Jan. 9, 1940. G. KINER 2,186,246

COMMUNICATION SYSTEM

Filed Oct. 9, 1936 4 Sheets-Sheet 1

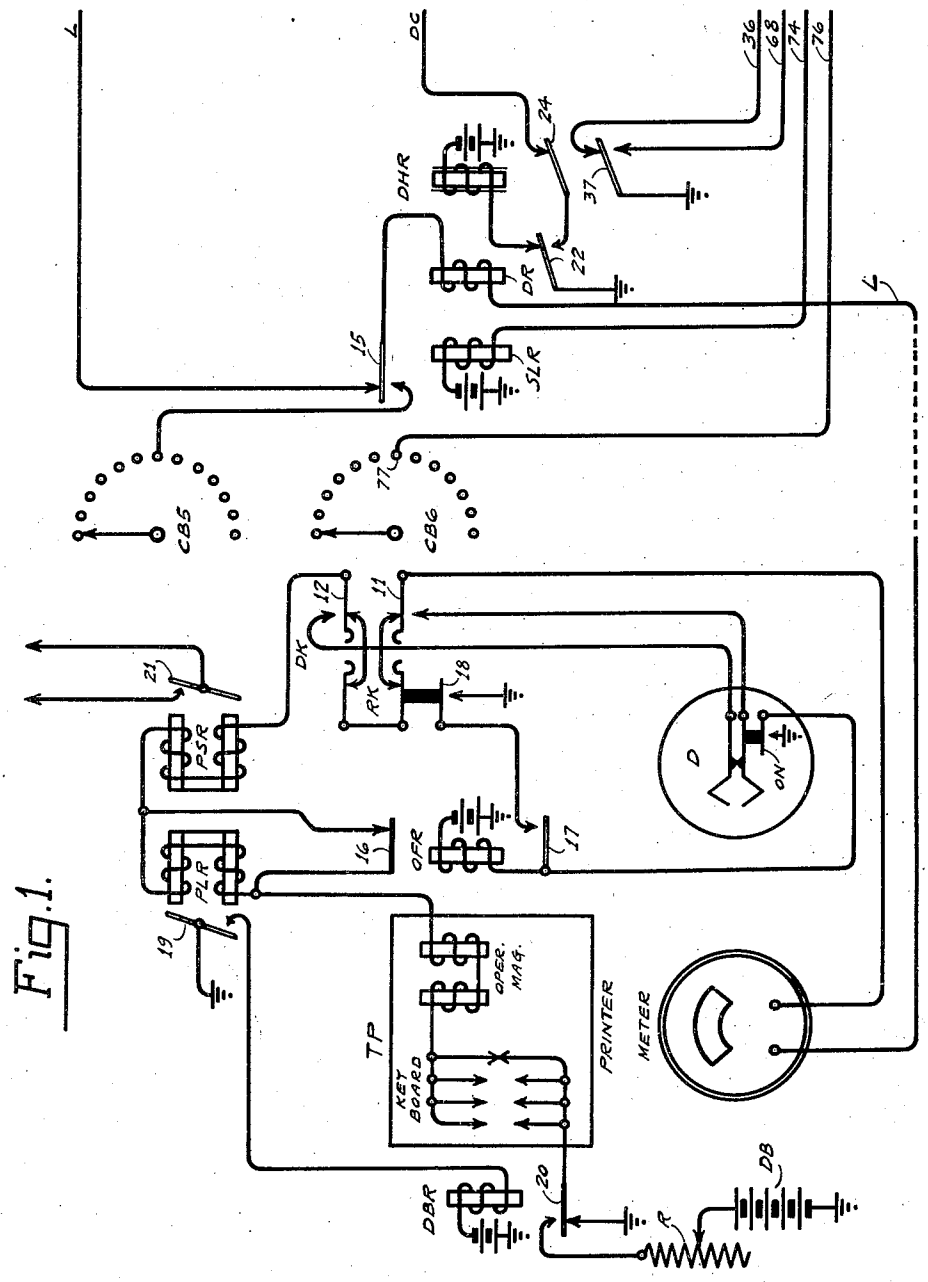

Fig. 1.

