and the line finder switch LF, and the well known operation of the first selector F, the second selector G, the third selector H and the connector R, it is thought that the operation will be fully understood wherein the connector E is assumed to select bank terminals 306′ to 308′, corresponding to telephone number 33141, thereby causing the call to be forwarded to telephone A′. The connector R will cause the direction of current traversing the polarized relay 360′ to be reversed in direction responsive to the party at telephone A′ removing his receiver from the switch-hook.

Element as C introduced into line primarily called by means of temporary jumpers

Fig. 1 shows the telephone A and the line leading therefrom disconnected at the terminals 60 and 61, and temporary jumpers 62, 63 and 64 introduced to connect with the random reserved element C. The temporary jumpers 392, 393 and 394 are introduced to complete the introduction of said element C. Normally, the terminals 65, 66 and 67 would be tied to terminals 394, 395 and 396, respectively, with the jumpers 62, 63, 64, 391, 392 and 393 not being run. The terminals 60, 61, under the latter said condition would be tied to terminals 65 and 66, respectively. The present invention thus comprehends readily adaptable means for introducing the random element C or C′ into a random line, when required, and for thereafter readily restoring the said line to its normal service condition by removing the jumpers and replacing the ties removed at the time the jumpers were run.

Operation of call meter when forwarding call

The call meters M and M′ are connected in the circuits of the lines numbers 22321 and 22311, in the manner described in the said copending application referred to at the outset, and operated responsive to a reversal of current. Moreover, call meters connected thus are well known in the art. These meters will register calls forwarded and responded to, and therefore may serve to indicate the benefits derived by the disconnected subscriber and form a basis of charges to him for forwarding his calls as contemplated by the present invention.

Tone to apprise the calling party call is one which will be forwarded

The tone source T applies tone audible to the calling party at the time the element as C or C′ is seized until relay as 362 or 362′, actuates. This apprises the calling party that the call is being forwarded. If the called party of a forwarded call hangs up first, causing relay as 362 or 362′ to deactuate, the tone source T will be again applied audible to the calling party to denote the latter said condition exists.

In foregoing descriptions of the exemplary form of the present invention, the descriptions have referred to calls to subscriber lines wherein the subscriber has changed to a new location in the exchange system. The present invention has other objects and uses. For example, applied to so-called private automatic exchanges, there may be numbers of the general exchange system which the subscriber of the private automatic exchange may have occasion to call frequently and it therefore may be convenient to him to be able to call such numbers with the same number of digits as employed in calling his local lines. That is, say by two or three pulls of the dial calling device, depending upon the rank of his system. In usual practice, the outside main exchange lines are reached by prefixing the digit "0" and then calling the general listed telephone number of four to seven or more digits. However, by considering the connector E as the

local connector of the private automatic exchange and the first selector F as the incoming selector of the main exchange, it will be clear that the elements C and C′ may refer to any desired main exchange lines, respectively. That is, by seizing the corresponding element C or C′ will cause the call to be forwarded to the desired main exchange line.

Under the last referred to application of the present invention, any well known, suitable form of so-called trunk repeater would be introduced in the trunk between the finder switch LF and the first selector F, in order to translate from four-conductor to two-conductor trunk operation. That is, the release trunk 36 would be grounded locally at the repeater. The lower armature of relay 31 may then be connected to the release trunk conductor 36, in place of extending on to the repeater; in fact this modification may be made under conditions of the exemplary embodiment, the conductor 213 being removed. The conductor 322 may also be removed under the latter condition, since the relay 320 would behave the same as described in the exemplary embodiment disclosed in the drawings although conductor 322 and armature 321 are removed, if the lower armature of relay 31 is connected to the conductor 36.

The scope of the present invention will be comprehended in view of the broadest interpretation of the subjoined claims.

I claim:—

1. In a telephone system, fixed connective terminals, a movable connective terminal for cooperation with a random one of said fixed terminals, a called line individual to each said fixed terminal, an automatic progressively movable selective switch common to said fixed terminals, and means including the said switch, operated responsive to cooperating the said movable terminal with a random one of said fixed terminals, for extending a connection from the said movable terminal to the specific called line individual to the cooperated fixed connective terminal.

