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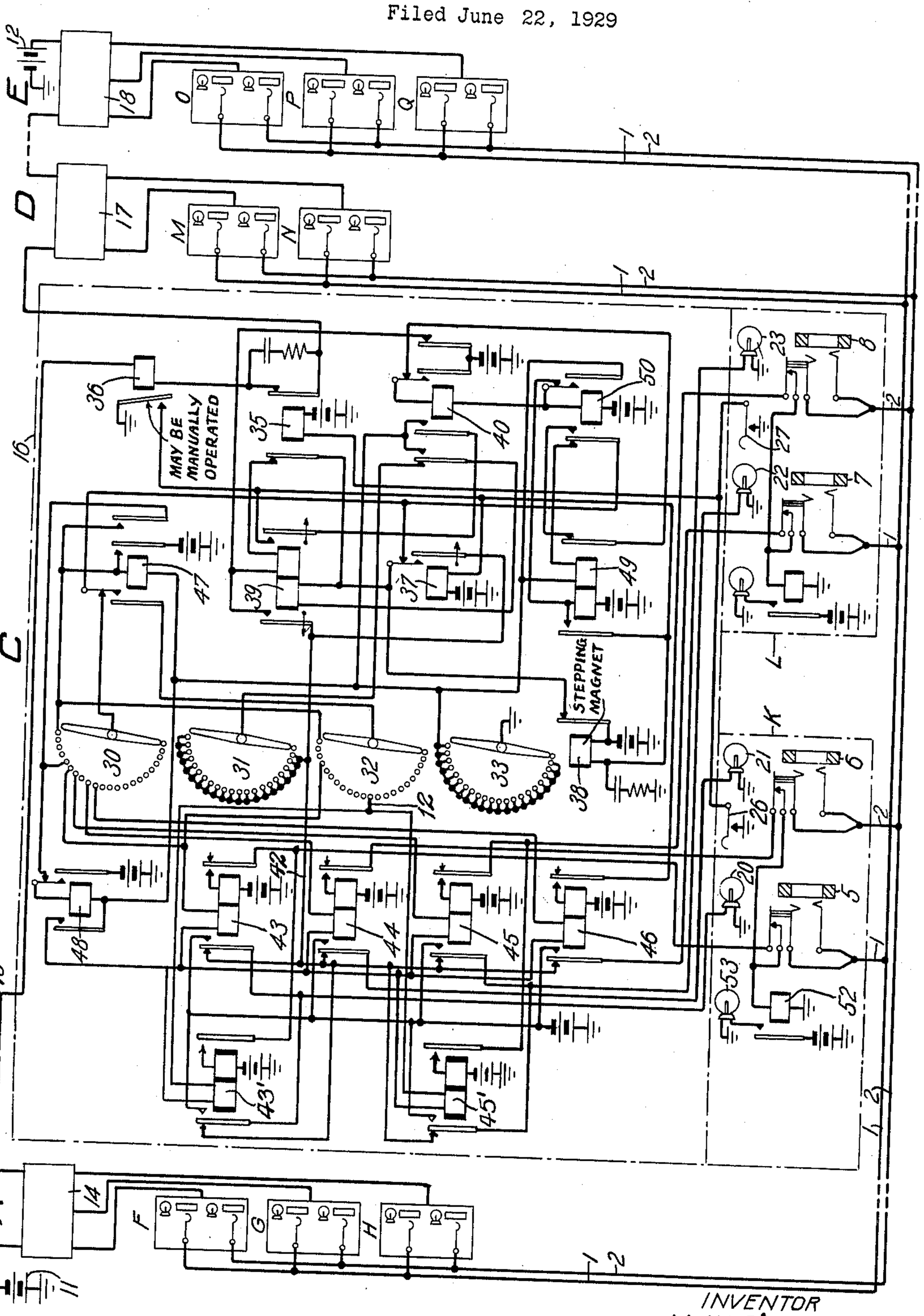

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SIGNALING SYSTEM

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This invention relates to signaling systems and particularly to selective signaling of stations.