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COMMUNICATION SYSTEM

Filed Oct. 9, 1936 4 Sheets-Sheet 2

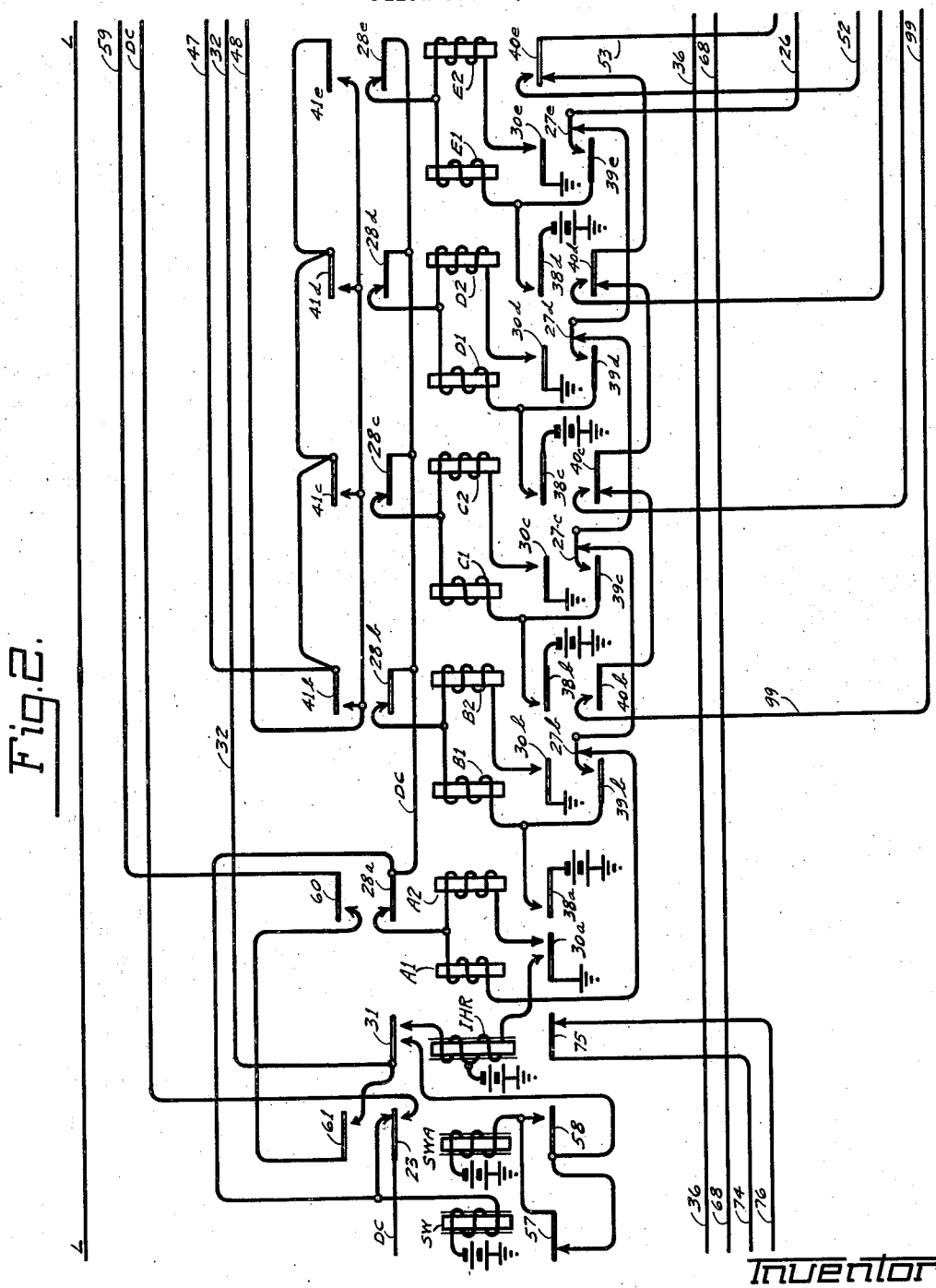

Fig.2.

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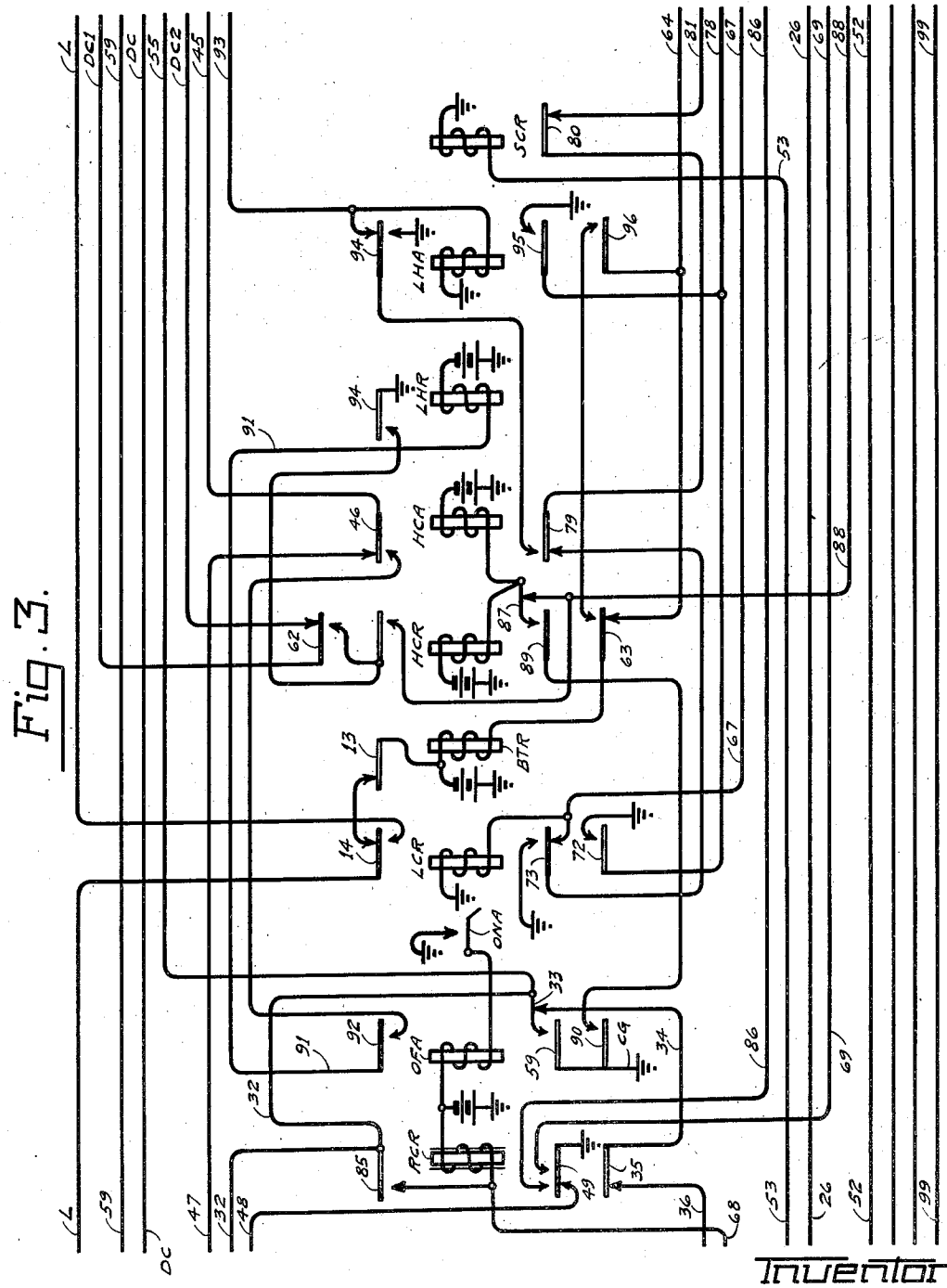

Fig. 3.

