

Jan. 21, 1930.

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1,744,696

AUTOMATIC TELEPHONE SYSTEM

Filed Dec. 22, 1927

5 Sheets-Sheet 1

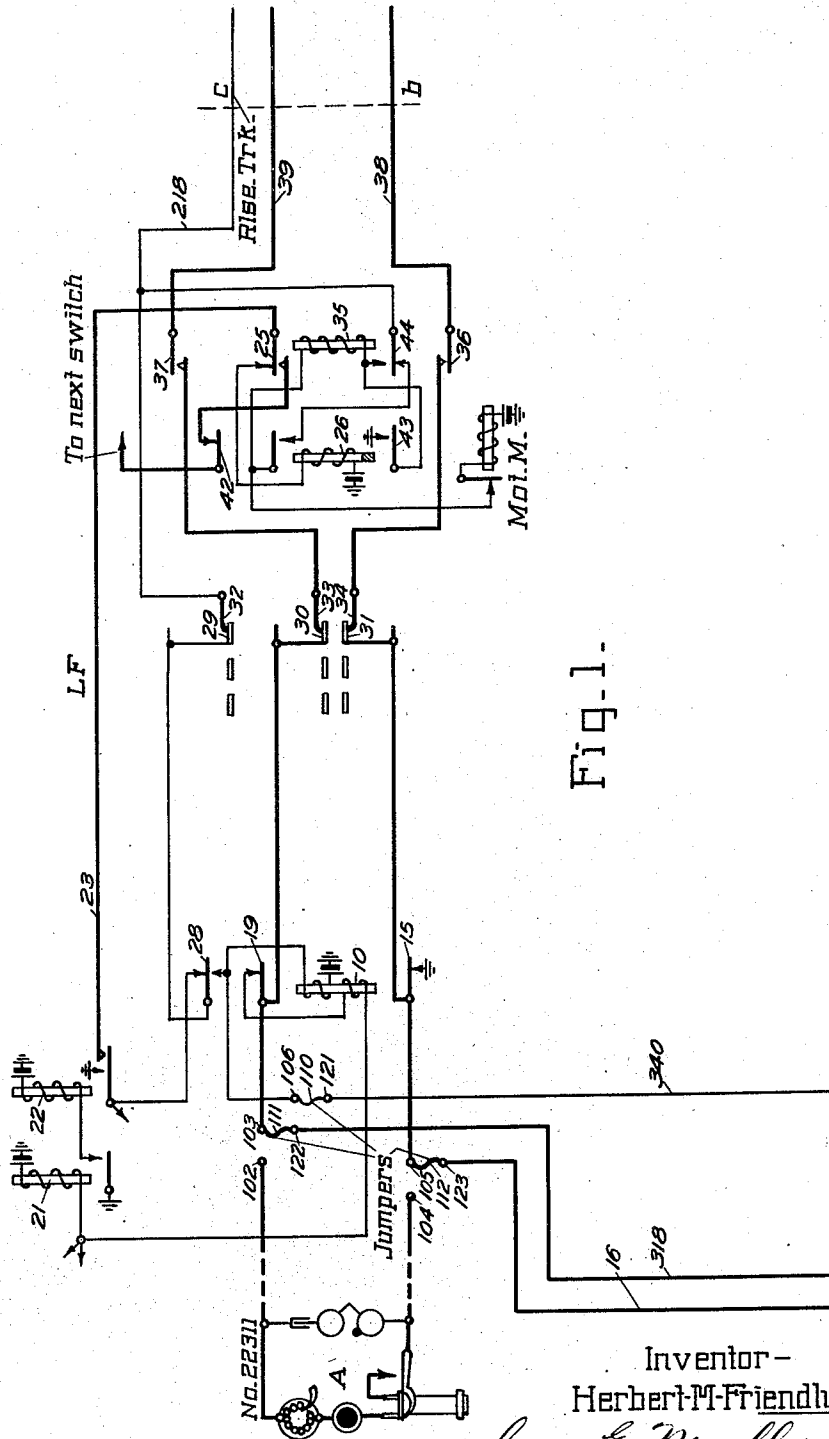


Fig. 1.

