April 24, 1934. G. R. EATON ET AL 1,956,437

TELEPHONE SYSTEM

Filed Jan. 27, 1932 5 Sheets-Sheet 1

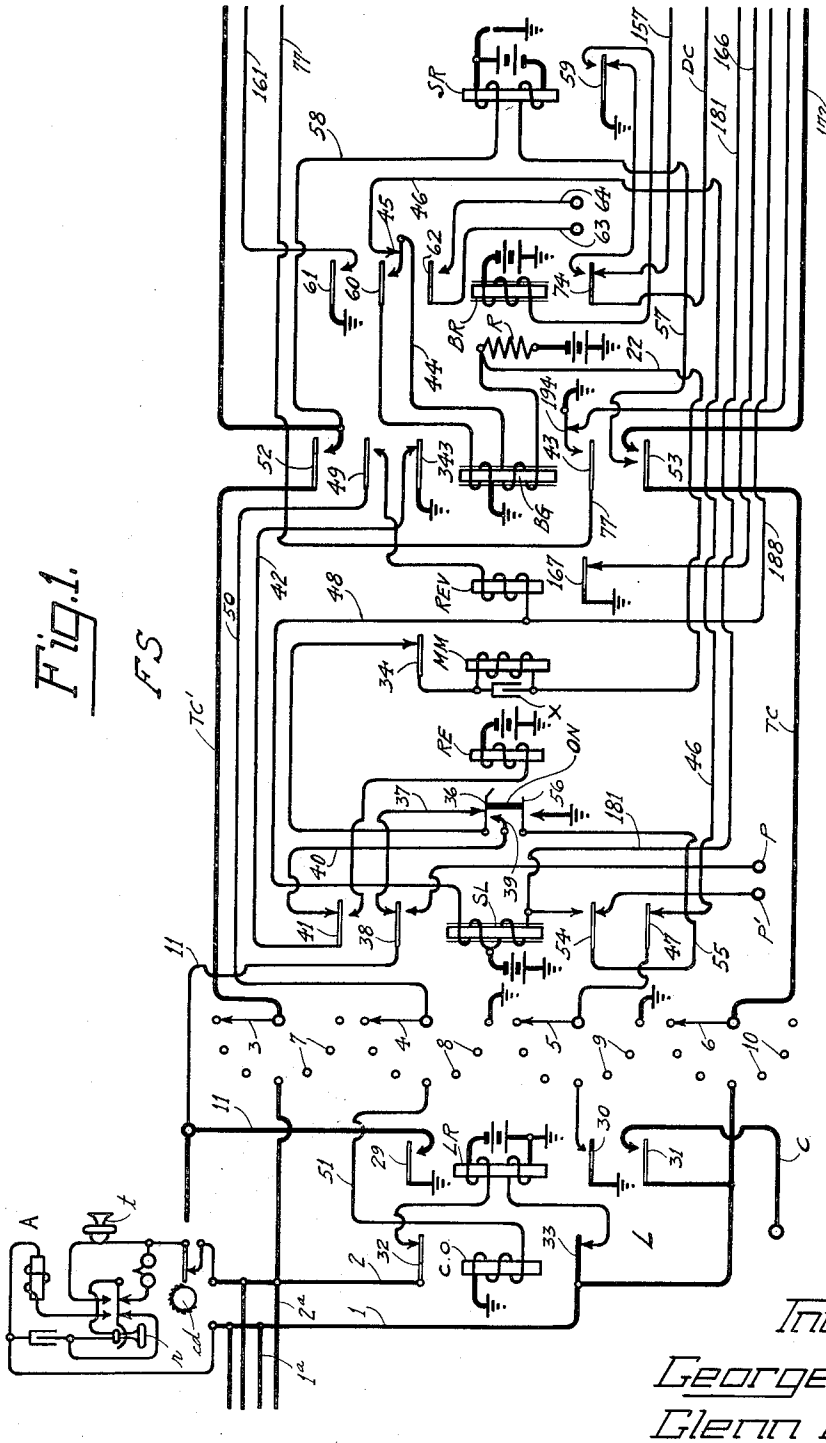

Fig. 1.

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TELEPHONE SYSTEM

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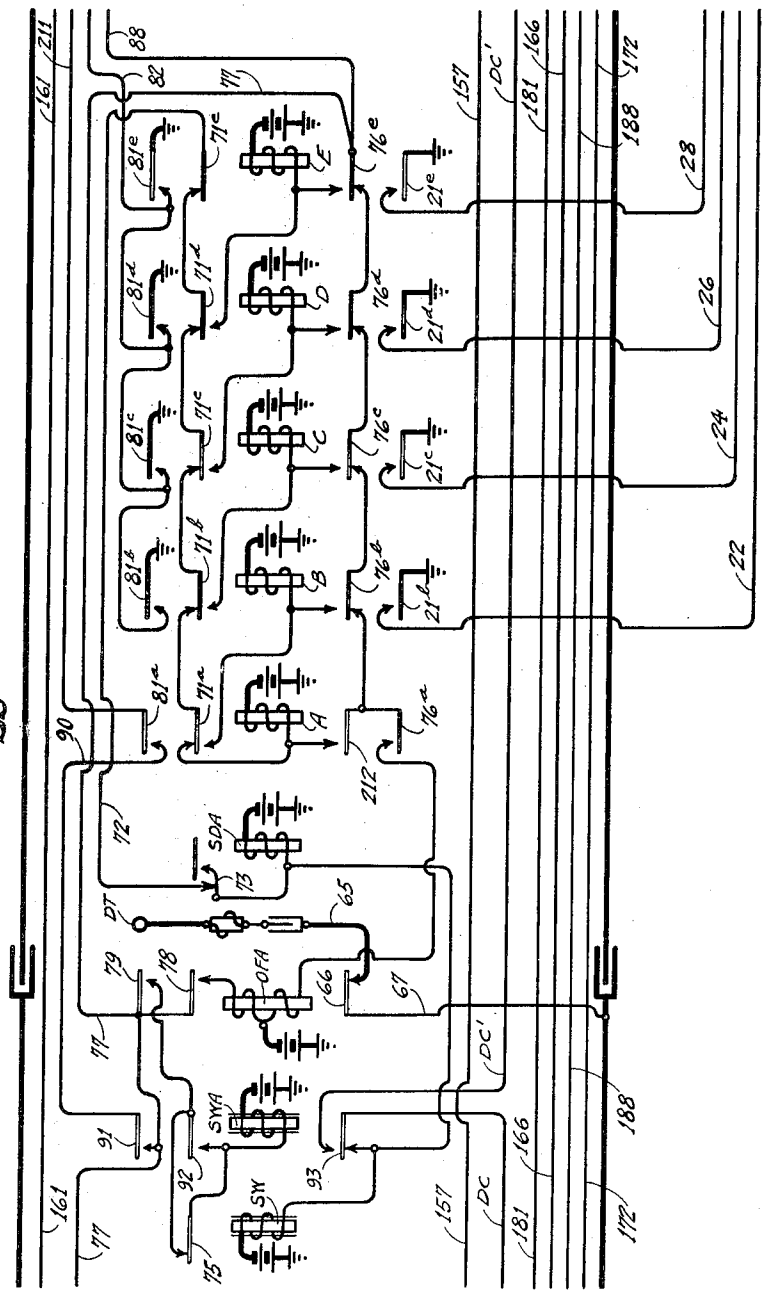