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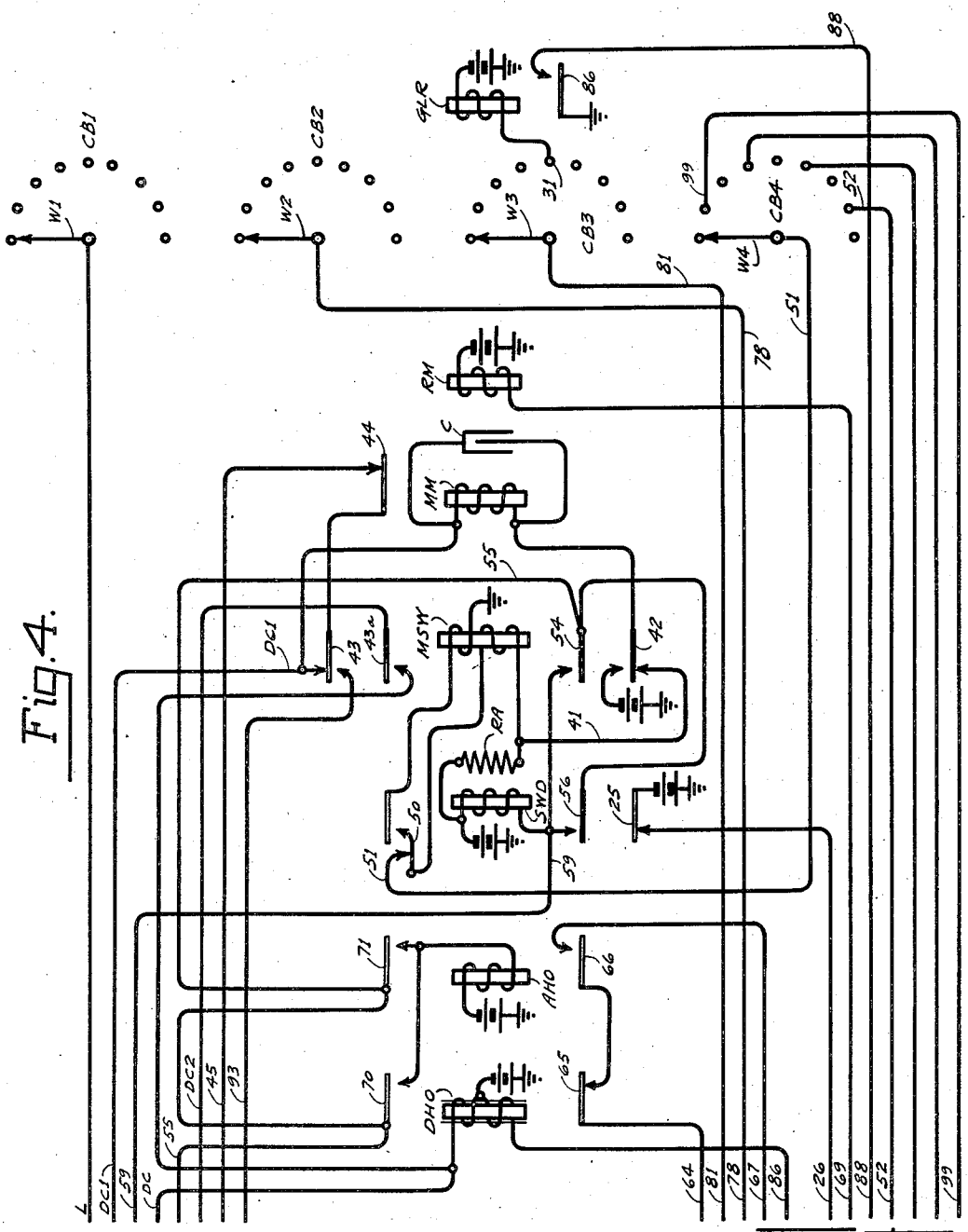

Fig. 4.

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2,186,246

UNITED STATES PATENT OFFICE

2,186,246

COMMUNICATION SYSTEM

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Application October 9, 1936, Serial No. 104,755

16 Claims. (Cl. 178—2)

My invention relates to a selector system for telegraph lines, and more particularly to that type of line used for printing telegraphs. In systems of this type it has been usual to have a plurality of printers associated with one line and means have been provided for connecting certain desired stations thereto, but my system provides means located at a central point for automatically connecting any one station to any other station.

A feature of my invention is the provision at a central point of selecting means controlled from a distant station to connect the said distant station to any other station terminating at the said central station to the exclusion of the other stations.

Another feature of my invention is the provision in the selecting means of a selector switch an electromagnetic means controlling said selector switch, whereby the selector switch can be stepped, or may be driven to a group contact and then stepped to a desired contact in the group, or may be driven to a group contact and then permitted to select any idle line in that group.

Other features will become apparent upon further perusal of the specification, and together with the features pointed out, will be explained hereinafter, reference being made to the accompanying drawings comprising Figs. 1 to 4 inclusive, which drawings, when placed from left to right in their numerical order, show a full schematic circuit arrangement of my selector system.

The present invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings 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 or 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 a group of telegraph lines extending from stations to a central station may be interconnected by the operation of a dialing means located at the respective stations. At the central station each respective telegraph line terminates in a selector of the type shown. Each selector comprises a group of impulse relays which control the movement of a rotary switch, whereby the said switch is driven to a certain group contact. In the contact bank CB4 associated with the switch every tenth or "tens" group contact is adapted to be connected to ground potential by a corresponding counting relay B2, C2, D2 or E2 of Fig. 2, these relays being operated successively when the first digit of the wanted number is dialed. Then other switching relays operate to place the selector switch under the direct control of the dialing means at the station to step the said selector switch to any desired contact in the group. Other relay means are provided to drive the selector switch to a certain group and then permit this switch to hunt for an idle line in the group.

The general operation of my system is as follows:

The operator at a station, as shown in Fig. 1, desiring to connect her station to another station associated with the central station, will operate the dial key DK and then proceed to dial the number of the desired station. The first actuation of the dial D causes the off-normal spring ON associated therewith to assume an alternate position to close an energizing circuit for the off-normal relay OFR which opens the shunt circuit around the polarized line relay PLR to permit the said relay to operate to condition the telegraph line for dialing. As the dial D returns to its normal position it interrupts the current flow over the telegraph line to dial the first digit in the well known manner. The impulse relays shown in Fig. 2 are affected by the interruption of the current flow over the line and operate to ground the "tens" contact in the contact bank associated with the selector switch, and at the same time close a self-interrupting operating circuit for the motor magnet, which causes the selector switch to be driven to ground at the "tens" contact as the impulse relays are rapidly energized and deenergized in succession, responsive to the dial impulses. The selector 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 selector 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 wipers engage the contact of the wanted subscriber's line.

