

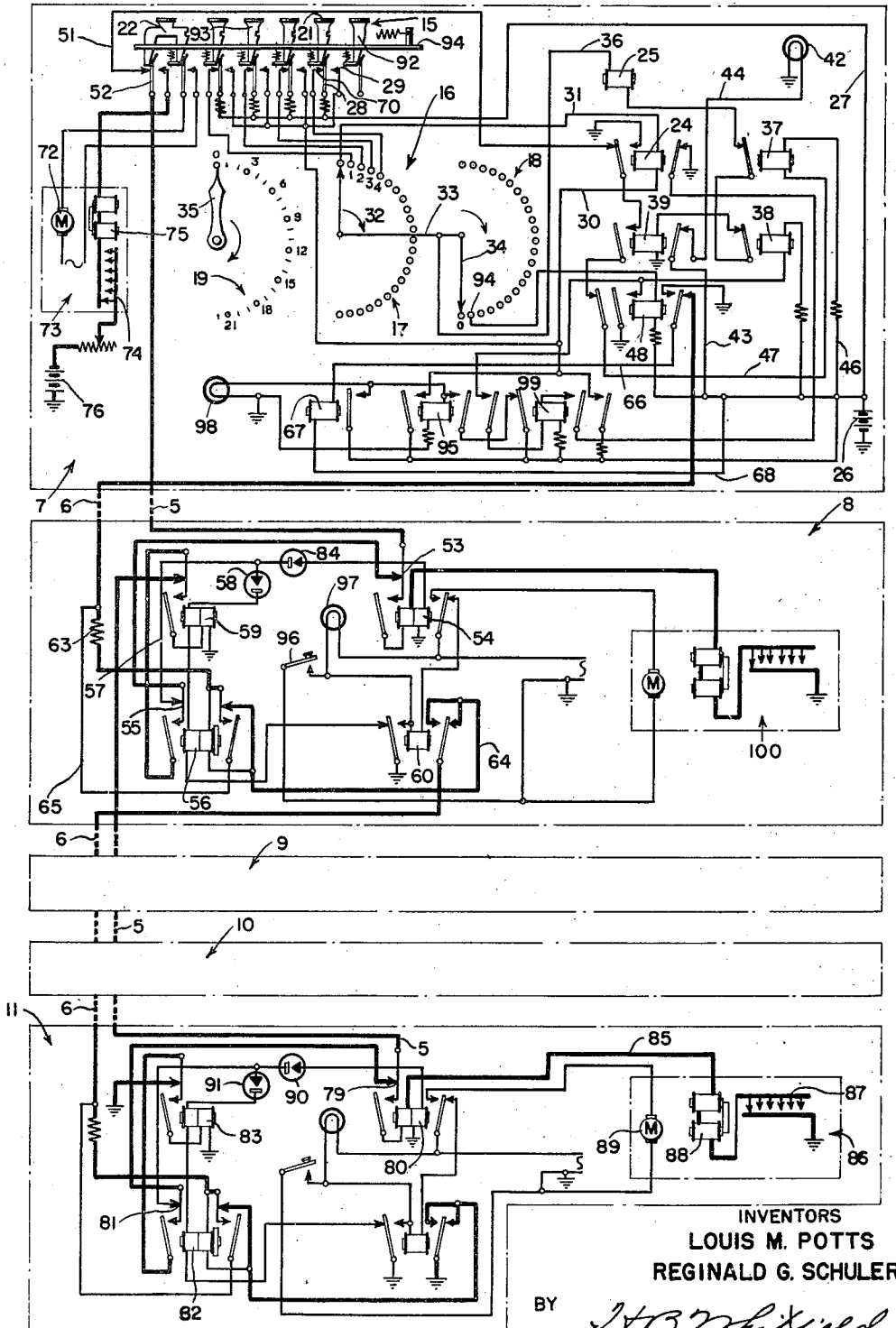
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PRINTING TELEGRAPH SYSTEM HAVING SERIALY CONNECTED, STEP-BY-STEP
AUTOMATICALLY SELECTIVE STATIONS

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PRINTING TELEGRAPH SYSTEM HAVING
SERIALLY CONNECTED, STEP-BY-STEP
AUTOMATICALLY SELECTIVE STATIONS

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This invention relates to telegraph switching systems and more particularly to such systems wherein the stations are included in a single telegraph circuit and may be selected for telegraphic communication.

The principal object of the invention is to provide a system arranged to permit a central station operator to select rapidly and automatically any station of the system, establish telegraph communication with said station, and disestablish the connection following the telegraphic communication.

