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TELEGRAPH SELECTOR

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FIG. 1

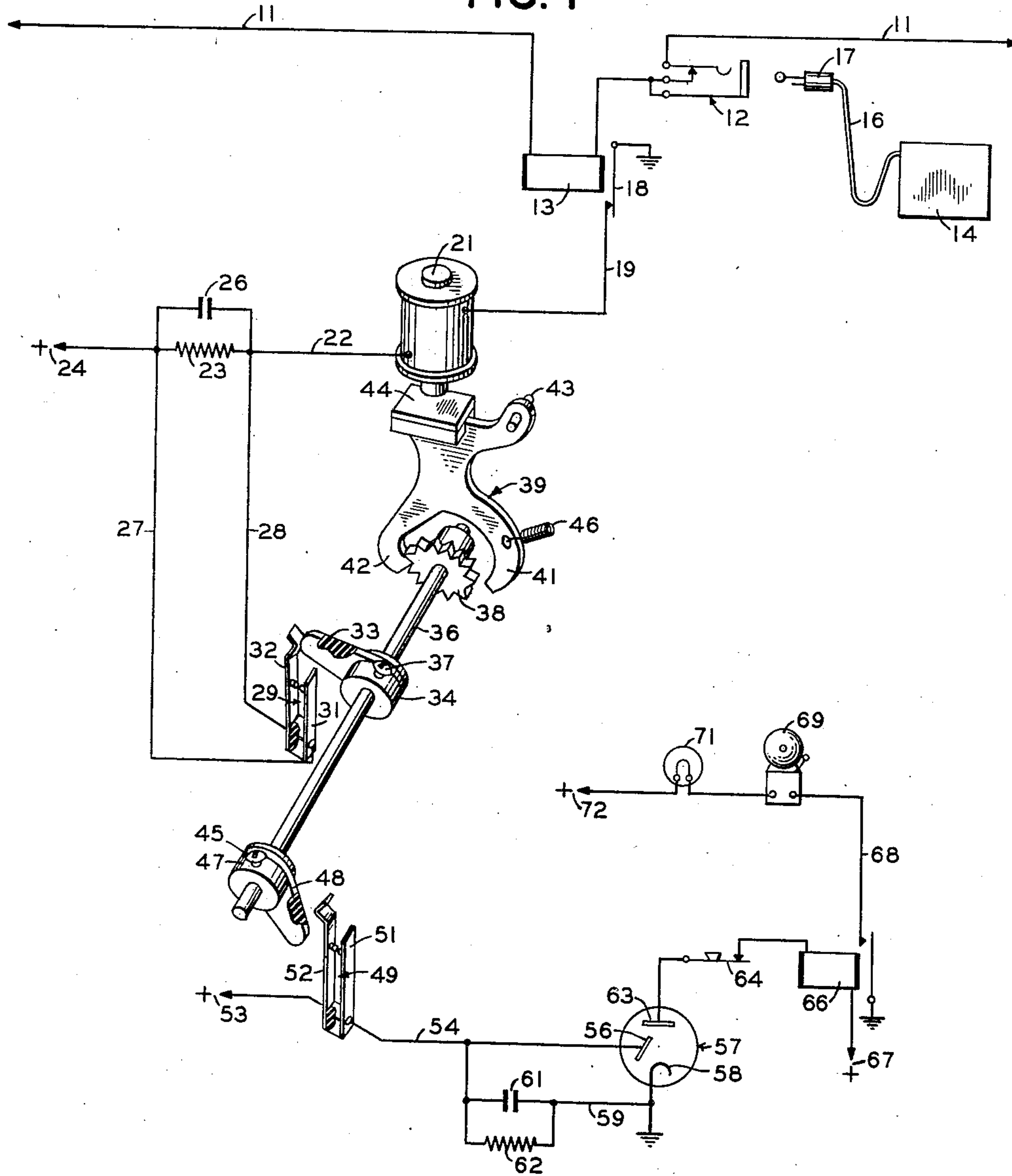
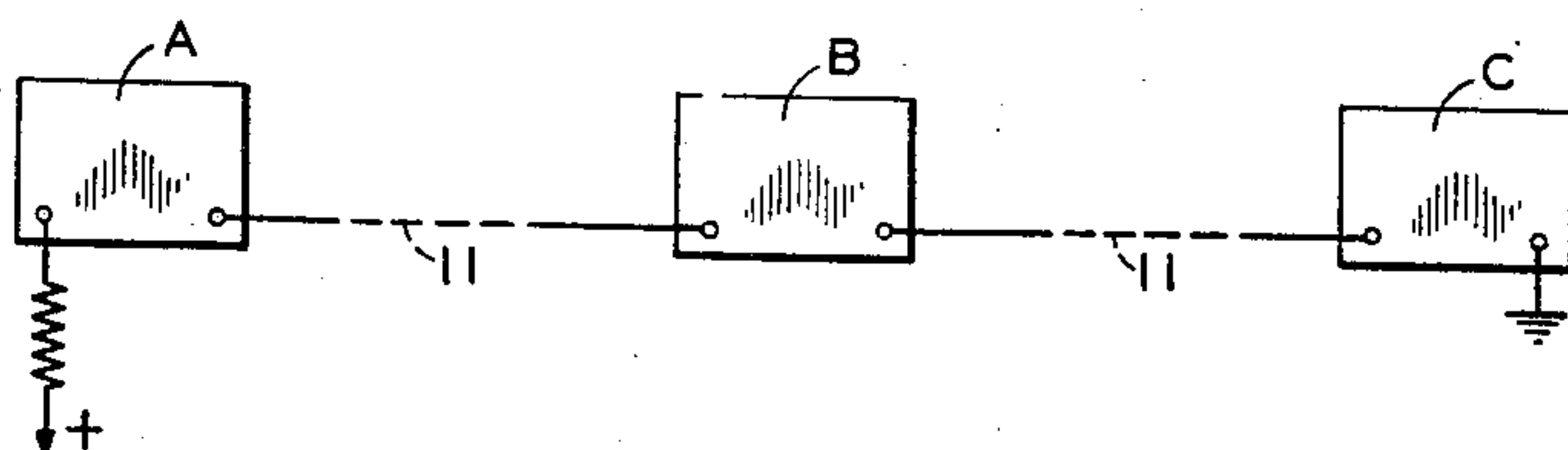