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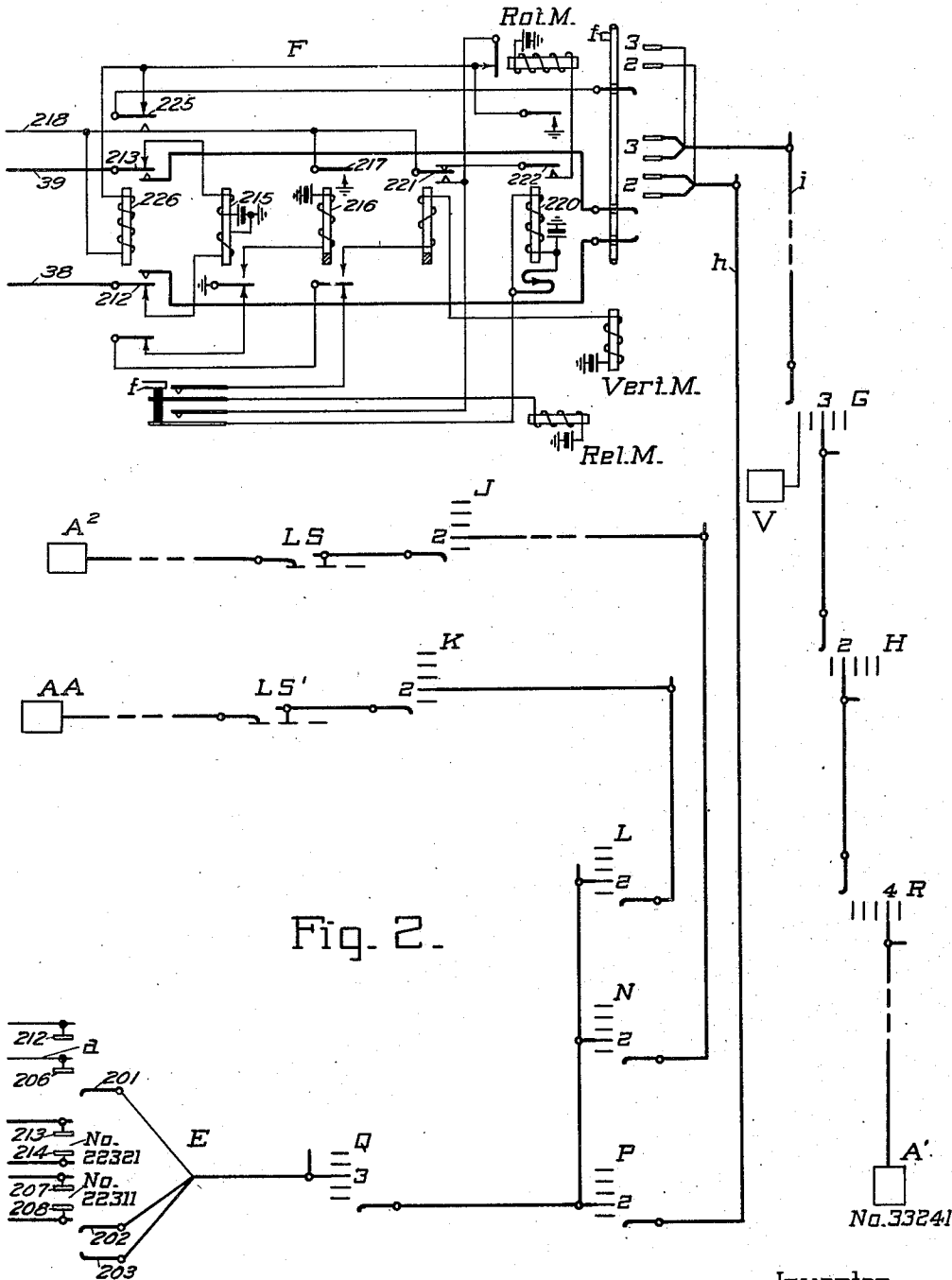
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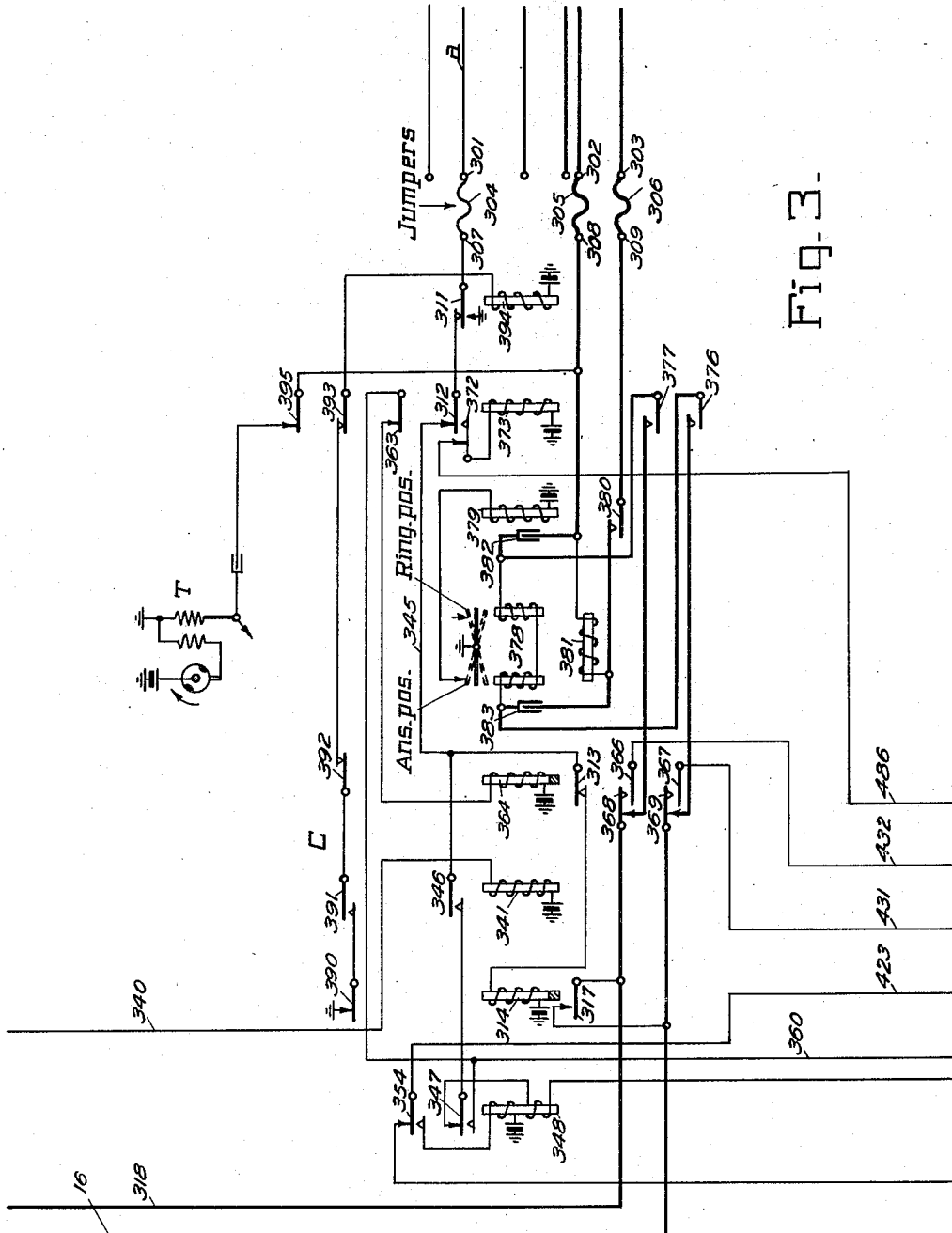
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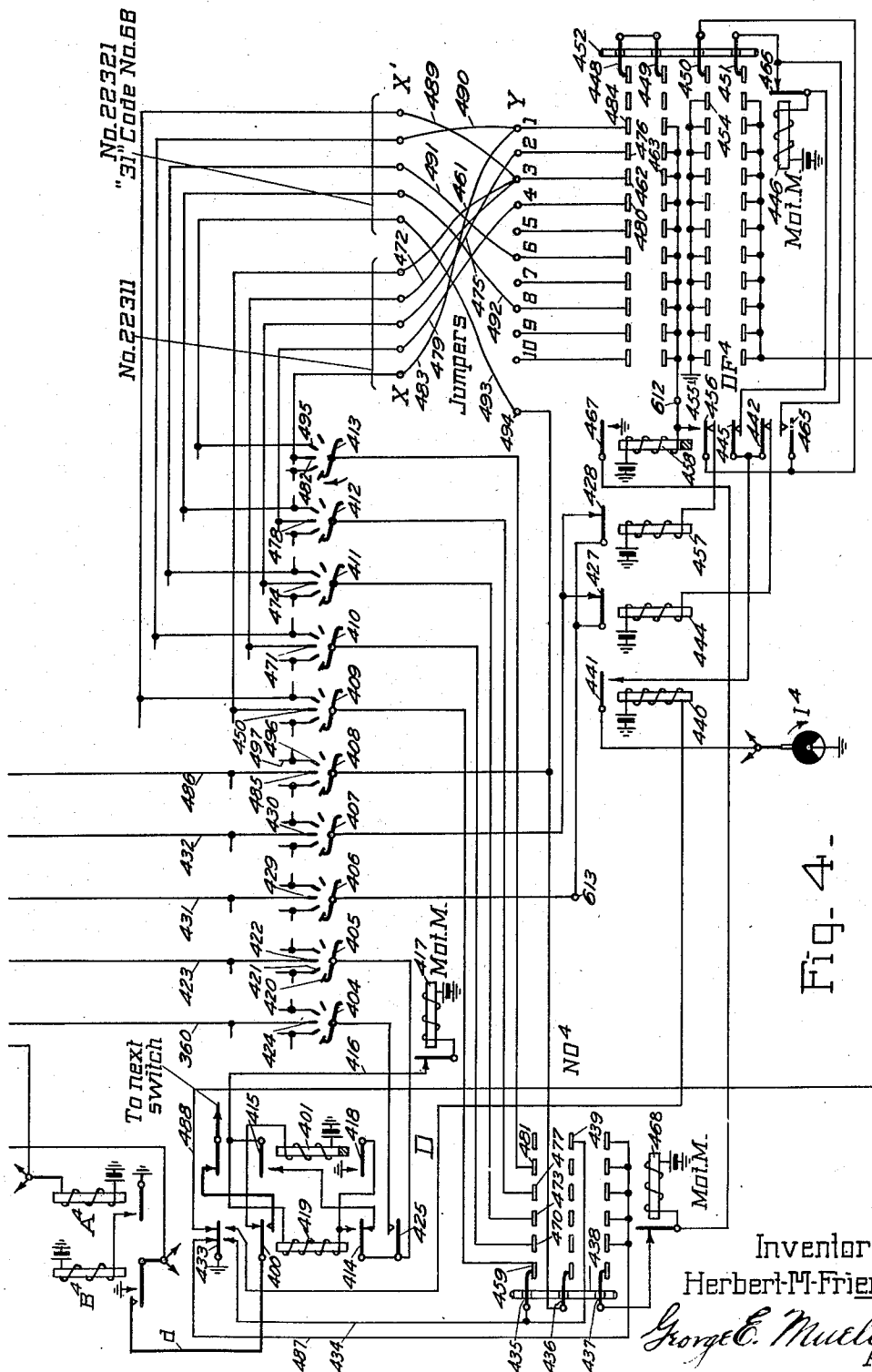
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AUTOMATIC TELEPHONE SYSTEM

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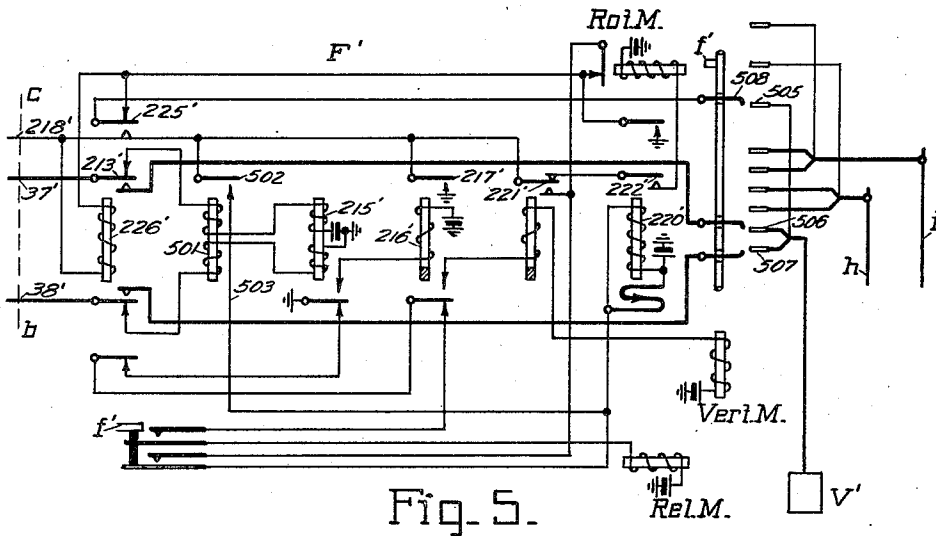


Fig. 5.

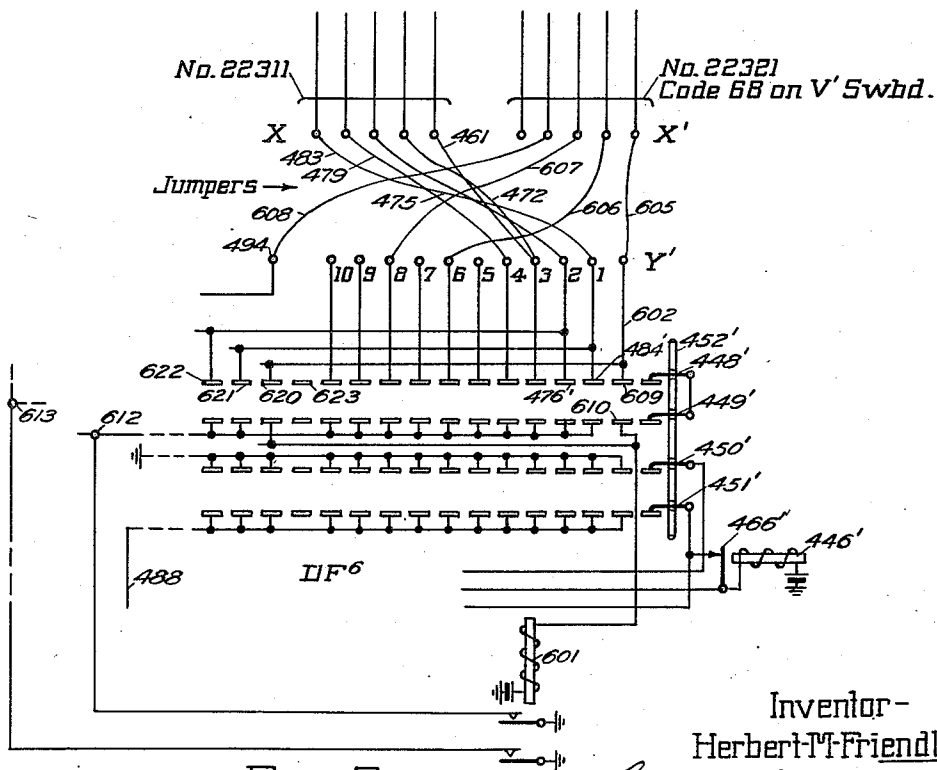


Fig. 6.

