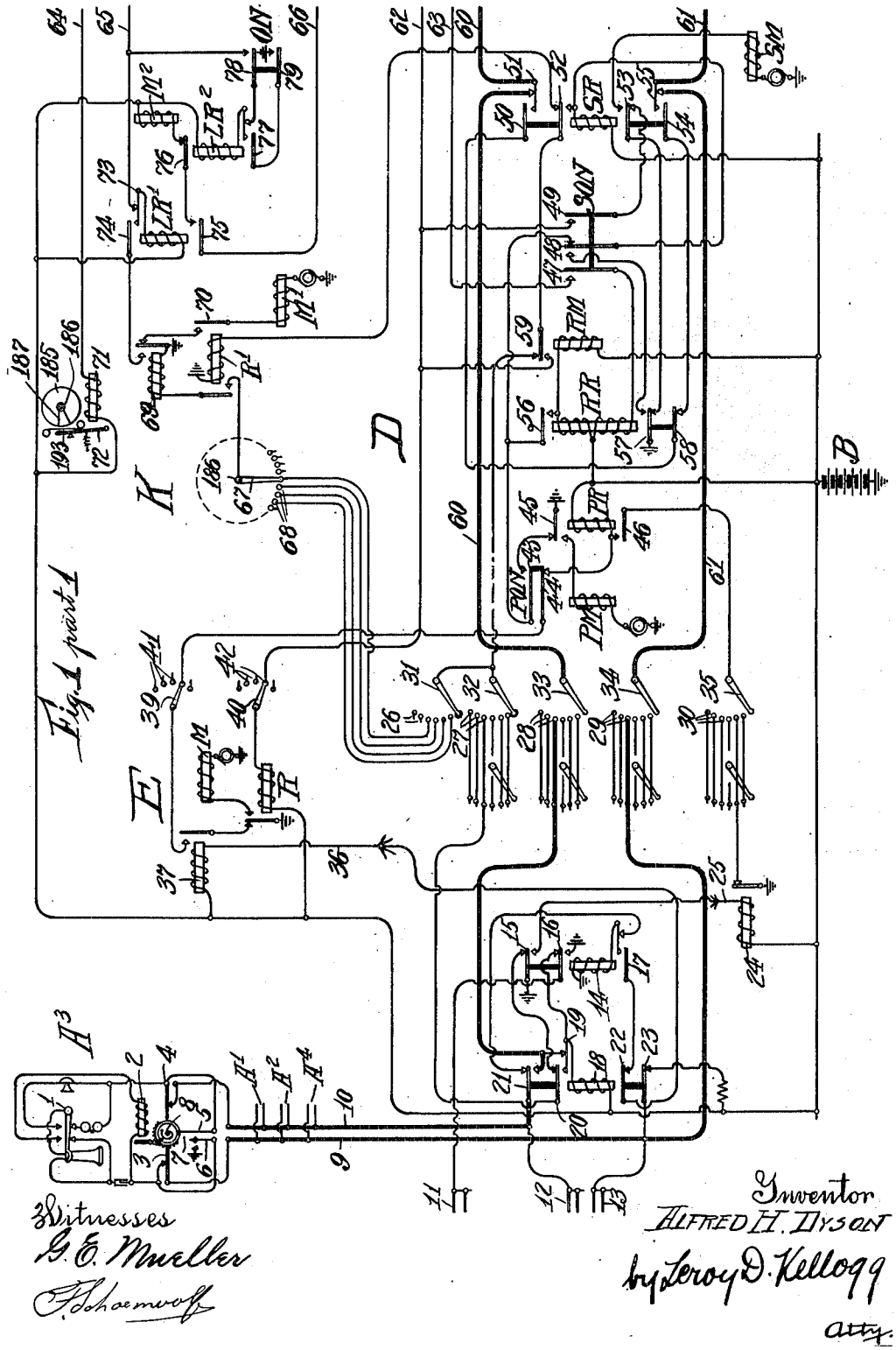
A. H. DYSON.

PARTY LINE CALL REGISTER FOR AUTOMATIC TELEPHONE SYSTEMS.

APPLICATION FILED JUNE 20, 1908.

958,863. Patented May 24, 1910.

5 SHEETS—SHEET 1.



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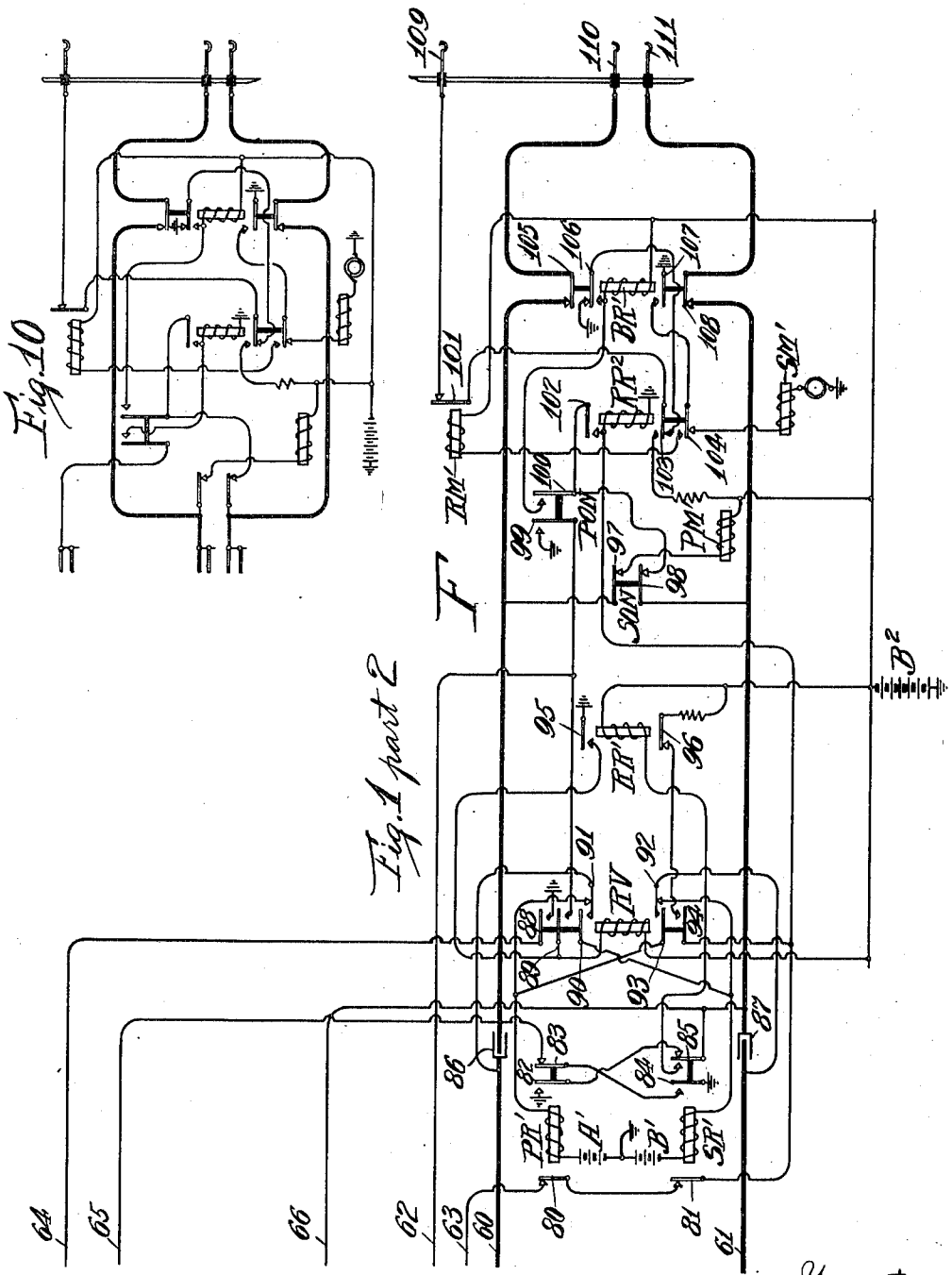