2. In a telephone system, fixed connective terminals, a movable connective terminal for cooperation with a random one of said fixed terminals, a called line individual to each said fixed terminal, an automatic progressively movable selective switch common to said fixed terminals, an impulse sending device common to said fixed terminals, and means including said switch and said impulse sending device, made effective responsive to cooperating said movable terminal with a random one of said fixed terminals, for extending a connection from the said movable terminal to the specific called line individual to the cooperated fixed terminal.

3. In a telephone system, fixed connective terminals, a movable connective terminal for cooperation with a random one of said fixed terminals, a called line individual to each said fixed terminal, an automatic progressively movable selective switch common to said fixed terminals, an impulse sending device common to said fixed terminals, and means for causing said impulse device to directively operate said switch to extend a connection from the random fixed terminal cooperated with the movable terminal, in the direction of the specific called line individual to said fixed terminal cooperated, responsive solely to the said cooperation.

4. In a telephone system, groups of fixed connective terminals, a movable connective terminal for each said group cooperative with a random, said fixed terminal of its corresponding group, a called line individual to each said fixed terminal, automatic switches, an impulse sending device common to said switches and said fixed terminals, means operated responsive to cooperating a random said movable terminal with a random said fixed terminal of its corresponding group for causing the impulse sending device to operate certain of said switches to select the called line individual to the fixed terminal cooperated with, and means operated responsive to cooperating another random said movable terminal with another random said fixed terminal of its corresponding group for causing the impulse sending device to operate certain of said switches to select the called line individual to the fixed terminal last cooperated with.

5. In a telephone system, groups of fixed connective terminals, a movable connective terminal for each said group cooperative with a random said fixed terminal of its corresponding group, a called line individual to each said fixed terminal, automatic switches, an impulse sending device common to said switches and said fixed terminals, means operated responsive to cooperating a random said movable terminal with a random said fixed terminal of its corresponding group for causing the impulse sending device to operate certain of said switches to select the called line individual to the fixed terminal cooperated with to thereby extend a call connection from the cooperated movable terminal to the called line individual to the cooperated fixed terminal, and means operated responsive to cooperating another random said movable terminal with another random said fixed terminal of its corresponding group for causing the impulse sending device to operate certain of said switches to select the called line individual to the fixed terminal last cooperated with while the first said call connection is maintained.

6. In an automatic telephone system, groups of fixed connective terminal for, movable connective terminals each said group cooperative with a random said fixed terminal of its corresponding group, a called line individual to each said fixed terminal, auto-

matic switches, an impulse sending device common to said switches and said fixed terminals, means operated responsive to cooperating a random said movable terminal with a random said fixed terminal of its corresponding group for causing the impulse sending device to operate certain of said switches to select the called line individual to the fixed terminal cooperated with to thereby extend a call connection from the cooperated movable terminal to the called line individual to the cooperated fixed terminal, means operated responsive to cooperating another random said movable terminal with another said fixed terminal of its corresponding group for causing the impulse sending device to operate certain of said switches to select the called line individual to the fixed terminal last cooperated with while the first said call connection is maintained, and means for preventing the operation of last said means until the first said call connection has been established.

7. In an automatic telephone system, an automatic switch, a movable terminal of the switch, a plurality of fixed terminals cooperative with the movable terminal, a called line individual to each said fixed terminal, switch mechanism, a selective switch for each said fixed terminal, a plurality of impulse sending devices commonly accessible from said selective switches, means operated responsive to directively operating the switch to set its movable terminal upon a desired random said fixed terminal for causing the selective switch coresponding to the selected fixed terminal to select a random one of said impulse sending devices, and means responsive to effecting the latter said selection for causing the selected impulse sending device to effectuate impulses for directively operating the switch mechanism for thereby extending connection from said selected fixed terminal to the called line individual thereto.