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UNITED STATES PATENT OFFICE

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AUTOMATIC TELEPHONE SYSTEM

Application filed December 22, 1927. Serial No. 241,792.

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 exchange 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 Letters Patent, Ser. No. 216,862, filed Sept. 1, 1927 issued as Patent #1,734,083, on Nov. 5, 1929, which said co-pending application covers a telephone system having objects as generally set forth in the foregoing paragraph. However, the present invention is directed to a system having more comprehensive capabilities than disclosed in the said co-pending application, looking further to the economic aspects of commercial embodiments wherein there is a considerable number of subscribers tributary to the same central office of an exchange who have changed to a new telephone number or numbers, respectively which are tributary to other central offices and wherein certain of the mechanism used in forwarding the calls serves the subscribers commonly. That is to say, only a relatively small portion of the equipment brought into play in forwarding a call is individual to a 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 of the system from that before concerned, or where he has subscribed for a

group of lines in 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 corresponding to the new telephone number. The call is thus forwarded over the general trunking system as if it were a new call initiated on the line of the old telephone number.

Also, the respective calls may, as in the said co-pending application, be directed to an attendant in the employ of the operating concern, or the concerned subscribers, 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 the said co-pending application the connector or the final switch seizes a mechanism element as C or C' constituting as a part thereof a hunting switch which will select an idle impulse sending mechanism of an accessible group of the latter said mechanisms and adapt the selected latter said mechanisms for sending a train of impulses specific to the said hunting switch seizing it. Thus, in the said co-pending application, a small plurality of impulse sending mechanisms will serve a larger plurality of said hunting switches wherein each of the said hunting switches correspond to a telephone number which has been changed to a new telephone number, or at least some predetermined number in 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.

However, the present invention comprehends that when the connector or the final switch seizes a mechanism element C generally like shown in the said co-pending application, similarly designated, a condition is thereby set up causing a hunting switch D to start its operation to hunt for and seize the

concerned said mechanism element. There are a plurality of the said hunting switches arranged so that the first idle one will start its hunting operation responsive to the said set up condition.

Individual to each said hunting switch is an impulse sending mechanism, so that when the hunting switch seizes the concerned said element an impulse sending mechanism is thereby cooperated with the seized element. There will be a small plurality of companion hunting switches and impulse sending mechanisms serving a larger plurality of said elements adapted to be seized by the connector or the final switch.

The hunting switch D, in addition to its five wipers on the left-hand for seizing and controlling the said element as C seized by the connector or the final switch, has five series train-setting wipers on the right-hand. All the said wipers are on the same shaft and rigidly connected thereto. Thus, when a said element as C, which has been seized by the connector as E has been thereafter hunted for and seized by the said hunting switch D the said sets of wipers are resting upon bank terminals individual to the said element as C. The five train-setting wipers of the switch D then rest upon bank terminals leading to cross-connecting terminals which are specifically jumpered to set the impulse mechanism consistent with the train of series of open impulses to be sent responsive to the connector as E seizing a random said element C corresponding to the line primarily called by the calling party, the train of series being specific to the said element seized due to the jumpering.

The train of series of open impulses may constitute any number from one to five in the present exemplary disclosure, though of course, this number may be increased by correspondingly increasing the number of said train-setting wipers. While the foregoing refers to sending open impulses, it will be understood that any desired type of impulses may be sent, and furthermore, mixed impulses may be sent. That is to say, open impulses and ground impulses may be sent in the same train.

In carrying out the present invention, the operating concern will provide a sufficient number of units as C, together with a lesser number of the hunting switches as D and individually cooperative parts. The operating concern will then introduce these elements as C into the desired random lines of the exchange, as required, perhaps contingent upon a specific rental and service payment. To introduce the said equipments, connections between certain terminals are opened, and certain terminals are jumpered to a unit as C; one element only (C), of the plurality provided, being shown in the drawings associated with line terminals of a random line

number 22311 accessible from a random connector E. The designated jumpers in Fig. 4 are then run to the cross-connecting rack terminals which correspond to the element C. Thus, when the element C has been seized by the set of wipers of the switch D the corresponding set of jumpers between terminals X and Y will be effective and constitute the train of series of impulses to be sent in forwarding the call from the terminals of line number 22311 seized by the connector E.

It will be noted that the same line relay 10 as formerly used by the disconnected telephone A is used in the forwarding of the call. Of course, any other suitable method of extending the call from the element C to the first selector as F may be employed in place of the method disclosed wherein the line finder switch LF is used.

There are additional operative features of the present invention which will be described in the specification relating to the exemplary embodiment (including preferred modifications) of the present 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 the switch LF. Fig. 1 also shows a line relay 10, and how the element C in Fig. 3 is introduced by jumpers into a random subscriber's line number 22311 for forwarding calls made to the said line. This element C is cooperative with the impulse sending mechanism shown in Fig. 4 through the agency of the finder switch D.

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

Fig. 3 shows the element C which is individual to the line number 22311 due to being cross-connected therein by means of temporary jumpers.

Fig. 4 shows an impulse sending mechanism (being one of a plurality not shown) which is common to element C and other elements similar to element C, but not shown. The sending mechanism finder switch D is also shown.

Fig. 5 shows a preferred modification F' of the first selector F.

Fig. 6 shows a preferred modification DF^o of the switch element DF⁴.

The Figs. 1, 2, 3 and 4 are assembled so that correspondingly designated lines extending towards the margins of the sheets containing them register. Other lines not des-

ignated will coincidently register with undesignated lines which are continuations of each other.

Equipment

5 The telephones A, AA, A² and A' are of the well known common-battery series automatic type.

10 The line finder switch LF is of the type illustrated and described on pages 55 to 57 of the third edition of Hershey's Automatic Telephone Practice.

15 The first selector F is of the well known type sometimes designated as the Powell selector, and described in the said third edition of Hershey's book, pages 59 to 61. The selectors G, H, J, K, L, N, P and Q indicated in Fig. 2 are similar to selector F, or may be of some other suitable type.

20 The connector E indicated in Fig. 2 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 my co-pending application Serial No. 215,034, filed August 24, 25 1927. The connector R in Fig. 2 is similar to connector E in the same figure.

30 The line switches LS and LS' in Fig. 2 are of the well known type illustrated and described on pages 53 to 55 in the said third edition of the Hershey book.

35 The hunting switch D in Fig. 4 has the same general mechanical hunting operation as the switch LF, the circuits and objects being modified in accordance with the present invention.

40 The switch elements NO⁴ and DF⁴ in Fig. 4 have the same general mechanical structure as the switch LF, the circuits and objects being modified in accordance with the present invention.

45 The selector F' in Fig. 5 is a preferred modification of selector F. It is like selector F, with the exception of the added differential relay 501 and circuits controlled by the said relay. The off-normal springs operate on either a rotary or a vertical off-normal movement. A level of bank terminals align with the restored position of the wipers. Otherwise, the trunks leading out from the bank 50 terminals of the off-normal levels of selector F' are the same trunks correspondingly positioned in the bank of the selector F. A selector having a normally aligned level and off-normal levels is shown in my copending application Ser. No. 171,637, filed May 29, 55 1917, and my copending application Ser. No. 481,626, filed June 29, 1921. Claims in the present application directed to this latter subject matter differ in scope from claims in the 60 latter two copending applications.

65 The switch element DF⁶ in Fig. 6 is a preferred modification of the switch element DF⁴ and includes an added relay 601 and circuits controlled by said relay.

Call from telephone A² to telephone line 22311 under the condition that the subscriber of the latter said line has arranged with the operating concern to have such calls automatically extended to his new telephone A', the number of which is 33241, tributary to a different central office 70

In view of the well known operation of the line switch LS, first selector J, incoming 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 applications of applicant, 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 A² for causing wipers 201 to 203 to be set upon the bank terminals 206 to 208, respectively, of the called line number 22311. 75

If it is assumed that the bank terminal 206 constitutes battery potential, derived through the winding of relay 314 over an obvious circuit path, due to no other connector of the group containing connector E being in seizure with a multiple of the said terminals 206 to 208 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 206 to ground potential to guard multiples of the seized line terminals against seizure by another connector, should some other party call for the line number 22311. The telephone A² may be considered a random telephone of the system. However, it is tributary to a central office other than the "2" central office. The selector N is an incoming second selector. 80

Bank terminals 206 to 208 lead to cross connecting rack terminals 301 to 303, respectively. Jumpers 304 to 306 serve to connect terminals 301 to 303 to terminals 307 to 309, respectively, of the element C. 85

Ground applied to bank terminal 206 is continued through armatures 311, 312 and 313 to the winding of the slightly slow-releasing relay 14, the latter said relay actuating. A circuit can now be traced from ground, armature 15, conductor 16, attracted armature 317, conductor 318, armature 19, lower winding of line relay 10 to the winding of common relay 21, the latter said relay actuating to close a local circuit operatively energizing common relay 22. Due to the actuation of relay 22, ground is applied over common conductor 23, armature 25 to the winding of slow-releasing relay 26, the latter said relay actuating. 90

Before proceeding with the operation of the switch LF, it is stated that the armature 28 on line relay 10 attracts into engagement 130

with its make contact, disconnecting from its resting contact. The other armatures 15 and 19 of the latter said relay are not operatively attracted under the sole influence of the lower winding of relay 10.