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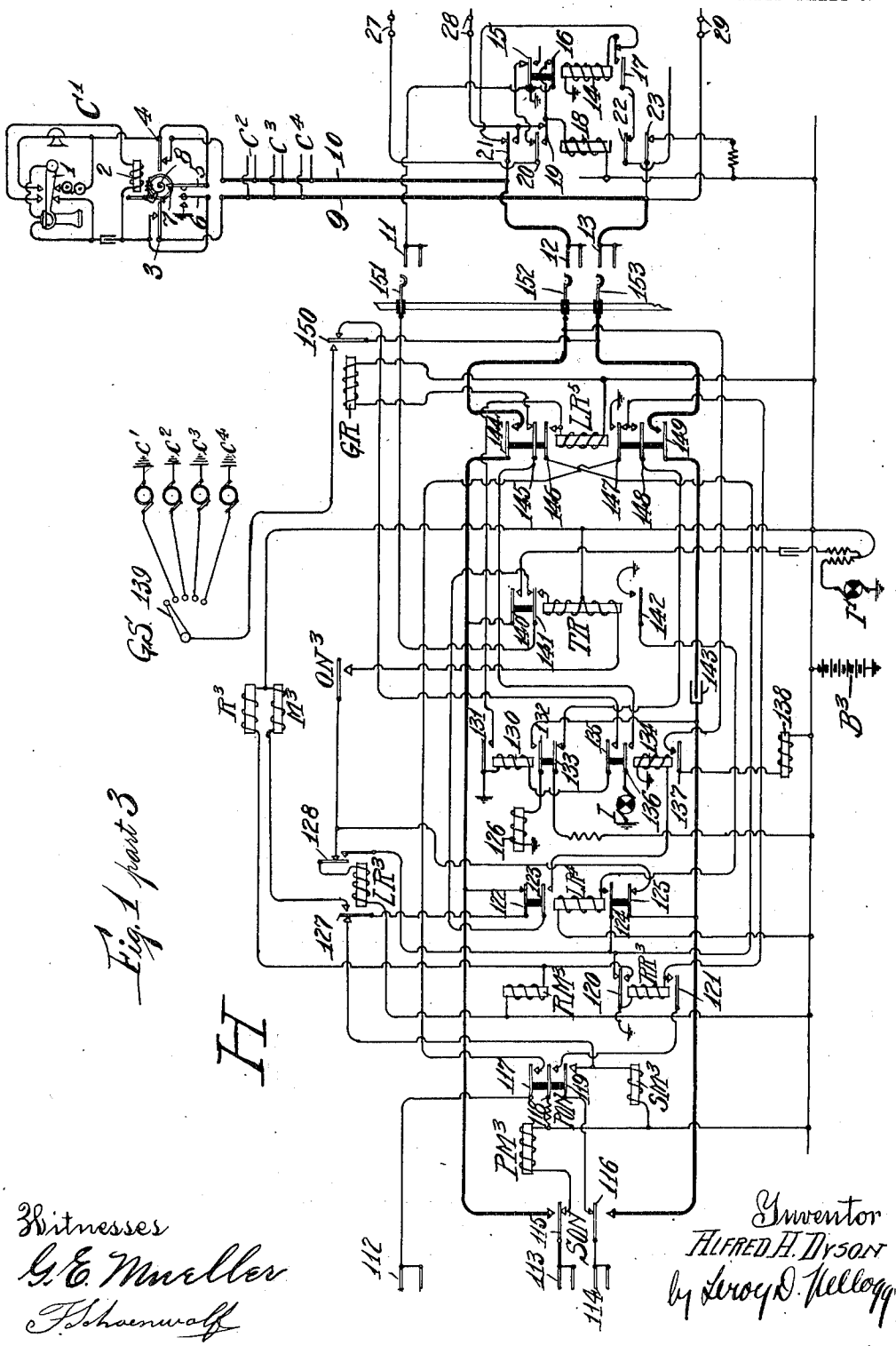

Fig. 1 (part 3)

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5 SHEETS—SHEET 4.

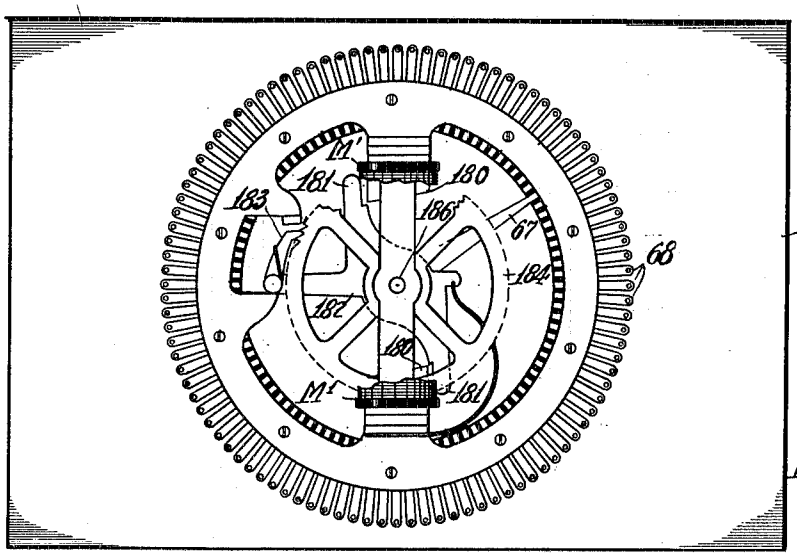

Fig. 2

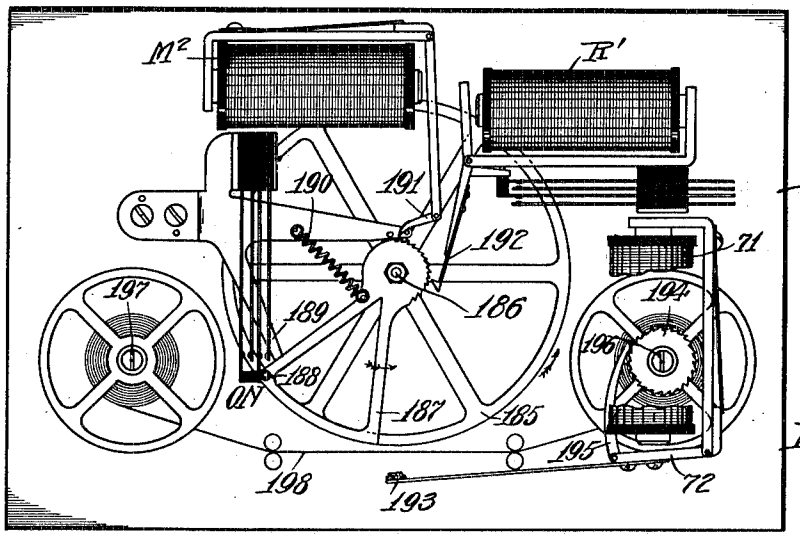

Fig. 3

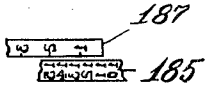

Fig. 4

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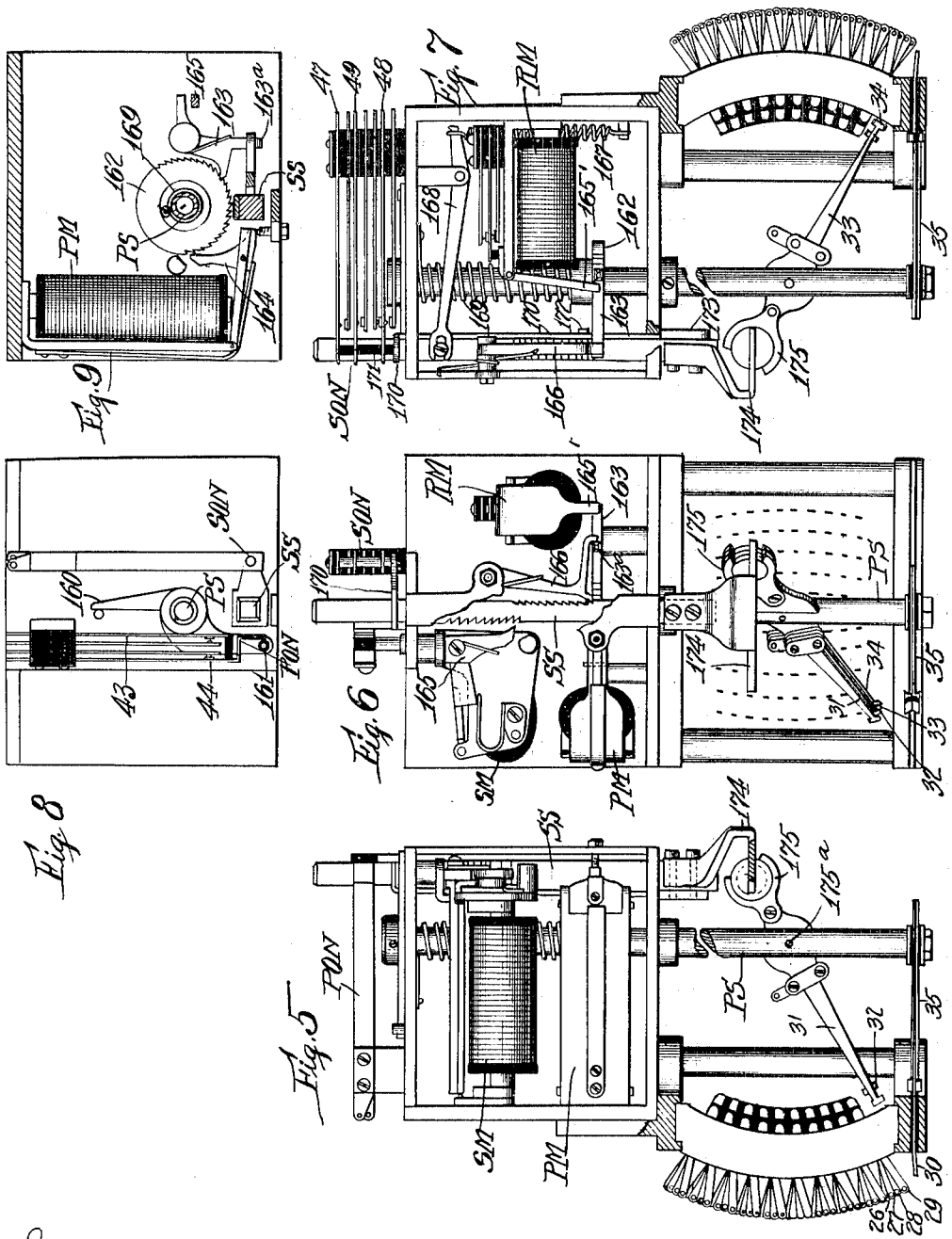
5 SHEETS—SHEET 5.