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TELEPHONE SYSTEM

Filed Jan. 27, 1932 5 Sheets-Sheet 3

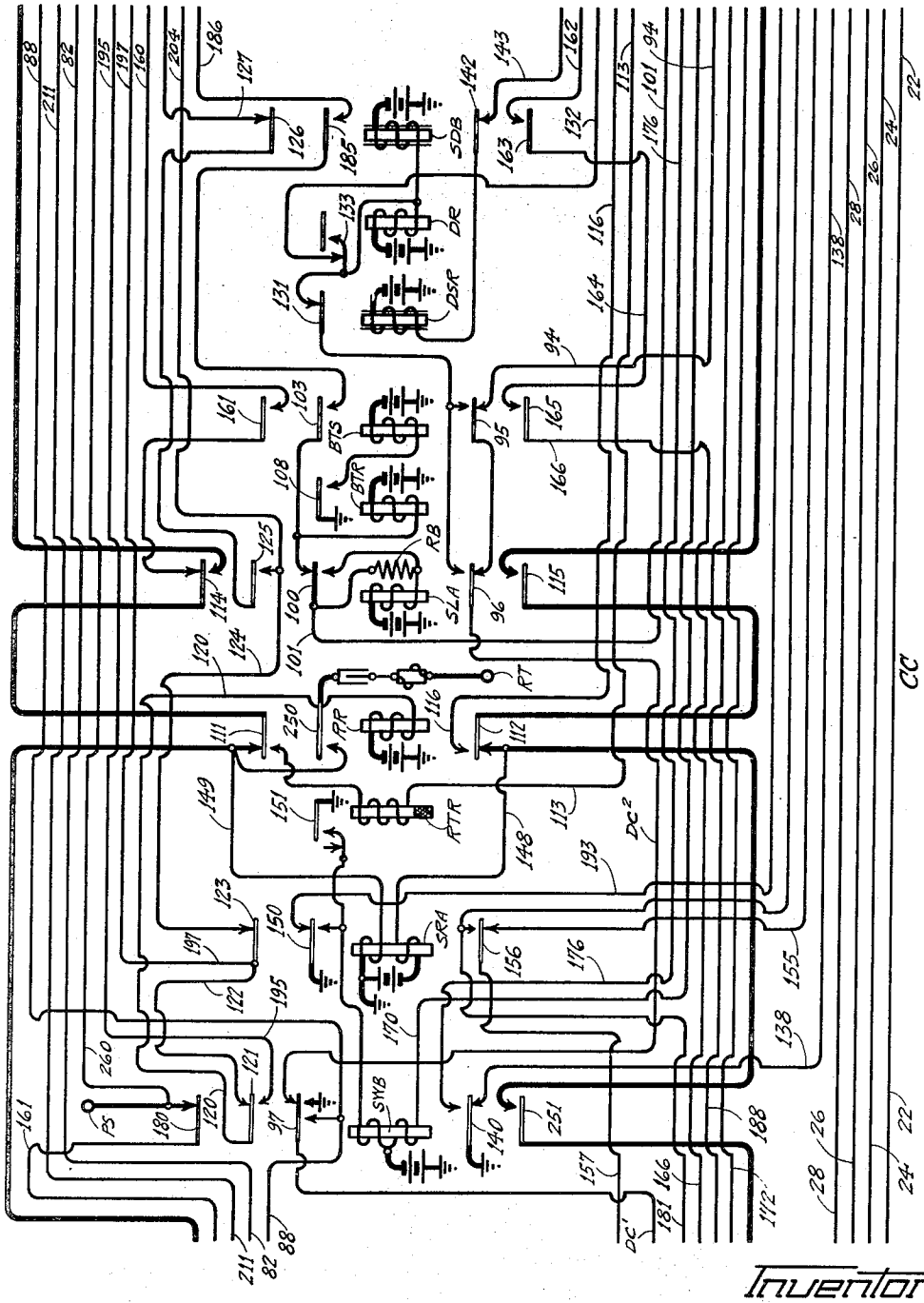

Fig. 3.

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TELEPHONE SYSTEM

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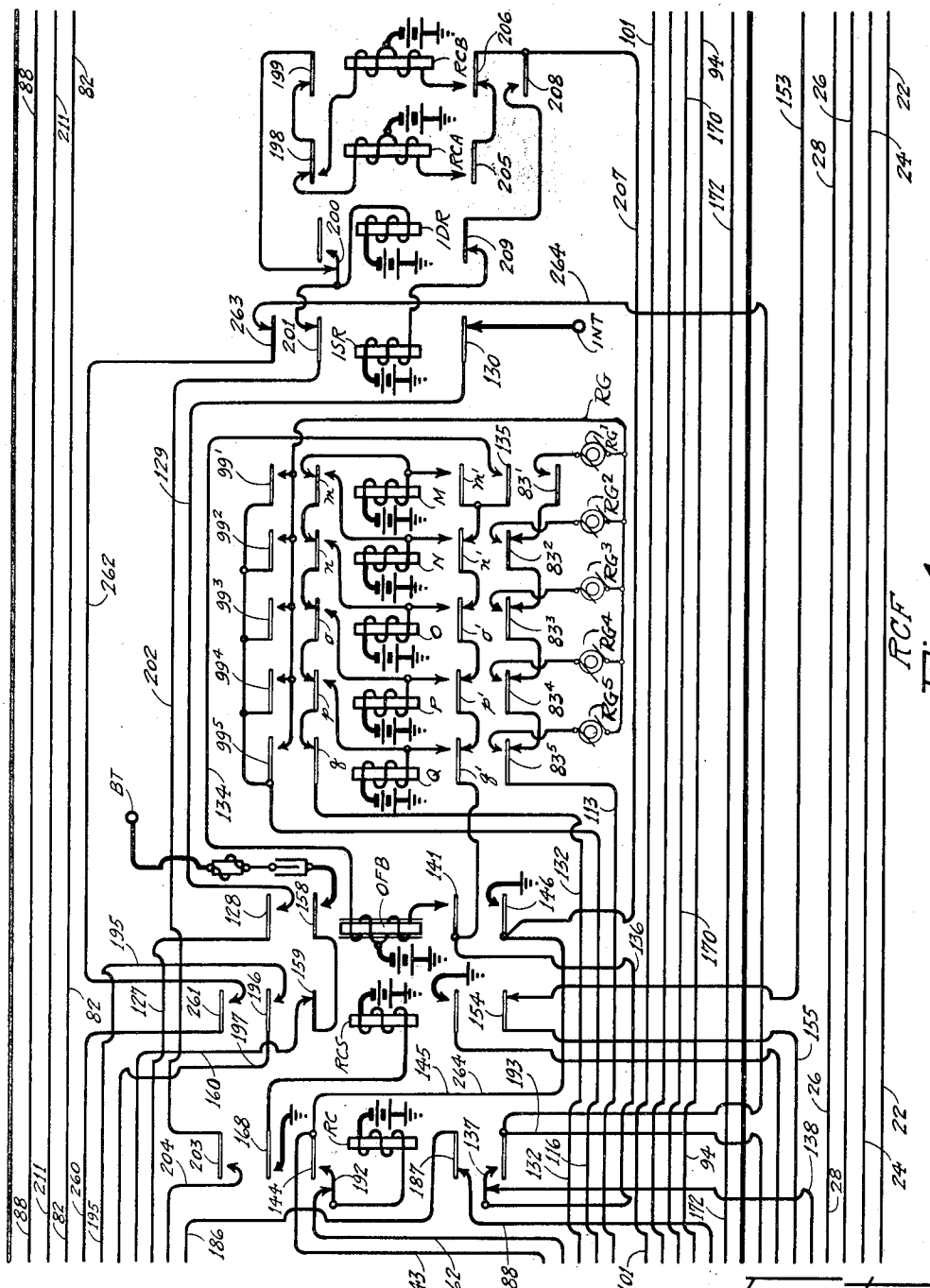

Fig. 4.

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TELEPHONE SYSTEM

Filed Jan. 27, 1932 5 Sheets-Sheet 5

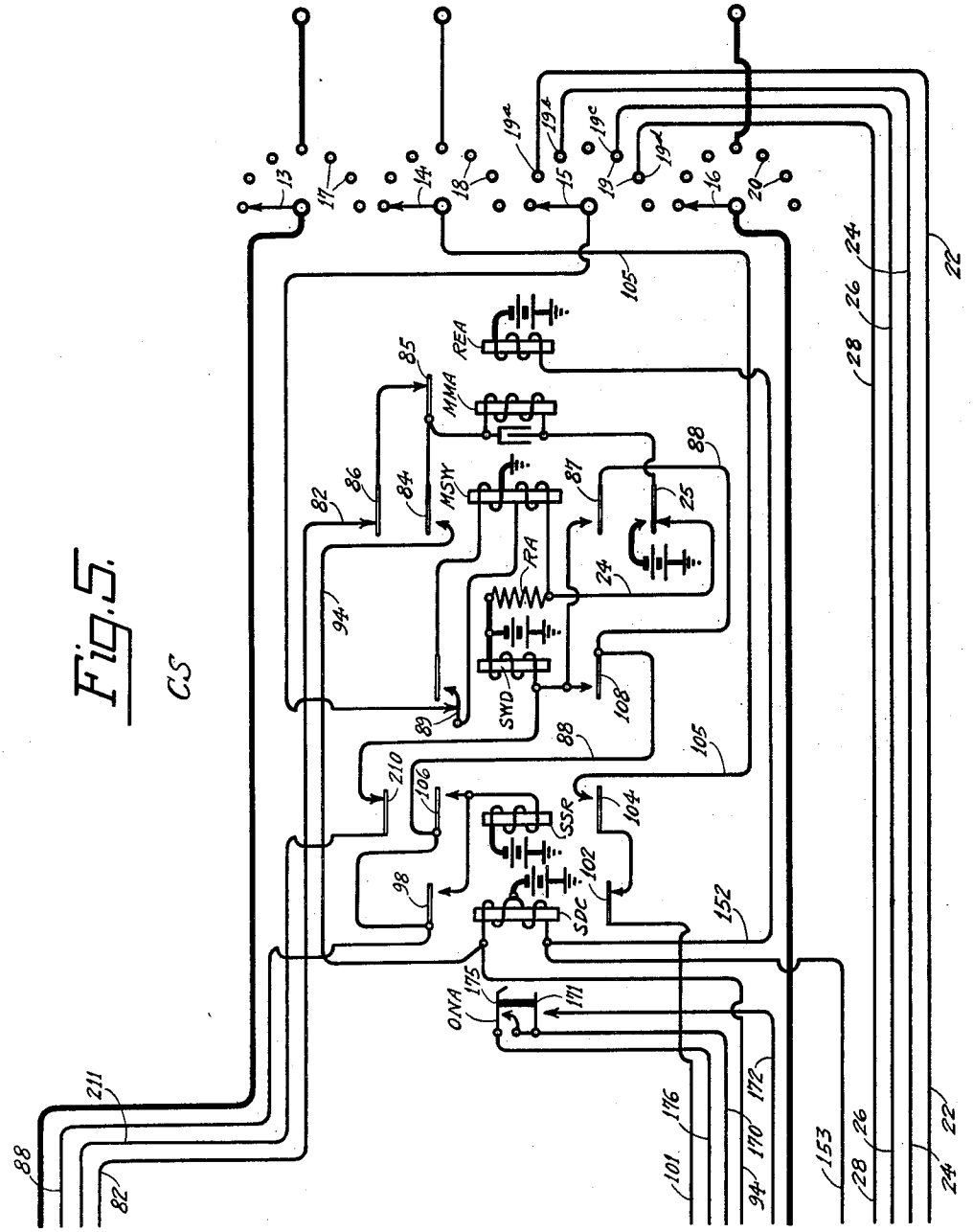

Fig. 5.