The objects of the invention are to increase the efficiency of selective signaling systems, to increase the selective capacity, to decrease the cost of the equipment employed, and to provide for varying the number of stations selectable over a line without making expensive changes or additions.

Heretofore systems have been used in which step-by-step selectors located at different stations and connected by a single wire were selectively controlled by code impulses to cause the corresponding station to be signaled. Systems of this general kind are shown in Patents 859,473 of July 9, 1907 to J. F. Webb Jr. and 1,647,284 of November 1, 1927 to J. C. Field.

A feature of this invention is a system of this kind in which the stations are divided in groups and with a small capacity single movement step-by-step switch and associated circuit arrangement for each of said groups and connected to a common line, and in which said switches may be selectively controlled over said common line to cause any station to be signaled.

Another feature of this invention is a system whereby groups of stations in any combination may be simultaneously signaled.

Another feature of the invention is a system whereby signal lamps at all the stations are variously operated while the line is engaged in signaling a station. During the actual sending of the code impulses the lamps are lighted once for each impulse, during the pause between the series of impulses of which the code is composed the lamps are flashed at a certain other rate. After the code has been transmitted the lamps at all but the called station are flashed at still other rates until the selectors at all of the stations are returned to normal when these lamps are extinguished while the lamp at the called station is lighted with a steady light until the called operator causes it to be extinguished. These various operations of the signal lamps serve to indicate that the line is engaged and to enable the operator to follow the progress of the call.

Another feature of this invention is a system whereby the lamps at all of the stations are flashed at a certain rate when the line is accidentally or otherwise held open or thereafter closed to cause the selectors to be operated off normal. Means is provided in this connection for closing the line or restoring the selectors to normal in case the line has been held open and then closed. This may be accomplished from any station by closing, opening, and again closing the line thereat in case of an accidentally open line and opening and closing the line a second time in case of an accidental opening and closing of the line.

Another feature of the invention is a system whereby, if a selector has been operated off-normal it may be restored to normal manually, and if it is desired to actuate the selector for a complete revolution and return it to normal at any station, this may be accomplished manually at that station.

This invention has been illustrated in the accompanying drawing in connection with order wires between a plurality of exchanges.

Referring to the drawing, two order wires 1 and 2 have been shown extending from exchange A to exchange E through exchanges C and D. These order wires, which may consist of two conductors each, terminate in jacks at a number of stations or positions at each exchange. At exchange A they terminate in positions F, G and H; at exchange C, in positions K and L; in exchange D, in positions M and N; and in exchange E, in positions O, P and Q. These positions may be located in ordinary switchboards used for maintenance service such as transmission test boards, repeater boards or toll test boards. The order wires and their corresponding jacks at the various boards have been shown diagrammatically except at exchange C where the jacks 5 and 6 for lines 1 and 2 in position K and jacks 7 and 8 for lines 1 and 2 in position L have been shown in detail.

The equipment in accordance with this invention comprises a single line 10 extending through the exchanges A to E. Line 10 may be any ordinary telegraph channel connected at exchange A to the positive end of the battery 11 and at exchange E to the negative side of the battery 12. Line 10 is looped through the common equipments at each exchange which has been indicated by boxes 14, 15, 17 and 18 at exchanges A, D and E and at exchange C in complete details enclosed in box 16. The connections between these common equipments and the individual positions have been indicated diagrammatically in the case of equipments 14, 15, 17 and 18 but shown in detail between the common equipment 16 and the positions K and L. Adjacent to each jack in the positions is located a lamp such as lamps 20, 21, 22, and 23 for jacks 5, 6, 7 and 8 in positions K and L. These lamps are employed for various indicating purposes during the calling of a position as will hereinafter be described.

The calling of a particular position over this line 10 from any one of the positions at any one

of the exchanges may be accomplished by the transmission of signals through the actuation of push buttons such as 26 and 27 for positions K and L, respectively. The signals are on the two digit basis, and a code number is assigned to each position. In the case of group selection, that is, calling simultaneously a number of positions either at different exchanges or at one exchange only depending on the particular arrangement made, signals comprising two digit numbers are employed.