Witnesses

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UNITED STATES PATENT OFFICE.

ALFRED H. DYSON, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

PARTY-LINE CALL-REGISTER FOR AUTOMATIC TELEPHONE SYSTEMS.

958,863. Specification of Letters Patent. Patented May 24, 1910.

Application filed June 20, 1908. Serial No. 439,573.

To all whom it may concern:

Be it known that I, ALFRED H. DYSON, residing in Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Party-Line Call-Registers for Automatic Telephone Systems, of which the following is a specification.

An object of my invention is to provide a call register at the exchange which will register completed calls made over a line and will also indicate which one of a number of parties connected to the line has made each call.

In developing my invention, I have arranged it more particularly for use in connection with automatic telephone systems which use the two sides of the line and a ground connection in adjusting the selective switches to complete a connection. In the particular system with which I have illustrated my invention, these selective switches are adjusted responsive to breaks made in the circuits of the two line limbs, a primary side of the line being first interrupted a number of times to correspond with a digit of the called number, whereafter a secondary side of the line is, when single party lines are employed, interrupted a single time to automatically produce circuit changes at the central office to prepare for the transmission of the next digit by further interruptions of the primary side of the line. In arranging for the party line register service, I preferably provide a selective switch at the exchange which is operated step by step by a break, or series of breaks, produced in the secondary side of the line, following the transmission of the first digit of the called number. Thus, assuming four parties connected to a line and a register also connected thereto, when party No. 1 calls, the breaks representing the first digit of the called number will be followed by one break in the secondary side of the line, and the register switch will be adjusted one step to bring opposite a printing hammer (which may be electromagnetically actuated at the proper time) a type character as "1" to indicate that substation 1 has made the call. If substation 2 had made the call, the impulses representing the first digit of the called number would be followed by two breaks in the secondary side of the line which would operate the connected register switch two steps to bring type "2" opposite the printing hammer. If the third party on the line had called, the breaks in the secondary side of the line would be three in number, causing three steps of the register switch to bring the number "3" opposite the printing hammer; and if the fourth line had made the call, four breaks in the secondary side of the line would bring "4" opposite the printing hammer. I preferably arrange the circuits of the system so that the printing hammer will only be actuated if and when the called subscriber answers, so that none but completed calls are registered against calling subscribers.

Although I have illustrated my invention in connection with systems in which selective switches operate responsive to breaks produced in the line limbs at the substations, it may equally well be employed in systems of other characters, as, for example, one in which the adjustments of the central office switches are produced responsive to successive groundings of a primary side of the line to transmit the called number, followed by a grounding or groundings of the secondary side of the line.

Another object of the invention is to produce a register system of the character above referred to, in which a relatively small number of register mechanisms are necessary. Thus in the system illustrated in the drawing, I provide for a group of calling lines a number of line selecting switches, which switches for each group of lines may be only one-tenth as numerous as the lines in the group, and associate with each such switch one of the register switches so that I only require about one-tenth as many register switches as there are lines. Obviously, however, the invention is not limited to the arrangement just indicated and there may equally well be one register switch provided for each telephone line. Furthermore, it will be seen that the invention is not limited to automatic telephone systems, but that it is entirely within the scope of the invention that the lines of a purely manual exchange may be provided with the party line registers of my invention, and this and other uses of the invention are within the scope of the appended claims.

Referring to the drawings, Figure 1, consisting of Parts 1, 2 and 3, illustrates circuits

of an automatic telephone exchange system embodying a preferred arrangement of the invention; Figs. 2 and 3 illustrate a preferred mechanical structure of a party line register switch; Fig. 4 shows the type arrangement upon the type frames 185–187 of Fig. 3; Figs. 5, 6 and 7 illustrate a preferred step-by-step switch for use in connection with the circuits of Fig. 1 in connecting calling lines with called lines; Fig. 8 illustrates the primary off-normal switch arrangement of said step-by-step switch; Fig. 9 is a sectional view disclosing the arrangement of the primary magnet and auxiliary mechanism of said switch; and Fig. 10 shows a second or third selector circuit.

Referring first to Fig. 1, I show at the left and right of said figure a pair of telephone lines, the one to the left having illustrated, as connected thereto, an automatic substation A^3, while three other substations are indicated by the taps marked A', A^2, A^4. Similarly, four substations, C', C^2, C^3, C^4, are indicated as connected to a line at the right of Fig 1.

The central office system indicated in Fig. 1 is, as shown, arranged for one thousand subscribers' lines. That is to say, first selectors F are provided, adapted for directive operation responsive to calling devices at substations to adjust their wipers 109, 110, 111 to select an idle connector H out of any one of ten groups of such connectors, the connectors of each group giving access to a different one hundred called lines. Thus the thousand lines, as called lines, will be divided into ten groups of one hundred each, and each one hundred lines will have their called contacts 11, 12, 13 multiplied to ten connectors H assigned for connection to them. The one hundred connectors H thus assigned by tens to the one thousand lines will have multiple contacts 112, 113, 114, arranged in groups before the first selectors F, the contact sets forming terminals for the connectors of each hundred being arranged in a group before the first selectors. Although first selectors only are illustrated, it will be understood that the ordinary automatic system is frequently arranged for a greater number of lines than one thousand, and that, between the first selectors and connectors, second selectors may be provided, or second and third selectors, the principle by which automatic telephone systems are extended in their capacities being now so well known that description thereof is superfluous. I have, however, indicated in Fig. 10 a circuit arrangement which may be used for a second or third selector, in case it should be desired to use such switches. The operation of this circuit of Fig. 10 will be sufficiently apparent after a description of the first selector F and will not be specifically referred to.

The first selectors F are preferably not individual to subscribers' telephone lines, but each has connected with a line selector D which serves, when operated, to seek out a calling line and thus connect the paired first selector F with such calling line, whereby the latter is placed under the control of the substation calling device. As calling lines, the thousand lines of the system are also preferably divided into ten groups of one hundred lines each. Each line of a group will have its multiple contacts 27, 28, 29 appearing with those of the other ninety-nine lines of the group before the wipers 32, 33, 34 of a suitable number of line selectors D, of which about ten may be provided per one hundred lines. The contact sets 27, 28, 29 of the one hundred lines are preferably divided into sub-groups of ten contact sets each at the line selectors D. Adjustments of wipers 32, 33, 34 are made step-by-step in one plane to select the sub-group in which the calling line has its contacts, whereafter said wipers move in an intersecting plane engaging successive contact sets of the selected sub-group to select that of the calling line.

Each sub-group of ten lines is provided with a group contact 30, multipled to each of its line selectors, and a group relay 24 adapted to remove ground from the multiple group contacts of a sub-group whenever any line initiates a call to render the sub-group selectable. The primary or group-selecting travel of a line selector D is controlled by the group wiper 35 moving over the contacts 30 in which it seeks out an ungrounded one. The wipers 32, 33, 34 move coincidently with the group wiper 35 and are thus controlled by it and caused to seek out the sub-group of the calling line. The secondary or contact set selecting travel of the line selector D is controlled by the private wiper 32, along with which the line wipers 33, 34 move on their secondary travel, the group wiper 35 remaining stationary at this time.