CS

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Patented Apr. 24, 1934 1,956,437

UNITED STATES PATENT OFFICE

1,956,437

TELEPHONE SYSTEM

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Application January 27, 1932, Serial No. 589,190

20 Claims. (Cl. 179—17)

Our invention relates to automatic telephone systems of the two-wire or metallic line type in which directively controlled switches at the exchange are operated in response to a series of rapid interruptions of the subscribers' line circuits to connect the calling subscriber thereat to the contacts of the line being called. The system which is herein disclosed is applicable to private automatic exchange or PAX systems such as they are commonly known.

When, in the usual system of this type, a subscriber removes his receiver to initiate a call, a line finder switch connects his line to a selector whereupon he operates his dialing device to step the switch wipers of the rotary selector switch into engagement with contacts leading to a connector which in turn is operated to connect its switch wipers to the contacts of the desired line.

It is an object of our invention to provide an improved circuit arrangement using a plurality of counting relays in the selector circuit which eliminates the selector switch and its associated banks of contacts.

A feature of our invention is the use of a single level rotary switch (shown herein as provided with 50 sets of contacts) in the connector circuit to which the subscriber's stations are connected.

Another feature is the provision in a telephone system of the type described of means for driving the switch wipers to a predetermined tens group and then stepping them into engagement with the desired set of contacts in the group.

A further feature is the inclusion in such a system of means whereby a calling subscriber may be automatically connected to another subscriber's station on his party line without the necessity of dialing a special number.

Another feature is the provision of means for limiting the ringing period on a revertive call.

Still another feature is the inclusion in our telephone system of automatic five frequency selective ringing means for signaling different subscribers on the same party line.

Further features provided in the telephone system of our invention are automatic trip of the ringing current on both silent and ringing periods; instantaneous release and recall by the calling subscriber; revertive ringing tone to calling subscriber; dialing tone to calling subscriber indicating a through channel; busy tone to calling subscriber when the called line is busy; starting circuit for the selecting line finder switch having the minimum travel to the calling line, automatic starting of interrupter and tone machine and pole changers and a busy group alarm.

Other features will become apparent upon a further perusal of the specification and together with the features pointed out, will be explained fully hereinafter, reference being had to the accompanying drawings comprising Figs. 1 to 5 inclusive, in which:

Fig. 1 is a schematic drawing of the apparatus and circuit connections therefor comprising the line finder switch of our invention,

Fig. 2 shows the selector circuit,

Fig. 3 shows the connector circuit,

Fig. 4 illustrates the revertive call and frequency selector circuit, and

Fig. 5 illustrates the connector switch circuit of my invention.

When Fig. 2 is placed to the right of Fig. 1 and Figs. 3, 4, and 5 are placed to the right of Figs. 2, 3 and 4 respectively, the entire circuit arrangement will be disclosed.

The present invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming a part of this specification, with the understanding, however, that the invention is not confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes and modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

It is believed an understanding of the present disclosure will be facilitated by a preliminary general description of the system. The invention provides means whereby the brushes of a switch having a single row of contacts, say fifty or more, may be driven under the control of the usual substation dial sending device to select, first, the tens group of the wanted line, and second, the units contact at which said line terminates.

In the connector switch (Fig. 5) every tenth or tens group contact is adapted to be joined to ground by a corresponding counting relay B, C, D or E of Fig. 2, these relays being operated successively by the impulses created when the first digit of the wanted number is dialed.

When one of the counting relays B, etc. is operated, in addition to grounding the corresponding tens contact at the connector, it acts, at its uppermost contact, to close a self-interrupting circuit for the connector motor magnet MMA (Fig. 5), thus causing the connector switch brushes to hunt for the grounded tens contact. As the counting relays B, etc. are rapidly energized and deenergized in succession responsive to the dial impulses, the connector switch brushes

will move continuously step by step to the selected tens contact.

Due to the usual change over operation, following the first series of impulses, the movement of the connector switch is placed under the direct control of the dial and moves step by step in unison with the dial impulses of the second series until its brushes engage the contacts of the wanted subscriber's line.

Means are also provided which are responsive to a third operation of the dial whereby the proper frequency of ringing current may be selected to ring a desired party on a party line.

It will be noted that the terminal contact of the subscriber whose line is numbered 10 or a multiple thereof is followed by the contact terminal of a line in the next tens group, i. e., contact of line 10 is followed by a contact terminal of line No. 21; contact of line 20 by contact of line 31, etc. The reason for this will become obvious when the operation of the connector switch under the influence of the dial is considered. For instance, in dialing the number "20", two impulses are sent responsive to the dialing of the "2" which will move the brushes of the switch to the second "tens" contact; when the zero is dialed ten additional impulses will be sent which will move the brushes of the switch from contact to contact until they come to rest on the thirtieth contact in the connector bank, but as the number dialed was "20" the line connected to this contact will be line No. 20.

Thus it will be seen that the connector switch occupies the same position when it is directed to the contacts of line No. 20 as it does when it moves by the group movement to the third "tens" contact. It is obvious that an additional or group contact could be provided which did not correspond to the terminal of a subscriber's line, if desired, but in the present case the group contact of the next group is the same as the line contact of the preceding line No. 10 or multiple thereof. In other words, if the subscriber dials the number "20" the brushes of the connector switch move to the thirtieth contact in the bank which is the contact of line No. 20 while if the subscriber dials the group digit "3" the brushes will move to exactly the same position but this will be the third "tens" group position.

Referring particularly to Fig. 1 of the drawings the line conductors 1 and 2 at the left of the drawing lead to a subscriber's station A, which is equipped with the usual automatic substation equipment such as is well known to those skilled in the art. The conductors 1 and 2 terminate at the private automatic exchange in a line circuit L which consists of a line relay LR and cut-off relay CO. Conductors 1^a and 2^a extend to other subscribers' stations on the same party line.

The line finder switch apparatus comprises a motor magnet MM which automatically operates when a call is initiated by a subscriber to step the wipers 3, 4, 5 and 6 over the bank contacts 7, 8, 9 and 10 to select the contacts of the calling line. A bridging relay BG is provided which energizes when the calling line is seized by the switch FS to open the circuit of motor magnet MM to prevent further advancement of the wipers 3, 4, 5 and 6 and to connect the calling line to the selector mechanism of switch SS. The sleeve relay SL energizes upon the actuation of relay BG to extend the starting conductor 11 to the next finder switch FS (not shown) of the group. A revertive call control relay REV is supplied.

A release magnet RE which restores the wipers 3, 4, 5 and 6 to normal is provided. A supervisory relay SR supplies talking battery to the subscriber's line and is alternately energized and deenergized when the subscriber actuates his dialing mechanism to cause the actuation of the selector SS, connector CC, revertive call switch RCF and connector switch CS. A busying relay BR is provided to cause the operation of an associated part of group busying means (not shown) and to start a tone machine operating as is well known in the art. If all the finder switches in the group with which the calling subscriber is associated are busy a group busy tone will be given the subscriber as soon as the line relay LR closes its alternate contact 31 and connects the conductor *c* to line 1. The relay BR in each finder switch of the group operates to condition apparatus to connect a group busy tone to the conductor *c* when all the finder switches are busy.

The selector switch SS is devoid of the rotary switch and bank contacts such as are customary in the present art but consists of a group of so-called impulse or counting relays A, B, C, D and E which operate under the control of a switching relay SW and a secret dialing relay SDA to control the operation of the motor magnet MMA of the connector switch CS. An off normal relay OFA and a switching relay SWA which extends the dialing conductor DC to the connector circuit CC are also provided.

The selector switch SS operates as a whole under the influence of the first operation of the dial to select the apparatus associated with the first digit of the desired number.

The connector circuit shown in Fig. 3 comprises apparatus for testing the called line including a busy test relay BTR and a busy test secondary relay BTS. A secret service relay SLA and a battery feed or supervisory relay SRA, which operates when the called subscriber responds to the calling signal, are also provided. The ringing signal is under the control of the ringing relay RR and the ringing trip relay RTR. The supervisory relay SRA which is under the control of the called subscriber controls an energizing circuit of a switching relay SWB. A dialing relay DR, a dial switching relay DSR and a slow dialing relay SDB are shown in this figure but operate in conjunction with the apparatus shown in Fig. 4 which is the revertive call and frequency selecting switch.