A description will now be made of a call from any of the exchanges A, D or E to the exchange C to call, for example, the position K and the code signal transmitted will be adapted for the calling of the jack 5 of order wire 1 by the lighting of lamp 20 associated therewith. The common equipment at each exchange includes a standard single movement step-by-step switch. At exchange C this switch has been shown having four banks with 22 terminals in each bank. These banks are numbered 30, 31, 32 and 33 respectively and associated therewith are suitable circuit arrangements and relay equipments for the actuation of the signals 20, 21, 22 and 23 at the positions K and L. The code numbers assigned for the calling of these jacks are 5—1 for jack 5, 5—4 for jack 6, 5—2 for jack 7 and 5—5 for jack 8.

Assuming now that the code number 5—1 for calling jack 5 at position K is transmitted over line 10 this transmission of code impulses may be accomplished by operating the key at any of the stations similar to key 26 or 27. The operation of such a key will cause the operation of a relay corresponding to relay 35 to interrupt the line 10 in accordance with the code. The impulses produced cause all line relays such as relay 36 at exchange C to be released in accordance with the code. On the first release of relay 36 a circuit is closed for the operation of relay 37 which is slow to release and remains operated during each series of impulses, in this case, during the transmission of five impulses. Relay 36 in releasing closes an obvious circuit for the stepping magnet 38 which is now operated a corresponding number of times for the stepping of the brushes of the switch banks a corresponding number of steps. It should be noted that on the first release of the stepping magnet 38 a circuit will be closed from battery through the armature and back contact of this magnet, armature and front contact of relay 37, lead 42 and from there through the left hand armatures and back contacts of relays 43, 44, 45 and 46 to ground through lamps 20, 21, 22 and 23 respectively. On each succeeding closure of this circuit on the release of the stepping magnet 38 the circuits for these lamps are closed, thus causing them to be flashed once for each impulse received.

At the end of the first series of impulses when relay 36 is operated relay 37 releases and a circuit is now completed from battery through the armature and back contact of stepping magnet 38, make-before-break contacts of relays 37 and 47, brush of bank 30, the fifth terminal of this bank, make-before-break contacts and winding of relay 48 to ground through the fifth terminal and brush of bank 33. This causes the operation of relay 48 which now provides a locking circuit for itself to battery through its right hand armature and front contact independent of the connection to battery through the armature and back contact of magnet 38. Another relay operating simultaneously with relay 48 is 49 over a circuit from battery, armature and back contact of magnet 38, make-before-break contact of relay 37, left hand armature and back contact of relay 50, right hand winding of relay 49, to ground at the brush of bank 33. The purpose of the operation of this relay will become apparent as the description proceeds. Relay 39 is also operated from battery at the stepping magnet 38, over a circuit through its left hand winding, outer left hand armature and back contact of relay 40, brush of bank 31, lead 42, through the lamps 20, 21, 22 and 23, to ground. These lamps are now lighted dimly as the circuit includes the resistance of the left hand winding of relay 39. When relay 39 operates, its original operating circuit is short-circuited by a circuit from battery, outer right hand armature and back contact of relay 40, left hand armature and front contact of relay 39 to lead 42. This latter circuit will now cause the lamps to light brightly and relay 39 to release. Relay 39 is therefore alternately operated and released and the lamps alternately lighted dimly and brightly. These operations will continue until the impulses of the second digit are transmitted. It should be noted that this so-called "quivering" of the lamps at the various boards in this exchange will also take place in the case of the lamps at the various boards in the other exchanges. That is, relays corresponding to relay 39 will be alternately operated and released in the same manner. This "quivering" of the lamps at the various boards indicates the pause between the series impulses comprising the called signal.