If the operator at the substation does not care to be connected to any particular line in the group, but to merely any idle line in the group, other change-over means are provided which

cause the selector switch, when it stops upon a predetermined contact of such a group of lines, to hunt for an idle line in the group. In such a connection the operator will dial the number in the usual manner and the dialing of the first digit will ground the proper "tens" contact and the dialing of the second digit will step the switch wipers to the group contact at which time the change-over means operate and cause the switch to step until it locates a set of contacts leading to an idle line.

Having described in general the circuit of the apparatus used in my invention, I will next describe the detailed operation of the same in establishing the different connections. Assuming that the subscriber at station "A" in Fig. 1 desires to be connected with another subscriber, he will operate his dial key DK which closes alternate contacts 11 and 12 to place the dial D in a series connection with the line L which extends to the central office. The flow of current from the central office is normally present on this line and may be traced from battery at relay 20 of Fig. 3 through normal contacts 13 and 14, line L, normal contact 15 of relay SLR in Fig. 1, through the winding of dial relay DR, and over the line L, through the dial key DK, the winding of the polarized start relay PSR, normal contact 16 of off-normal relay OFR, and through the telegraph printer TP to ground.

Assuming that the number of the desired station is 55, the operator will dial the first digit, or "5", by operating the dial D in the usual manner. An energizing circuit for the relay OFR is closed at off-normal contacts ON of the dial D. The relay OFR closes a locking circuit for itself through its alternate contact 17 to ground at alternate contact 18 of release key RK. The relay OFR opens contact 16 which removes the shunt around the polarized line relay PLR, which will thereupon be energized by current flowing over the line in the previously described manner. The closing of alternate contact 19 of relay PLR establishes an obvious energizing circuit for the dial battery relay DBR which energizes to close alternate contact 20 to connect the dialing battery DB to the line L which reverses the flow of current in the previously described line circuit and causes the operation of the polarized start relay PSR which closes its alternate contact 21 to close a start circuit for the usual motor which is used for driving the telegraph printer.

The first interruption of the flow of current over the line by the dial D causes the dialing relay DR to deenergize and restore its contact 22 to its normal position, which places ground upon the dialing conductor DC to close an energizing circuit for the switching relay SW and the first impulse relay A1. The relay SW is operated by current flowing from grounded battery through the winding of relay SW, normal contact 23 of relay SWA, dialing conductor DC, alternate contact 24 of relay DHR, which is of the slow-to-release type and holds up even though its energizing circuit has been opened at contact 22 of relay DR, to ground at normal contact 22 of relay DR. The first impulse relay A1 is operated by current flowing from battery through the closed contact 25 of relay SWD in Fig. 4, conductor 26, closed contact 27*c* of impulse relay E1, and through the contacts 27*d*, 27*c*, 27*b*, the winding of relay A1, normal contact 28*a*, conductor 29, normal contact 23 of SWA, and the dialing conductor DC to ground at normal contact 22 of dialing relay DR. When the line L is again closed by the dial contact D, after the first interruption, the dialing relay DR energizes and opens its normal contact 22 to open the energizing circuits for the relays SW and A1, just described. The relay SW, due to its construction, is of the slow-to-release type and remains operated during this brief interruption. Relay A1, however, has closed its contact 30*a* and as soon as the contact 22 is opened, the current flows through the winding of impulse relay A2 to ground at alternate contact 30*a* of relay A1. Relay A2 operates and opens normal contact 28*a* to extend the dialing conductor DC to the next set of impulse relays. Meanwhile an obvious energizing circuit for impulse hold-over relay IHR has been closed at alternate contact 30*a* of relay A1 and said relay IHR is locked up by current flowing from grounded battery through winding of relay IHR, its alternate contact 31, conductor 32, closed contact 33 of relay 18, conductor 34, normal contact 35 of relay 17, conductor 36 to ground at alternate contact 37 of relay DHR in Fig. 1.

The restoration to normal of contact 22 of dial relay DR, due to the second interruption by the dial D, causes the energization of the second impulse relay B1 by current flowing from grounded battery through alternate contact 38*a* of relay A2, through winding of second impulse relay B1, normal contact 28*b*, over the dialing conductor DC to ground at normal contact 22 of relay DR. The relay B1 closes its alternate contact 30*b* and immediately upon the opening of contact 22 by the reenergization of the dialing relay DR, after the second impulse, the relay B2 is operated by current flowing from battery through contact 25 of relay SWD in Fig. 4, over the previously traced circuit, and through contact 27*b*, alternate contact 39*b* of relay B1, the winding of relays B1 and B2 to ground at alternate contact 30*b* of B1. The operating circuit for the impulse relays A1 and A2 was opened at contact 35*b* of relay B1 and they accordingly restored to normal. The operation of relay B2 disconnects, by the opening of contact 28*b*, the second impulse relays B1 and B2 from the dialing conductor DC and closes contact 40*b* to place ground potential upon the first "tens" contact in the contact bank CB4. This potential can be traced from ground, through the winding of relay SCR, conductor 53, normal contacts 40*e*, 40*d*, 40*c*, of the counting chain or impulse relays, alternate contact 40*b* of relay B2 and conductor 99 which leads to the first "tens" contact.

Relay B2 energizes and closes alternate contact 41*b* to establish an energizing circuit for the motor magnet MM, which is energized by current flowing from grounded battery at relay SWD in Fig. 4, through the resistance RA, conductor 41, normal contact 42, through the winding of the motor magnet MM, normal contact 43 of relay MSW, normal contact 44 of the motor magnet MM, conductor 45, normal contact 46 of hunt control switch relay HCA, conductor 47, alternate contact 41*b* of relay B2, conductor 48, normal contact 49 of relay RCR to ground. The motor magnet MM opens its contact 44 to interrupt the energizing circuit and the motor magnet MM is deenergized and steps the wipers W1, W2, W3 and W4 one step. The motor magnet MM is so constructed that it moves the wipers W1 to W4 one step each time it is deenergized. Upon its deenergization the energizing circuit is again completed at contact 44 and the motor magnet MM again energizes and deenergizes to

again step the wipers. This action is continuous until the wiper W4 engages one of the "tens" contacts which is grounded.