The circuits of a party line call register, individual to the line selector D, are indicated at K. This party line register comprises a selective switch wiper 67 which is adapted to wipe over the contacts 68, of which there will be one hundred, namely, one contact for each line to which the line selector D can connect. Each contact 68 is connected with a contact 26, of which one is provided for each line and placed adjacent to the multiple contact set 27, 28, 29 of such line. Thus, when wipers 32, 33, 34 have selected the multiple contacts 27, 28, 29 of a calling line, the wiper 31 will have selected the non-multiple contact 26 for that line; and when the line selector D comes to rest, the wiper 67 will be caused to start its travel and seek out its particular contact 68 connected with the contact 26 which the wiper

31 is then engaging. Upon the same shaft with the wiper 67, is mounted a type wheel 185 having upon its circumference a type for each line of the hundred which its associated line selector serves. This type wheel thus travels with the wiper 67, and when the latter has sought out the contact 68 for the calling line, the type for that line will be brought around into operative position with the printing hammer 193 shown at the upper part of K. Then when, at the conclusion of the transmission of the first set of impulses from the calling substation, breaks in the secondary side of the calling line are produced, the independently movable type frame 187 will be adjusted to bring a type corresponding to the number of the calling substation on its line into operative position with the type hammer 193. After connection with the called line and upon the response of the called subscriber, the printing magnet 71 will be actuated to cause the hammer 193 to impact upon the types thus brought opposite it and print upon a suitable paper ribbon the number of the line which made the completed call and the type character designating the party which made the call from that line.

To describe the arrangement of Fig. 1 more in detail, the sheets being placed in numerical order with Part 1 at the left, it will be observed that substation A^3 includes, in addition to the regular telephone transmitting and receiving equipment, a calling device comprising a spring-returned dial 8 upon which are mounted suitable teeth of insulating material for actuating the impulse springs 4 and 3. The spring 4 controls the circuit of the primary side of the line 10, while spring 3 controls that of the secondary side of the line 9. Upon the clockwise rotation of dial 8 by hand, the stud 7, mounted thereon, frees spring 5, whose tension caused it to engage spring 6 and connect both springs 5 and 6 to ground, whereby both limbs 9 and 10 of the line are grounded. The clockwise rotation of dial 8 causes the insulating teeth to move over the ends of springs 4 and 3 and the direction of rotation is such that no opening of contacts 3, 4 is produced. When a number of teeth have been brought below spring 4 to correspond with the units of a digit of the called number, the dial 8 is released and its associated spring returns the same to normal, opening contact 4 as many times as teeth have been brought below said contact, whereafter the three teeth, shown at the left of dial 8 as normally below the spring 3, will actuate said spring three times to disengage its contact an equal number of times. When dial 8 finally reaches normal, stud 7 again engages spring 5 and the springs 5 and 6 free one another and ground. While contact 4 is being successively opened to produce openings in the circuit of the primary line limb 10, secondary line limb 9 remains grounded through the closed contact 3, spring 6 to ground. While openings at contact 3 are being produced in limb 9, limb 10 remains grounded through contact 4, contacts 5 and 6, to ground. The arrangement of substations A^7, A^2, A^4 and substations C' to C^4, inclusive, will be identical with those of substation A^3, except that each subscriber on a party line will have a different number of teeth normally extending below the spring 3.

Each line is provided at the exchange with a line circuit including a line relay 14, which, by its control of group relay 24, determines the condition of the group contacts 30 of the line's sub-group and also the electrical condition of the private contacts 27 of the line, so as to render the group contact and the individual contact set selectable at the line selectors, calling multiple contact sets of non-calling lines being normally unselectable. The line relay also controls a master-switch E, of which there is one for the hundred lines and which serves to start an idle line selector D in search of the calling line when any line relay 14 is operated. The line circuit of each line also includes a cut-off relay 18 which is operated whenever connection is made to the line either as a called line by a connector, or as a calling line by a line selector, to destroy the substation control of the line relay.

In the following description, it will be assumed that the substation at A^3 is about to make a call and that said substation is substation 3 of those connected to its line. Further, as indicated by the position of the group contact 30 and the individual private contact 27 connected with the line of A^3, its number among the one hundred lines, having their contacts before the same line selectors as the line of A^3, is 24; *i, e.*, line 4 in sub-group 2. For purposes of description, the number of the called line will be assumed to be 4321, the last digit specifying the generator of proper frequency to ring the bell at substation C'.

The subscriber at A^3, initiating a call, removes his receiver, whereupon hook-lever 1 arises, opening the bell branch and closing a conductive bridge between line limbs 9 and 10, traced from 9, through contact 3, impedance coil 2, switch-hook 1, the transmitter, and contact 4 to limb 10. The line relay 14 is thereupon operated by current from ground, through normal contact 21, line limbs 10, 9, returning through contact 23 to battery B. Armature 15 removes ground from private contacts 27, rendering them selectable, and armature 16 connects ground to the called contacts 11 of the connectors, rendering the calling line busy against incoming calls. Group relay 24 is connected to

common conductor 25 having branches, one to each line relay of its sub-group, so that armature 15, engaging its alternate contact, operates the group relay 24, whose attracted armature removes ground from group contacts 30, rendering them selectable. Each line selector D, serving a group of one hundred lines, has its contacts 41, 42 before wipers 39, 40 of the master-switch E, and the wipers 39, 40 normally rest engaging the contacts of an idle line selector. The master-switch E has a relay 37 connected to a common wire 36 having one hundred branches, one to each line relay of the line group, so that relay 14, by armature 17, has locked itself in series with the relay 37 and operated said relay, whose armature grounds the starting wire connected to wiper 39 to start the line of selector D (it being assumed for purposes of description that the master-switch E is engaging contacts of switch D).

As soon as relay 14 operated by current over the line, its armature 17 terminated the flow of current thereover. The impedance 2 at substation A^3, in addition to its well known function in the talking circuit, serves as a magnet to control a locking pawl for the dial 8, said pawl, as shown, normally engaging a tooth of the dial and preventing its actuation. The impulse of current over the line, initially operating relay 14, actuates the winding of magnet 2 to momentarily unlock dial 8, but as at this time the current is momentary only, the armature of magnet 2 immediately releases and locks dial 8, holding it locked until the calling line has finally been selected by line selector D, as presently to be explained.

As soon as master switch relay 37 operates, as described, current flows from ground, through normal contact of relay R, contact of relay 37, contact 39—41, primary off-normal contact 44 at line selector D, and to battery B through primary relay PR, which energizes and attracts its armature 45 to close generator circuit for primary magnet PM and armature 46 to connect its winding with the private group wiper 35. As switch D proceeds on its primary travel responsive to actuations of magnet PM, group wiper 35 maintains relay PR locked by successive grounds encountered upon group contacts 30, until said wiper 35 engages the group contact of the group in which the calling line A^3 is included. At this time, owing to the attraction of the armature of the group relay 24, relay PR deënergizes, its armature 45 preventing further actuations of primary magnet PM, and the wipers 31 to 35 inclusive rest in the position adjacent to the second sub-group of lines among which that of A^3 is included. At the first primary step of switch D, the primary off-normal (PON) contacts 43, 44 shifted to their alternate positions, so that when armature 45 retracts on the deënergization described of PR, circuit is closed from ground, through contact 43, secondary off-normal (SON) contact 48 and secondary relay SR to battery, operating said relay SR, whose armature 53 closes a generator circuit for secondary magnet SM extending to ground at normal contact 57, while armature 52 connects the winding of relay SR with private wiper 32 over a circuit including normal contact 59. Magnet SM now steps the wipers 31, 32, 33, 34 (wiper 35 remaining stationary) up over successive contact sets 26, 27, 28, 29 of the selected group.

As long as the private wiper 32 is passing over multiple contacts 27 of non-calling and unselected lines, relay SR continues locked by current over wiper 32 and to ground connections at successive contacts 27 pertaining to lines that are not calling and are unselected. As soon as wiper 32 engages the fourth contact 27—that pertaining to the line of A^3—the absence of ground upon said contacts, due to the attracted armature 15 of relay 14, will deënergize relay SR, opening the circuit of magnet SM so that wipers 31, 32, 33, 34 come to rest in engagement with the contact sets 26, 27, 28, 29 of the calling line, that of A^3. As soon as relay SR first energized, relays PR′ and SR′ at the first selector F were operated by current from the positive side of battery A′, through relay PR′, normal contact 91, over wire 60, through alternate contact 50, normal contact 58, contact 54—55, wire 61, contact 92, relay SR′, to battery B′. When, now, relay SR is deënergized, by the make-before-break arrangement at 50, 51, a new circuit for relay PR′ is established via normal contact 51, contact 33—28, normal contact 19, cut-off relay 18 to battery, whereupon relay 18 attracts its armature 21 and establishes another new circuit for relay PR′ extending over line limb 10, through the substation via the winding of magnet 2, returning over line limb 9, contact 29—34, normal contact 55, relay SR′ to battery B′. These shiftings of the circuits of relays PR′ and SR′ are produced without the retraction of the armatures of either relay. Armature 22 of relay 18 opens the circuit including relays 14 and 37 and both deënergize. Armature 20 connects relay 18, via contacts 19—20, 27—32, normal contacts 59 and 52, with relay R′ and ground at switch K, the circuit just traced being the locking circuit over which the cut-off relay 18 is maintained energized until the time of disconnection.