Under the condition of armature 28 being attracted, busy ground does not exist on private bank terminal 29 of the group 29 to 31, though it does exist on all private bank terminals corresponding to bank terminal 29 of all the lines accessible from the line finder switch LF not having the armature corresponding to only 28 attracted because of an initiated call that has not yet been completed to the line finder switch, as will appear presently.

The line finder switch LF will now operate in the well known manner, in view of the references, to seize terminals of the line corresponding to the line relay 10 the wipers 32 to 34 are shown resting upon. Had the wipers 32 to 34 been resting upon some other bank terminals they would hunt over busy-guarded bank terminals until the bank terminal group 29 to 31 are found, having in mind that some other line may be unguarded and thus subject to seizure by the wipers 32 to 34 if its line relay corresponding to 10 has only its armature corresponding to 28 attracted against its make contact.

When the wiper 32 fails to short-circuit the winding of the switching relay 35 due to an ungrounded bank terminal being encountered by said wiper, the relay 35 will actuate to effect the seizure, and relay 26 will deactuate consistent with its slow-releasing characteristic. The conductors 16 and 318 are now continued through bank terminals 31—30, wipers 34—33, armatures 36—37, conductors 38—39, armatures 212—213 to the lower and upper windings of relay 215 to ground and grounded battery, respectively, the latter said relay actuating.

Responsive to the actuation of relay 215, its dependent slow-releasing relay 216 will actuate whereby its armature 217 will apply ground over the release trunk 218 through wiper 32, bank terminal 29, armature 28, to the upper winding of relay 10, the latter said relay being now energized sufficiently solely by its upper winding to operatively attract all its armatures. The ground on armature 28 is continued over conductor 340 to the winding of relay 341, the latter said relay actuating. The conductor 23 is continued through armatures 25 and 42 to the armature corresponding to 25 of the next finder switch (not shown) of the group containing the switch LF, there being a first selector as F individual to and companion to each finder switch as LF having common access to subscribers' lines.

In this connection, it will be noted that the conductor 340 normally has battery potential, derived through the upper winding

of the relay 10, and this condition will endure after a call is initiated on the corresponding line until ground from the release trunk 218 is applied to it by the actuation of relay 35, and which ground is thereafter supplemented and maintained from the armature 217. The relay 35 is sustained actuated by the ground first applied through armature 43 to its lower winding terminal, and then sustained by the ground thereafter applied back from the armature 217 through the armature 44. The relay 341 thus first actuates responsive to the armature of the first selector F, after which time the sending of impulses effective to the selector F may start. Relay 341 will thus sustain actuated as long as release trunk 218 constitutes ground potential.

Responsive to the actuation of relay 341, ground is applied from bank terminal 206, armatures 311, 312, conductor 345, armatures 346, 347, lower winding of relay 348, winding of common relay A⁴, the latter said relay actuating to close a local circuit operatively energizing common relay B⁴. Due to the actuation of relay B⁴, ground is applied over the heavy common conductor to the armature 400 and the winding of slow-releasing relay 401, the latter said relay actuating.

Before proceeding further with the operation of the switch D, it is stated that the armature 354 on relay 348 attracts into engagement with its make contact, disconnecting from its resting contact. The other armature 347 of the latter said relay not operatively attracting under the influence of the lower winding of the relay 348.

With relay 401 actuated, a circuit can be traced from the wiper 405 of group 404 to 413, armatures 414, 415, conductor 416 to the winding of the motor magnet 417. Also, a circuit can be traced from ground, armature 418, winding of switching relay 419 to the conductor 416.

If wiper 405 is assumed resting on a busy, grounded bank terminal, this ground will be applied through armatures 414 and 415 to conductor 416, causing the motor magnet 417 to operate, stepping the wipers 404 to 413 under the control of the interrupter armature on the motor magnet 417. However, if the wiper 405 is assumed resting upon an idle, ungrounded bank terminal, the conductor 416 will not then constitute ground potential to cause the operation of the motor magnet 417. Under the latter said condition there is no ground received through the wiper 405 to short-circuit the winding of relay 419, so that the windings of the motor magnet 417 and the relay 419 will be in a series path to ground on the make contact of attracted armature 418. The relay 419 will actuate under the latter said condition, while the motor magnet 417 will not operatively

attract its armature, due to its marginal adjustment. The actuation of relay 419 disconnects the winding of relay 401, so that the latter said relay will deactuate consistent with its slow-releasing characteristic, the relay 419 being sustained from ground on the make contact of armature 418 as long as said armature 418 is attracted. It will appear presently, that the lower winding terminal of relay 419 will receive ground through wiper 404 before the armature 418 retracts.

It will be assumed that the bank terminals 420 and 421 constitute ground potential when the relay 401 actuated responsive to the connector E seizing the element C. The wipers 404 to 413 will thereupon advance responsive to the motor magnet 417, until wiper 405 rests upon bank terminal 422, which due to the armature 354 being attracted, is applied to battery potential through the upper winding of relay 348. Under the latter said condition, the winding of relay 419 is not short-circuited, so that the latter said relay actuates; energized through the winding of motor magnet 417. When the armature 414 attracts, ground is applied from make contact, armatures 418, 414, wiper 405, bank terminal 422, conductor 423, armature 354 to the upper winding of relay 348, the latter said relay operatively attracting all its armatures. Ground from bank terminal 206 will now be applied over conductor *a*, jumper 304, armatures 311 and 312, conductor 345, armatures 346 and 347, conductor 360, bank terminal 424, wiper 404, armature 425 to the lower winding of relay 419 before the armature 418 has had time to retract, so that when the latter said armature retracts consistent with the slow-releasing characteristic of the relay 401, the relay 419 will be energized over the traced path including wiper 404 and jumper 304, conductor *a* to bank terminal 206; this latter ground being applied through said armature 425, wiper 405, bank terminal 422, conductor 423, armature 354 to the upper winding of relay 348 to sustain the latter said relay fully actuated dependent upon the ground on wiper 201 resting on bank terminal 206 being applied through retracted armature 312.

In this connection, it will be noted that when armature 354 first attracted, it disconnected its normal connection from the winding of common relay B⁴. Also, when armature 347 operatively attracted it disconnected the lower winding of relay 348, so that relays A⁴ and B⁴ will then deactuate in sequence. It will also be noted that when relay B⁴ actuated, it placed a busy ground on all armatures corresponding to 354 of the idle elements like C, not shown, so that the wiper 405 will find ground to bar seizure on all bank terminals excepting that one corresponding to the element C or an element as C which has been seized by a connector as E and has not yet been seized by the switch D, or seized by

another similar switch of the group containing switch D. That is to say, when the element as C is seized by a connector as E, the switch D, or the first idle switch of its group will start hunting for it to seize it, the common conductor *z* being thereby continued through armatures 400 and 426 to the armature corresponding to 400 of the next switch, not shown, but like switch D.

At the time ground was applied to conductor 360, this ground was extended through armature 363 to the winding of relay 364 which is slightly slow-releasing, the latter said relay actuating. Relay 314 will be deenergized, due to the attraction of armature 313 and it will deactuate consistent with its slightly slow-releasing characteristic, insuring that armatures 366 and 367 engage the make-before-break springs 368 and 369, respectively, before the armature 317 retracts.

A circuit can now be traced from the armatures 427 and 428 in multiple, wipers 406—407, bank terminals 429—430, conductors 431—432, armatures 367—366, springs 369—368, conductors 16—318, and over the traced path including the lower and upper windings of line relay 215 in selector F, the latter said relay being maintained actuated.

At the time relay 419 actuated, ground from armature 433 is applied to conductor 434. This grounds wiper 435 of the group 435 to 437 on shaft 438 of the switch element NO⁴. Bank terminal 439 is also grounded, and armature 433 also applies ground to the winding of impulse control relay 440, causing it to actuate.

The ground interrupter I⁴ revolves so that it will send ground impulses at the rate of approximately twelve per second. Upon the relay 440 actuating, the ground impulses from source I⁴ will be applied through armatures 441 and 442 to the winding of the impulsing relay 444. The said impulses are also applied through armature 445 to the winding of the motor magnet 446 of the switch element DF⁴, causing the wipers 448 to 451 on the shaft 452 to step advance over the cooperative bank terminals. The operation of the relay 444 is nullified due to the retracted condition of armature 428. However, when the wiper 450 engages bank terminal 454 ground from source 455 is applied through armature 456 to energize relay 457, so that for each impulse applied by the interrupter I⁴ while slow-releasing relay 458 remains normal an impulse will be sent to relay 215 by the armature 427.

Ground from the wiper 435 is applied through bank terminal 459, wiper 409, bank terminal 450, jumper 461 to bank terminal 462. When the wiper 448 encounters the grounded bank terminal 462, this ground is communicated through wiper 449, bank terminal 463 to the winding of relay 458, the latter said relay actuating and locking through

armature 456 to grounded wiper 450, the latter said wiper being constantly grounded at all positions other than as drawn. The ground on wiper 450 will be applied through armature 465, interrupter armature 466 to the winding of the motor magnet 446, the latter said magnet operating to drive the wipers on the shaft 452 forward to the drawn position by interrupter action. The relay 458 will terminate the sending of impulses when it actuates to deenergize relays 444 and 457, three open impulses having been sent by armature 427 when the wiper 448 encountered bank terminal 462, although the wipers actually took four steps, but wherein the armature 428 was retracted until wiper 450 encountered bank terminal 454.