The impulses of the second digit are now transmitted. The second digit in this case is one. Relay 36 will therefore be released and operated once to cause relay 37 to operate and magnet 38 to step the brushes of the banks one step. It should be noted that when relay 37 is operated, the circuit for relay 49 is opened, but this relay will now be held operated from battery, through its left hand winding and armature and front contact to ground at the armature and back contact of relay 36. When relay 36 is operated, relays 49 and 37 will release. If the second digit had comprised more than one impulse, relay 49 would nevertheless have been released at the end of the first impulse for purposes as will be hereinafter described. Relay 50 is also operated upon the release of relay 36 over a circuit, from battery, through the winding of this relay and its make-before-break contact, left hand armature and front contact of relay 49, to ground at relay 36. Relay 50 provides a locking circuit for itself through its right hand armature and front contact to ground at the brushes of bank 33. As magnet 38 steps the brushes of the bank, in accordance with the second digit the lamps at the boards in the various exchanges will flash accordingly in the same manner as during the sending of the impulses of the first digit. In this case, of course, the lamps will merely flash once.

Upon the release of relay 37 a circuit will be completed for relay 43 as follows: battery at magnet 38, make-before-break contacts of relay 37, make-before-break contacts of relay 47, brush of bank 30 and the sixth terminal, left hand winding of relay 43, left hand armature and front contact of relay 48, to ground at the sixth terminal and brush of bank 33. Relay 43 in operating provides a locking circuit for itself through its right hand winding and armature and front contact to ground, through the closed contacts of jack 5 and winding of relay 52 in board K. Relay

52 operates in this circuit and lights a lamp 53, which is common to all the jacks in board K and indicates when lighted that a call is being made in this board. It should be observed that relay 43 in operating closes a circuit for the lighting of lamp 20 steadily from battery, through the left hand armature and front contact of this relay, to ground through the lamp 20. Lamp 20 is associated with jack 5 and the steady lighting of this lamp indicates to the operator at board K that a connection is desired over the line 1 associated with jack 5.

Relay 39 as well as all relays corresponding to relay 39 at all other exchanges will now be alternately operated and released in the same manner as hereinbefore described to cause all lamps at the various boards to "quiver" to indicate that the line is still occupied in calling a station. The release of relays 37 and 49 and operation of relay 50 now causes a circuit to be completed for the operation of relay 40 as follows: from battery at magnet 38, make-before-break contacts of relay 37, left hand armature and front contact of relay 50, right hand armature and back contact of relay 49, make-before-break contacts of relay 40, winding of this relay, right hand armature and front contact of relay 50 to ground at the brush of bank 33. Relay 40 provides a locking circuit for itself from battery, through its inner right hand armature and front contact to ground at the brush of bank 33. As all the relays corresponding to relay 40 at the other exchanges will also be operated in a similar manner, the switches at all the exchanges will now be returned to normal. The circuit for operating magnet 38 may be traced from battery, winding of this magnet, right hand armature and front contact of relay 39, as this relay will continue to be alternately operated and released as hereinbefore described, inner left hand armature and front contact of relay 40 to ground at the brush of bank 33. Magnet 38 will thus be alternately operated and released in unison with the operation and release of relay 39. In this case the lamps at the various exchanges will be flashed in accordance with the stepping of the magnets. The flashing circuits for these lamps will be the same as when the lamps were operated by code impulses as relay 37 will be operated the first time relay 39 is operated over a circuit from battery, winding of relay 37, right hand armature and front contact of relay 39, inner left hand armature and front contact of relay 40, to ground at the brushes of bank 33. Relay 37 will remain operated during the pulsing of magnet 38 and thus cause the lamps to flash each time magnet 38 is released over a circuit from battery, through the armature and back contact of this magnet, armature and front contact of relay 37 to conductor 42, and from there through contacts of relays 44, 45 and 46, through lamps 21, 22 and 23 to ground. When the switches have returned to normal, the ground supplied to the brush of bank 33 will be removed and relays 50, 40, 37 and 48 will be released and relay 39 prevented from further operation. The lamps at the various exchanges will thus be extinguished to indicate that the line 10 is available for use in calling other stations.