8. In an automatic telephone system, an automatic switch, a movable terminal of the switch, a plurality of fixed terminals cooperative with the movable terminal, a calling line, a called line individual to each said fixed terminal, switch mechanism, a selective switch for each said fixed terminal, a plurality of impulse sending devices commonly accessible from said selective switches, means operated responsive to directively operating the switch over the calling line to set its movable terminal upon a desired random said fixed terminal for causing the selective switch corresponding to the selected fixed terminal to select a random one of said impulse sending devices, and means responsive to effecting the latter said selection for causing the selected impulse sending device to effectuate impulses for directively operating the switch mechanism for thereby extending connection from said selected fixed terminal to the called line individual thereto, to thereby complete a connection from the calling line to the called line corresponding to the fixed terminal the movable terminal is set upon.

9. In an automatic telephone system, an automatic switch, a movable terminal of the switch, a plurality of fixed terminals cooperative with the movable terminal, a calling line, a called line individual to each said fixed terminal, switch mechanism having movable selective terminals, a selective switch for each said fixed terminal, a plurality of impulse sending devices commonly accessible from said selective switches, means operated responsive to directively operating the switch over the calling line to set its movable terminal upon a desired random, said fixed terminal for causing the selective switch corresponding to the selected fixed terminal to select a random one of said impulse sending devices, means responsive to effecting the latter said selection for causing the selected impulse sending device to effectuate impulses for directively operating the switch mechanism for thereby extending connection from said selected fixed terminal to the called line individual thereto, to thereby complete a connection from the calling line to the called line corresponding to the fixed terminal the movable terminal is set upon, and means whereby the selective switch employed in establishing the connection will not be a link of said established connection thereafter forming a talking path between the calling line and the called line.

10. In an automatic telephone system, an automatic switch, a movable terminal of the switch, a plurality of fixed terminals cooperative with the movable terminal, a called line individual to each said fixed terminal, switch mechanism, a plurality of impulse sending devices, means responsive to directively operating the switch to set its movable terminal upon a desired random said fixed terminal for causing a random one of said impulse sending devices to become connected with the fixed terminal the movable terminal is set upon, and means responsive to effecting the latter said connection for causing the said connected impulse sending device to effectuate impulses for directively operating the switch mechanism for thereby extending connection from said movable terminal to the called line individual to its cooperated fixed terminal.

11. In an automatic telephone system, an automatic switch, a movable terminal of the switch, a plurality of fixed terminals cooperative with the movable terminal, a selective switch for each said fixed terminal, an impulse train sending device, means operated responsive to directively operating the switch to set its movable terminal upon a desired random, said fixed terminal for causing the selective switch corresponding to the selected fixed terminal to connect to a random one of said

impulse train sending devices, means responsive to effecting the latter said selection for causing the selected impulse train sending device to effectuate impulses with specific predetermined correspondence with the fixed terminal the movable terminal is set upon, means for varying the respective series and the number of series in the train of impulses sent by the impulse train sending device dependent upon what said fixed terminal the movable terminal is set upon, and means in the impulse train sending device for causing it to be excluded from the connection responsive to completing the sending of the train and for thereupon rendering it subject to use in a new call while permitting the antecedent call to be maintained.

12. In an automatic telephone system, a calling line, a trunk line, a call indicator for the far end of the trunk line, a first directive device on the calling line, another directive device, automatic switch mechanism for linking a connection from the calling line to the near end of the trunk means, for variably operating a portion of said switching mechanism directly responsive to corresponding operation of said first directive device, and means responsive to said operation of said mechanism for causing the remainder of said mechanism to be operated by said another directive device to complete a connection from the calling line to the near end of the trunk line and for causing the call indicator to indicate what particular operation of the said first directive device occurred.