At the time relay 458 actuated, its armature 467 applied ground to the winding of the motor magnet 468 of the element NO⁴, preparatory to causing the wipers on the shaft 438 to advance one step when the armature 467 retracts when the wipers on the shaft 452 reach the drawn position and relay 458 unlocks and deactuates consistent with its slow-releasing characteristic to make a pause sufficient for the first selector F to rotate in and seize an idle trunk to selector G before annexing the following series. Ground from wiper 435 is now applied through bank terminal 470, wiper 410, bank terminal 471, jumper 472 to bank terminal 462. The relay 458 being deactuated, wipers on the shaft 452 will start step advancing in the manner before described, the operation continuing as before until bank terminal 462 is encountered by wiper 448, because both jumpers 461 and 472 lead to the same numerical terminal having a digit value of 3. Three open impulses will be effectuated by armature 427 as before.

Bank terminal 473 is connected through wiper 411, bank terminal 474, jumper 475 to bank terminal 476, corresponding to third digit 2.

Bank terminal 477 is connected through wiper 412, bank terminal 478, jumper 479 to bank terminal 480, corresponding to fourth digit 4.

Bank terminal 481 is connected through wiper 413, bank terminal 482, jumper 483 to bank terminal 484, corresponding to fifth digit 1.

The general operation of the switches NO⁴ and DF⁴ described in connection with the sending of the first and second digits 33 will hold for the sending of the third, fourth and fifth digits 2—4—1, the digits in each case being determined by the terminal connected to at the lower end of the respective jumpers 461, 472, 475, 479 and 483 in the cross-connecting rack terminal group designated Y.

It is thought that in view of the references, the operation of the switches F, G, H and R in extending the call to telephone A',

number 33241, responsive to the train of five digit series 3—3—2—4—1 will be fully understood, and therefore will not be described in detail, in imparting a comprehensive disclosure of the operation of the system involving the present invention. After sending the fifth digit of the series (which latter series is a single impulse) of the train, and after relay 458 deactuates, the wiper 436 will encounter grounded bank terminal 439, applying ground through wiper 408, bank terminal 485, conductor 486, make-before-break spring 372 to the winding of relay 373, the latter said relay actuating and locking to bank terminal 206. Responsive to the attraction of armature 363 the relay 364 will deactuate consistent with its slightly slow-releasing characteristic, relay 314 being disabled due to the attracted condition of armature 312. The attracting of armature 312 will also remove the ground received by armature 347, so that the locking ground applied through armature 425 will be removed. Relays 348 and 419 thus deactuate, and ground is removed from the bank terminals 422 and 424. The ground on said terminal 422 serves to guard the element C from seizure by a switch of the group containing switch D, should it hunt while the switch C is seized by switch D.

When armature 433 retracts, its ground is applied over conductors 487 and 488 to ground the bank terminals engaged by wipers 437 and 451 when off-normal, which will cause the wipers on the shafts 438 and 352 to be restored to their respective drawn positions by interrupter action of the motor magnets 468 and 446, respectively. All the relays, switch elements and circuits of the impulse sending mechanism shown in Fig. 4 is now at normal, subject to new use. It is noted, in this connection, that the wipers 404 to 413 remain in the position last used. That is to say, on the terminals corresponding to the element C, but inoperative with respect to said element C.

If it is assumed that some other connector of the group containing connector E seizes multiples corresponding to bank terminals 212 to 214, respectively, leading to an element like C, not shown, the relays A⁴ and B⁴ will actuate to cause the switch D to start hunting for the ungrounded terminal cooperative with wiper 405 corresponding to the said element like C and seize thereat. The latter said element like C corresponds to line number 22321. It will be clear that since the switch D was freed from element C forthwith upon the termination of the impulse series train by the actuation and locking of relay 373, the switch D may be immediately cooperated with a said element like C which has been seized by the concerned connector as E, but not yet cooperated with a switch of the group containing switch D. This will be so although the call forwarded

to telephone A' with which the switch D was concerned has not been responded to or the line leading to telephone A' may have been busy.

5 The switches NO⁴ and DF⁴ companion to the switch D are immediately restored to normal responsive to self control involved in the switch D when the forwarding impulse train has been sent due to wiper 436 encountering bank terminal 439 and thereby causing
10 relay 373 to actuate and lock.

15 Returning to the operation wherein the relay 364 deactuated responsive to the actuation of relay 373 immediately following the termination of the last series of the forwarding impulse train. The conductors 16—318 are continued through the resting contacts of springs 369—368, armatures 376—377 to the winding terminals of polarized relay 378. The latter said winding is now in series with
20 the windings of the line relay in connector R, and is energized so that its armature tilts counter-clockwise into the designated "Ring. pos.". Relays 314, 364 and 379 are now deactuated, and relays 341 and 373 are actuated. The connector E is now applying ringing
25 current to bank terminals 207—208, but there is no operative path over the conductors leading to the left from said bank terminals due to relay 379 being deactuated wherein
30 armature 380 is retracted.

When the party at telephone A' responds to the call, the operation of the back-bridge relay in the connector R will cause the direction
35 of current traversing the winding of polarized relay 378 to be reversed so that the armature thereof will tilt clock-wise into the designated "Ans. pos.". Under the latter said condition, the relay 379 will be energized to attract its armature 380. The retardation coil 381 is now in bridge across
40 the terminals 207—208 and causes the ring-cut-off relay and the back-bridge relay in the connector E to operate. The calling telephone A² is now in talking relation with the telephone A' over the heavy conductors,
45 wherein the condensers 382 and 383 are interposed.

If it is assumed that the party at telephone A' replaces his receiver on the switch-hook
50 first, thereby reversing the direction of current traversing the winding of polarized relay 378, the relay 379 will deactuate and thereby open the energizing path of the back-bridge relay in the connector E. When the
55 party at telephone A² thereafter replaces his receiver on the switch-hook the front-bridge relay in the connector E will deactuate, causing the latter said connector to restore. Relay 373 will deactuate responsive to the restoration of the connector E, and the retraction of armatures 376—377 will open the energizing circuit for the front-bridge relay in
60 connector R, the latter said connector restoring. Incidental to the front-bridge relay in connector R deactuating, the ground is
65

removed from the release trunk continued back over conductor 340 to the winding of relay 341, the latter said relay deactuating, as well as the restoring the switch mechanism involved in forwarding the call.

When the relay 373 deactuated, a circuit
70 path was closed from ground, armatures 390 to 393 to the winding of relay 394, the latter said relay actuating, its armature 311 applying ground to bank terminal 206. The purpose of this grounding the bank terminal 206
75 is to insure that even if the connector E has restored, the bank terminal 206 will constitute ground potential to bar seizure thereof (as well as of its multiples, not shown), until the relay 341 deactuates. This is having in mind
80 that in the restoring of the connector E an appreciable time elapses before the release relay in the connector R removes the ground from the release trunk to restore the switch
85 mechanism used in forwarding the call from the connector E to connector R, and this ground placed on bank terminal 206 will thus guard the element C against seizure until the ground has been removed from the release
90 trunk and relay 341 has deactuated resultant thereto.

If it is assumed that the party at telephone A² replaces his receiver on the switch-hook
95 first, the switches antecedent to the connector E will thereby restore forthwith. The connector E will remain in seizure with the terminals of the line primarily called until the party at telephone A' replaces his receiver on the switch-hook to cause the relay 379 to deactuate and remove the retardation coil from
100 the bridge between the bank terminals 207—208. The latter said relay will deactuate and cause the restoration of the connector E before the relay 341 has had time to deactuate, due to the fact that the front-bridge (line)
105 relay in connector R will not deactuate to remove ground from the release trunk maintaining the relay 341 until after the connector E restores and permits the relay 373 to deactuate to open the bridge (at armatures
110 376—377) including the winding of polarized relay 378. When relay 373 deactuates under the present condition, the circuit from ground including armatures 390 to 393 to the
115 winding of relay 394 is closed by armature 393, the latter said relay actuating to apply ground through its armature 311 to the bank terminal 206 to guard the element C against seizure until relay 341 deactuates, thereby
120 opening the energizing path for relay 394 at armature 391.

Calling party is apprised by tone when connection is effected to line terminals from which the call will be forwarded, so that he will be prepared for the forwarding delay

The tone source T is normally connected through armature 395 to the talking conduc-

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tor leading to the bank terminal 207, so that when the connector E seizes the element C the calling party will perceive this tone intermediate of the periodic applications of ringing current from connector E. However, when the relay 373 actuates at the termination of the forwarding impulse train, the tone T will be disconnected at armature 395.

Abandoning the call after selecting the line leading to telephone A', but before a response is obtained

If the party at telephone A² replaces his receiver on the switch-hook before the party at telephone A' removes his receiver, although the line to said telephone A' has been selected by connector R, the connector E will forthwith restore and remove ground from the bank terminal 206, so that relay 373 will deactuate to disconnect the bridge involved in the winding of polarized relay 378, causing the connector R to restore. After relay 373 deactuates, and until relay 341 deactuates when the ground is removed from the release trunk leading back from connector R to conductor 340, a circuit will be closed from ground through armatures 390 to 393 to the winding of relay 394 to cause armature 311 to apply ground to the bank terminal 206 to guard the element C against seizure. The latter described operation is essentially as when the party at telephone A' answered and replaced his receiver on the switch-hook before the party at telephone A² did so.

Abandoning call while the impulse sending mechanism in Fig. 4 is in the process of sending an impulse train in forwarding a call.