Another object of the invention is the provision of simple and efficient relay selecting means at each of several remote stations responsive to conditions established by a central station operator for rendering the printing telegraph equipment thereat operative with corresponding equipment at the central station.

A feature of the system resides in the provision of a plurality of station identifying keys which, when depressed, establish a condition whereby the station identified with such key will be selected and prepared automatically for telegraphic communication and will be maintained for telegraphic communication pending further operation of the central station.

A further feature of the invention resides in the provision of a system of station selection and telegraphic communication wherein station selection and communication take place over one line conductor and maintenance of the selection during the communication is assured by conditions established over a second or companion line conductor.

The above and other objects of the invention are attained by connecting a central station with a plurality of remotely situated stations by means of a pair of line conductors on one of which impulses determined in accordance with the operation of a station identifying key are transmitted, the number being determined by the operated station key, for operating apparatus at the remote station to connect and prepare automatically the telegraph apparatus at such station for telegraphic communication. The other conductor of the pair of conductors extending from the central station to the remote stations is utilized for the purpose of maintaining the telegraphic connection established through the operation of the key identified with the desired station by establishing a condition at the selected remote station whereby the telegraphic connection cannot be disturbed except through a

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manual operation by the central station operator.

Specifically, the objects of invention are accomplished by providing at the central station a plurality of keys, one identified with each of the remote stations which are connected to the central station by a pair of line conductors extending from the central station to the remote stations and connecting said stations serially. Associated with the keys is a step-by-step switch mechanism responsive to the operation of any of the station keys for effecting transmission automatically of the number of step-by-step station selecting impulses required for the selection of the desired station, which are transmitted over one of the pair of line conductors to the remote station desired for communication where relays are operated to open the line conductor extending to the other stations located beyond the selected station and for preparing a condition for the connection to such line conductor of the printing telegraph apparatus at the selected remote station. Following the establishment of the identified condition the operator at the central station operates another key to connect the printing telegraph apparatus at the central station with the line conductor and to operate another relay which connects through its contacts the printing telegraph apparatus individual thereto and located at the selected remote station. Maintenance of the established telegraphic communication between the central station and the remote station is achieved by applying at the central station to the other conductor of the pair of conductors a battery supply which maintains the several relays at the remote station energized during the period of telegraphic communication.

The central station operator may disestablish the previously established connection with a remote station or select another station by operating one of the several keys at the central station, which establishes conditions on the line circuit for the achievement of the desired purpose.

Any of the remote stations may signal the central station, indicating that it desires to establish telegraphic communication with it. The central station operator, upon observing the operation of the calling signal, will establish a condition whereby the step-by-step impulse transmitting selector at the central station will operate to transmit a number of impulses required for the selection of the station identified with the highest number of digital impulses. The number of impulses is determined by the calling

station's position along the line conductor and the controlling circuit pulses until it encounters an open ground at a substation. If more than one station has signaled for a connection, the central station will transmit the smallest number of impulses that is required to reach the nearest substation. Following the selection of the station under these circumstances, the operator proceeds with the telegraphic communication in the manner previously outlined.

The invention may be more fully understood from the following description, when read in conjunction with the accompanying drawing, which shows a telegraph system embodying the features of the present invention.

Referring now to the drawing, there is disclosed a pair of line conductors 5 and 6 extending from a central station 7 to a plurality of remotely situated stations 8, 9, 10, and 11. As disclosed, the line conductors 5 and 6 connect the several stations 8, 9, 10, and 11 in series with the central station 7. While the drawing discloses but a single pair of line conductors 5 and 6 extending from the central station 7, it is manifest that the system may include a plurality of other pairs of line conductors 5 and 6 extending from the central station 7 and connecting therewith a plurality of different remotely situated stations in the same manner as described above.

The apparatus at the central station 7 is included in the area within the broken lines. Likewise, the several remotely situated stations 8, 9, 10, and 11 are indicated by broken lines. However, only two of the remote stations have been shown complete, but it is, of course, understood that remote stations 9 and 10 include apparatus identical with the apparatus disclosed for stations 8 and 11.