Fig. 4 comprises a group of frequency selecting relays M, N, O, P and Q which operate under the influence of impulses of current caused by the operation of the calling subscriber's dialing mechanism in dialing the third digit of the desired number. As the calling device *cd* in Fig. 1 is operated the dialing relay DR and slow dialing relay SDB operate to prepare for the operation of relays M, N, etc. depending on the frequency of the selected ringing current. An off normal relay OFB, a revertive call relay RC and a revertive call secondary relay RCS are used when the calling and called subscribers are on the same line, and revertive call ringing selector relays RCA and RCB control the application of ringing current on such a call. An interrupter switching relay ISR and an interrupter dialing relay IDR are also provided.

The present embodiment of our invention utilizes a fifty point switch which makes a fifty line

exchange. Five frequency selective ringing is provided so that each line can have as many as five subscribers connected thereto which makes a total capacity of two hundred fifty subscribers. However, it is readily apparent that a larger switch can be used to increase the capacity of the exchange. If a larger switch is used it will be necessary to add one more counting relay for each ten lines added as will be apparent from the ensuing specification. Likewise additional fifty point switches can be added to increase the capacity of the exchange.

In our system it is necessary that the dial be operated three times in placing a call. The first operation causes the connector switch wipers to be driven to the group of contacts in which the desired line is located. The second dialing operation steps the wipers of the switch to the contacts of the desired line and the third operation selects the proper ringing current to signal the desired particular party on that line. As a result the first line will be arbitrarily designated line number 11 and the subscribers connected to this line will have the numbers 111, 112, 113, 114 and 115 respectively if there are five of them. The second line is number 12 upon which the subscribers whose numbers are 121, 122, 123, 124 and 125 are located, and so on to the first "tens" contact which leads to line number 10 upon which subscribers number 101, 102, 103, 104 and 105 are located. The contact after line number 10 is number 21 and then 22 and so forth to the second next "tenth" contact which is associated with line number 20. The next lines are numbers 31, 32, etc. to 39 and then 30 after which comes line number 41. The next to the last contact on the switch is associated with line number 59 and the last contact with line 50. It will thus be seen that provision is made for fifty lines numbered 10 to 59 each of which may have five subscribers connected thereto. The impulse or counting relays respond to the first operation of the dial and set up a driving and a stopping circuit for the connector switch. The stopping circuit is formed by grounding the "tenth" contacts 19 but as the impulse relays operate in advance of the connector switch the stopping circuit is removed in sufficient time to prevent the switch from stopping before it reaches its group destination. When the relay B in Fig. 2 operates it closes its contact 21^b to ground the contact 19^a which is the first tens contact. When relay C operates contact 19^b is grounded at alternate contact 21^c; when relay D operates contact 21^d grounds contact 19^c; when E operates contact 19^d is grounded at 21^e.

The connector switch CS shown in Fig. 5 is of a construction substantially similar to that of the finder switch FS and comprises a shaft which carries the wipers 13, 14, 15 and 16 which are adapted to be stepped into engagement with the bank contacts 17, 18, 19 and 20 through the medium of a motor magnet MMA. A release magnet REA is also provided which when actuated releases the switch wipers 13, 14, 15 and 16 and restores them to normal. The contacts 17, 18, and 20 which are the tip, sleeve and ring conductors respectively, are multipled to contacts 7, 8 and 10 respectively of line circuits associated with the called subscribers' stations, not shown in the drawings but similar to the line circuit L of Fig. 1 associated with the calling subscriber's line, and lead to called subscribers' lines.

In the system of our invention the brushes of the connector switch CS are driven, by a hunting operation, to the first contact of the tens group within which appears the contact corresponding to the called subscriber's line and are then stepped under direct control of the substation sending device into engagement with the desired set of contacts. Upon the first dialing movement the counting relays A, B, C, etc. operate in sequence to ground the "tens" contact selected and drive the connector switch CS to this contact where it will come to rest. Upon the second dialing movement the connector switch CS is stepped one point for each interruption of the line conductors 1 and 2 and after the last interruption reaches the desired contact. Upon the third dialing movement the relays M, N, etc. are operated in sequence to select the proper ringing current.

For instance, if the number of the called party is 354 the calling subscriber will dial 3 in the usual manner which will interrupt the line conductors three times and cause the operation of relays A, B and C which will ground contact 19^b which is the second "tenth" contact and leads to the subscriber's station whose number is twenty. The magnet MMA will drive the wipers 13, 14, 15 and 16 to the set of contacts in which grounded contact 19^b is located where they will stop. The calling subscriber will next dial the five and the motor magnet MMA will step the wipers to the fifth set of contacts after 19^b which contacts lead to the line having the arbitrary number 35. Upon the next dialing movement the relay P will be operated to select ringing current to call the subscriber whose number is 354.

Having described in general the circuit of the apparatus used in our invention, we will next describe the operation of the same in establishing the different connections.

Assuming that the subscriber A whose line terminates in Fig. 1 desires to converse with another subscriber at the private branch exchange, he will remove his receiver from its switchhook which establishes an energizing circuit for the line relay LR of line circuit L. This circuit may be traced from battery, through the upper winding of relay LR, normal contact 32 of relay CO, conductor 2, through the closed switchhook contacts at the calling subscriber's station back over conductor 1, normal contact 33 of relay CO, and through the lower winding of relay LR to ground. The line relay LR energizes and closes its alternate contacts 29, 30 and 31. The closure of contact 29 grounds the conductor 11 and causes the motor magnet MM to operate to step the wipers 3, 4, 5 and 6 into engagement with the first set of contacts 7, 8, 9 and 10. The energizing circuit of motor magnet MM may be traced from battery, resistance R, conductor 22, motor magnet MM, normal closed contact 34, normal closed contact 36 of the off normal springs ON, conductor 37, normally closed contact 38 of sleeve relay SL, conductor 11, to ground at alternate contact 29 of relay LR. The circuit of the motor magnet MM is opened upon the first step of the wipers 3, 4, 5 and 6 due to the opening of contact 36 of the off normal springs ON which assume their alternate position upon the first movement of the wipers 3, 4, 5 and 6. The closure of alternate contact 56 of ON establishes an illuminating circuit for an off normal pilot (not shown) through the punching p'. This off normal pilot lamp remains illuminated during the time the switch is hunting the calling line and if the switch does not find the line the lamp will indicate which switch is giving the trouble.

A substitute circuit for the motor magnet MM is established if the first set of contacts 7, 8, 9 and 10 are not the contacts of the line of the calling subscriber. This circuit may be traced from battery, resistance R, motor magnet MM, closed contact 34, alternate contact 39 of the off normal springs ON, conductor 40, normal contact 41, conductor 42 to ground at normal closed contact 343 of the bridging relay BG. The contact 34 of the motor magnet MM is moved to its alternate position upon the energization of the motor magnet MM and thus opens the energizing circuit of the same which immediately releases its armature and again closes the contact 34 to establish another energizing circuit for the magnet MM to step the wipers 3, 4, 5 and 6 into engagement with the next set of contacts. The alternate opening and closing of the contact 34 causes the wipers to be stepped over the contacts 7, 8, 9 and 10 in search of the contacts of the calling line. Condenser *x* is bridged across the motor magnet MM to prevent sparking during the rapid opening and closing of the contact 34.

The instant wiper 5 engages the contact 9 associated with the calling line, a shunt circuit for the motor magnet MM is established which prevents the further operation of the motor magnet and the wipers remain in engagement with contacts 7, 8, 9 and 10 of the calling line. This shunt circuit which is also an energizing circuit for the bridging relay BG may be traced from battery through resistance R, lower winding of the relay BG, conductor 44, normal closed contact 45 of the relay BR, conductor 46, normal closed contact 47 of the sleeve relay SL, wiper 5, contact 9, to ground at alternate contact 30 of relay LR. Due to the relative resistances of MM and BG the flow of current through MM will be insufficient to energize MM and the wipers will remain in engagement with the contacts of the calling line.

Upon energizing, bridging relay BG also opens the circuit of the motor magnet MM at its contact 343 and establishes an energizing circuit for the sleeve relay SL, the revertive call control relay REV and the cut-off relay CO which circuit may be traced from battery, through the upper winding of relay SL, conductor 48, winding of relay REV, alternate closed contact 49 of relay BG, conductor 50, wiper 4, contact 8, conductor 51, through the winding of relay CO to ground. The cut-off relay CO energizes and opens its contacts 32 and 33 to deenergize relay LR which removes ground from contact 9 and starting conductor 11. The removal of ground from contact 9 allows the wipers of another finder switch of the group to pass over the line of this calling subscriber should another finder switch of the group be operated during the present connection.

The heavy marked talking conductors TC and TC' are closed at alternate contacts 52 and 53 of the bridging relay BG to extend the talking circuit through to the connector circuit. The closing of contact 54 of the relay SL opens the circuit of the off normal pilot lamp and also establishes a locking circuit for the said relay which may be traced from battery through the lower winding of the relay SL, alternate contact 54, conductor 55, to ground at alternate contact 56 of the off normal springs ON. This circuit maintains the sleeve relay SL in its energized position until the off normal springs ON are restored to normal which restoration does not take place until the wipers 3, 4, 5 and 6 have been restored to their normal position by the operation of the release relay RE. The conductor 11 is a common starting conductor and is associated with the contact 29 of all the relays LR of the group. Upon the energization of relay SL its contact 38 assumes its alternate position to extend the common starting conductor 11 through to the next finder switch of the group by way of punching *p*.