In the meantime, however, the third interruption of the line has been caused by the dial D and the dial relay DR has been deenergized to again ground the dialing connector DC to establish an energizing circuit for the third impulse relay C1, which relay is energized by current flowing from battery, through alternate contact 38b of the second impulse relay B2 through the winding of relay C1, normal contact 39c of relay C2, and over the dialing conductor DC to ground at normal contact 22 of relay DR. Relay C1 operates and closes alternate contact 39c to interrupt the energizing circuits of relays B1 and B2, which, accordingly, restore their contacts to normal. The opening of contact 40b removes the ground from the first "tens" contact in contact bank CB4 but the closing of contact 40c of relay C2 has placed ground potential on the next "tens" contact. The opening of contact 38b of relay B2 removes battery from the energizing circuit of relay C1, but a substitute battery has been connected thereto at contacts 39c and 27c of relay C1, and, as soon as the line L has again been closed and the relay DR again energized to remove ground from the dialing conductor DC, the relay C2 is energized by current flowing from battery at armature 25 of relay SWD over the previously traced circuit, through the contacts 27c and 39c, the windings of the relays C1 and C2 to ground at 39c. The closing of alternate contact 41c of relay C2 continues the self-interrupting energizing circuit of the motor magnet MM. This circuit is closed at contact 41c before it is opened at contact 41b of relay B2 so that the motor magnet MM continues to operate at this time. The closing of contact 40c of relay C2 extends ground to the second "tens" contact on the contact bank CB4. The respective relays are so constructed and their operation so timed that the counting relays will remove the ground from one "tens" contact and place it on the next contact before the wipers W1 etc. can possibly reach the first "tens" contact.

The fourth and fifth dialing impulses cause the operation of the counting chain relays D1 and D2 and E1 and E2 in the same manner, and the relay E2 will remain energized after the cessation of the dialing, and the fourth "tens" contact will be grounded. When the wiper W4 reaches the fourth "tens" contact, an energizing circuit is closed for the motor switching relay MSW. This relay is energized by current flowing from grounded battery through the resistance RA, through the lower winding of relay MSW, closed contact 50 of relay SWD, conductor 51, wiper W4, conductor 52, alternate contact 40e of relay E2, conductor 53, through the winding of the sleeve control relay SCR, which also energizes, to ground. Relay MSW opens normal contact 43 to interrupt the circuit for the motor magnet MM, which accordingly is prevented from further operation at this time.

The closing of alternate contact 54 of relay MSW establishes an energizing circuit for the switching relay SWD which is energized by current flowing from grounded battery through the winding of relay SWD, alternate contact 54 of MSW, conductor 55, alternate contacts 33 and 59 of relay OFA to ground. The relay SWD locks itself up through its alternate contact 56 and closes a locking circuit for the relay MSW at make-before-break contact 50. The opening of contact 25 of SWD removes the battery from the energizing circuit of relays E1 and E2 and these relays restore to normal and remove ground from the fourth "tens" contact on bank CB4, and also open the energizing circuit of relay SCR.

In the meantime, an energizing circuit for the off-normal relay OFA has been closed at the off-normal contacts ONA, which assume their alternate position upon the first movement of the wipers W1, etc. The dialing relay DR remains energized and its contact 22 is in its alternate position, and therefore, the switching relay SW, which remained energized during the dialing of the first digit, falls back and closes its normal contact 57, which causes the energization of the switching relay SWA by current flowing from grounded battery through the winding of relay SWA, normal closed contact 57 of SW, alternate contact 31 of relay IHR, conductor 32, alternate contacts 33 and 59 of the off-normal relay OFA to ground. The relay SWA locks itself up over the same circuit through its alternate contact 58 and the contact 23 of relay SWA assumes its alternate position to extend the dialing conductor DC, and thereby place the operation of the motor magnet MM directly under the control of the dial D through the contact 22 of relay DR.

The dialing of the second digit, which we assumed was 5, takes place in the following manner. The dial D is moved in the usual way to interrupt the flow of current over the line circuit five times. The dialing relay DR responds directly to these interruptions and restores its contact 22 upon each interruption of the line. Upon the first restoration to normal of contact 22 of the relay DR, an energizing circuit for the dial hold-over relay DHO is established. This relay is energized by current flowing from battery through the upper winding of relay DHO, conductor DC, alternate contact 23 of relay SWA to ground at normal contact 22 of relay DR. The closing of contact 70 of relay DHO completes an energizing circuit for the relay AHO, which may be traced from battery through the winding of relay AHO, alternate contact 70 of relay DHO, conductor 55, alternate contacts 33 and 59 of relay OFA to the common ground CG. Relay AHO locks itself up through its alternate contact 71 to the common ground CG. The relay DHO is of slow-to-release construction and remains energized during the five interruptions of the line by the dial D. Each time the contact 22 of relay DR is restored to normal, the motor magnet MM is energized and deenergized to step the wipers W1, etc. This energizing circuit can be traced from grounded battery, alternate contact 42 of MSW, the winding of motor magnet MM, dialing conductor DC1, normal contact 62 of relay HCR, dialing conductor DC2, alternate contact 43a of MSW, and dialing conductor DC to ground at alternate contact 22 of relay DR.

After the last interruption contact 22 of relay DR remains in its alternate position and removes ground from the dialing conductor DC, which causes the restoration of the relay DHO.

If the called line is idle

If the called line, the multiple contacts of which are engaged by the wipers W1 and W2, is idle, an energizing circuit for the line control relay LCR is established as soon as the relay DHO restores its contact 65. This relay is ener-

gized by current flowing from grounded battery through the winding of relay BTR, normal contact 63 of HCR, conductor 64, normal contact 65 of relay DHO, and alternate contact 66 of relay AHO, conductor 67, through the winding of relay LCR to ground. The busy test relay BTR is not operated when an idle line is engaged by the wipers W1 and W2, as the resistance of the relay LCR is too high to permit the relay BTR to energize. The line control relay LCR closes its alternate contact 72 to place ground upon the wiper W2 for the purpose of busying this line against selection by another switch. Alternate contact 73 of LCR is closed to place ground upon the wiper W3 of this switch for busying purposes.