At the central station there is a bank of keys 15 including a key individual to each of the remote stations which, when depressed, establishes a condition for the transmission of the number of impulses required for the selection of the remote station identified with the depressed key. Such impulses are generated through the operation of a step-by-step selector switch 16 which includes two banks of contacts 17 and 18 and a station indicator mechanism 19. A contactor in the case of the banks of contacts 17 and 18 and a pointer in the case of the station indicator 19 are movable step by step in response to the operation of a stepping magnet; that is, for each operation of the stepping magnet the contactors and the pointer progress from their zero position step by step to a position determined by the particular key previously depressed. The impulses so generated are impressed on line conductor 5 and traverse such line conductor to the several remote stations progressively, depending upon the number of the desired station. At each of the remote stations a single pair of counting relays is operated for establishing conditions preparatory to the connection with the line conductor of the printing telegraph apparatus at such remote station. The counting relays at any station merely advance the circuit or line conductor to the next station, except when the called or calling station is reached, when stepping will stop. When this position is reached, circuit conditions are established to apprise the central station operator that the station has been selected. The central station operator then operates a print key which disassociates from one of the line conductors the step-by-step impulse generating mechanism and connects to such line conductor

the printing telegraph apparatus at the central station. Concurrently with the connection of the printing telegraph apparatus at the central station with the line conductor the polarity of the battery applied to the line conductor is changed, with the result that a relay is operated at the selected remote station for opening the line circuit and for connecting the printing telegraph apparatus at the remote station with the line conductor. Also at the central station a condition is established whereby locking battery is applied to the other conductor of the pair of line conductors for maintaining the relays at the remote station operated until the operator at the central station operates a clear-out key or operates another station key.

Assume, for example, that the central station operator desires to establish a connection with station 11, which may be designated by the number 11, in which case the operator would depress key 21 of the bank of keys 15 after making certain that key 22 of such bank of keys is in the call position or the position shown in the drawing. Of course, with the key construction disclosed, when a station key is depressed, all other keys are released with the result that key 22 automatically assumes a calling position. With the depression of key 21 positive battery is impressed on relay 24 and stepping magnet 25 over a circuit extending from grounded battery 26, conductor 27, swinger 28, and contact 29 of key 21, conductor 30, winding of relay 24, conductor 31, zero contact of bank of contacts 17, wiper 32, through a conductor 33, adjacent the shaft (not shown) on which the wipers 32 and 34 of the bank of contacts 17 and 18 and the pointer 35 of the station indicator 19 are mounted, conductor 36, winding of stepping magnet 25, left-hand armature and back contact of relay 37, left-hand armature and back contact of relay 38, and the winding of relay 39 to ground. Relay 24, stepping magnet 25, and relay 39 will be energized over the circuit just traced. With the de-energization of the stepping magnet 25, the wipers 32 and 34 and the pointer 35 will be advanced one step. With the energization of relay 39 the circuit of lamp 42 will be interrupted, which extends normally from grounded battery 26, conductor 43, right-hand armature and back contact of relay 39, conductor 44, and through the lamp 42 to ground. Consequently, with the opening of the back contact of relay 39, the circuit of the lamp 42 will be interrupted and it thereby being energized and de-energized, the wipers 32 and 34 and the pointer 35 will be advanced one step and then later step by step until the circuit, through the magnet 25, is opened. Relay 24, which may be energized only when the wiper 32 of the bank of contacts 17 is in its zero position, applies through its left-hand front contact and armature, ground to the left-hand front contact of relay 39. Consequently, when relay 39 is energized, an energizing circuit is established for relay 37 extending from grounded battery 26, conductor 45, winding of relay 37, conductor 47, extreme left-hand armature and back contact of relay 48, left-hand armature and front contact of relay 39, left-hand armature and front contact of relay 24 to ground. It is significant to note also that relay 24 in energizing opens at its left-hand back contact the circuit extending to line conductor 5 and also that with the energization of relay 37 the energizing circuit for the stepping magnet 25 is opened. With this operation the stepping magnet 25 will be de-energized.

As a result of the operations just described, the wiper 32 together with the pointer 35 are moved to their second position, in the case of wiper 32 to the position corresponding to the key of the bank of keys 15 for the remote station identified by the numeral 1. Under such circumstances relays 24 and 39 will be de-energized. Relay 39 in de-energizing again closes the circuit for lamp 42. Also, with the de-energization of relay 39 the energizing circuit for relay 37 is opened. When wiper 32 engages the first station contact of the bank of contacts 17 the energizing circuit for stepping magnet 25 and relay 39 is again completed; with the consequent result that lamp 42 will be extinguished and relay 37 will be energized over a circuit extending from grounded battery 26, conductor 46, winding of relay 37, conductor 47, extreme left-hand armature and back contact of relay 48, left-hand armature and front contact of relay 39, left-hand armature and back contact of relay 24, conductor 51, swinger 52 of key 22, line conductor 5, normally closed contact 53 of relay 54, normally closed contact 55 of relay 56, conductor 57, positive current rectifier 58, left-hand winding of relay 59, left-hand winding of relay 56, back contact and left-hand armature of relay 60 to ground. Relays 56 and 59 are energized over the circuit just traced in addition to the energization of relay 37 at the central station. With the energization of relay 59, the holding circuit for this relay is established through its right-hand winding and front contact to the left-hand armature and front contact of relay 56. Relay 56 in energizing, short-circuits ballast resistor 63 and establishes through its right-hand winding a locking circuit extending from ground at the last station over conductor 6 and through the several intermediate stations, right-hand back contact and armature of relay 60, conductor 64, right-hand winding of relay 56, front contact and right-hand armature of relay 56, conductor 65, conductor 6, right-hand back contact and armature of relay 48, conductor 66, winding of relay 67 at the central station, conductor 68, to grounded battery 26. Relay 59 will be released upon the energization of relay 39, since its holding circuit is broken at front contact of the left armature of relay 39.