The relay 364 and the relay 419 receives sustaining ground from the bank terminal 206 through armature 312 during the time the forwarding train of impulses is under way, the conductor 360 being thus grounded. If the calling party now abandons the call causing the connector E to be restored, thereby removing ground from bank terminal 206 the said relays 364 and 419 will be restored, opening the energizing circuit including the conductors 16 and 318. Relay 341 is in its actuated condition. When relay 364 deactuates, its armature 392 closes a circuit path from ground through armatures 390 to 393 to energize relay 394 to cause armature 311 to apply ground to bank terminal 206 to guard the element C against seizure until the relay 341 deactuates responsive to ground being removed from the release trunk leading back to conductor 340. It will be noted that when the relay 419 deactuated the switch D is thereupon free of the element C, and subject to new use, though the relay 341 may still remain actuated to maintain ground on bank terminal 206 until the ground is removed from the release trunk extension from conductor 340 from ahead.

In the commercial embodiment of the present invention there may be a group of any number of elements like C, twenty five, for example, which respectively correspond to random telephone lines of the central office served by random groups of connectors like E or other final switches. A smaller group of switches like D, three for example, may serve the said group of elements. The number of elements placed in a group and the number of switches like D serving the said group of elements will depend upon the number of calls made to lines concerned. Since on an average approximately ten seconds would be required after an element as C is seized by a connector as E until the forwarding impulse train has been terminated and the impulse sending mechanism including the switch as D has been excluded ready for new service, each switch as D may nominally serve approximately six calls per minute.

In this connection, it will be noted that if all switches as D are busy sending impulse trains when an additional call is made to an element as C embraced by the said switches no conflict will result beyond the delay until it is seized upon a switch as D becoming idle, whereupon under the condition it will immediately start its hunting operation due to relays A⁴ and B⁴ being actuated. The tone from source T will be audible to the delayed party during the delay period.

The cross-connecting rack terminals X' correspond to an element like C, not shown, which element is seized when the line number 22321 is seized. The operation of the switch D (or other switch of its group) and its individual impulse sending mechanism will be the same as described with reference to the element C being seized, with due variation because of its different jumpering from the terminals X' as compared to the jumpering from terminals X, as will be pointed out.

Jumpers 489 to 492 will cause an impulse train corresponding to digits 3—1—6—8 to be sent by the armature 427 (or corresponding armature concerned). The first two series 3—1 will cause the first selector as F to select a second selector as G, and the latter selected selector to then select an idle trunk to the operator's switch-board V. The trunks to the latter said switch-board will terminate in a well known so-called call-indicator equipment, or such equipment modified as has been referred to in my co-pending application, Serial No. 216,862, filed September 1, 1927. This call indicator equipment will then indicate the number 68 responsive to the last two digit series of the train. The responding operator at switch-board V will know from her records to what telephone line this refers. That is to say, what telephone number was called from which the call was forwarded to her switch-board V. Of course, jumpers could be run in accordance with the five

digits of the number called, by first providing for two more impulse series by obvious modification of the circuits in Fig. 4 to send a maximum total of seven series, in place of five, for a train.

Since only four digit series comprise the train of the latter described forwarding to the switch-board V, the jumper 493 run to terminal 494 causes ground to be applied from wiper 435, bank terminal 481, wiper 413, bank terminal 495, said jumper 493, terminal 494, wiper 408, bank terminal 496, conductor 497 to the spring corresponding to 372 of the element like element C corresponding to line number 22321, causing the switch D to be freed in the manner before described, but wherein the ground was not applied through wiper 408 until wiper 436 engaged bank terminal 439 following an additional (fifth) impulse series.

In view of the number 68 being indicated on the call indicator equipment at switch-board V, it will appear that this number may be permanently attached to the element like C corresponding to the cross-connecting rack terminals X' and the bank terminals 212 to 214, so that if the said element like C is disconnected from the present assumed line and introduced into another random line, the same number 68 will indicate to the operator responsive to calls to the bank terminals of the latter said line. However, the operator's records will serve to prompt her as to the number of the line primarily called. This, thus saves re-running the jumpers from the terminals X' to the terminals Y when the corresponding said element is transferred to another subscriber's line.

In this connection, it will be clear that if in place of sending two digit series into the call-indicator equipment, three digit series were to be sent, the jumper 493 would be run to the terminal in the group Y corresponding to the desired third digit. The terminal 494 would not then have a jumper from the group X', the wiper 436 engaging bank terminal 439 following the fifth series of the train causing the ground to be applied through the wiper 408 to exclude the switch D and its individual mechanism.

Element C introduced by jumpers

Normally, the terminals 102—103, 104—105 are connected by tie conductors. Also, tie conductors connect terminals 106—301, 103—302 and 105—303. Also, the jumpers 110 to 112 and 304 to 306 are not run as drawn. This excludes the element C. The element C has incoming terminals 307 to 309 and outgoing terminals 121 to 123. Thus, the element C may be introduced by jumpers 110 to 112 and 304 to 306 between the connector terminals of the line number 22311 and the line relay 10 of the corresponding line, while the telephone A is rendered out of

service by opening the tie conductors between terminals 102—103 and 104—105. The element C is thus universal with respect to any subscriber line of the central office and may readily be introduced and again disconnected for new service with some other line.

Preferred modifications

The selector F' in Fig. 5 is like selector F in Fig. 2, excepting that the relay 501 has its windings differentially connected; introduced in series with the corresponding windings of the line relay 215' corresponding to relay 215 in selector F; in fact the primed index numbers in selector F' designate like parts with the corresponding unprimed index numbers in selector F. The selector F' is substituted for the selector F in the preferred embodiment where indicated by the dotted line *b—c*. Selector F' will rotate in directly from normal position.

When the selector F' is seized by the corresponding finder switch LF seizing, the line relay 215' actuates, followed by the release relay 216' to apply ground to the release trunk 218'. Under ordinary operation, as in forwarding a call from line terminals 206 to 208, the selector F' operates like selector F. The differentially connected relay 501 does not operate under the latter said condition, so only the circuits in selector F' that correspond exactly to those in selector F are concerned.

The switch element DF⁶ is a modification of the switch element DF⁴ in that the relay 601 and associated circuits are introduced, as well as conductor 602. The designated elements in switch DF⁶ corresponding to elements in switch DF⁴ are primed.

Assume that Fig. 6 is introduced into Fig. 4 where indicated by its designated elements, displacing the switch DF⁴. The object of the preferred modification disclosed in Fig. 6 is to enable first selector F' of Fig. 5 when substituted for the first selector F to rotate in directly from normal position and select trunks to the operator's switch-board V' corresponding to the switch-board V without depriving the selector F' of one of its numerical levels as was the case with selector G. The selector G has its 1 level trunks extending to the switch-board V. These trunks would be transferred to the normal level of the selector F', the wipers of which are normally aligned therewith.

Jumpers 505 to 608 correspond to jumpers 489 to 492, respectively, as between the jumpers shown in Figs. 6 and 4, but the former jumpers extend downward from terminals in group X' to different terminals in the group Y' shown in Fig. 6, which correspond to the terminals Y in Fig. 4.

When relay 419 actuates, its armature 433 applies ground to wiper 435 and over the traced path including wiper 409, bank ter-

minal 450, jumper 605, to bank terminal 609. When wipers 448'—449' engage bank terminals 609—610, respectively, this ground from wiper 435 is communicated to relay 601, the latter said relay actuating. The armatures of relay 601 apply ground to each of terminals 612 and 613, which terminals are also shown in Fig. 4. By referring to Fig. 4, it will be obvious that grounding terminal 612 causes relay 458 to actuate and lock and the wipers on shaft 452 to restore to the drawn position in the manner before described. It will be clear that grounding the terminal 613 short-circuits the lower winding of relay 501 in selector F', which, due to its differential connection, will thereupon actuate, causing ground from the release trunk 218' to be applied through its armature 502 to the winding of the interrupter relay 220', the latter said relay actuating and locking through the armature on the rotary magnet to the upper armature of the said relay 220'. The upper armature of the relay 220' grounds the upper winding terminal of relay 226'.

When the relay 220' actuates, ground from the release trunk conductor 218' will be applied through armature 221' and 222' to the winding of the rotary magnet. The rotary magnet will operate to step the wipers of selector F' into engagement with the first set of bank terminals 505 to 507 and unlock relay 220'. If the bank terminal 505 cooperative with private wiper 508 constitutes ground potential, due to the corresponding trunk being busy, this ground will be communicated through armature 225', interrupter armature on the rotary magnet, off-normal springs to the winding of relay 220' to reactuate and re-lock the said relay as before, at the same time stepping the wipers to the next bank position. If the private wiper 508 there encounters ground, the wipers will be stepped to the next set of bank terminals, the operation continuing until an idle trunk is found or the wipers step off the last set of terminals. When the private wiper fails to receive ground when stepped to a cooperative bank terminal there will be no ground to short-circuit the winding of the switching relay 226' so that the latter said relay will then actuate, energized in series with the winding of interrupter relay 220', the latter said relay not actuating due to its marginal adjustment. The leading-in lines 218', 27' and 38' are thus continued to corresponding conductors of the trunk seized.

The trunks leading from the normal level (aligned with the normal position of the wipers) of selector F' are to be considered as the same trunks as were assumed as leading from the first or 1 level of the second selector G and terminating in the switch-board V, as before stated. In fact, the switch-board V' shown in Fig. 5 may be assumed as the identical switch-board V in Fig. 2, or one

equipped like it, including the trunks leading thereto.

It will be noted that the jumpers 606 and 607, which correspond to digits 6 and 8, respectively, will have ground applied to them in successive order by the wiper 435, causing the armature 427 to send two digit series 6—8 effective to the call-indicator equipment at the switch-board V' to set up a corresponding indication thereon. When the wiper 435 then steps to bank terminal 477 ground will be applied over jumper 608 to terminal 494 to cause the relay corresponding to 273 in the element like C concerned to actuate and lock in the manner before described to exclude and render idle the switch D and mechanism individual thereto. The operator at switch-board V' may now respond to the call and be in communication with the party calling telephone number 22321, knowing from the indication 6—8 on her call-indicator, in view of her records, that the calling party called the specific line 22321. The restoration of the switch mechanism concerned in the call will be effectuated in the manner before described under the various conditions exemplified.