Upon the closure of alternate contacts 52 and 53 of BG an energizing circuit is established for the supervisory relay SR which circuit may be traced from battery through the lower winding of relay SR, conductor 57, alternate contact 53 of relay BG, wiper 6 and contact 10, over the subscriber's line and back through contact 7 and wiper 3, alternate contact 52 of BG, conductor 58, through the upper winding of relay SR to ground. Relay SR energizes and closes its alternate contact 59 which establishes an energizing circuit for busy relay BR. This circuit may be traced from battery, through the relay BR to ground at alternate contact 59 of relay SR. The opening of contact 47 of relay SL interrupted the original energizing circuit of the bridging relay BG but as the relay BG is slow to release a substitute circuit is closed through alternate make-before-break contact 60 of relay BR and the bridging relay BG is maintained energized by current flowing from battery, through resistance R, lower winding of relay BG, conductor 44, make-before-break contact 60 and upper winding of BG to ground.

The closing of alternate contact 61 of relay BR establishes a power starting circuit for a ringing and tone machine (not shown) which supplies ringing current, a dialing tone, a busy tone and group busy tone. This circuit can be traced from ground at alternate contact 61 of BR, conductor 161, normal contact 130 of SWB to punching PS and then through the machine. The closing of alternate contact 62 of relay BR conditions apparatus in a group busy circuit (not shown) over conductors 63 and 64.

As soon as the relay BG operates to connect the finder switch FS to the selector switch SS the calling subscriber will receive a dialing tone which informs the subscriber that the dialing may be started. This dialing tone circuit may be traced from conductor 65 which leads to the ringing tone machine and is common to the switch group, normal contact 66 of off normal relay OFA of the selector circuit, conductor 67, over the heavily marked talking conductor TC, alternate contact 53 of relay BG, wiper 6, contact 10, conductor 1 to the subscriber's receiver. Upon receiving this signal the calling subscriber will know that the apparatus is in condition for the dialing operation.

Assuming that the called subscriber's number is "432", the calling subscriber will operate the calling device *cd* to dial the number 4 and thereby interrupt the talking conductors four times in the usual manner. Upon the first interruption of the talking conductors the supervisory relay SR will restore to normal and close its normal contact 59. The relay BR will remain in its operated position due to the copper slugs which make it slow acting, thus grounding the dialing conductor DC and closing the energizing circuits for the switching relay SW, the secret dialing relay SDA and the first counting or impulse relay A. The circuit for the switching relay SW may be traced from battery through the winding of the relay SW,

normal contact 93 of SWA, to the conductor DC; the one for the secret dialing relay SDA from battery through the winding of the relay SDA through normal contact 93 to the dialing conductor DC; and the circuit for the relay A from battery through the relay A, normally closed contact 71^a of relay A, normal contacts 71^b, 71^c, 71^d, 71^e, conductor 72, normal contact 73 of SDA, normal contact 93, to the dialing conductor DC, which dialing conductor is connected to ground at normal contact 59 of relay SR through alternate contact 74 of relay BR.

Switching relay SW will open its normally closed contact 75 to prevent switching relay SWA from operating at this time and as it is slow to release will remain operated during the dialing operation. The secret dialing relay SDA will operate and open its contact 73 to prevent the operation of more than the relay A of the counting relays. If the interruption of the talking conductors is prolonged the relays A, B and even C, may operate and to prevent the operation of relays B and C at this time the secret dialing relay SDA is inserted to time the length of impulse to the counting relays. This timing of the impulse assures the desired operation of the relay A. Relay A energizes and attracts its contact 76^a to close the energizing circuit for the off normal relay OFA which may be traced from battery through the lower winding of the relay OFA, alternate contact 76^a, normal contacts 76^b, 76^c, 76^d and 76^e of the relays B, C, D and E, conductor 77 to ground at alternate contact 43 of bridging relay BG. The off normal relay OFA closes a locking circuit for itself through its upper winding and alternate contact 78 and attracts its contact 66 to disconnect the dialing tone from the talking conductors.

Upon the next interruption of the talking conductors the relay SR again deenergizes and restores its contact 59 to normal thereby again placing ground upon the dialing conductor DC and closing a circuit for the relay SDA which again regulates the length of the impulse to the second impulse relay B which circuit may be traced from battery through the winding of the relay B, alternate contact 71^a of relay A, to ground at normal contact 59 over the previously described path. The relay B attracts its armature 76^b to open the energizing circuit of the relay A which restores to normal. The relay B also closes its alternate contact 21^b thereby furnishing ground to contact 19^a as above explained. It also attracts its contact 81^b to furnish ground to the motor magnet MMA of the connector switch CS which operates over the following circuit; battery, resistance RA, conductor 24, normal contact 25 of motor magnet switching relay MSW, through the winding of the motor magnet MMA, normally closed contact 85 of MMA, normal contact 86 of MSW, conductor 82 to ground at 81^b of the relay B. The motor magnet MMA operates to step the wipers 13, 14, 15 and 16 to the first set of contacts 17, 18, 19 and 20 and also opens its contact 85 which interrupts the energizing circuit for the motor magnet MMA which accordingly restores to normal and again closes its contact 85 to form another energizing circuit for itself. Each time the motor magnet MMA is energized it steps the wipers of the switch to the next set of contacts as explained in connection with the motor magnet MM of the finder switch FS.

Upon the third interruption of the talking conductors a circuit is provided for the third impulse relay C which circuit may be traced from battery, through the winding of the relay C, alternate contact 71^b of relay B, to ground at normal contact 59 of the relay SR. The attraction of the armature 76^c opens the energizing circuit of the relay B which restores to normal and opens its contact 21^b to remove ground from the contact 19^a and restores its contact 81^b to remove ground from the circuit of the motor magnet MMA. However, the contact 81^c of relay C closes before the contact 81^b opens to supply ground to the circuit of the motor magnet MMA which continues to operate. The closing of alternate contact 21^c of relay C grounds the contact 19^b. Each of the relays A, B, C, etc. establishes a locking circuit for itself through its alternate contact 76^a, 76^b, 76^c, etc. and conductor 77 to ground at alternate contacts 43 of BG. However, each relay A, B, C, D and E opens the locking circuit for the previous relay so that all except the last relay to operate restore to normal.

Upon the fourth interruption of the talking conductor the relay D operates over a circuit traced from battery through the winding of the relay D, alternate contact 71^c of the relay C, to ground at normal contact 59 of the relay SR. The relay D closes its alternate contact 21^d to supply ground to the contact 19^c and opens its contact 76^d to open the circuit for the relay C which deenergizes and restores its contact 21^c which disconnects ground from the contact 19^b and also restores its contact 81^c which disconnects ground from the conductor 82 leading to the motor magnet MMA. The closing of contact 81^d of relay D supplies ground to the motor magnet MMA which continues to operate over the previously described circuit. As we have assumed that the number of the called party is "432" this fourth interruption is the last one and the locking circuit for the relay D will be closed which circuit may be traced from battery through the winding of the relay D, alternate contact 76^d, normal contact 76^e, and conductor 77 to ground at alternate contact 43 of BG.

As soon as the dialing is discontinued the energizing circuit of the relay SW is opened at contact 59 of SR and SW deenergizes and restores its contact 75 to normal thereby closing an energizing circuit for the switching relay SWA. The circuit may be traced from battery through the winding of the relay SWA, normal contact 75, alternate contact 79 of OFA, conductor 77, to ground at alternate contact 43 of BG. The relay SWA closes a locking circuit for itself through its alternate contact 92. The motor magnet MMA continues to operate until the wiper 15 reaches the contact 19^c which is the third "tenth" contact of the group, which was connected to ground by the closing of alternate contact 21^d of relay D. At this stage of the operations we find the connector switch contact arms resting on the thirtieth line. The sleeve conductor associated with contacts 18 is open at contact 104 of the sleeve switching relay SSR so that there is no interference with line #30 should it be in use over another circuit. When the wiper 15 reaches contact 19^c an energizing circuit for the motor magnet switching relay MSW is established; current flowing from battery, resistance RA, through the lower winding of the relay MSW, normal contact 89, wiper 15, contact 19^c, conductor 26, to ground at alternate contact 21^d. This circuit also establishes a shunt around the motor magnet MMA and this, together with the opening of normally closed contact 86, which interrupts the circuit of

the motor magnet MMA effectively stops the movement of the wipers 13, 14, 15 and 16. The closing of alternate contact 87 of the relay MSW closes an initial energizing circuit for the switching relay SWD which may be traced from battery through the winding of SWD, alternate contact 87, conductor 88, conductor 77, to ground at alternate contact 43 of BG. The relay SWD energizes over this circuit and closes a locking circuit for itself which may be traced from battery through the winding of SWD, alternate contact 108, conductor 88, conductor 77, to ground at alternate contact 43 of relay BG.

The operation of the connector switch in reality consists merely in an automatic hunting for the first digit contact which has been grounded by a selected counting relay A, B, C, D or E.

The step by step operation of the connector switch is so rapid that by the time the last first digit impulse has been registered the brushes of the connector switch are traversing the final group of the contacts so that the first digit selection is completed before the dial can possibly be operated to send the second digit impulse.