The wiper 32 of the sequence switch 16 has completed another circuit from grounded battery through relays 39 and stepping magnet 25, contact No. 2 of contacts and the left-hand normally closed contacts of the No. 2 key of the bank of keys 15. Stepping magnet 25 and relay 39 operate as previously described. Likewise, relays at station No. 2 are energized which are similar to relays 59 and 56 at station No. 1, to complete the circuit conditions previously described as being established at station 8. This action is repeated until the wiper 32 of sequence switch 16 reaches segment No. 11 of the bank of segments 17, at which position swinger 28 will be out of engagement with contact 70, whereupon the energizing circuit for stepping magnet 25 and relay 39 will not be completed. For such operation eleven impulses for the selection of the station will be transmitted. The wiper 32 will, under such circumstances, not be further advanced for such selection. Pointer 35 will be opposite the segment numbered 11, which will indicate to the central station operator that station 11 corresponding to key 21 has been selected and has its circuits established preparatory to the connection of the printing telegraph apparatus at such station with line conductor 5.

It is significant to note that in connection with the energization and de-energization of relay 39, lamp 42 will flash, thus indicating to the operator that switch 16 is being advanced step by step to select the desired station determined by the particular key of the bank of keys 15 which has been operated. However, when lamp 42 glows continuously, the operator is apprised of the completion of the station selection.

Upon the observance of the continuous glow of the lamp 42 the operator at the central station 7 depresses the call or print key 22 to open its left-hand contact, thereby opening the circuit extending through conductor 51, and closing at its right-hand contacts two circuits. One circuit completes the operating circuit for driving motor 72 of the printing telegraph equipment 73, which includes a transmitter 74 and selector magnet 75 of a receiving printer of any well-known commercially available type. The other circuit completed through the right-hand contacts of key 22 extends from negative battery 76 through the normally closed contact of transmitter 74, receiving printer (windings of the selector magnet thereof), through the contacts of key 22 to line conductor 5 extending through the normally closed contact 53 of relay 54 at station 8, the contact of the relay corresponding to relay 54 at stations 9 and 10, contact 79 of relay 80 at station 11, contact 81 of relay 82, negative current rectifier 90, and right-hand winding of relay 80 to ground. With regard to the rectifiers associated with each of the relays 59 and 83 at stations 8 and 11, respectively, it is noted that the rectifier 58 or 91 in circuit with the left-hand winding of relays 59 and 83, respectively, is poled to pass only current of positive polarity, whereas the other rectifiers, namely 84 and 90, are poled for current of a negative polarity. Consequently, relay 83 will respond only to current of a positive polarity and relay 80 will respond only to current of a negative polarity.

The connection of negative battery 76 to line conductor 5 causes the energization at station 11 of relay 80 over the circuit previously traced. Relay 80, in energizing, closes through its left-hand armature and front contact the circuit from line conductor 5 to conductor 85 which extends to printing telegraph equipment 86, including transmitter 87 and receiving printer 88. It is noted that the left-hand winding of relay 80 is included in the circuit of line conductor 5 but the relay armature will not follow the signals impressed on the line conductor 5 through the operation of either the transmitter 74 at the central station 7 or the transmitter 87 at station 11. Contact 79 of relay 80 is also opened upon the energization of such relay, thereby to open the line circuit 5 at such point extending to the stations beyond station 11 and cause the deenergization of relay 83. Through the right-hand armature and front contact of relay 80 the power supply for driving motor 89 of the printing telegraph equipment 86 is completed.

A driving motor 72 of printing telegraph equipment 73 and the driving motor 89 of printing telegraph equipment 86 are now operating to supply power to the respective equipment. The operator at the central station 7 now operates the transmitter 74 to transmit a code combination of impulses to cause operation of the receiving printer 88 to select the function bar allocated to the bell signal. When such function bar operates, the bell associated with such printer operates to notify the operator at station 11 that the central station

desires to communicate telegraphically. Telegraphic communication may now take place between central station 7 and the remote station 11 over the line conductor 5. It would, of course, not be necessary for the operator at the central station 7 to operate the bell signal of printer 88, for it is manifest that telegraphic communication might be commenced immediately upon the completion of the connection between line conductor 5 and conductor 85 at station 11. Maintenance of the described connection is assured due to the holding current applied to the other conductor 6 which, together with line conductor 5, constitute a pair of line conductors extending from the central station 7 to the station 11 through the several intermediate stations such as 8, 9, and 10. Under locking conditions conductor 6 extends through the locking winding of the relays corresponding to relay 56 at each station.