13. In an automatic telephone system, a calling line, a plurality of called lines each having a specific location designation in the system, a first directive device on the calling line, another directive device, automatic switch mechanism for linking call connections from the calling line to a desired one of said called lines, means responsive to operating said first directive device in accordance with the specific designation of a random one of said called lines for causing the calling line to be connected to said another directive device, and means responsive solely to effecting said connection to said another directive device but depending upon what said called line is designated by the operation of said first directive device in causing last said connection for causing said another directive device to send impulses effective to operate the switch mechanism to complete the call connection from the calling line to the called line indexed by the called line designation effected by said first directive device.

14. In an automatic telephone system, a calling line, a first directive device on the calling line, an automatic switch, a movable terminal of the switch, fixed terminals cooperative with said movable terminal, a second directive device, switch mechanism, a plurality of called lines, means for operating said movable terminal responsive to said first directive device to select a desired one of said fixed terminals, means for selecting said second directive device responsive to selecting a random one of said fixed terminals, and means responsive to selecting said second directive device for causing said second directive device to operate to direct said switch mechanism to extend a connection from said selected fixed terminal to a specific one of said called lines in correspondence with the fixed terminal selected.

15. In an automatic telephone system, a calling line, called lines, a first directive device on the calling line, another directive device, switch mechanism, means responsive to said first directive device for operating a first portion of said switch mechanism to select a random one of said called lines and to cause a connection to be thereby completed from the calling line to a specific said random line under call, means dependent upon which said line is under call for determining whether said another directive device will operate responsive to the operation of said first portion of said mechanism to in turn operate the remainder of said mechanism to complete the call from the calling line to the line under call or whether the connection to the said line under call will be completed by said first portion of said mechanism, a tone source, means for applying said tone source audible on the calling line only provided the said another directive device is introduced indicative that a delay will thereby occur in completing the connection to the line under call because of the requirement of said another directive device and the remainder of said mechanism in the specific said call.

16. In a telephone system, fixed connective terminals, a movable connective terminal for cooperation with a random one of said fixed terminals, a numerically positioned called line individual to each said fixed terminal, automatic numerical switches, an impulse sending device, means for extending connection from said movable terminal to said impulse sending device responsive to setting said movable terminal on a random one of said fixed terminals, and means responsive to effecting said extension for causing the impulse sending device to direct a plurality of said switches into a train to thereby extend a connection from said movable terminal to the called line individual to said random fixed terminal wherein said fixed terminal determines the specific said called line to which the connection becomes extended.

17. In a telephone system, fixed connective terminals, a movable connective terminal for cooperation with a random one of said fixed terminals, a called line individual to each said fixed terminal, automatic switches, an impulse sending device, means for extending connection from said movable terminal to

said impulse sending device responsive to setting said movable terminal on a random one of said fixed terminals, means responsive to effecting said extension for causing the impulse sending device to direct a plurality of said switches into a train to thereby extend a connection from said movable terminal to the called line individual to said random fixed terminal wherein said fixed terminal determines the specific said called line to which the connection becomes thereby extended, and means controlled over the called line for converting said connection to a talking connection from said movable terminal over said random fixed terminal to the called line.

18. In a telephone system, a trunk line, a plurality of near paths over which connection to the near end of said trunk may be effected, automatic switches, a plurality of remote paths over which connection may be effected away from the remote end of said trunk, means including a movable switch terminal for effecting connection to one of said near paths, means involving a plurality of said switches for connecting the trunk to one of said remote paths, and means dependent upon which said near path is employed in effecting connection to the trunk for determining over which said remote path the connection will be thereby completed.

19. In a telephone system, a trunk line, a plurality of near paths over which connection to the near end of said trunk may be effected, automatic switches, a plurality of remote paths over which connection may be effected away from the remote end of said trunk, movable connective terminals, means including one of said movable connective terminals for effecting connection to one of said near paths, means involving a plurality of said switches for connecting the trunk to one of said remote paths, and means dependent upon which said near path is employed in effecting connection to the trunk for determining over which said remote path the connection will be thereby completed.

20. In an automatic telephone system, an impulse sending device, a plurality of paths over any one of which said impulse sending device can be connected with, means for connecting to said impulse sending device over a random one of said paths, and means for causing the impulse sending device to effectuate a variable train of series of impulses, varied with predetermined correspondence with the path employed in effecting connection to the impulse sending device.