It will be noted, that under the latter described condition the wiper 413 was not concerned, so that if all elements corresponding to C embraced by the switch D are pertinent, by reason of corresponding cross-connections, to forwarding calls to the switch-board V', or other switch-boards requiring like number of digit series in the train, the wiper 413 may be dispensed with, there being as many wipers 409 to 413 as there are series of impulses or operations equivalent thereto in the train used in forwarding the call.

While the digits 6—8 have been described as being set up on the call indicator to denote the specific line primarily called by the calling party, it will be understood that where desired the entire number of the primarily called line may be set up on the call-indicator by suitably running jumpers and amplifying the switch D by providing one or more additional digit wipers like 413 and cooperating bank and cross-connecting rack terminals and bank terminals cooperative with the wipers on shaft 438. Setting-up but two digits on the call-indicator shortens the time of holding the switch as D, and where they are not more than a certain number of lines receiving the forwarding service, will usually answer the requirements. The latter method also enables the elements like C to be changed from line to line without the expense and trouble of altering the jumpers from the terminals as X and X'; in fact these jumpers may be permanently run wires, the elements like C then having permanent numbers which correspond to the jumpering and the number to be set up on the call-indicator.

The number of the elements like C accessible from the group of switches like D may be varied, as well as details of the switches like C and D. For example, the wipers on the switches like D may have two ordinate movements, without departing from the spirit of the invention.

With further reference to Fig. 6, the bank terminals 620 to 622 and those vertically aligned therewith, are in multiple with corresponding terminals designated 609, 484' and 476', respectively. Also, a set of dead unconnected bank terminals of which terminals 623 is the uppermost terminal precedes the set of terminals having terminals 620 uppermost. This arrangement is merely illustrative of the multiple arrangement wherein the switch DF⁶ may have three sets of bank terminals like shown in switch DF⁴, wherein all the live or connected terminals of the first set (right-hand thirteen vertical rows) are multiplied to two sets of thirteen vertical rows on the left, so that corresponding bank terminals of the three sets will be in multiple. Bank terminals which have no wire connection are not multiplied. This provides three normal positions for the wipers, having in mind that circular switch banks are usually made up in sizes having more than thirteen steps around and the fact that long steps are undesirable.

The so-termed preferred modifications have been shown as such in place of in the main embodiment in order to simplify the disclosure of the comprehensive, preferred embodiment. However, it will be understood that the embodiment may be variously modified in meeting commercial conditions and operating requirements, without departing from the spirit of the present invention as defined by the 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 plurality of impulse sending devices, a finder switch individual to each said impulse device, means responsive to setting said movable terminal on a random one of said fixed terminals for causing a random one of said finder switches to operate to individually cooperate its corresponding impulse sending device with the fixed terminal cooperated with by the movable terminal, and means dependent upon which said fixed terminal is cooperated with by the finder switch for causing its corresponding impulse sending device to send a train of impulses specific to said random fixed 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, automatic switch mechanism for linking a connection from said

random fixed terminal to its corresponding called line, a plurality of impulse sending devices, a finder switch individual to each said impulse device, means responsive to setting said movable terminal on a random said fixed terminal for causing a random one of said finder switches to operate to individually cooperate its corresponding impulse sending device with the fixed terminal cooperated with by the movable terminal, means dependent upon which said fixed terminal is cooperated with by the finder switch for causing its corresponding impulse sending device to send a train of impulses specific to the called line individual to said random fixed terminal, and means whereby said impulses will thereby directly operate the switch mechanism to link a connection from the cooperated movable terminal to the 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 plurality of impulse sending devices, a finder switch individual to each said impulse device, means responsive to setting said movable terminal on a random one of said fixed terminals for causing a random one of said finder switches to operate to individually cooperate its corresponding impulse sending device with the fixed terminal cooperated with by the movable terminal, means dependent upon which said fixed terminal is cooperated with by the finder switch for causing its corresponding impulse sending device to send a train of impulses specific to said random fixed terminal, and means automatically operated by the impulse sending device itself for disassociating itself and the corresponding finder switch from its said cooperation and to thereby render it idle and subject to a new use as before.

4. In an automatic telephone system, a plurality of fixed terminals, automatic switch mechanism for extending connections to the respective said terminals, an impulse sending device common to said terminals, a switch individual to said sending device, means responsive to extending a connection to a random one of said terminals for causing said switch to cooperate said sending device individual to the said random terminal, and means for causing said sending device to send impulses with predetermined correspondence with the said random terminal wherein said sending of impulses will be different for various said fixed terminals.

5. In an automatic telephone system, a plurality of fixed terminals, automatic switch mechanism for extending connections to the respective said terminals, an impulse sending device common to said terminals, a switch for said sending device, means responsive to extending a connection to a random one of said

terminals for causing said switch to cooperate said sending device individual to the said random terminal, and means for causing said sending device to send impulses with predetermined correspondence with the said random terminal wherein said sending of impulses will be different for various said fixed terminals.

6. In an automatic telephone system, a plurality of fixed terminals, automatic switch mechanism for extending connections to the respective said terminals, an impulse sending device common to said terminals, a switch for said sending device, means responsive to extending a connection to a random one of said terminals for causing said switch to cooperate said sending device individual to the said random terminal, and means for causing said sending device to send impulses in a train of series with predetermined correspondence with the said random terminal wherein said sending of impulses will be different for various said fixed terminals.

7. In an automatic telephone system, a plurality of fixed terminals, automatic switch mechanism for extending connections to the respective said terminals, an impulse sending device common to said terminals, a switch for said sending device, means responsive to extending a connection to a random one of said terminals for causing said switch to cooperate said sending device individual to the said random terminal, means for causing said sending device to send impulses with predetermined correspondence with the said random terminal wherein said sending of impulses will be different for various said fixed terminals, and means automatically controlled by the operation of the said sending device for thereupon rendering the sending device subject to use in a new call while said connection to said random fixed terminal is maintained.

8. In an automatic telephone system, a plurality of called lines, fixed terminals individual to the respective said called lines, a sending device common to said fixed terminals, a switch individual to said sending device, means for extending connection to a random one of said fixed terminals, switch mechanism for extending connection from the respective said random terminals to the respective corresponding called lines, means for causing said switch to connect said sending device individual with said random fixed terminal responsive to effecting connection thereto, and means for thereupon causing the sending device to directly operate the switching mechanism to link a connection from the said random terminal to its corresponding called line.

9. In an automatic telephone system, a plurality of called lines, fixed terminals individual to the respective said called lines, a sending device common to said fixed terminals,

a switch individual to said sending device, means for extending connection to a random one of said fixed terminals, switch mechanism for extending connection from the respective said random terminals to the respective corresponding called lines, means for causing said switch to connect said sending device individual with said random fixed terminal responsive to effecting connection thereto, means for thereupon causing the sending device to directly operate the switching mechanism to link a connection from the said random terminal to its corresponding called line, and means automatically controlled by the operation of the said sending device for thereupon rendering the sending device subject to use in a new call while said connection to said random fixed terminal is maintained.

10. In a telephone system, a calling line, a plurality of called lines, fixed terminals individual to said called lines, certain of said called lines connected directly to its corresponding fixed terminal, certain of said called lines not connected directly to its said fixed terminal, automatic switch mechanism for linking connections from certain last said fixed terminal to its corresponding called line, means whereby connecting to a random said fixed terminal will insure connection from the calling line to the corresponding called line either directly or through the agency of said automatic switch mechanism depending upon which said fixed terminal is the said random fixed terminal connected with, and means for applying a signal to the calling line indicative that the said switch mechanism will form a link of the connection from the calling line to the called line.

11. In a telephone system, a calling line, a plurality of called lines, fixed terminals individual to said called lines, certain of said called lines connected directly to its corresponding fixed terminal, certain of said called lines not connected directly to its said fixed terminal, automatic switch mechanism for linking connections from certain last said fixed terminal to its corresponding called line, means whereby connecting to a random said fixed terminal will insure connection from the calling line to the corresponding called line either directly or through the agency of said automatic switch mechanism depending upon which said fixed terminal is the said random fixed terminal connected with, and means for applying a tone to the calling line indicative that the said switch mechanism will form a link of the connection from the calling line to the called line to apprise the party on the calling line that a delay will be occasioned while said automatic switch mechanism is operating to complete the connection to the called line.

12. In a telephone system, a calling line, a plurality of called lines, fixed terminals indi-

vidual to said called lines, an impulse sending device common to said fixed terminals, a hunting switch individual to said impulse sending device, means for extending a connection from said calling line to a random one of said fixed terminals, automatic means responsive to effecting said connection for causing said impulse sending device to be rendered individual to said random terminal, automatic switch mechanism for extending the connection from said random fixed terminal to the corresponding called line, and automatic means for causing said sending device to send impulses to operate said automatic switch mechanism to link a connection to the specific called line individual to the said random fixed terminal responsive to the operation of second said means.

13. In a telephone system, a calling line, a plurality of called lines, fixed terminals individual to said called lines, an impulse sending device common to said fixed terminals, a hunting switch individual to said impulse sending switch, means for extending a connection from said calling line to a random one of said fixed terminals, automatic means responsive to effecting said connection for causing said impulse sending device to be rendered individual to said random terminal, automatic switch mechanism for extending the connection from said random fixed terminal to the corresponding called line, automatic means for causing said sending device to send impulses to operate said automatic switch mechanism to link a connection to the specific called line individual to the said random fixed terminal responsive to the operation of second said means, and means for rendering said hunting switch and its said individual impulse sending device subject to new use as before while the established said connection from the calling line to the called line is maintained.