When the communication between central station 7 and station 11 has been completed the operator at central station 7 may interrupt the established connection either through the operation of clear-out key 92 of key bank 15 or the operation of another station key such as 93 thereof which may be identified with station number 2 or station 9 of the circuit disclosed in the drawing. The operation of either clear-out key 92 or key 93 will cause through the movement of lock bar 94 of the key bank 15 the restoration of previously depressed station key 21 and key 22. Through such operation the circuit for stepping magnet 25 will be completed and the wipers 32 and 34, together with the pointer 19, will be advanced step by step in the manner previously described in connection with the selection of station 11. This step-by-step operation will continue until wiper 32 reaches the contact identified with key 93 or station 2, which in the disclosure is identified as station 9.

Assume, for example, that instead of depressing key 93 the central station operator depressed clear-out key 92. The wipers 32 and 34 will be advanced step by step until wiper 34 contacts segment 94, which is the segment just prior to the zero segment or zero position of the wipers 32 and 34. As the wipers 32 and 34 proceed to such position, all of the stepping relays at the several stations will be operated successively and all of the relays corresponding to relays 56 and 82 will be energized and locked up over a circuit including line conductor 6. When wiper 34 engages segment 94, a circuit will be completed for the energization of stepping magnet 25 and relays 39 and 48. Relay 48 operates to open at its extreme left-hand armature line conductor 5 and to open at its right-hand armature and back contact line conductor 6. Consequently, all of the energized relays corresponding to relays 56 and 82 at stations 8 and 11 will be de-energized. Relay 48, in energizing, also completes the circuit to the contacts of relay 95 and also completes an energizing circuit for relay 38 which opens at its contact, the energizing circuit for stepping magnet 25 and relay 39. With such operation the wipers 32 and 34 will be stepped an additional step or to the zero position to await the operation of a key in the key bank 15. When any one of the individual station calling keys such as key 93 and clear-out key 92 are depressed, all other keys in the bank of keys are released and the last depressed key is locked down. When key 22 is depressed it is locked depressed but does not release any other keys although it is released through

the depression of any of the other keys of the key bank.

If any one of the several outlying stations desires to communicate with the central station, the operator at the remote station depresses switch 96 to establish an energizing circuit for relay 60, which closes through its left-hand armature and front contact a holding circuit therefor, including signal lamp 97 which indicates to the operator at such station that an attempt is being made to establish a connection with the central station. Relay 60 in attracting its left-hand armature removes the ground from the windings of relays 56 and 59, with the result that these relays cannot, through the operation of the keys in the key bank 15, be energized. At the right-hand back contact of relay 60, which is opened only momentarily, the line conductor 6 is opened.

When line conductor 6 is momentarily opened at its back contact, relay 67 at the central station is de-energized, applying battery to the winding of relay 95 which is energized and which is locked up over a circuit extending from grounded battery 26, left-hand armature and back contact of relay 99, inner right-hand armature and front contact of relay 95, winding of relay 95, to ground. Also, through the de-energization of relay 67, signal lamp 98 at the central station 7 will remain illuminated. Through the energization of relay 95, positive battery is now applied to the zero contact of the bank of contacts 17 with the result that stepping magnet 25 and relays 24, 39, and 37 will be energized. Under such circumstances the wipers 32 and 34 and the pointer 35 will be advanced one step in a manner previously described; that is, assuming that the wiper 32 was on its zero segment. However, should the wiper 32 not be on the zero segment and it is required to rotate through the zero position to reach the selected station, the wipers 32 and 34 and the pointer 35 will be advanced step by step until the wiper 34 engages segment 94, to establish a circuit to relay 39, stepping magnet 25, and relay 48. Relay 48 will be energized, opening the circuit of line conductor 6, as previously described, and connecting ground through a contact of relay 95 to the winding of relay 99. During the time relay 48 maintains its right-hand front contact closed, a circuit for maintaining relay 67 energized is established. Relay 99 will be energized and locked to ground through a contact of relay 24 and will also open the locking circuit of relay 95 and again place positive battery from grounded battery 26 on the zero segment of the bank of contacts 17. As relay 48 operated, it opened the circuit extending to line conductor 5, rendering the closure of the line conductor at relay 39 ineffective, and thus precluded the application of pulsing current to line conductor 5. Such a condition prevents any false stepping of the stepping relays at any of the outlying stations. With positive battery now connected to the zero segment of the bank of segments 17, the wipers 32 and 34 and the pointer 35 will be advanced step by step through the energization and de-energization of stepping magnet 25 until wiper 32 engages an open segment corresponding to the station at which key 96 has been operated. When this occurs, lamp 42 will glow continuously and the operator at central station 7 will be apprised of the selection of the station desiring to communicate with the central station. The central station operator will now de-