21. In an automatic telephone system, an impulse sending device, a plurality of paths over any one of which said impulse sending device can be connected with, means for connecting to said impulse sending device over a random one of said paths, and means for causing the impulse sending device to effectuate a variable train of series of impulses, varied in number of series with predetermined correspondence with the path employed in effecting connection to the impulse sending device.

22. In an automatic telephone system, a called line, a plurality of circuit paths over any one of which connection to the called line can be taken, an indicating device on the called line, and means for operating said indicating device in a specific manner following the completion of the connection to the called line, indicative of the circuit path of said plurality of paths employed in gaining connection to the called line.

23. In an automatic telephone system, a plurality of link circuits, an impulse sending device common to said link circuits, relays of said sending device each individual to respective said links, means for connecting to a random one of said link circuits, means including the relay specific to the link circuit connected to for setting up a specific variable condition in the sending device with correspondence to the link circuit connected to, whereby the impulse sending device will thereupon operate to send impulses from the connected link circuit characterized with predetermined correspondence to the link circuit connected to.

24. In an automatic telephone system, a plurality of link circuits, called lines each individual to a said link circuit, switch mechanism for extending connection from a random one of said link circuits to its corresponding called line, a plurality of impulse sending devices common to said link circuits, a relay of each of said sending devices individual to the respective said link circuits, means for connecting to a random one of said link circuits, means responsive to said connection for rendering a random one of said impulse sending devices individual to the said random link circuit, means including the said relay of the said individual impulse sending device specific to said random link circuit for setting up a specific variable condition in the sending device with correspondence to said random link circuit, whereby said individual impulse sending device will thereupon operate to send impulses over said random link circuit with predetermined correspondence to the said random link circuit, to directively operate the switch mechanism to effect a connection from the calling line via said random link circuit to the specific called line corresponding to said random link circuit.

25. In a telephone system, a plurality of circuit elements, a common automatic selective switch, a common impulse sending device, means for initiating a call on a random one of said circuit elements, means for thereupon associating the impulse sending device individual to said circuit element and for

thereupon initiating the operation of the impulse sending device to directively operate the selective switch in a predetermined manner with correspondence to and dependent upon the particular said circuit element the call was initiated on.

26. In a telephone system, a plurality of initial circuit elements, a call receiving circuit, an impulse sending device, switch mechanism, means for initiating a call on a random one of said initial circuits, means responsive to the initiation of said call for causing the impulse sending device to operate the switch mechanism to extend connection from said random initial circuit to said receiving circuit and for further operating the impulse sending device in predetermined manner to send impulses to said receiving circuit, said impulses sent in said further operation being adapted for operating step by step mechanism associated with said receiving circuit to indicate by the position assumed by last said mechanism which particular one of said plurality of initial circuit elements the call was initiated on as disinct from impulses sent antecedent thereto for extending connection from said random initial circuit.

27. In a telephone system, a plurality of initial circuit elements, a call receiving circuit, an impulse sending device, switch mechanism, means for initiating a call on a random one of said initial circuit elements, means responsive to the initiation of said call for causing the impulse sending device to send a series of impulses to operate the switch mechanism to effect the completion of connection from said random circuit element to said receiving circuit and for further sending a series of impulses to the receiving circuit adapted to identify said random circuit element irrespective of said effected connection.

28. In a telephone system, a plurality of initial circuit elements, a call receiving circuit, an impulse sending device, switch mechanism, means for initiating a call on a random one of said initial circuit elements, means responsive to the initiation of said call for causing the impulse sending device to send a series of impulses to operate the switch mechanism to effect the completion of connection from said random circuit element to said receiving circuit and for further sending a series of impulses to the receiving circuit adapted to identify said random circuit element irrespective of said effected connection, and means on the receiving circuit responsive to said impulses sent to said receiving circuit for displaying a visual indication that identifies the particular initial circuit on which the call was initiated.