14. In a telephone system, fixed connective terminals, a movable connective terminal for cooperation with a random one of said fixed terminals, a plurality of impulse sending devices, a finder switch individual to each said impulse device, means responsive to setting said movable terminal on a random one of said fixed terminals for causing a random one of said finder switches to operate to individually cooperate its corresponding impulse sending device with the fixed terminal cooperated with by the movable terminal, means dependent upon which said fixed terminal is cooperated with by the finder switch for causing its corresponding impulse sending device to send a train of impulses specific to said random fixed terminal, and a cross connecting rack having terminals and jumpers for temporary interchangeable connection to certain of said terminals for predetermining what said train of impulses will be sent.

15. In a sending and receiving apparatus,

an impulse sending device, an impulse receiving device, an energized circuit path intermediate of said sending and receiving device for controlling the operation of said receiving device by said sending device, means for causing said impulse device to send a series of open impulses to successively momentarily deenergize said circuit, means in said impulse sending device for also sending an impulse to ground said energized circuit by momentarily applying ground to said circuit while it is in an energized condition, and means for pre-setting said sending device by a single movement regardless of which kind of impulses are to be sent, the said pre-setting differing only in extent of said movement.

16. In an impulse sending and receiving apparatus, an impulse sending device, switch mechanism, a circuit path between said device and said mechanism, means for causing said impulse sending device to send a single impulse of one kind of impulses over said circuit to operate said switch mechanism in one manner from normal position to an off-normal set position, means in said impulse sending device for causing a single impulse of a different kind to be sent over said circuit to control said switch mechanism and which differs in character from first said impulse to control said switch mechanism in another manner from normal position to an off-normal set position, and means for pre-setting said sending device by a single movement regardless of which kind of impulses are to be sent the said pre-setting differing only in extent of said movement.

17. In a telephone system, an automatic switch having a wiper, fixed terminals accessible from said wiper, a line leading-in to said switch, a pre-setting impulse sending device, means responsive to said pre-setting device when first pre-set to operate said switch controlled over said line to set the wiper on only certain of said fixed terminals by a single ordinate movement of said wiper, and means responsive to said pre-setting device when first pre-set to operate said switch controlled over said line to set the wiper on only certain of said fixed terminals by coordinate movements of said wiper.

18. In a telephone system, an automatic switch having a wiper, fixed terminals accessible from said wiper, a line leading-in to said switch, a pre-setting impulse sending device, means responsive to said pre-setting device when first pre-set to operate said switch controlled over said line to set the wiper on only certain of said fixed terminals by a single ordinate movement of said wiper, and means responsive to said pre-setting device when first pre-set to operate said switch controlled over said line to set the wiper on only certain of said fixed terminals by coordinate movements of said wiper wherein

the last of said coordinate movements has the same ordinate as said ordinate movement.

19. In a sending and receiving apparatus, an impulse storing and sending device, an impulse receiving mechanism, a loop circuit path intermediate of said sending device and said receiving mechanism for controlling the operation of said receiving mechanism by said sending device, means for causing said impulse device to send a series of stored impulses to directively operate said impulse receiving mechanism over the sides of said loop in series, means in said impulse sending device for also sending a stored impulse to ground over said circuit to directively operate said impulse receiving mechanism, and means whereby all said impulses are stored before any of said impulses are sent.

20. In a sending and receiving apparatus, an impulse storing and sending device, an impulse receiving mechanism, a circuit path intermediate of said sending device and said receiving mechanism for controlling the operation of said receiving mechanism by said sending device, means for causing said impulse device to send a series of stored open impulses to directively operate the said impulse receiving mechanism, means in said impulse sending device for also sending a stored impulse to ground said circuit, and means whereby all said impulses are stored before any of said impulses are sent.

21. In a sending and receiving apparatus, an impulse storing and sending device, an impulse receiving mechanism, an energized circuit path intermediate of said sending device and said receiving mechanism for controlling the operation of said receiving mechanism by said sending device, means for causing said impulse device to send a series of stored open impulses to successively momentarily deenergize said circuit, means in said impulse sending device for also sending a stored impulse to ground said energized circuit by momentarily applying ground to said circuit while it is in energized condition, and means whereby all said impulses are stored before any of said impulses are sent.

22. In a telephone system, an impulse sending device, a closed circuit path, means for pre-setting said device for causing it to send an open impulse to said circuit path, means for pre-setting said device for causing it to send a closed impulse to said circuit path while maintaining said circuit path closed, means for pre-setting said device for sending a single kind of said impulses to said circuit, and means for pre-setting said impulse device for sending a combination of open and closed impulses to said circuit path.

23. In a telephone system, an impulse sending device, a closed circuit path, means for variably pre-setting said device to send a plurality of open impulses to said circuit path responsive to said pre-setting, and means for

causing the impulse sending device to send successive impulses to said circuit path wherein the respective impulses may vary in character in accordance with the said pre-setting and wherein said character is without respect to the length of the respective said impulses.

24. In a telephone system, a line, automatic switch mechanism for said line, an impulse sending device, switch mechanism for extending connection to said impulse sending device over a random one of a plurality of paths, and means for causing the impulse device to send impulse trains over said line to the switch mechanism, the said trains made up of impulse series that vary in character depending upon the said path employed and wherein the said character of the series is irrespective of length of impulses and the number of impulses in series.

25. In a telephone system, a line, switch mechanism for extending connection to said line, an impulse sending device, means for causing said impulse sending device to send a predetermined series of impulses over said line responsive to effecting said connection to said line, a tone source, and means for applying said tone source to the connection antecedent to said line while said impulses are being sent and responsive to effecting said connection and for terminating said application following the sending of the impulses and consequent to the operation of the impulse sending device regardless of control over said line.

26. In a telephone system, a line, switch mechanism for connecting with terminals of said line but without effecting talking connection to said line, a receiving line, means responsive to said connection for extending said line into connection with said receiving line, a plurality of impulse sending devices, means responsive to last said connection for connecting a random one of the impulse sending devices to first said line and for transmitting a predetermined series of impulses thereto, and means controlled by the impulse device employed for disconnecting itself from the connection and for connecting first said line in talking connection to said switch mechanism.

27. In a telephone system, a trunk line, a wiper selective switch at the far end of the trunk line, a plurality of levels containing outgoing lines accessible in common via the wiper of the selective switch, a plurality of switching link paths by which connection to the trunk line may be taken, and automatic impulse sending means operating responsive to and in correspondence with said link path taken for causing the selective switch to respectively extend the connection to a line of one of the said levels by a single ordinate movement or by coordinate movements of its wiper.

28. In a telephone system, a trunk line having incoming connection terminals, a wiper selective switch at the far end of the trunk line, a plurality of levels containing outgoing lines accessible in common via the wiper of the selective switch, a plurality of switching link paths by which connection to the said terminals of the trunk line may be taken, and automatic means operating responsive to and in correspondence with said link path taken for causing the selective switch to respectively extend the connection to a line of one of the said levels by a single ordinate movement or by coordinate movements of its wiper.

29. In a telephone system, fixed connective terminals, means for extending connection to a random one of said fixed terminals, an impulse sending device, a finder switch companion to the impulse sending device, means responsive to extending connection to said random fixed terminal for causing the finder switch to operate to operatively cooperate its companion impulse sending device with the random fixed terminal connected with, and means operated dependent upon which said fixed terminal is cooperated with by the finder switch for causing its companion impulse sending device to send a train of impulse series specific to said random fixed terminal, last said means including a special common wiper of the finder switch and a cooperated bank terminal therefor specific to the random fixed terminal for independently determining each series of said train sent.

30. In a telephone system, fixed connective terminals, means for extending connection to a random one of said fixed terminals, an impulse sending device, a finder switch companion to the impulse sending device, means responsive to extending connection to said random fixed terminal for causing the finder switch to operate to operatively cooperate its companion impulse sending device with the random fixed terminal connected with, means operated dependent upon which said fixed terminal is cooperated with by the finder switch for causing its companion impulse sending device to send a train of impulse series specific to said random fixed terminal, last said means including a special common wiper of the finder switch and a cooperated bank terminal therefor specific to the random fixed terminal for independently determining each series of said train sent, and a cross connecting rack having terminals corresponding to said bank terminals for temporary interchangeable connection for predetermining what specific impulse series will constitute the said train.

In witness whereof, I hereunto subscribe my name this 7th day of October, 1927.

HERBERT M. FRIENDLY.

DISCLAIMER

1,744,696.—*Herbert M. Friendly*, Chicago, Ill. AUTOMATIC TELEPHONE SYSTEM. Patent dated January 21, 1930. Disclaimer filed October 9, 1933, by *Milton S. Friendly* and *The Central Republic Trust Company*, as co-executors of the estate of *Herbert M. Friendly*, deceased.

Hereby enter this disclaimer to the claims in said specification which is in the following words, to wit:

"22. In a telephone system, an impulse sending device, a closed circuit path, means for pre-setting said device for causing it to send an open impulse to said circuit path, means for pre-setting said device for causing it to send a closed impulse to said circuit path while maintaining said circuit path closed, means for pre-setting said device for sending a single kind of said impulses to said circuit, and means for pre-setting said impulse device for sending a combination of open and closed impulses to said circuit path.

"23. In a telephone system, an impulse sending device, a closed circuit path, means for variably pre-setting said device to send a plurality of open impulses to said circuit path responsive to said pre-setting, and means for causing the impulse sending device to send successive impulses to said circuit path wherein the respective impulses may vary in character in accordance with the said pre-setting and wherein said character is without respect to the length of the respective said impulses."

[*Official Gazette October 31, 1933.*]