press key 22 to complete the communication circuit, start the motor 72 of the printing telegraph equipment 73, and energize relay 54 to connect its associated printing telegraph equipment 100 with line conductor 5 in a manner previously described for the selection of station 11.

Upon the de-energization of relay 24 during the period wiper 32 is moving from its zero to its No. 1 contact, the locking circuit of relay 99 is opened, whereupon this relay is released. Relays 95 and 99 will remain de-energized until a subsequent break signal is received from one of the remote stations, when the cycle of operation previously described will be repeated. Of course, with the de-energization of relays 95 and 99 and the closure of line conductor 5 through the right-hand armature and back contact of relay 48, relay 67 is again energized and remains in the position shown in the drawing until the line circuit, due to the energization of relay 60 at station 8 or the relay corresponding thereto at the other stations, is energized.

While the invention has been disclosed and described as applied to particular circuits and apparatus, it is manifest that modifications are possible without departing from the spirit and scope of the invention.

What is claimed is:

1. In a telegraph system, a central station, a plurality of substations, a line conductor extending from said central station to said plurality of substations and serially connecting said central station with said substations, printing telegraph apparatus at each of said stations, a single series of counting relays with a single unit of said relays at each substation, means at the central station for generating a series of step-by-step impulses to operate the units of said relays successively comprising a plurality of segments, a contactor engaging said segments, means for advancing said contactor step-by-step to generate step-by-step impulses, and means identified with a called substation for controlling the degree of operation of said contactor whereby relays at said substations will be operated to prepare for telegraphic communication over said line conductor by said telegraphic apparatus.

2. In a telegraph system, a central station, a plurality of substations, a line conductor extending from said central station to said plurality of substations and serially connecting said central station with said substations, printing telegraph apparatus at each of said stations, a single series of counting relays with a single unit of said relays at each substation, means at the central station for generating a series of step-by-step impulses to operate the units of said relays successively comprising a plurality of segments, a contactor engaging said segments, means for advancing said contactor step-by-step to generate step-by-step impulses, means identified with a called substation for controlling the degree of operation of said contactor whereby relays at said substations will be operated to prepare for telegraphic communication, and means for connecting said telegraphic apparatus with said line conductor following the arrestment of the contactor.

3. In a telegraph system, a central station, a plurality of substations, a line conductor extending from said central station to said plurality of substations and serially connecting said central station with said substations, printing telegraph apparatus at each of said stations, a single series

of counting relays with a single unit of said relays at each substation, means at the central station for generating a series of step-by-step impulses to operate the units of said relays successively comprising a plurality of segments, a contactor engaging said segments, an electromagnetic means for advancing said contactor step by step to generate step-by-step impulses, means identified with a called substation for controlling the degree of operation of said contactor whereby relays at said substations will be operated to prepare for telegraphic communication, and means at the called substation responsive to a condition established at the central station for connecting the substation printing telegraph apparatus to the line conductor.

4. In a telegraph system, a central station, a plurality of substations, a line conductor extending from said central station to said plurality of substations and serially connecting said central station with said substations, printing telegraph apparatus at each of said stations, a single series of counting relays with a single unit of said relays at each substation, means at the central station for generating a series of step-by-step impulses to operate the units of said relays successively comprising a plurality of segments, a contactor engaging said segments, means for advancing said contactor step-by-step to generate step-by-step impulses, means identified with a called substation for controlling the degree of rotation of said contactor whereby relays at said substations will be operated to prepare for telegraphic communication, and a relay at the called substation responsive to a condition established at the central station for connecting the substation printing telegraph apparatus to the line conductor.

5. In a telegraph system, a central station, a line conductor extending from said central station to a plurality of substations and serially connecting said central station with said substations, printing telegraph apparatus at each of said stations, a single series of counting relays with a single unit of said relays at each substation, means at the central station for generating in a step-by-step manner substation selection impulses of a predetermined character to operate the units of said relays successively, means at the substations responsive to said step-by-step selection impulses for conditioning its printing telegraph apparatus for connection with said line conductor, and means at the selected substation in response to a superadded impulse of a different character from the station selection impulses for connecting the substation printing telegraph apparatus to the line conductor.