29. In a call forwarding system, a calling line, individual terminals corresponding to respective discontinued lines, a receiving line, switch mechanism for completing connection from the calling line to the receiving line, an impulse sending device, means for effecting call connection from the calling line to the terminal of a desired discontinued line, means operated responsive to effecting last said connection for causing the operation of the impulse sending device for directing the operation of the switch mechanism to complete connection from the calling line to the receiving line and for thereupon annexing signal identification impulses to the receiving line, the annexed impulses being variable and governed by what particular disconnected line terminal the connection from the calling line was extended to in order to signal to the receiving line the particular discontinued line called.

30. In an automatic telephone system, a plurality of link circuits, an impulse sending device common to said link circuits, means for connecting to a random one of said link circuits, means for setting up a specific variable condition in the sending device with correspondence to the link circuit connected to, whereby the impulse sending device will thereupon operate to send a train of impulses over the link circuit connected to, wherein the number of series in the train sent will depend upon the link of said plurality connected to.

31. In a telephone system, a plurality of link circuits, a corresponding plurality of receiving circuits, each receiving circuit individual to a said link circuit, an impulse sending device, means including said impulse sending device operated responsive to effecting connection to a random said link circuit for causing said connection to be progressed to the specific receiving circuit individual to the link circuit connected to, and means whereby a plurality of connections between respective said link circuits and corresponding receiving circuits may endure at the same time.

32. In a telephone system, a plurality of link circuits, a plurality of receiving circuits, an impulse sending device, automatic switch mechanism, means including said impulse sending device operated responsive to effecting connections to a random said link circuit for directing the operation of certain of said switch mechanism for thereby linking said connection to a predetermined receiving circuit, and means whereby a plurality of said connections between respective said link circuits and receiving circuits may endure at the same time.

33. In a call forwarding system, a plurality of numerically designated initial circuit elements of an exchange system, an impulse sending device, a numerically designated receiving circuit, and means whereby initiating a call on a random said circuit element will cause the impulse sending device to variably

operate in sending two trains of impulses, one of said trains identifying the numerical designation of the receiving circuit, and the other of said trains identifying the numerical designation of said random circuit element.

34. In a telephone system, a specifically characterized initial circuit element, a receiving circuit, an impulse sending device, switch mechanism, means for initiating a call on the initial circuit element, means responsive to the initiation of said call for causing the impulse sending device to send a specific train of impulses with correspondence to the initial circuit element to operate the switch mechanism to thereby effect connection from the initial circuit element to the receiving circuit and for further operating the impulse sending device in predetermined manner to send a succeeding train of impulses to the receiving circuit with predetermined correspondence to and identitive of the specifically characterized initial circuit element.

35. In a call forwarding system, a calling line, a receiving line, a terminal of a discontinued line, a terminal of a connected line, switch mechanism for completing connection from first said terminal to the receiving line, an impulse sending device, means for effecting connection from the calling line to one or the other of said terminals, means operated responsive to effecting last said connection only if the connection is to first said terminal for causing the operation of the impulse sending device for in turn directing the operation of the switch mechanism to complete connection from first said terminal to the receiving line, and means for applying a signal to the calling line responsive to effecting connection to only first said terminal to indicate that the terminal connected to is that of a discontinued line and that the connection will be thereupon extended to the receiving line.

36. In an automatic telephone system, a link circuit, an impulse sending device, means for connecting to said link circuit, a called line, automatic switch mechanism for extending connection from said link circuit to said called line, a start conductor for said impulse sending device, and means operated responsive to connecting to said link circuit for extending connection to said switch mechanism and for closing a circuit in said switch mechanism including said start conductor to start the operation of the sending device to thereby directively operate the switch mechanism to extend a connection from the link circuit to the called line, last said means only operative when said switch mechanism is made in condition for responding to the directive impulses, following extending the connection thereto.

In witness whereof, I hereunto subscribe my name this twenty-ninth day of August, 1927.

HERBERT M. FRIENDLY.