The closing of alternate contact 14 of relay LCR disconnects the battery associated with relay BTR from the line and extends the line L to the wiper W1 associated with contact bank CB1 and over the multiple connections to the contact bank CB5 associated with the called line. The sleeve relay SLR in the called line is energized by current flowing from grounded battery through the winding of sleeve relay SLR, conductor 74, normal contact 75 of relay IHR of the called line circuit, conductor 76, contact 77 of bank CB6 and its multiple connection to the contact bank CB2, wiper W2, conductor 78 to ground at alternate contact 72 of relay LCR. The sleeve relay SLR in the called line closes alternate contact 15 to connect the station on the called line in series connection with the called station. The operator will then restore the dial key DK to disconnect the dial D from the line. The operator at the calling station "A" will operate the meter key M to connect the meter into the line and the reading on the meter will inform the operator that the called station has been selected and the line is ready for the transmission of the message. The series line connection can be traced from grounded battery DB through the resistance R, alternate contact 20 of the dial battery relay DBR, through the printer keys and operating magnets of the printer, the winding of polarized relays PLR and PSR, normally closed contacts of release key RK and dial key DK, through the meter M, line L, the winding of relay DR, normal contact 15 of relay SLR of the calling line, line L, alternate contact 14 of relay LCR, line L, wiper W1, contact bank CB1, and multiple connection, to contact bank CB5, alternate contact 15 of relay SLR of the called line, the winding of relay DR, line L, normal keys DK and RK, the winding of polarized start relay PSR, and the polarized line relay PLR, through the operating magnet and printer keys of the printer at the called station to normal contact 20 and ground. The relay PSR of the called line is operated by current flowing from battery at the calling station and closes its contact 21 to start the motor which drives the telegraph printer at the called station.

If the called line is busy

If the called line is busy, the engagement of the multiple contact associated with the called line by wiper W2 will permit the operation of the busy test relay BTR. The circuit for this relay can be traced from grounded battery through the winding of relay BTR, normal contact 63 of relay HCR, conductor 64, normal contact 65 of relay DHO, alternate contact 66 of relay AHO, conductor 67, normal contact 73 of relay LCR, normal contact 79 of relay HCA, normal contact 80 of relay SCR, conductor 81, wiper W3, multiple contacts of the bank CB3 to the wiper W3 or the previously connected line, and conductor 81, normal contacts 80 and 79, and alternate contact 73 of relay LCR of the other line, to ground. The line control relay LCR does not operate, because of the direct shunt, but the opening of contact 13 of relay BTR disconnects the battery return from the line L with the result that the polarized line relay PLR deenergizes and breaks the holding circuit of the relay DBR. The relay PSR is deenergized and opens its contact 21 to stop the driving motor of the printer TP. The dialing relay DR is deenergized and contact 22 is restored to normal, thereby opening the energizing circuit of the dialing hold relay DHR which deenergizes and closes its normal contact 37 to establish an energizing circuit for the release control relay RCR which is operated by current flowing from grounded battery through the winding of relay RCR, conductor 68 to ground at normal contact 37 of relay DHR. The release control relay RCR establishes a locking circuit for itself through its alternate contact 85, conductor 32, alternate contacts 33 and 59 of relay OFA to the control ground CG.

The closing of alternate contact 49 establishes an energizing circuit for the release magnet RM which is energized by current flowing from grounded battery through the winding of RM, conductor 69, to ground at alternate contact 49 of relay RCR. The relay DHO is also energized by current flowing from grounded battery through the lower winding of relay DHO, conductor 86 to ground at alternate contact 49 of relay RCR. Relay DHO opens contact 65 to break the original energizing circuit of the busy test relay BTR. The operation of release magnet RM causes the wipers W1 to W4 to be restored to their normal position, and as soon as they are the off-normal contacts ONA are opened to cause a deenergization of the off-normal relay OFA, which opens contact 59 to remove the control ground, which causes the deenergization of the release control relay RCR and the deenergization of relay IHR in Fig. 2 which closes contact 75 to render the line idle and permit the calling line to be connected to as a called line. Upon the restoration to normal of the dial key DK and the operation of the key M by the operator at station "A" the attendant will know that a busy line has been engaged because there will be no current flow and the reading on the meter will indicate the opening of the line. In such a case it will be necessary for the attendant at station "A" to again dial the called station at a later time.

Operation when called station is in first group

If the desired called station terminates at the central exchange in the first group of contacts on the contact bank, the dialing number for that line will have the first digit "1" and the second digit will correspond to the location of that line in the group. The operator at the calling station "A" will throw the dialing key DK to its alternate position to connect the dial D in a series connection with the line L and will thereby cause the operation of the off-normal relay OFR, polarized relay PLR and the dialing relay DBR, which connects the dial battery DB to the line, through its alternate contact 29, to cause the operation of the polarized start relay PSR. The operator next proceeds to dial the first digit, which is "1", on the dial which interrupts the energizing circuit of the dialing relay DR which

restores its contact 22 to normal to close an energizing circuit for the switching relay SW and for the relay A1, as explained in conjunction with the former line connection. The relay IHR is operated and opens contact 75 to render the selector and the calling line busy and prevent its selection by another selector as a called line. The relay IHR, of course, locks itself up to ground at alternate contact 37 of relay DHR. Immediately upon the cessation of the dialing impulse, the first impulse relays A1 and A2 are held operated through the substitute circuit previously described. The dialing relay DR is again energized and the switching relay SW accordingly restores to normal to permit the energization of the switching relay SWA which closes its alternate contact 61 to establish an energizing circuit for the switching relay SWD of Fig. 4, which is energized by current flowing from grounded battery through the winding of relay SWD, conductor 59, alternate contact 60 of relay A2, alternate contact 61 of relay SWA, and conductor 32 to ground at alternate contact 37 of relay DHR.

The relay SWD closes its alternate contact 50 to establish an energizing circuit for the magnet switching relay MSW, which circuit can be traced from battery through the resistance RA, the lower winding of relay MSW, alternate contact 50 of relay SWD, the upper winding of relay MSW to ground. The energization of relay MSW causes the closing of alternate contact 42 to place the motor magnet directly under the control of the dial at station "D". The operator at the calling station then dials the second digit, which causes the motor magnet MM to operate to step the wipers W1, etc., into connection with the contacts of the desired line, from which time the operation of this system is the same as described in the connection to line 55.