6. In a telegraph system, a central station, a line conductor extending from said central station to a plurality of substations and serially connecting said central station with said substations, printing telegraph apparatus at each of said stations, a single series of counting relays with a single unit of said relays at each substation, means at the central station for generating in a step-by-step manner substation selection impulses of a predetermined character to operate the units of said relays successively, means at the substations responsive to said step-by-step selection impulses for conditioning its printing telegraph apparatus for connection with said line conductor, and a relay at the selected substation responsive to a superadded current impulse of a character different from the im-

pulses which effected the selection of the substation for connecting the substation printing telegraph apparatus to the line conductor.

7. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at the central station for establishing printing telegraph control conditions selectively with any of said substations and for terminating the line conductor at the selected substation, and means at the substation responsive to a condition different than the condition which effected its selection for connecting the printing telegraph apparatus thereat with the line conductor.

8. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said stations, means at the central station for establishing printing telegraph control conditions selectively with any of said substations and for terminating the line conductor at the selected substation, a second line conductor extending from said central station to each of said substations, and means operative over said second line conductor for maintaining the operative connection of the printing telegraph apparatus at the substation with said other line conductor.

9. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, means at said central station for establishing printing telegraph control conditions selectively with any of said substations and for terminating the line conductor at the selected substation, means at said substations operative in response to conditions generated at the central station for extending the line conductor step-by-step from substation to substation until the called substation is selected, and means at the central station for indicating to the operator thereat when the called station has been selected.

10. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at said central station for establishing telegraphic conditions selectively with any of said substations and for terminating the line conductor at the selected substation, means at said substations operative to conditions generated at the central station for extending the line conductor step by step from substation to substation until the called substation is selected, means at the central station for indicating to the operator thereat when the called station has been selected, and means operated following the selection of the called substation for connecting the printing telegraph apparatus thereat with the line conductor.

11. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at said central station for establishing telegraphic conditions selectively with any of said substations and for terminating the line conductor at the selected substation, means at said sub-

stations operative to conditions generated at the central station for extending the line conductor step by step from substation to substation until the called substation is selected, means at the central station for indicating to the operator thereat the process of establishing a connection and when the called station has been selected, and means operated by a condition different from the station selecting conditions following the selection of the called substation for connecting the printing telegraph apparatus thereat with the line conductor.

12. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, a single series of counting relays with a single unit of said relays at each substation, means at the central station for generating a series of step-by-step impulses to operate the units of said relays successively comprising a plurality of segments, a contactor engaging said segments for generating impulses to said line conductor, means for advancing said contactor step by step, a key identified with each of the substations, and means operative under the control of an operated key for determining the degree of rotation of said contactor and for terminating the impulses impressed on said line conductor whereby the relays at the substation identified with the operated key will be operated to prepare for telegraphic communication over said line conductor by said telegraphic apparatus.

13. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each station, means at said central station for establishing printing telegraph control conditions selectively with any of said substations and for terminating the line conductor at the selected substation, means at said substations operative in response to conditions generated at the central station for extending the line conductor step by step from substation to substation until the called substation is selected, and means at each of said substations for terminating the line conductor thereat when a connection with the central station is desired and for establishing conditions whereby the means at said central station will be operated automatically to select a calling station.

14. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at said central station for generating step-by-step impulses of a predetermined polarity, means at said substations operative in response to said step-by-step impulses for extending the line conductor step by step from substation to substation until the called substation is selected, and means at the selected substation responsive to an impulse of a polarity different from the step-by-step impulses for connecting the printing telegraph apparatus thereat with said line conductor.

15. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at said central station for generating step-by-step impulses of a predetermined polarity, means at said substations operative in response

to said step-by-step impulses for extending the line conductor step by step from substation to substation until the called substation is selected, and a relay at the selected station responsive to a current impulse of a polarity different from the polarity of the step-by-step impulses for connecting the printing telegraph apparatus thereat with the line conductor.

16. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at said central station for generating step-by-step impulses of a predetermined polarity, means at said substations operative in response to said step-by-step impulses for extending the line conductor step by step from substation to substation until the called substation is selected, and a relay at the selected station responsive to a current impulse of a polarity different from the polarity of the step-by-step impulses for connecting the printing telegraph apparatus thereat with the line conductor and for terminating said line conductor at the selected substation.