When the operator at board K notices the lamps 20 and 53 lighted, she will insert the plug of the calling cord into jack 5 and communicate with the operator at the calling board for the transaction of whatever business is required in connection with the maintenance of the service. The insertion of the plug in jack 5 opens the connection for relays 52 and 43 and thus causes these relays to release and extinguish lamps 53 and 20.

A description will now be made of the arrangement whereby the operators at a plurality of boards at various exchanges may be called simultaneously. By calling a certain code number lamps at these boards will be simultaneously lighted. This code number has been assumed to be 1—3. When the first digit is sent, the brushes will therefore come to rest on the first terminal. Relay 47 will now operate on the release of relay 37 over a circuit as follows: battery at magnet 38, make-before-break contact of relay 37, make-before-break contact of relay 47, brush of bank 30 and first terminal, winding of relay 47, to ground at the brush of bank 33. Relay 47 in operating provides a locking circuit for itself from battery, through its inner right hand armature and front contact, to ground at bank 33. Relay 47 in operating closes a circuit for the operation of relay 48 as follows: battery, inner right hand armature and front contact of relay 47, outer right hand armature and front contact of this relay, make-before-break contacts of relay 48 and its winding to ground at the brush of bank 33. Relay 48 locks up as hereinbefore described.

When the second digit is sent the relays, for controlling the lamps at the various boards in the group to be selected, will be selected for operation through the connections in bank 32 and the corresponding banks at other exchanges from the second terminals thereof. Therefore, when the second digit is transmitted, the brushes will be moved another three steps and in this case all the relays in the group of boards to be selected will be operated over a circuit as follows: for example, in exchange C, relay 43 will be operated over a circuit from battery at magnet 38, make-before-break contacts of relay 37, left hand armature and front contact of relay 47, brush of bank 32, the fourth terminal, left hand winding of relay 43, left hand armature and front contact of relay 48, to ground at the brush of bank 33. Relay 43 in operating causes lamps 53 and 20 to be lighted, and in the same manner the corresponding lamps in the other boards will be lighted. The operators at these boards will now be able to communicate with each other over call wire 1 by inserting plugs in the jacks corresponding to jack 5 at these boards. Following these operations of the selectors at the various exchanges, the selectors will be returned to normal in the same manner as hereinbefore described due to the operation of the relay 40. In case it is desirable to signal different boards or stations in the same exchange instead of boards or stations in a plurality of exchanges, it is evident that this can be accomplished by means of other terminals in bank 32 and other relays similar to relays 43 to 46 by merely having the left hand windings of such relays connected to such other terminals and dial another code number. For example, stations K and L may be signaled simultaneously by dialing the code 1—11 and relays 43′ and 45′ are provided for this purpose. These relays have their windings wired in the same manner as relays 43 and 45, respectively, except that their left hand windings are wired to terminal 12 of bank 32. If then the code 1—11 is dialed, relays 47 and 48 are actuated on the dialing of the first digit and on the dialing of the second digit the brush of bank 32 is connected with its terminal 12 and thereby closes the circuit for the operation of relays 43′ and 45′

through their left hand windings. Consequently, the signals 20 and 22 are lighted to call stations K and L simultaneously.

If the line 10 is accidentally or otherwise held open for any length of time, the lamps at the various boards will "quiver" to indicate that the line is busy. The opening of the line will release the relay 36, thus causing the operation of the magnet 38 and relay 37. A circuit will now be closed for relay 39 from battery, outer right hand armature and back contact of relay 40, right hand winding of relay 39, left hand armature and back contact of relay 35, armature and front contact of relay 37 to conductor 42 and from there through the left hand armatures and back contacts of relays 43, 44, 45 and 46 to ground through lamps 20, 21, 22 and 23. When relay 39 operates, the right hand winding of this relay is short-circuited through its left hand armature and front contact, thus causing this relay to release and again operate and release at a certain rate to cause the lamps to "quiver".