The secondary off-normal contacts 47, 48, 49 were all shifted to their alternate positions on the first secondary step of switch D, the shifting of contact 48 having rendered secondary relay SR thereafter dependent upon the circuit through wiper 32 for its energization. An effect of the already de-

scribed deënergization of relay SR is to connect ground at normal contact 57, via normal contact 53, contact 49, with the contact 42 of the operated line selector D at the master-switch E. Since wiper 40 engages contact 42, relay R is operated and closes generator circuit for master-switch magnet M which steps the wipers 39, 40 rotarily in search of idle contacts 41, 42. Relay R will be maintained energized by successive grounds encountered upon contacts 42 of busy line selectors until it reaches a contact 42 of one at normal. Such contact will be ungrounded, as an inspection of the normal condition at D will show, and relay R deënergizes, opening the circuit of magnet M, and the switch E then rests engaging the contacts of such idle line selector, ready to start the same on the initiation of a call from some other line. The switch E may be a non-restoring switch, its wipers 39, 40 always traveling in the same direction of rotation, the contacts 41, 42 being preferably arranged to form a circle. For driving the wipers, the ordinary rotary shaft, having fastened to it said wipers, and a rotary ratchet may be employed, the magnet M having the customary armature actuated driving pawl for rotating ratchet, shaft and wipers.

The establishment of the locking circuit for relay 18, before described, which included the winding of relay R′, actuates the latter relay to attract its armature 70, which closes the circuit of magnet M′ of switch K, which magnet, by the ordinary armature actuated pawl, rotates a rotary ratchet-supporting shaft, which also carries the wiper 67, and the type wheel 185. The wiper 67 and type wheel 185 have no definite normal positions, but rest in such position that wiper 67 will be engaging the contact 68 of the last line which initiated a call. It will be observed that while every calling line of the group has a contact 26 at each line selector D assigned to it, the said contacts 26 at different line selectors are not connected together; *i. e.*, are not multiplied. By the operation of cut-off relay 18, battery through said relay's winding has now been connected via wiper 32 and wiper 31 with the fourth contact 26, which contact alone of those including switch D will have a battery connection. Magnet M′ will continue to step the wiper 67 and type frame 185 until said wiper 67 engages the contact 68 connected to contact 26 that has battery connected to it. At this time, circuit may be traced from battery at contact 26, through contact 68—67, attracted armature of relay R′, relay 69 to ground. Operated relay 69, by its armature, opens the generator circuit of magnet M′, whereby wiper 67 and the type frame 185 are arrested, the latter then of course having placed the number 26 of the calling line opposite the printing hammer 193 of armature 72. These parts remain in this position until the time of disconnection.

Magnet 2 at substation A^3, having been operated by current through relays PR′ and SR′ at F, has unlocked the dial 8, which the subscriber now actuates to count out the called subscriber's number. A first actuation will be to the extent of four teeth brought below spring 4 and, the dial being released, four openings in the line limb 10 will be produced, while limb 9 remains grounded, followed by three openings of line limb 9, while limb 10 remains grounded, whereafter the conductive bridge through the substation will be reëstablished before the grounded conditon of line limbs 9 and 10 at contacts 5 and 6 is terminated. Each opening of contact 4 will obviously produce a deënergization of relay PR′ at F, while relay SR′ remains operated by current flowing to ground through contact 3. Each deenergization of said relay PR′ transmits a current impulse from ground, through contact 84, normal contact 83, contact 97, primary magnet PM′, to battery B^2, whereby the wipers 109, 110, 111 of first selector F are adjusted to positions adjacent to the group of contact sets 112, 113, 114, forming terminals of a group of connectors H assigned for connection to the fourth hundred of the exchange. The impulse occasioned by the first deënergization of relay PR′ passes in part over wire 65, through normal contact at 73, relay LR′ to battery, operating said relay, which, by armature 74, locks to ground at the alternate contact of relay 69. The operation of this relay LR′ is for the purpose of closing contact 75 in the circuit of magnet M^2, which will presently be operated responsive to the breaks in line limb 9 to adjust the party line type frame 187 to operative relation with the printing hammer.

The first primary step of switch F closed the primary off-normal (PON) contacts 99, 100, so that, on the first opening of line limb 9 and the resulting deënergization of relay SR′, occurring while relay PR′ remains operated by current through ground at contact 4 at A^3, an impulse of current will flow from ground at attracted armature 82, through normal contact 85, normal contact 98, contact 100, relay BR′ to battery. Relay BR′, by armature 107, closes generator circuit for secondary magnet SM′, which steps wipers 109, 110, 111 up over successive contacts 112, 113, 114 of the selected group. Magnet SM′ will continue to receive actuations and produce successive steps of the wipers until wiper 109 engages contact 112 of an idle connector H, since said wiper will establish successive locking circuits for relay BR′, extending through alternate contact 106, normal contacts 103, 101, wiper 109, to contact 112 of already busy connectors H.

As soon as an idle contact set 112, 113, 114 is engaged by the wipers of switch F, relay BR′ deënergizes because of the absence of ground on contact 112, and its armature 107 opens the circuit of magnet SM′, while armature 106 connects ground through wiper 109 upon the multiple private contacts 112 of the selected connector H, so rendering it busy. On the first secondary step of switch F, secondary off-normal (SON) contacts 97, 98 were shifted so that magnet PM′ and relay BR′ were disconnected from the talking conductor (which I have indicated throughout by heavily marked lines), the opening of contact 98 further rendering relay BR′ entirely dependent for its circuit upon the wiper 109, so that the latter openings of line limb 9 have no effect upon said relay.

A part of the first impulse transmitted by the deënergization of relay SR′ passed over the wire 66, through contact 75 at switch K, through magnet M^2 to battery, whereby a first step of type frame 187 is produced to bring the number "1" opposite the printing hammer. The other two deënergizations of relay SR′, caused by the return of dial 8 to normal at the conclusion of the transmission of the first digit, sent two additional impulses through magnet M^2 and the type frame 187 will be moved two steps more to bring the number "3" opposite the hammer, it being remembered that "3" is the designating number of the line of A^3 on the party line.

Reviewing for a moment the operation of the switch K, it will be seen that the operation of line selector D has been effective to bring the type, designating the number of the calling line, operatively before the printing device, and that the first actuation of the substation calling device has brought the designating number of the substation calling before it.

The calling subscriber at A^3 will now operate the dial 8 to produce three breaks in the circuit of line limb 10, whereby the connector H will be automatically adjusted to select the third group of multiple called line contacts before its wipers. The openings of line limb 10 will of course be followed by three in line limb 9, as before. Tracing this in detail, each deënergization of relay PR′ transmits a current impulse from ground, through contacts 84, 83, 105, 110—113, normal contact 115, primary magnet PM^3 of connector H to battery B^3, said magnet PM^3 then effecting three steps of wipers 151, 152, 153 in a primary direction to select the required group. The first impulse, transmitted by a deënergization of relay PR′, passed in part over the wire 65, through the contact 78, locking relay LR^2, to battery, which relay, by armature 77, locked itself to ground at contact 79, the off-normal contacts 78, 79 having been closed on the first step of the type frame 187 in a well known manner. The attraction of armature 76 has now opened the circuit of magnet M^2 so that the openings in the circuit of line limb 9, produced after the primary adjustment of connector H, will have no effect upon the magnet M^2. The first opening in the circuit of limb 9 now occurs, deënergizing relay SR′, and transmits a current impulse from ground, through contacts 82, 85, 108, 111—114, normal contact 116, the contact 119, secondary magnet SM^3 to battery, the primary off-normal (PON) contacts 117, 118, 119 of connector H having been shifted on the first primary step of said switch. Magnet SM^3 is actuated and effects a first secondary step of wipers 151, 152, 153, but said wipers are not moved sufficiently to engage the first contact sets 11, 12, 13 of the selected group because the wipers of the connector are so adjusted with respect to the edge of the contact bank that only on the second secondary step do they engage the first contact set of a selected group. The first secondary step described, however, has shifted the secondary off-normal (SON) contact 115 to engage its alternate contact, while 116 is shifted sufficiently to disengage its normal contact, but not to engage its alternate contact, the latter engagement being effected only on a second secondary step. Since this first step has opened contact 116, the two additional impulses transmitted by the energization of relay SR′ have no effect whatever upon the circuits of the central office mechanism.

The subscriber A^3 now operates his dial 8 to produce two breaks in the circuit of line limb 10 which of course will be followed by three in the circuit of line limb 9. Two deënergizations of relay PR′ produced by this operation of the calling device, transmit two impulses from ground through contact 84, normal contact 83, through contact 110—113, alternate contact 115, contacts 122, 127, secondary magnet SM^3 to battery B^3. Two resulting actuations of magnet SM^3 moves wipers 151, 152, 153, to engage the second set of contacts 11, 12, 13, said contacts forming terminals of line 432. The first deënergization of relay SR′ now produced, transmits a current impulse over the before traced path, through contact 111—114, alternate contact 116, contacts 125, 128, and locking relay LR^3 to battery, which relay by armature 129, locks itself to ground at normal contact 120. Normal contact at 128 having been now opened, the two additional impulses transmitted by the deënergizations of relay SR′ are of no effect.