17. In a telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at each of said substations, means at said central station for generating step-by-step impulses of a predetermined polarity, means at said substations operative in response to said step-by-step impulses for extending the line conductor step by step from substation to substation until the called substation is selected, a relay at the selected station responsive to a current impulse of a polarity different from the polarity of the step-by-step impulses for connecting the printing telegraph apparatus thereat with the line conductor, a second line conductor extending from said central station and connecting said substations in series therewith, and means operated over said second line conductor for maintaining the connection established through the operation of said relay with said other line conductor.

18. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at the central station, printing telegraph apparatus at each of the substations, a single series of counting relays with a single unit of said counting relays located at each remote station, means at the central station to generate a variable number of stepping impulses over said line conductor to operate the relay units at the different substations in succession, means identified with each substation, means operated through the actuation of the means identified with the substation for initiating the operation of said impulse generating means, and means controlled by said relay unit for connecting the printing telegraph apparatus at the substation with the line conductor.

19. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at the central station, printing telegraph apparatus at each of the substations, a single series of counting relays with a single unit of said counting relays located at each remote station, means at the central sta-

tion to generate a variable number of stepping impulses over said line conductor to operate the relay units at the different substations in succession, means identified with each substation, means operated through the actuation of the means identified with the substation for initiating the operation of said impulse generating means, means controlled by said relay unit for connecting the printing telegraph apparatus at the substation with the line conductor, and means for discontinuing the operation of said impulse generating means when the called station has been selected.

20. In a printing telegraph system, a central station, a plurality of remote substations, a line conductor extending from said central station and connecting said substations in series therewith, printing telegraph apparatus at the central station, printing telegraph apparatus at each of the substations, a single series of counting relays with a single unit of said counting relays located at each remote station, means at the central station to generate a variable number of stepping impulses over said line conductor to operate the relay units at the different substations in succession, a key identified with each substation, means operated through the actuation of the key identified with the substation for initiating the operation of said impulse generating means, means for discontinuing the operation of said impulse generating means when the called station has been selected as determined by the actuated key, and means controlled by the relay unit for connecting the printing telegraph apparatus at the substation with the line conductor.

21. In a printing telegraph system, a central station, a plurality of remote stations, a line conductor extending from said central station in series through said remote stations, printing telegraph apparatus at each station, automatic means at the central station to condition the line conductor from the central station to any of the remote stations for telegraphic communication, a calling key at each remote station to initiate the operation of said automatic means at the central station in response to the depression of any of said calling keys, means at the central station to indicate the station to which the line conductor is conditioned in response to the operated calling key, and means to connect the printing telegraph apparatus at the central station and the printing telegraph apparatus at the connected remote station simultaneously to the line conductor and to initiate their operation.

22. In a telegraph system, a central station, a plurality of remote stations, a line conductor extending from said central station and connecting said remote stations in series therewith, automatic control means comprising a counting chain with a single unit of said chain at each station to connect the central station to any one of the remote stations, telegraph apparatus at each of the stations, means to connect simultaneously the telegraph apparatus at the central station and at the selected station with the line conductor, and automatic means to initiate the operation of said automatic control means in response to the disconnection of the telegraph apparatus from the line conductor.

23. In a printing telegraph system, a central station, a plurality of remote stations, a line conductor extending from said central station and connecting said remote stations thereto, printing telegraph apparatus at each station, a calling key at each remote station, automatic step-by-step

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selector switch control means at the central station to connect the central station to any selected station, means to initiate the stepping of said automatic switch control means in response to the depression of any of said keys, and means to connect the printing telegraph apparatus at the central station and the printing telegraph apparatus at the connected remote station simultaneously to the line conductor and to initiate their operation.

24. In a printing telegraph system, a central station, a plurality of remote stations, a line conductor extending from said central station and connecting said remote stations thereto, printing telegraph apparatus at each station, a calling key at each remote station, automatic step-by-step selector switch control means at the central station to connect the central station to any selected station, means to initiate the stepping of said automatic switch control means in response to the depression of any of said keys, means at the central station to indicate to the operator thereat the particular remote station then connected to the line conductor, and means to connect the printing telegraph apparatus at the central station and the printing telegraph apparatus at the connected remote station simultaneously to the line conductor and to initiate their operation.

25. In a telegraph system, a central station, a plurality of remote stations, a line conductor con-

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necting said remote stations with said central station, a single series of counting relays with a single unit of said relays at each substation, switch control means at the central station effective through said counting relays to connect any of the remote stations to the line conductor, telegraph apparatus at each station, means to register calls at a plurality of stations simultaneously, means at the central station responsive to said registration to initiate the operation of said switch control means, means to connect the telegraph apparatus to the line conductor in response to the establishment of a condition at any one of the calling stations, and means responsive to the disconnection of the telegraph apparatus from the line conductor to initiate again the operation of the switch control means at the central station.

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