If the line is now closed the brushes of the switches of the various exchanges will be advanced to the first position and thus it will be necessary to restore them to normal condition. This is done by interrupting line 10 a second time. At the first closing of the line, relay 37 is released and relays 47, 48 and 49 are operated as hereinbefore described. At the next opening relay 50 is operated and at the next closing relay 49 is released and relay 40 is operated, as hereinbefore described. During these relay operations the lamps will continue to quiver through the operation and release of relay 39 under control of the circuits as hereinbefore described through the left hand winding of this relay. When relay 40 operates, the switches are automatically operated to return to normal position as hereinbefore described.

If the line should be accidentally or otherwise opened and closed, the switches are restored to normal in the same manner by opening and closing the line a second time.

If the switch at any one of the exchanges has been accidentally operated one step from the normal position, it may be restored to normal by manually operating the armature of relay 36 so as to stimulate the opening and closing of line 10 once. If it is decided to operate the switch at any one exchange independently, this may be done by manually operating the armature of relay 36 to close the circuit through its armature and back contact twice to simulate the two-digit code 1—1 and thus cause it to make a complete revolution.

It should be understood that, while the invention has only been illustrated in connection with one disclosure, it is not limited thereby, but may readily be applied to a plurality of other systems without departing from the spirit thereof.

What is claimed is:

1. In a signaling system, a line, groups of stations, a selector switch associated with each group of stations, means controlled over said line for actuating said switches, relays one for each station, a signal at each station, means responsive to the particular setting of a switch for actuating the relay for the corresponding station, means operative on the actuation of said relay for maintaining said relay operated independent of the original operating means controlled by the particular setting of the switch, means controlled by the actuation of said relay for actuating the corresponding signal, means for restoring said switch to normal without restoring said relay, and means thereafter operative for releasing said relay and restoring the actuated signal to normal.

2. In a signaling system, a line, groups of stations, a selector switch associated with each group of stations, means controlled over said line for actuating said switches, relays one for each station, a signal at each station, means responsive to the particular setting of a plurality of switches for simultaneously actuating a relay of each group of stations associated with each of said set switches, means for restoring said set switches to normal without restoring said actuated relays and means thereafter operative for releasing said actuated relays and restoring the actuated signals to normal.

3. In a signaling system, a line, groups of stations, signals at each station, a selector switch associated with each group of stations, means controlled over said line for actuating said switches, means controlled during the actuation of said switches for operating all of said signals, means responsive to a particular setting of a switch for operating a signal at a certain station of the group associated with said switch, and means responsive to another particular setting of said switch for operating signals at a plurality of stations in said group.

4. In a signaling system, a line, stations, a signal at each station, means responsive to impulses transmitted over said line for calling certain stations by actuating the signals thereat in a certain manner, and means for actuating the signals at all the stations in a different manner in response to said impulses during the calling of said certain stations to indicate the progress of the call.

5. In a signaling system, a line, stations, a signal at each station, means controlled by series of interruptions of current over said line for actuating the signal in a certain manner at a station for calling said station, and means for actuating the signals at all of the stations each time the current on the line is interrupted and for actuating said signals in a different manner between series of interruptions and for actuating the signals at all but the called stations in a still different manner for a short period after said station has been called.

6. In a signaling system, a line normally connected to a current supply, stations, a signal at each station, means responsive to different combinations of interruptions of the current on said line for actuating the signal in a certain manner at corresponding stations to call said stations, and means responsive to a single opening of the line for actuating the signal at all of the stations in a different manner.

7. In a signaling system, a line normally connected to a current supply, groups of stations, a selector switch associated with each group of stations, means controlled by interruptions of currents over said line for actuating said switches, a signal at each of said stations, means responsive to the particular setting of a switch for actuating the signal at a corresponding station, means responsive to the setting of switches under control of a single interruption of the current on the line for actuating the signal at all of said stations, means thereafter responsive to a second interruption of the current on the line for restoring said switches to normal, and means responsive during restoring of the switches to normal for actuating said signals at intervals.