Disconnection of line

After the attendant has communicated with the called line and the connection is no longer desired, she will move the release key RK to its alternate position, thereby opening the line circuit to cause the deenergization of dial relay DR, which will open alternate contact 22 and cause the release of dialing relay DHR, which will close its normal contact 37 to cause the energization of the release control relay RCR. The release control relay RCR energizes and closes its alternate contact 49 to establish an energizing circuit for the release magnet RM, which operates to restore the wipers W1, etc. to normal, at which time the contacts ONA are opened to deenergize the off-normal relay OFA which disconnects the common ground CG and permits the restoration to normal of all the operated apparatus at the central station. The operation of the release key RK opened the locking circuit for the off-normal relay OFR, which deenergized to establish the shunt for the winding of the polarized line relay PLR which is deenergized and opens its contact 19 to cause the deenergization of the dial battery relay DBR which removes the dial battery DB from the line.

After a suitable time has elapsed the operator moves the key RK to its normal position so that the line associated therewith will be in condition for selection as a called line by another calling line.

Hunting of idle line in a desired group

In telegraph printer systems a number of lines may terminate at a single office which is equipped with a telegraph printer for each line terminating therein. Oftentimes another station may desire to be connected to a certain individual line at this office, in which case the operation of this system is the same as that described in connection with the selection of line 55. At other times the calling station may not desire to be connected to a certain individual station, but may be desirous of being connected to any line terminating at the office. Provision has been made in my system whereby these lines terminate in the contact bank in a certain group and whereby the selector switch is changed over from a driving or stepping operation to a hunting operation. When the wiper arms of the selector switch engage the first contact of this group, the control of the switch is removed from the calling line and it proceeds to hunt for the first idle line in the group.

The operation of my system in such a connection is as follows:

Let us assume that this group is the fourth "tens" or 50 group. The operation for driving the switch wipers W1, etc., to the fourth "tens" contact is the same as in the selection of line 55 previously described. Then, however, the operator will dial the second digit, which in this case is "1", and as soon as the switch wipers engage the contact associated with line 51, an energizing circuit for the group line relay GLR is completed. This circuit can be traced from grounded battery through the winding of relay GLR, wiper W3, conductor 81, normal contacts 80 and 79, normal contact 73 of relay LCR, through the winding of relay LCR to ground. The line control relay LCR is not energized by current flowing over this circuit due to the resistance of the winding of the relay LCR. The group line relay GLR closes contact 86 to establish an energizing circuit for the hunt control switching relays HCR and HCA. These relays are energized by current flowing from battery through the winding of the respective relays, normal contact 87, conductor 88 to ground at alternate contact 86 of relay GLR. The relays HCR and HCA are locked up through alternate contact 89 of relay HCR and alternate contact 90 of relay OFA to the common ground CG. Following the single interruption of the line L, the dial hold-over relay DHO deenergizes and closes contact 65, but the busy test relay BTR cannot operate at this time due to the fact that its circuit has been opened at contact 63 of relay HCR.

If the contacts of the first line engaged by the selector switch wipers are busy, they will be at ground potential and an energizing circuit for the line hunting relay LHR will be closed. This circuit can be traced from battery through the winding of relay LHR, conductor 91, alternate contact 92 of OFA, alternate contact 46 of relay HCA, conductor 45, normal contact 44 of motor magnet MM, alternate contact 43 of relay MSW, conductor 93, normal contact 94 of relay LHA, alternate contact 79 of relay HCA, normal contact 80 of relay HCR, conductor 81, wiper W3 to contact CB3 through the multiple connection to the busy selector switch, through wiper W3 of the said busy switch, its conductor 81, normal closed contacts 80 and 79 to ground at alternate contact 73 of the line control relay LCR in the busy switch or in certain instances to ground at alternate contact 95 of relay LHA. LHR energizes and at its alternate contact 94 closes an energizing circuit for the motor magnet MM,

which motor magnet is energized by current flowing from grounded battery, alternate contact 42 of relay MSW, winding of motor magnet MM, conductor DCI, alternate contact 62 of relay HCR to ground at alternate contact 94 of relay LHR. Each time the wipers engage the contacts of a busy line, the line hunting relay LHR is energized and causes the operation of the motor magnet MM. Each time the motor magnet MM is energized, it opens its contact 44 to interrupt the energizing circuit for the relay LHR, which in turn interrupts the energizing circuit for the motor magnet MM, which deenergizes and steps its wipers W1, etc.

This action takes place until the wiper W3 engages a contact leading to an idle line in the group. When this occurs there is no ground potential on the engaged contact and the shunt around the line hunting relay LHA is removed and the flow of current from the battery associated with relay LHR is through the winding of the relay LHA, which relay energizes and closes normal contact 94 to place a ground potential upon the contact bank CB3 associated with the wiper W3 to prevent the connection of another calling line to the line associated with the selector switch shown. Relay LHA closes alternate contact 95 to place a ground potential upon the wiper W2 to again busy the selector switch and the line associated therewith. The closing of alternate contact 96 of relay LHA establishes an energizing circuit for the line control relay LCR, which relay is energized by current flowing from battery through the winding of relay BTR, alternate contact 63 of relay HCR, alternate contact 96 of relay LHA, conductor 64, normal contact 65, alternate contact 66, conductor 67, through the winding of relay LCR to ground. The relay BTR, as above explained, does not operate over this circuit due to its resistance. The line control relay LCR closes its alternate contact 14 to complete the line L so as to enable the connected stations to communicate with each other. The subsequent disconnection is the same as previously described.

While I have described a preferred embodiment of my invention, it is to be understood that modifications and changes will suggest themselves to those skilled in the art. I therefore desire to be limited only by the scope and spirit of the appended claims.

Having described my invention, what I claim is new and desire to secure by United States Letters Patent is:

1. A communication system including a plurality of substations, a central office, lines joining said substations to said central office, a single level switch at said central office, wipers for said switch in which one of said lines terminates, contact terminals of the other of said lines in said switch arranged to be traversed by said wiper, said contacts being arranged in groups, means for moving said wiper to a desired group of contacts, means for directively moving said wiper to a predetermined contact in said group and means acting incident thereto for causing said wiper to automatically seek a contact of an idle line.