To select the generator of proper frequency to ring the called subscriber's substation, the subscriber C actuates his dial 8 to produce one break in the circuit of line

limb 10, a resulting deënergization of relay PR′ transmitting a current impulse over the before traced path, through contact 110—113, alternate contact 115, normal contact 122, alternate contact 127, magnet M^3 to battery, the resulting actuation of magnet M^3 by an ordinary armature actuated pawl produced a single step of the wiper 139 of generator switch GS, the wiper of which may be carried by the customary rotary shaft having a ratchet for engagement by said pawl.

For party line service, selective ringing is of course preferred, and the present system is arranged upon the now well known harmonic principle. In accordance with this arrangement, the bells at substation C′, C^2, C^3, C^4, are attuned to respond only to generator current of predetermined frequencies respectively. Thus generator c' delivers current of frequency to ring the bell of substation C′ without ringing the bells at C^2, C^3 and C^4, and in a similar manner, the generators c^2, c^3, c^4, will ring the bells at stations C^2, C^3, C^4, respectively, without ringing other bells on the line. The last digit of the called number designates the number of steps which the wiper 139 is to be caused to make to select the frequency required. Thus, to ring the substation C′, one step of wiper 139 has been caused and if substation C^4 were to be rung, four steps would be produced by operating calling device 8 to cause four breaks in line limb 10.

The first opening in line limb 9 following that in line limb 10, by a deënergization of relay SR′, transmits a current impulse from ground over the before traced path, through contact 111—114, alternate contact 116, normal contact 125, the closed off-normal contact ON^3 (which forms part of generator switch GS, and is shifted on the first step thereof), through the lower winding of test relay TR to battery. The resulting actuation of relay TR, by attracted armature 142, actuates locking relay LR^4, the latter, by armature 124, locking to ground normal contact 120. The opening of contact 125 thereon disconnects the winding of relay TR from the lower talking conductor so that the two additional breaks produced in the circuit of line limb 9 and the resulting deënergizations of relay SR′ are without effect. Attracted armature 141 of relay TR connects the relay's upper winding to the test wiper 151 now engaging the multiple private contact 11 of the called line. If the line is idle, said contact 11 is, as shown, connected to battery through contact 16 and cut-off relay 18. As the opposite terminal of relay TR is also connected to the same side of battery B^3, said relay now deënergizes and, by closing alternate contact 141, completes circuit from ground through relay 134, contacts 123, 141, 151—11, 16, cut-off relay 18 to battery, whereby relays 18 and 134 operate. Ground at 134 upon multiple contacts 11 renders the called line busy to the other connectors having access to it. Armature 21 of relay 18 renders relay 14 of the called line unoperable and the closing of contact 20—19 connects the ground at contact 11 to the private contacts 27 at the line selectors having access to the called line so that said called line continues unselectable at the line selectors. Circuit may now be traced from ground through constantly operating interrupter I, attracted armature 136, normal contact 145, generator relay GR to battery, which relay alternately energizes and deënergizes, its armature 150 thereby periodically connecting current from generator c' with the called line, which finds its way over limb 9 to the substation, through condenser and bell at C′ ringing the same, the return circuit being traced from line limb 10, contact 12—152, attracted armature 137, and impedance 138 to battery B^3 and ground.

When the called subscriber answers the call and removes his receiver, a conductive bridge at substation C′ is closed and as soon as armature 150 is retracted, circuit may be traced from ground through relay 130, contact 135, normal contact 150, contact 153—13, line limb 9, through inductance coil and transmitter at substation C′, returning over line limb 10, contact 12—152, contact 137, impedance 138 to battery, whereby talking current is supplied to the called transmitter. Armature 131 operates relay LR^5 whose armature 146 locks said relay to ground at normal contact 120; armatures 144, 149, complete the talking circuit with connector H, while armature 145 opens the circuit of relay GR so that armature 150 remains retracted and generator excluded from the called line.

Attracted armature 132 of relay 130 at H connects ground through impedance 126, over the lower talking conductor to the left through the alternate contact 116, contact 114—111, through alternate contact 85 at F, to battery B^2, through release relay RR′, which now energizes and by armature 95, operates the reversing relay RV, whose attracted armatures 90 and 93 reverse the battery connections of A′ and B′ to the wires 60 and 61 and so to the called line, such reversal being capable of employment in connection with any of the polarized special service devices of the art; armature 88 of relay RV connects ground over wire 64 to battery through the winding of the printing magnet 71 whose armature 72 actuates printing hammer 193 to print the character identifying the calling substation upon a strip of paper. It will be observed that armature 89 of reversing relay RV has locked said relay not only to ground at contact 99, but also to ground over wire 62, through contact 49, contact 53, and normal contact 57 so that

said relay RV can only be deënergized when the calling subscriber replaces his receiver at the conclusion of conversation to restore the switch D as will hereafter be explained. By this means, any re-operation of magnet 71 and the consequent double recording of a call against the calling line is effectually prevented. The calling and called subscribers are now in conversation, the talking circuit being traced from the calling substation A^3 to the calling substation C' throughout by the heavily marked conductors. When the connected subscribers finish their conversation, the replacing of the receiver at substation C' will be effective to restore the switches F, H, and generator switch GS, with the exception that relays PR' and SR' and RV at F will remain to be deënergized when the calling subscriber at A^3 replaces his receiver. If the calling subscriber at A^3 first replaces his receiver, the act will restore to normal the switches D, K, and F, the connector H and switch GS remaining to be restored when the called subscriber replaces his receiver.

Assuming that the receiver at substation A^3 is first replaced, the consequent opening of the conductive bridge through the substation deënergizes simultaneously now for the first time, the relays PR' and SR' whose retracted armatures 80 and 81 close a circuit from ground through release relay RR^2 over wire 63, contact 47, lower winding of release relay RR of line selector D to battery. Armature 56 of relay RR locks said relay to ground at shifted contact 43 and also operates release magnet RM by current to the same ground. Magnet RM, when actuated, withdraws retaining pawls from the primary and secondary shafts of line selector D, and the wipers and primary and secondary off-normal switches of the switch D are restored to normal. During restoration, relay SR is energized by current flowing through alternate contact 48, and to ground at alternate contact 57. When line selector D reaches normal, the primary off-normal and secondary off-normal contacts will have been restored to normal, and relays PR and SR and magnet RM will be deënergized.

The operation of relay RR^2 at F, as described, was effective by armature 102 to lock said relay RR^2 through contact 100 in series with relay BR', whereupon circuit may be traced from ground through attracted armatures 107, 104, release magnet RM' to battery, whereupon said release magnet withdraws the retaining pawls of first selector F which is automatically restored to normal including its primary and secondary off-normal switches.

As soon as ground is removed from contact 99 and the wire 62 at D reversing relay RV has its circuit opened and deënergizes, its armature 88 then deënergizing the printing magnet 71 whose armature restores and moves the paper strip so that an unused surface is presented to the printing hammer. When, in the release of line selector D, relay SR energized, the circuit of relay R' at K was opened and the deënergization of said relay withdrew a retaining pawl from the ratchet of the type frame 187 and the associated spring thereupon returned said type frame to normal. The retracted left armature of magnet R' deënergized relay 69 whose retracted armature unlocked relay LR' which deënergized. The restoration of type frame 187 opened off-normal contacts 78 and 79 and locking relay LR^2 deënergized so that the mechanism of switches K, D and F is all at normal.

When the called subscriber C' replaces his receiver, the opening of the conductive circuit at the substation deënergizes relay 130 and its retracted armature 133 completes a circuit as follows: from ground through release relay RR^3, alternate contact 148, normal contact 133, to battery. Armature 121 of relay RR^3 locks the relay to battery through primary off-normal contact 118, while armature 120 actuates release magnet RM^3 which withdraws the retaining pawls of the connector H whose wipers and primary and secondary off-normal switches then restore to normal. Attracted armature 120 also opens the locking circuit of relays LR^3, LR^4 and LR^5 which are deënergized, the resulting opening of contact 123 of relay LR^4 deënergizing relay 134 and cut-off relay 18 of the called line. The release magnet R^3 of the switch GS is connected to battery B^3 in parallel with release magnet RM^3 so that magnet R^3 now energizes and withdraws a retaining pawl from the ratchet of switch GS, and the wiper 139 is automatically restored by an associated spring in the customary manner.