The subscriber next dials the digit 3 and thereby causes the energizing circuit of the relay SR to be interrupted three times. Upon the first interruption the relay SR restores its contact 59 to normal thereby closing the energizing circuit for the motor magnet MMA which may be traced from battery through alternate contact 25 of MSW, the winding of motor magnet MMA, alternate contact 84 of MSW, conductor 94, normal closed contact 95 of BTS, normal closed contact 96 of SLA, normal closed contact 97 of SWB, dialing conductor DC', alternate contact 93 of SWA, dialing conductor DC, alternate contact 74 of BR to ground at normal contact 59 of SR. The motor magnet MMA operates over this circuit and steps the wipers 13, 14, 15 and 16 to the next set of contacts in the bank. The slow dialing relay SDC also operates over this circuit and closes its alternate contact 98 thereby establishing an energizing circuit for the sleeve switching relay SSR which may be traced from battery through the winding of SSR, alternate contact 98 of SDC. The relay SSR closes a locking circuit for itself which may be traced from battery through the winding of SSR, alternate contact 106, conductor 88, conductor 77 to ground at alternate contact 43 of relay BG. Each time the relay SR is restored to normal the contact 59 closes an energizing circuit for the motor magnet MMA as described to step the wipers to the next set of contacts.

Upon the third interruption the wipers are caused to engage the contacts of the called line. The relay SDC being slow to release remains energized during the stepping of the wipers to the contacts of the called line, and maintains its contact 102 in its alternate position to prevent the premature operation of the secret service relay SLA.

If the called line is idle the secret service relay SLA will be operated by current flowing over the following described path, battery, winding of relay SLA, resistance RB, conductor 101, normal contact 102 of SDC which has restored to normal, alternate contact 104 of SSR, conductor 105, wiper 14, contact 18 and through the winding of a relay CO associated with the line circuit of the called subscriber's line. An energizing circuit for the busy test relay BTR through the normally closed contact 100 of relay SLA and the described energizing circuit for relay SLA is also closed, but the relay BTR being of high resistance and slow-acting does not energize at this time as the relay SLA is quick to operate and causes its contact 100 to assume its alternate position and thereby shunt the resistance RB. Should the wiper of another connector switch engage a multiple of the contact 18 here shown, the contacts will test busy and the operative connection of the second switch will not be established.

The circuit is now ready to receive the dialing of the final digit which is to select the proper ringing frequency generator which in this case is Number 2. The calling subscriber A operates his calling device *cd* which causes the restoration of the supervisory relay SR in the finder switch FS. The relay SR restores its contact 59 to normal and closes an energizing circuit for the dialing relay DR, the slow dialing relay SDB and the impulse relay M. This circuit may be traced from battery, through the windings of the relays DR and SDB, normal contact 131 of relay DSR, alternate contact 96 of SLA, dialing conductor DC^2, normal contact 97 of SWB, dialing conductor DC', alternate contact 93 of SWA, dialing conductor DC, alternate contact 74 of relay BR, to ground at normal contact 59 of supervisory relay SR. The circuit for the relay M may be traced from battery through the winding of the relay M, normal contacts *m*, *n*, *o*, *p* and *q*, conductor 132, normal contact 133 of relay DR to ground over the previously traced circuit. The dialing relay DR opens its contact 133 and thereby controls the length of the impulse sent to the impulse relays for the same purpose as explained in connection with the contact 73 of the relay SDA in the selector switch SS. The relay M closes a locking circuit for itself which may be traced from battery through the winding of the relay M, alternate contact *m'*, and normal contacts *n'*, *o'*, *p'*, *q'*, conductor 136, normal contact 137 of relay RC, conductor 138, to ground at normal contact 140 of relay SWB. An energizing circuit for the off normal relay OFB is also established. This circuit may be traced from battery through the upper winding of the relay OFB, conductor 134, alternate contact 135 of relay M to ground at normal contact 140 of SWB as just traced. The relay OFB locks up through its alternate contact 141.

As the line conductors 1 and 2 are only momentarily interrupted by the calling device the relay SR again operates thereby opening the circuit for the relay DR which accordingly restores. The second impulse caused by the interruption of the line conductors 1 and 2 again causes the relay SR to deenergize and restore its contact 59 to its normal position which again causes the energization of relay DR and also closes an energizing circuit for the relay N, traced from battery through N, alternate contact *m* over a previously traced circuit to ground at normal contact 140 of relay SWB. The relay N closes its alternate contact *n'* to form a locking circuit for itself and open the locking circuit of the relay M. The relay SR again energizes and deenergizes the relay DR and also the relay SDB which being slow to release because of its construction did not restore previously. An energizing circuit for the dial switching relay DSR is established by the closure of normal contact 142 of SDB. This circuit may be traced from battery through the winding of relay DSR, normal contact 142 of SDB, conductors 143 and 145 to ground at alternate contact 146 of the off normal relay OFB. The relay DSR opens its alternate contact 131 which will prevent any

accidental movement of the switchhook of the calling subscriber's telephone from causing any alteration of the connection as now established.

The restoration of the slow dialing relay SDB establishes an energizing circuit for the ringing relay RR which may be traced from battery through the winding of the relay RR, conductor 120, normal contact 121 of relay SWB, conductor 122, normal contact 123, conductor 124, alternate contact 125 of SLA, normal contact 126 of SDB, conductor 127, alternate contact 128 of off normal relay OFB, conductor 129, normal contact 130 of interrupter switching relay ISR to punching INT which leads to ground through an interrupter machine which causes the relay RR to be intermittently energized and deenergized. Upon each energization of the relay RR it closes its alternate contacts 111 and 112 to connect ringing current of the proper frequency from the selected generator. The circuit for the ringing current can be traced from ringing generator RG^2, alternate contact 83^2, normal contacts 83^3, 83^4 and 83^5, conductor 113, through the winding of ringing trip relay RTR, alternate contact 111 of RR, over the heavily marked conductors to wiper 13, contact 17, then through the subscriber's loop and back through contact 20, wiper 16, the heavily marked conductors, to alternate contact 112 of RR, conductor 116, alternate contact 99^2 of relay N to the return generator lead RG.

A revertive ringing tone is transmitted to the calling subscriber thereby informing the subscriber that the called party is being signalled. The circuit for this tone may be traced from terminal RT which is connected to the tone source, alternate contact 250 of relay RR and thence to the subscriber's station over the heavily marked conductor.

The circuit is arranged so that the ringing is instantly stopped upon the removal of the receiver from its switchhook at the called subscriber's station. If the receiver is removed during a ringing period an energizing circuit for the ringing trip relay RTR is established over the same circuit as that for the ringing current. This relay does not operate when the ringing current flows through its winding but it does operate when the switchhook contacts are closed to permit the flow of direct current therethrough. If the subscriber answers during the silent period an energizing circuit is established for the supervisory relay SRA. This circuit may be traced from battery through the lower winding of the relay SRA, conductor 148, normal contact 112 of relay RR over the heavy conductors, through the subscriber's station back to normal contact 111 of relay RR, conductor 149 to ground through the upper winding of the relay SRA. Regardless of which relay operates an energizing circuit is established for the switching relay SWB which is energized by current flowing from battery through the upper winding of the relay SWB to ground at either alternate contact 150 of relay SRA or alternate contact 151 of relay RTR. The relay SWB opens its normal contact 121 to interrupt the energizing circuit of the ringing relay RR which falls back if operated or remains deenergized if unoperated. A locking circuit for the relay SWB may be traced from battery through the lower winding of the relay SWB, conductor 170, alternate contact 175 of off normal springs ONA, which assume their alternate position upon the first movement of the wipers 13, 14, 15 and 16, conductor 176 to ground at alternate contact 140 of relay SWB. The locking circuit of the off normal relay OFB and frequency selector relay N is opened at contact 140 and the relays OFB and N restore to normal.

The master control ground is transferred from the control of relay BG in the finder switch FS to relay SWB at alternate contact 97 thereby placing the control of all the apparatus under the called subscriber. The power starting circuit is opened at alternate contact 180 of relay SWB thereby stopping the ringing and interrupter and tone machines should no other channel of this circuit be in use at this time. The circuit is now ready for conversation.

Upon the termination of the conversation the calling subscriber A replaces his receiver upon its switchhook thereby causing the deenergization of the supervisory relay SR which restores its contact 59 to normal thereby opening the energizing circuit for the busying relay BR which restcres its contact 60 thereby opening the energizing circuit of the bridging relay BG which also restores its contact 343 to establish an energizing circuit for the release magnet RE which circuit may be traced from battery through the winding of the relay RE, alternate contact 41 of SR, conductor 42 to ground at normal contact 343 of relay BG. Release magnet RE energizes and restores the wipers 3, 4, 5 and 6 and the off normal springs ON to their normal positions thereby making it possible for the calling subscriber to make a recall by removing his receiver and selecting another line finder switch. The sleeve relay SL remains energized over a circuit traced from battery through the lower winding of the sleeve relay SL, conductor 181, alternate contact 156 of supervisory relay SRA, conductor 157, normal contact 74 of relay BR, conductor DC, alternate contact 93 of switching relay SWA, conductor DC' to master control ground at alternate contact 97 of switching relay SWB. The relay SL remaining energized prevents the finder switch FS from picking up another call until the remaining portion of the circuit has been cleared by the called subscriber hanging up his receiver.