2. A communication system including a plurality of substations, a central office, lines joining said substations to said central office, a plurality of single level switches at said central office, one for each of said lines, contact terminals of said lines in said switches respectively, a wiper for each switch in which its respective line terminates and arranged to traverse the contacts thereof, said contacts being arranged in groups, means for moving a wiper to a desired group of contacts, means for directively moving said wiper to a predetermined contact in said group and means for thereupon causing said wiper to automatically seek a contact of an idle line.

3. A communication system including a plurality of substations, a central office, lines joining said substations to said central office, a plurality of single level switches at said central office, one for each of said lines, contact terminals of said lines in said switches respectively, a wiper for each switch in which its respective line terminates and arranged to traverse the contacts thereof, said contacts being arranged in groups, a marking contact for each group of contacts, means for placing a distinguishing potential on the marking contact of a desired group, means for moving said wiper to the marking contact having the distinguishing potential thereon, means for directively moving said wiper to a predetermined contact in said group and means for thereupon causing said wiper to automatically seek a contact of an idle line.

4. A communication system including a plurality of substations, a central office, lines joining said substations to said central office, a plurality of single level switches at said central office, one for each of said lines, contact terminals of said lines in said switches respectively, a wiper for each switch in which its respective line terminates and arranged to traverse the contacts thereof, said contacts being arranged in groups, a marking contact for each group of contacts, a series of counting relays for placing a distinguishing potential on the marking contact of a desired group of contacts, means for causing said wiper to automatically seek and select the marking contact having the distinguishing potential thereon, means for directively moving said wiper to a predetermined contact in said group and means for thereupon causing said wiper to automatically seek a contact of an idle line.

5. A communicating system including a plurality of telegraph lines, contacts arranged in groups and connected to said lines, a group designating contact in each group, a group of counting relays adapted to mark respective designating contacts, a single level wiper associated with said contacts and means causing said wiper to hunt for and select the marked designating contact, and other means under the control of said lines for stepping said wiper to a selected predetermined contact in the group and for causing said wiper to then select a contact in the group connected to an idle line.

6. A communicating system including a plurality of substations, a central station, lines extending between said substations and said central station, dialing means at each of said substations, switching means at said central station for interconnecting any two lines under the control of the said dialing means, a source of current at said exchange normally connected to said line, polarized relays at said substation not responsive to current from said source, a source of current at said substation, relays responsive to said dialing means connecting said second source of current to said line to operate said polarized relays.

7. A communicating system including a plurality of substations, a central station, lines extending from said substations to said central station, contacts at said central station arranged in groups and connected to said lines, a single level selecting wiper for each line associated with said

contacts for interconnecting any two of said lines, dialing means at the substations, counting relays at the central station responsive to the first operation of the dialing means to condition a group of said contacts, means for driving said wiper to said group of contacts, change over means for placing said operating means under the control of the subscriber's line to step said wiper to a certain selected contact in a group and relay means causing said wiper to seek a contact in said group connected to an idle line.

8. A communicating system including a plurality of subscribers' lines, dialing means on said lines, a plurality of contacts connected to said subscribers' lines and arranged in groups, a selecting wiper adapted to engage said contacts, means including a group of counting relays for associating said wiper with a predetermined group of contacts, change-over means for placing said wiper directly under the control of said dialing means to step said wiper to a certain contact in said group, and relay means associated with said contact for removing said wiper from said dial control and causing it to hunt a contact connected to an idle line.

9. A communicating system including a plurality of contacts connected to subscribers' lines, a single level selecting wiper, said contacts being arranged in groups, means for associating said selecting wiper with a predetermined group of said contacts, other means for connecting said selecting wiper to a predetermined contact of said predetermined group of contacts and third means for causing said wiper to hunt a contact connected to an idle line in the group.

10. A communicating system including a plurality of contacts connected to subscribers' lines, a single level selecting wiper, said contacts being arranged in groups, means for operating said selecting wiper, relay means associated with said contacts for stopping said selecting wiper at a predetermined contact, change-over means for placing said operating means under the control of the subscribers' line to step said wiper to a certain selected contact in a group and other means causing said wiper to select a contact associated with an idle line.

11. In a communicating system a group of subscribers' lines, a single series of contacts in which said lines terminate, said contacts being divided into groups, a contact of each group being a marking contact, a switch having a wiper arranged to traverse the contacts of said series, substation controlled means arranged to place a distinguishing potential on a desired one of said marking contacts and means for causing said wiper to hunt for the marking contact having the distinguishing potential thereon.

12. In a communicating system a group of subscribers' lines, a single series of contacts in which said lines terminate, said contacts being divided into groups, a contact of each group being a marking contact, a switch having a wiper arranged to traverse the contacts of said series, substation controlled means arranged successively to place a distinguishing potential on said marking contacts and means for causing said wiper to hunt for the last marking contact having the distinguishing potential thereon.

13. In a communicating system a group of subscribers' lines, a single series of contacts in which said lines terminate, said contacts being divided into groups, a contact of each group being a marking contact, a switch having a wiper arranged to traverse the contacts of said series, substation controlled means arranged successively to place a distinguishing potential on said marking contacts until a desired one is reached and means for causing said wiper simultaneously to hunt for the last marking contact having the distinguishing potential thereon.

14. In a communicating system a group of subscribers' lines, a single series of contacts in which said lines terminate, said contacts being divided into groups, a contact of each group being a marking contact, a switch having a wiper arranged to traverse the contacts of said series, a sending device, a series of counting relays controlled thereby arranged to place a distinguishing potential on a desired one of said marking contacts and means for causing said wiper to hunt for the marking contact having the distinguishing potential thereon.

15. In a communicating system a group of subscribers' lines, contacts in which said lines respectively terminate, said contacts being divided into groups, a contact of each group being a marking contact, a switch having a wiper arranged to traverse said contacts, substation controlled means arranged successively to place a distinguishing potential on said marking contacts and means for causing said wiper simultaneously to hunt for the last marking contact having the distinguishing potential thereon.

16. In a communicating system a group of subscribers' lines, contacts in which said lines respectively terminate, said contacts being divided into groups, there being a marking contact for each group of contacts, a switch having a wiper arranged to traverse said contacts, a sending device, a series of counting relays controlled thereby arranged successively to place a distinguishing potential on said marking contacts and means for causing said wiper simultaneously to hunt for the last marking contact having a distinguishing potential placed thereon.

GLENN KINER.