If subscriber C' first replaced his receiver, switches H and GS would have been restored as before. The opening at contact 132 would have removed ground from the lower talking conductor and would have deenergized the relay RR' at F whose retracted armature 96 would connect battery B^2 through attracted armature 94 with the winding of relay RR^2 which relay would cause the restoration of the first selector F as before. Relays PR', SR' and RV would of course, as before suggested, remain to be deënergized when subscriber H replaces his receiver, and at such time, the release of line selector D and of switch K would proceed as before. It will, of course, be observed that when switches D and F are restored to normal, the ground is removed from the contact 42 of switch D at the

master-switch E so that the contacts of the line selector may be selected whenever wipers 39, 40 are moved to engage them.

Let it be assumed that the called line C' was busy, when at the conclusion of the last set of impulses transmitted from substation A^3, relay TR energized. In such case, the multiple contacts 11 of the called line would be connected to ground in one of the several ways heretofore referred to, and on the attraction of armature 141, relay TR would be locked to ground at the engaged contact 11. The busy machine I' will now remain connected with the calling subscriber's line, circuit being traced through attracted armature 140 and over the upper talking conductor through the exchange, and over the calling line, the return circuit being traced to battery B' through secondary relay SR'. The calling subscriber hearing the busy signal in his receiver, will now replace the same on the switch hook causing the restoration of switches D, K and F as before described. In the present case, the continued energization of relay TR at H has prevented the operation of relay 134 so that relay 130 remains unoperated and ground at 126 disconnected from relay RR' at F; hence reversing relay RV has remained un-energized so that printing magnet 71 has not operated and the restoration of switch K is produced without a call being registered against the calling substation.

In the restoration of switch F, it will be observed that relay RR^2 energizes before relay BR' and magnet RM' so that, on the operation of the former, an impulse of current will flow through alternate contacts 103, 101, 109—112, 117, normal contact 147 (relay LR^5 having remained inert), through release relay RR^3 to ground. This impulse is of sufficient duration to actuate the relay RR^3 which, by armature 121, locks to battery through contact 118, and causes restoration of connector H and switch GS, in a manner readily understood from the previous description.

For working in connection with the circuits shown at D, F, H, and the second and third selectors shown in Fig. 10, switches having mechanical connections such as shown in Figs. 5 to 9 inclusive may be employed. The switch there shown is specifically a line selector D, and corresponding parts in mechanical figures have the same reference characters, as like parts of D in Fig. 1. The one hundred multiple contact sets (each set comprising four contacts in the line selector), are preferably arranged in vertically extending groups in the contact bank, one group being shown in Fig. 5, while in Fig. 6 each set of four contacts 26, 27, 28, 29 is represented by a single short line. In said Fig. 6, there are accordingly indicated ten groups of vertically extending contact sets, and the sets are arranged as if extending through the inner surface of a section of a hollow sphere. The group contacts 30 are mounted in the base of the bank and group wiper 35 is rigidly fastened to the primary shaft PS. Rotary movements of wipers 31 to 34 from left to right are produced to select a group, whereafter the contact ends of said wipers are rotated upward to move over the contact sets of the selected group.

The wipers 31 to 34 inclusive, are pivoted at 175^a in a rotary primary shaft PS, which is journaled to the main switch frame and has fastened to it a ratchet 162 shown in the sectional view of Fig. 9. The pawl 164, actuated by the armature of magnet PM, is adapted to engage successive teeth of ratchet 162, turning said ratchet, shaft PS, and wipers 31 to 34, clockwise step-by-step, each step bringing said wipers to a position below a different group of contact sets. A spring 169 is fastened to shaft PS and to the main switch frame and, to prevent back movement of the primary shaft by said spring, a primary retaining pawl 163, engaging ratchet 162, is provided. The wipers 31 to 34 have a rearwardly extending arm 175 engaging, by a suitable bearing, the broad piece 174 screwed to secondary shaft SS. The primary adjustment of the wipers having been effected by actuations of magnet PM, actuations of the secondary magnet SM (Fig. 6) by pawl 165 will step secondary shaft SS downwardly, and the piece 174 will then rotate the switch wipers about the pivot 175^a, moving their contact ends step by step to engage successive contact sets of the selected group. The spring 167, drawing down on one end of the pivoter rocker-arm 168, whose distant end engages loosely a screw threaded to shaft SS, tends to raise shaft SS upward; and to prevent back movement, a secondary retaining pawl 166 is provided to engage teeth of a suitable retaining ratchet cut in shaft SS. Thus, by actuations of magnet PM, the wipers 31, 34 may be adjusted to select any group, whereafter actuations of magnet SM will move them to select a contact set of the group. To release the switch, release magnet RM is provided, whose armature 165', on energization of the magnet, engages a rearwardly extending finger on the pivoted primary retaining pawl 163 and rotates said pawl free of ratchet 162.

An arm 163^a of pawl 163 extends to engagement with retaining pawl 166; and when pawl 163 is freed from shaft 162 as described, pawl 166 is withdrawn from the secondary shaft. Spring 167 then raises shaft SS upward until the wiper ends are free from the contact bank, when spring 169 is effective to rotate the wipers reverse clockwise back to normal. Until the wiper ends are, in their restoration, brought to the

lower edge of the contact bank, the tension of spring 169 is ineffective to exert rotary pressure and so create friction, because a piece 170 is provided extending parallel to shaft SS and having a tooth 172 for engagement with a tooth of ratchet 162. On the first actuation of shaft SS, the piece 173, fastened thereto, frees the lower end of the piece 170 which drops down so that its tooth 172 engages the rotary ratchet. Then, not until the secondary shaft is restored and the piece 173 raises piece 170 so that tooth 172 disengages ratchet 162, can the turning force of spring 169 be effective. The primary off-normal switch springs 43, 44, best shown in Fig. 8, are freed, by a stud 161 on an arm 160 fastened to primary shaft PS, on the first primary step of said shaft, said springs then, by their tension, assuming their abnormal positions. When the rotary shaft later reaches normal, the stud 161 will obviously restore the springs 43, 44. The piece 170, whose operation has already been described, normally engages the insulating spacer for secondary off-normal springs 47, 48, 49, so that the first secondary step of the switch causes piece 170 to free the spacer 171, and the associated springs assume their alternate positions. The restoration of piece 170, occurring as described with the restoration of shaft SS, obviously restores the secondary off-normal switch spring to normal.

The switch thus described may, as before suggested, be used for the directively operated switches F and H, the respective off-normal combinations shown in the circuit drawings being, of course, provided. Also, in such employment, the group wiper 35 and the group contact 30 are unnecessary.

In Figs. 2 and 3, is shown, to a certain extent diagrammatically, a preferred form of mechanism for use at K in Fig. 1. The mounting plate 500 is provided and Fig. 2 illustrates the apparatus on one side of said plate, and Fig. 3 that on the other side. A shaft 186 extends suitably journaled through the plate 500 and carries, rigidly fastened to it, the ratchet wheel 184 having one hundred ratchet teeth, the wiper 67 and the type wheel 185, having the one hundred designating number types on its periphery. For driving the shaft 186, the magnet M′ is provided having the pole pieces 180 adapted to attract the rocking armature 181 which fits loosely about the shaft 186 and is provided with a suitable spring for restoring it after actuation. The arm 182 of armature 181 carries a suitable actuating pawl 183 adapted to engage successive teeth of ratchet wheel 184 and so rotate the wiper 67 in search of that contact 68, out of the one hundred shown, whose line is calling, type frame 185 shown in Fig. 3 moving along with the wiper so that the type of the called number will be immediately beneath the printing hammer 193. As indicated in Fig. 4, the party line type frame 187 is arranged to be rotated reverse clockwise by actuations of magnet M^2, whose pawl 191 engages the adjacently disposed ratchet teeth of 187. The relay R′, it will be remembered, is energized as soon as the calling line is selected and remains energized until disconnection, so that its armature is attracted and the retaining pawl 192 placed in engagement with a ratchet tooth of frame 187 to hold said ratchet, when actuated, against back movement under the influence of spring 190. When, at the time of disconnection, relay R′ deënergizes, the spring 190 restores frame 187 back to normal. The stud 188 on said frame closes and opens contacts On on operation and restoration in an obvious manner. The mechanism associated with magnet 71, shown in Fig. 3 comprises the printing hammer 193 adapted, when armature 72 is attracted, to strike the tape 198 and print upon it whatever numbers on frames 185 and 187 are opposite. The hammer 193 is preferably flexibly attached to the armature 72 so as to rebound slightly from the frames when actuated. To secure the printing on the tape 198, the type of the frames 185, 187, may be self-inking, or printing ribbon may be interwound with the tape 198. The latter has a storage spool mounted upon a rotary shaft 197. A receiving spool is fastened to the rotary shaft 196, which also carries a ratchet 194. When armature 72 is attracted on the response of the called subscriber, pawl 195 engages an adjacent tooth of ratchet 194. When, at the time of disconnection, the calling subscriber replaces his receiver and relay 71 deënergizes, armature 72 retracts and pawl 195 rotates shaft 196 and ratchet 194 a step, whereby a clean printing surface of tape 198 is presented opposite hammer 193.