When the called subscriber hangs up the supervisory relay SRA restores to normal which closes an energizing circuit for the release magnet REA which circuit can be traced from battery through the winding of the release magnet REA, conductors 152 and 153, normal contact 154 of relay RCS, conductor 155, normal contact 156 of SRA, conductor 157, normal contact 74 of relay BR, conductors DC and DC' to master control ground at alternate contact 97 of switching relay SWB. The release magnet REA restores the wipers 13, 14, 15 and 16 and the off normal contacts ONA to normal. The slow dialing relay SDC is also operated over this circuit and opens its contact 102 thereby opening the sleeve conductor circuit which releases the sleeve relay SLA. The switching relay SWB which has been locked up through the off normal contacts ONA restores when the wipers have been restored to normal. The deenergization of the switching relay SWB removes master control ground to restore the release magnets RE and REA and the sleeve relay SL. All the apparatus used in establishing the connection is now in its normal position ready for a new call.

If the called subscriber does not answer the signal caused by the transmission of the ringing current to his substation after a reasonable time the calling subscriber A will replace his receiver upon the switchhock. The supervisory relay SR will restore and cause the restoration of relays

BR, BG and REV as above explained. The release magnet RE will energize to restore the wipers 3, 4, 5 and 6 and the off normal contacts ON to normal and the release magnet REA will be energized to restore the wipers 13, 14, 15 and 16 and the off normal contacts ONA to normal with the subsequent restoration of the sleeve relay SL and the secret service relay SLA and switching relay SWB which places all the apparatus in its normal condition.

If the line is busy the operation of the apparatus will be the same up to the point where the switches 13, 14, 15 and 16 engage the contacts 17, 18, 19 and 20 of the called line. If the called line is busy as a called line the secret service relay SLA of another connector switch CS will have operated in series with the cut-off relay of the line circuit of the called subscriber and closed its alternate contact 100 to shunt the resistance RB in the other switch CS. Therefore, when the contacts 13, 14, 15 and 16 of this connector switch engage the contacts of the called line the secret service relay SLA of this connected switch will not operate due to the inclusion of the resistance RB in the circuit. The busy test relay BTR will be operated by current flowing from battery through the relay BTR, normal contact 100 of SLA, conductor 101, normal contact 102 of relay SDC, alternate contact 104 of relay SSR, conductor 105, wiper 14, contact 18 to ground through the cut-off relay. The busy test relay BTR closes its alternate contact 108 to energize the busy test secondary relay BTS which closes its contact 103. The third digit is dialed as previously described which causes the operation of the dialing relay DR, slow dialing relay SBD, relays M, N, and off normal relay OFB of the frequency selecting circuit RCF. The off normal relay OFB energizes to close its alternate contact 158 to connect a distinctive busy tone to the calling subscriber's receiver. This tone may be traced from punching BT which is connected to the ringing tone machine previously mentioned through the usual reactance coil and condenser to alternate contact 158 of off normal relay OFB, normal contact 159 of relay RCS, conductor 160, alternate contact 161 of busy test secondary relay BTS, normal contact 114 of secret service relay SLA, over the heavily marked talking conductors to the calling subscriber's station. The calling subscriber will recognize this tone and replace his receiver to restore the apparatus to normal in the manner previously described. The relay BTS also opens its normal contact 95 which prevents the operation of the motor magnet MMA when the subscriber hangs up. If contact 95 was not opened the restoration of contact 59 of supervisory relay SR would cause the energization of motor magnet MMA and the stepping of the wipers 13, 14, 15 and 16 to the next set of contacts.

If the called line is busy as a calling line the sleeve relay SL of another finder switch FS will be energized through the winding of the cut-off relay CO associated with the line circuit of the called subscriber. The secret service relay SLA of the connector switch CS shown in the drawing will not operate because of the resistance RB but the busy test relay BTR will operate to connect the busy tone signal to the calling subscriber's receiver.

This system has also been arranged to handle a revertive call, that is, a subscriber may call another subscriber on the same line without calling a special number. With our system it is possible to call the regular number as listed. Assuming that Number 431 is calling Number 432, the operation is identical to that previously described for a busy line. The busy test relay BTR and the busy test secondary relay BTS operate as before described. The initial energizing circuit of the relay REV can be traced from battery through the upper winding of the sleeve relay SL, conductor 48, winding of the relay REV, alternate contact 49 of relay BG, conductor 50, wiper 4, contact 8, conductor 51 to ground through the winding of the cut-off relay CO. Another circuit may be traced from battery through the winding of the relay BTR, normal contact 100 of secret service relay SLA, battery, through the winding of the relay SLA and resistance RB to conductor 101, normal contact 102 of relay SDC, alternate contact 104 of relay SSR, conductor 105, wiper 14, contact 18 to ground through the cut-off relay CO over the multipled contacts.

The relay SLA does not operate over this circuit but the relay BTR does operate to close an energizing circuit at its alternate contact 108 for the busy test secondary relay BTS which operates to close a shunt circuit across the revertive call relay REV. This shunt circuit may be traced from normal contact 100 of SLA, alternate contact 103 of BTS, alternate contact 185 of SDB, conductor 186, normal contact 187 of relay RC, conductor 188 to one side of the relay REV. Therefore, when the connector switch contact arm 14 lands on the same line with which the line finder switch of the same circuit is connected the above described shunt circuit restores relay 5 which closes its normal contact 167 to form an energizing circuit for the revertive call relay RC. This circuit may be traced from battery, through the winding of relay RC, normal contact 192, conductor 162, alternate contact 163 of relay SDB, conductor 164, alternate contact 165 of BTS, conductor 166, to ground at normal contact 167 of REV. The secondary revertive call relay RCS is energized by battery flowing through the winding of the relay RCS to ground at alternate contact 168 of relay RC. The subscriber next dials the third digit which causes the restoration of the supervisory relay SR with the subsequent operation of the relays DR, SDB, M and OFB as in connection with the selection of the proper ringing frequency. The relay OFB is locked up through its alternate contact 141, conductor 136, alternate make-before-break contact 137, conductor 193, to ground at normal contact 150 of relay SRA. A locking circuit is established for the revertive call relay RC through make-before-break contact 192, alternate contact 144, conductor 145 to ground at alternate contact 146 of the off normal relay OFB.

The calling party having completed the dialing places his receiver on the switchhook thereby releasing the line finder switch in a manner previously described. However, the sleeve relay SL is maintained energized to hold the line finder switch busy but allows the wiper arms 3, 4, 5 and 6 to restore to their normal position. The power starting circuit for the tone machine is maintained through the conductor 260, alternate contact 261 of RCS, conductor 262, normal contact 263 of ISR, conductors 264 and 193 to ground at normal contact 150 of SRA. The instant that the contact arm 4 of the line finder switch is dis-

engaged from the contact 8 the ground is removed from the multiple contacts 8 and 18 which causes the energization of the secret service relay SLA which opens its normal contact 100 to cause the deenergization of the relay REV. The energization of the secret service relay SLA causes the closing of the talking conductors at alternate contacts 114 and 115. The restoring of the relay BG in the finder switch operates the switching relay SWB and the connector circuit over the following described circuit, current flowing from battery through the winding of the relay SWB, conductor 170, alternate contact 171 of the off normal contacts ONA, conductor 172, to normal contact 194 of BG. The contacts 43 and 194 of relay BG are so arranged that the contact 194 is closed before the master ground is removed by the opening of the contact 43. Relay SWB operates to establish the master control ground through its alternate contact 97 before the master control ground is removed by the contact 43. The switching relay SWB locks up to master control ground at alternate contact 97 over a circuit previously described. The ringing relay RR operates to connect ringing current to the called subscriber's line. The energizing circuit for the ringing relay RR may be traced from battery, conductor 120, alternate contact 121, conductor 195, alternate contact 196 of RCS, conductor 197, normal contact 123 of SRA, conductor 124, alternate contact 125 of SLA, normal contact 126 of SDB, conductor 127, alternate contact 128 of OFB, conductor 129, normal contact 130 of ISR through the punching INT which is connected to an interrupter. The ringing relay RR operates to connect ringing current to the line which current flows over a previously described path.