8. In a signaling system, a line normally connected to a current supply, groups of stations,

a selector switch associated with each group of stations, a signal at each station, means controlled by interruptions of the current on the line for actuating said switches, means responsive to the particular setting of a switch for actuating the signal at a corresponding station, means responsive to the opening of the line for actuating the signals at all of said stations at intervals, means responsive to the subsequent closing of the line for actuating the switches at all of said stations, and means responsive to said actuation of said switches for actuating said signals at said stations, and means responsive to a subsequent momentary interruption of the current on the line for returning the switches to normal and restoring the signals to normal condition.

9. In a signaling system, a line normally connected to a current supply, stations, a selector switch at each station, a signal at each station, means responsive to a single interruption of the current on said line for actuating the switches at all of the stations, means responsive to said actuation of the switches for actuating the signals at said station, means responsive to a second interruption of the current on the line for restoring said switches to normal, means responsive during the restoring of the switches to normal for actuating said signals at intervals, and a manually controlled means for returning any one of said switches individually to normal.

10. In a signaling system, groups of stations, a single conductor between said groups of stations, a step-by-step switch associated with each of said groups of stations and with said conductor, a signal at each of said stations, means for controlling all of said switches simultaneously over said conductor, means responsive to the setting of any one of said switches in a particular manner for actuating the signal at a corresponding station of the group associated with said switch, means operative after the setting of the switches has been completed for restoring said switches to normal without disabling an actuated signal, and means for disabling an actuated signal.

11. In a signaling system, a line normally connected to a current supply, groups of stations, a signaling device at each station, means responsive to the interruption of the current of said line in a series of interruptions for selecting a corresponding group of stations and for the actuation of the signaling devices thereat in a certain manner, and means responsive to a single opening of the line for actuating the signaling device at all of the stations in a different manner.

12. In a signaling system, a line, groups of stations, a selector switch associated with each group of stations, means controlled over said line for actuating said switches, a signal at each of said stations, means responsive to a particular setting of a switch for actuating a signal at a particular station of the group associated with said switch, a plurality of relays for each group of stations, means responsive to another particular setting of a switch for actuating the relays for the group of stations associated with said switch, and means controlled by the actuation of said relays for actuating the signals at the corresponding stations.

13. In a signaling system, a line, groups of stations, a selector switch associated with each group of stations, means controlled over said line for actuating said switches, a signal at each of said stations, means responsive to the particular setting of a switch for actuating a signal at a particular station of the group associated with said switch, a plurality of relays for each group of stations, means responsive to another particular setting of a switch for actuating the relays for the group of stations associated with said switch, means controlled by the actuation of said relays for actuating the signals at the corresponding stations, means for restoring said set switch to normal without restoring said actuated relays, and means thereafter operative for releasing said actuated relays individually and for restoring the actuated signals to normal.

14. In a signaling system, a line, exchanges, a group of stations at each exchange, a selector switch at each exchange, means controlled over said line for actuating said switches, a plurality of signals at each station, means responsive to particular settings of a switch for selecting and actuating any one of the plurality of signals at any of the plurality of stations at the same exchange, and means responsive to a particular setting of a switch for simultaneously selecting and actuating a signal at each of a plurality of stations at the same exchange.

15. In a signaling system, a line, exchanges connected by said line, a group of stations at each exchange, signals at each station, means for transmitting series of current impulses over said line from any exchange to select any other exchange, a selector switch at each exchange, means controlled by said series of impulses for actuating said switches, means controlled during the setting of said switches for actuating said signals, means controlled between the series of impulses for actuating said signals in a different manner, means controlled after a particular setting of a switch at an exchange in response to a second series of impulses for actuating a signal at a certain station at said exchange, and means controlled after another particular setting of a switch at an exchange in response to a second series of impulses for actuating a signal at each of a plurality of stations at said exchange.

16. In a signaling system, groups of stations, a single conductor between said groups of stations, a step-by-step switch associated with each of said groups of stations and with said conductor, a signal lamp at each of said stations, means for controlling all of said switches simultaneously over said conductor and for flashing the signals at all of said stations during the control of said switches, means responsive to the setting of one of said switches in a particular manner for actuating a signal at a corresponding station of the group associated with said switch to discontinue flashing and light steadily and means operative after the setting of said switch for preventing further flashing of the remaining signals.

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