While I have in the circuit drawings indicated a plurality of batteries, all battery symbols indicating sources of a given polarity may, and preferably will be, a single source. Likewise, the various generators may be a single source except that for harmonic ringing, different frequencies require separate sources.

It will be understood that the mechanical drawings, while indicating in a general way preferred mechanisms, are, as are the circuit drawings, to a certain extent diagrammatic in character and are, in no sense, working drawings to scale.

Having thus described one particular form of the invention, I claim:—

1. A register for party lines including a device connected with a line adapted for adjustment to indicate that one of a plurality of stations on the line initiating a call, and means subsequently beyond the

control of the calling party for recording the indications of said device.

2. A register for party lines including a device individual to and connected with a line adapted for adjustment to indicate that one of a plurality of stations on the line initiating a call, a called line adapted to be connected with said first-mentioned line, and means responsive to current over said called line to record the indication of said device.

3. A telephone system including a register device, a party line connected therewith, impulse transmitting means at each station adapted, on initiation of calls, to adjust said device to indicate the particular station calling, and means subsequently beyond the control of the calling party for recording the indications of said device.

4. A telephone system including a register device, a party line connected therewith, impulse transmitting means at each station adapted, on initiation of calls, to adjust said device to indicate the particular station calling, a called line adapted to be connected with said party line, and means responsive to current over said called line to record the indication of said device.

5. A telephone system including a party line, a register device comprising a movable type frame, means operating to adjust said frame to correspond with the particular station initiating a call, and means for printing the type of said station to record the call.

6. A telephone system including a party line, a register device comprising a movable type frame, means operating to adjust said frame to correspond with the particular station initiating a call, means for printing the type of said station to record the call, and circuit connections for restoring said frame while preventing printing of said type if the call is not completed.

7. A telephone system including a party line, a register device comprising a movable type frame, means operating to adjust said frame to correspond with the particular station initiating a call, a called line adapted to be connected with said first-mentioned line, and apparatus responsive to current over said called line to automatically print the type of the calling station.

8. A telephone system including a party line, a register device comprising a movable type frame, means operating to adjust said frame to correspond with the particular station initiating a call, a called line adapted to be connected with said first-mentioned line, apparatus responsive to current over said called line to automatically print the type of the calling station, and circuit connections for restoring said frame while preventing printing of said type if the call is not completed.

9. A telephone system including a party line, a link-circuit at the exchange, selective switch mechanism at the exchange for automatically connecting said link-circuit and line responsive to initiation of a call at any substation connected to said line, a register device for said link-circuit, means for adjusting said device to indicate that substation of the line initiating the call, and means for recording the indications of said device.

10. A telephone system including a party line, a link-circuit at the exchange, selective switch mechanism at the exchange for automatically connecting said link-circuit and line responsive to initiation of a call at any substation connected to said line, a register device for said link-circuit, means for adjusting said device to indicate that substation of the line initiating the call, means for recording the indications of said device, and apparatus preventing said recording if the call is not completed.

11. A telephone system including a party line, a link-circuit at the exchange, selective switch mechanism at the exchange for automatically connecting said link-circuit and line responsive to initiation of a call at any substation connected to said line, a register device for said link-circuit, means for adjusting said device to indicate that substation of the line initiating the call, a called line for connection with said party line, and means for recording the indication of said device responsive to current over said called line.

12. A telephone system including a party line, a link-circuit at the exchange, selective switch mechanism at the exchange for automatically connecting said link-circuit and line responsive to initiation of a call at any substation connected to said line, a register device for said link-circuit, means for adjusting said device to indicate that substation of the line initiating the call, a called line for connection with said party line, means for recording the indication of said device responsive to current over said called line, and apparatus preventing said recording if the call is not completed.

13. A telephone system including a call register device, a number of party lines, automatic means responsive to initiation of a call over any line to cause said device to indicate the particular line calling, means for thereafter causing said device to indicate the particular substation calling, and means for recording the indications of said device.

14. A telephone system including a call register device, a number of party lines, automatic means responsive to initiation of a call over any line to cause said device to indicate the particular line calling, means for thereafter causing said device to indicate the particular substation calling, a called line adapted to be connected with the calling

line, and an electromagnet operating by the response at the called substation to record the indications of said device.

15. A telephone system including a call register device, a number of party lines, automatic means responsive to initiation of a call over any line to cause said device to indicate the particular line calling, means for thereafter causing said device to indicate the particular substation calling, a called line adapted to be connected with the calling line, an electromagnet operating by the response at the called substation to record the indications of said device, and means controlled at the calling station for restoring said device to normal without record of its indications prior to a response at the called station.

16. A telephone system including party lines, a link-circuit, a line finding switch for said link-circuit adapted, on initiation of a call, to select the calling line, a call register for said link-circuit and switch, an electrically adjustable type frame for said register operating to indicate the particular line selected, a second electrically adjustable type frame for said register, means for adjusting said second frame to indicate the particular calling station of the selected line, and means for recording the indications of said frames.

17. A telephone system including party lines, a link-circuit, a line finding switch for said link-circuit adapted, on initiation of a call, to select the calling line, a call register for said link-circuit and switch, an electrically adjustable type frame for said register operating to indicate the particular line selected, a second electrically adjustable type frame for said register, means for adjusting said second frame to indicate the particular calling station of the selected line, a called line, means for connecting said link-circuit therewith, and a magnetically controlled printing device for operation to print the indications of said frames when the called subscriber responds.

18. A telephone system including party lines, a link-circuit, a line finding switch for said link-circuit adapted, on initiation of a call, to select the calling line, a call register for said link-circuit and switch, an electrically adjustable type frame for said register operating to indicate the particular line selected, a second electrically adjustable type frame for said register, means for adjusting said second frame to indicate the particular calling station of the selected line, a called line, means for connecting said link-circuit therewith, a magnetically controlled printing device for operation to print the indications of said frames when the called subscriber responds, and means for restoring said frames to normal with their indications unrecorded prior to the response of the called subscriber.

19. An automatic telephone system including telephone lines, party lines included therein forming a group, link-circuits for connection with calling lines, provided each with a line selector adapted to select any party line initiating a call, a call register for each said link-circuit, an electrically adjustable frame for said register operating to indicate the line selected, and an auxiliary frame for said register.

20. An automatic telephone system including telephone lines, party lines included therein forming a group, link-circuits for connection with calling lines, provided each with a line selector adapted to select any party line initiating a call, a call register for each said link-circuit, an electrically adjustable frame for said register operating to indicate the line selected, an auxiliary frame for said register, means for operating said auxiliary frame to indicate the particular calling station of the selected line, a called line, selectors and connectors at the exchange directively operable responsive to currents over the calling line to connect with the called line, and means controlled by the response of the called subscriber to record the indications of said frames.

21. An automatic telephone system including telephone lines, party lines included therein forming a group, link-circuits for connection with calling lines, provided each with a line selector adapted to select any party line initiating a call, a call register for each said link-circuit, an electrically adjustable frame for said register operating to indicate the line selected, an auxiliary frame for said register, means for operating said auxiliary frame to indicate the particular calling station of the selected line, a called line, selectors and connectors at the exchange directively operable responsive to currents over the calling line to connect with the called line, a magnet at the exchange, a printing device to record the indications of said frames operating under control of said magnet, and circuit connections at the called station for controlling said magnet.

22. An automatic telephone system including telephone lines, party lines included therein forming a group, link-circuits for connection with calling lines, provided each with a line selector adapted to select any party line initiating a call, a call register for each said link-circuit, an electrically adjustable frame for said register operating to indicate the line selected, an auxiliary frame for said register, means for operating said auxiliary frame to indicate the particular calling station of the selected line, a called line, selectors and connectors at the exchange directively operable responsive to currents over the calling line to connect with the called line, a magnet at the exchange, a printing device to record the indications of

said frames operating under control of said magnet, circuit connections at the called station for controlling said magnet, and a switch at the substation of the calling line adapted to restore said frames to normal with their indications unrecorded prior to the response of the called subscriber.

23. A telephone system including a party line, means at each station of said line operative, upon the initiation of calls, to transmit impulses characteristic of its station, a register responsive to such impulses to indicate the particular station calling, and means subsequently beyond the control of the calling party for recording the indications of said device.

24. A telephone system including a telephone line, a plurality of stations on said line, an impulse transmitter at each said station operative, on initiation of calls, to transmit a number of impulses over said line corresponding to its station, a register responsive to such impulses to assume different positions corresponding to said stations, and means subsequently beyond the control of the calling party for recording the indication according to the position at which the register is set.

In witness whereof, I hereunto subscribe my name this 18th day of June, 1908.

ALFRED H. DYSON.

Witnesses:

CAROLYN WEBER,

G. E. MUELLER.