The called subscriber's telephone will ring but twice on a revertive call. Upon the first operation of the ringing relay RR an energizing circuit is established for the interrupter dialing relay IDR and the revertive call ringing selector relay RCA. The circuit for the relay RCA can be traced from battery through its normal contact 198, normal contact 199 of revertive call ringing selector relay RCB, normal contact 200 of relay IDR, normal contact 201 of relay ISR, conductor 202, alternate contact 203 of relay RC, conductor 204, alternate contact 125 of SLA, normal contact 126 of SDB, conductor 127, alternate contact 128 of OFB, conductor 129, normal contact 130 to the interrupter punching INT. The relay RCA closes a locking circuit for itself which may be traced from battery through its lower winding, alternate contact 205, normal contact 206 of relay RCB, conductor 207, to ground at alternate contact 146 of relay OFB. The relay IDR operates and opens its contact 200 which controls the length of the impulse to prevent the premature operation of the relay RCB. As soon as ground is removed from this circuit by the rotation of the interrupter the relay IDR restores to normal thereby closing its normal contact 200 and upon a further rotation of the interrupter a circuit is established for the relays RCB and IDR. This circuit can be traced by battery flowing through the upper winding of the relay RCB, alternate contact 198 of RCA, normal contact 199 of RCB, normal contact 200 to ground through the interrupter as previously described. The relay RCB locks up through its alternate contact 206 to ground at alternate contact 146 of relay OFB. The opening of normal contact 206 breaks the locking circuit of relay RCR which restores to normal. The closing of contact 208 of RCB closes a circuit for the interrupter switching relay ISR as soon as the relay IDR restores its contact 209. This circuit can be traced from battery through the winding of the relay ISR, normal contact 209 and alternate contact 208, conductor 207, to ground at alternate contact 146. The relay ISR operates to open its contact 130 which removes the interrupter INT thereby preventing the further operation of the ringing relay RR to connect ringing current to the called line and opens its contact 263 to disconnect ground from the power starting circuit and thereby stop the operation of the ringing and tone machine. The circuit remains in this condition until either the called or calling subscriber removes his receiver which will cause the operation of the supervisory relay SRA with the results as above described. When both receivers have been returned to their respective switchhooks the relay SRA will restore to cause the restoration of the switches to normal in the same manner as already described.

The above description covers a regular busy and revertive call to Number 432. Numbers starting with "1" operate slightly different at the first selector and connector circuits because it is not necessary to drive the connector switch to a point determined by the first selector circuit.

Assuming Number 101 as the number desired, we find the same operation of the line finder switch FS as described in connection with the call to Number 432. The first digit dialed being "1", the relays SDA, A, SW, and OFA of the selector switch SS operate. There being but one impulse only the selector relay A will operate. The slow to release switching relay SW closes its normal contact 75 to cause the energization of the switching relay SWA thereby setting up a switching circuit at the connector switch from a driving position to a stepping position. The circuit for the relay SWA can be traced from battery through the winding of the relay SWA, normal contact 75, alternate contact 79 of OFA, conductor 77, to ground at alternate contact 43 of relay BG. The relay SWA operates to close an energizing circuit for the relay SWD. The circuit for SWD can be traced from battery through the winding of SWD, normal contact 210, conductor 211, alternate contact 81a of relay A, which is locked up through its contact 212, conductor 90, alternate contact 91 of SWA, conductor 77 to ground at alternate contact 43 of relay BG. Relay SWD closes an energizing circuit for the motor magnet switching relay MSW which can be traced from battery through the resistance RA, the lower winding of the relay MSW, alternate make-before-break contact 89, to ground through the upper winding of MSW. MSW attracts its armatures 25 and 84 to prepare an energizing circuit for the motor magnet MMA. The operating of the relays SWD and MSW prepared the stepping circuit for the motor magnet MMA through dialing conductors DC2, DC' and DC. It will be noted that magnet MMA has not operated and the wipers have not moved.

The next digit dialed being "0" the wipers of the connector switch will be stepped ten steps to line number "10" as the relay SR will be deenergized and energized ten times under the control of the calling device *cd* to operate the motor magnet MMA. The selection of the ringing frequency will be the same as that described in connection with establishing the call to subscriber Number 432.

Assuming that the number of the called party

is 201 the subscriber will first dial "2" which will interrupt the talking conductors twice. The first interruption causes the operation of the relay A and the second interruption causes the operation of the relay B which closes its alternate contact 21^b to ground contact 19^a which is the first "tenth" contact in the bank. The motor magnet MMA will be operated due to the closure of alternate contact 81^b of relay B to drive the wipers 13, 14, 15 and 16 until they reach the contact 19^a at which point they will stop due to the closing of a shunt circuit around the motor magnet MMA as explained in the previous circuit connection. The subscriber wil next dial "0" which interrupts the talking conductors ten times to step the wipers 13, 14, 15 and 16 over ten sets of contacts to the second "tenth" set of contacts which will be line Number 20. The subscriber will next dial "1" to select the proper ringing frequency and the conversational circuit will be subsequently established.

While we have described our invention in certain particular embodiments, we desire that it be understood that modifications and alterations may be made and that we intend no limitations upon our invention other than those imposed by the scope of the appended claims.

Having described our invention, what we claim as new and desire to secure by United States Letters Patent is:

1. An automatic telephone system including a plurality of contacts connected to subscriber's lines, a connector switch, said contacts being arranged in groups and means including a group of counting relays for associating said connector switch with a predetermined group of said contacts.

2. A telephone system including a plurality of contacts connected to subscriber's lines, a connector switch, said contacts being arranged in groups, means including a group of counting relays for associating said connector switch with a predetermined group of said contacts and other means for connecting said connector switch to a predetermined contact of said predetermined group of contacts.

3. A telephone system including a plurality of contacts connected to subscriber's lines, a connector switch, said contacts being arranged in groups, means for operating said connector switch, a set of counting relays associated with said contacts for stopping said connector switch at a predetermined contact.

4. A telephone system including subscribers' lines, a plurality of substations on each of said lines, a plurality of contacts connected to said lines and arranged in groups, a connector switch, means for conditioning a group of said contacts, means for connecting said connector switch to a predetermined contact in said conditioned group and means for signaling one of said substations associated with said contacts.

5. A telephone system including subscribers' lines, a plurality of substations on each of said lines, a link circuit for interconnecting said lines, a switch, means including a group of counting relays for driving said switch to a predetermined line and means for signaling any one of said substations on said line.

6. A telephone system including subscribers' party lines, a link circuit for interconnecting certain of said lines, a switch, operating means for said switch, a group of counting relays controlling the operating means of said switch, a plurality of ringing generators and a second group of counting relays for selecting a predetermined generator.

7. A telephone system including a telephone exchange, subscribers' lines terminating at said exchange, a plurality of substations for each line, signals at each of said substations, means at said exchange for actuating said signals, and a group of counting relays for selecting the proper means for operating a predetermined signal.

8. A telephone system including an automatic exchange, subscribers' lines terminating at said exchange, a plurality of substations for each line, means for interconnecting any two of said substations, impulse imparting means at said substations, a group of counting relays, each succeeding relay being responsive to each succeeding impulse of said impulse imparting means, said counting relays controlling said interconnecting means, and a second group of counting relays for connecting signaling means to said interconnected substations.

9. A telephone system including an automatic exchange, subscribers' lines terminating at said exchange, a plurality of substations on each of said lines, means including a switch and a group of counting relays controlling said switch for automatically interconnecting any of said substations.

10. A telephone system including a subscriber's line, a plurality of substations on said line, means including a switch and a group of counting relays controlling said switch for interconnecting any two of said substations.

11. A telephone system including a subscriber's line, a plurality of substations on said line, means including a group of counting relays for interconnecting any two of said substations, signaling means, and a second group of counting relays for connecting said signaling means to said line.

12. A telephone system including a subscriber's line, a plurality of substations on said line, means including a group of counting relays for interconnecting any two of said substations, signaling means, a second group of counting relays for connecting said signaling means to said line, means for disconnecting said signaling means from said line after a predetermined interval.

13. A telephone system including a plurality of subscribers' lines, a plurality of stations on each of said lines, dialing means at said stations, signaling means, a group of counting relays responsive to said dialing means to interconnect any two of said stations and a second group of counting relays for connecting said signaling means to said line.

14. A telephone system including a plurality of subscribers' lines terminating at an automatic exchange, a plurality of stations on each of said lines, contacts for each of said lines arranged in groups, a switch for engaging said contacts, operating means for said switch, a group of counting relays controlling said switch operating means, a plurality of ringing generators and a second group of counting relays for selecting one of said plurality of ringing generators.

15. A telephone system including a plurality of subscribers' lines, a plurality of stations on each of said lines, a link circuit for interconnecting any two of said stations, a switch, a plurality of contacts each associated with one of said lines, means for driving said switch to a predetermined contact and then stepping said switch to a desired contact, and means for signaling one certain station on the line associated with said desired contact.

16. A telephone system including a plurality of subscribers' lines, a plurality of stations on each of said lines, a link circuit for interconnecting any two of said stations, a switch, a plurality of contacts each associated with one of said lines, means for driving said switch to a predetermined contact and then stepping said switch to a desired contact, a plurality of ringing generators, and means including a group of counting relays for selecting one of said ringing generators.

17. A telephone system including a plurality of subscribers' lines, contacts arranged in groups and connected to said subscribers' lines, a group designating contact in each group, a group of counting relays adapted to mark respective designating contacts, a switch associated with said contacts and means causing said switch to hunt for and select the marked designating contact.

18. A telephone system including a plurality of subscribers' lines, contacts arranged in groups and connected to said subscribers' lines, a group designating contact for each group, a group of counting relays, a substation sending device, means for operating said counting relays under the control of said sending device to mark a desired designating contact, a switch associated with said contacts and means causing said switch to hunt for and select the marked designating contact, and other means for stepping said switch to a desired contact in the selected group.

19. A telephone system including a plurality of contacts arranged in groups, counting relays for conditioning a group of said contacts, a switch associated with said contacts, and means for operating said switch to hunt the conditioned group of contacts.

20. A telephone system including subscribers' lines, a plurality of stations on each line, contacts arranged in groups associated with said lines, a link circuit for interconnecting any two of said lines, counting relays for conditioning a group of said contacts, and means causing said switch to hunt said conditioned group of contacts.

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