FIG. 2



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TELEGRAPH SELECTOR

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This invention relates primarily to telegraph selectors, and more particularly to that type of selector that may be used on way-wire circuits having a plurality of way-stations associated therewith whereby any one of the stations may selectively communicate with any one or a number of the other stations on the way-wire.

On a way-wire circuit such as along a railroad right of way, the sending and receiving mechanisms which may be, for example, key and sounder sets, are, for obvious reasons, normally disconnected from the line. When a station wishes to communicate with another, the sending and receiving mechanism thereat is connected to the way-circuit and a calling signal or signals transmitted which selectively operates selectors at the desired station or stations to operate visible and/or audible calling or signaling means thereat. On the operation of the visible and/or audible calling or signaling means at the called station or stations, the operator thereat connects his sending and receiving mechanism to the way-circuit and transmits an acknowledgment signal back to the calling station whereupon the calling station transmits the message. In this manner any station is permitted to selectively call any one or a number of the other stations without disturbing the uncalled stations. The selectors at each station on the way-wire respond to different predetermined signal sequences so that each station may be selectively called. Selectors have been developed which operate in the manner above described but are extremely intricate in design, expensive to maintain because of the need of frequent servicing and adjustments, are relatively expensive to manufacture and require for their proper operation a signaling code wherein the individual signal impulses have a very definite timed relationship with each other.

In accordance with the above, it is one of the primary objects of the present invention to provide a signal selector which is easy to manufacture and maintain, has few moving parts and which may be easily changed to respond to a different calling signal.

Another object of the invention is to provide a signal selector which during the normal flow of traffic over the way-wire does not respond to the normal traffic signals and is only operated following a predetermined line condition.

Another object of the invention is to provide a signal selector which responds to a relatively simple calling signal, as distinguished from the

prior art devices which are operated in response to comparatively complicated calling signals.

Still another object of the invention is to provide a selecting device whereby more than one station may be selectively called in response to a single general calling signal.

These and other objects of the invention will be more apparent when taken in conjunction with the following detailed description and the accompanying drawing, in the latter of which:

Fig. 1 is a diagrammatic view of the essential elements of a selector constructed in accordance with the teachings of the present invention and the electrical circuits thereto; and

Fig. 2 is a diagrammatic view of a plurality of way stations on a way-wire circuit.

Referring first to Fig. 1, a way-wire or circuit 11 is shown looped through a jack 12 and a line relay 13 as is the general arrangement at a way-station. An answer set 14 has a cord 16 with a plug 17 associated therewith whereby on the insertion of the plug 17 in the jack 12 the answer set 14 may be connected in series to the wire 11 in the well known manner. The answer set 14 may also include transmitting means and, if the way-wire is to be operated in response to Morse signals, the answer set 14 would include a key and sounder, or, if the way-wire is to be operated in accordance with other types of signals, such as start-stop signals, the answer set 14 would include a keyboard and a printing mechanism.

The particular type of answering set employed in conjunction with the invention is immaterial, as will be apparent hereinafter, the only requirement being that means be provided therein or at other points to enable the origination of the calling signals in a manner pointed out. The tongue 18 of the line relay 13 is grounded, and the associated make stop is connected by a conductor 19 to one of the terminals of a magnet 21. The other terminal of the magnet 21 is connected by a conductor 22 through a resistance 23 to a source of potential at 24. A condenser 26 of appropriate value is connected in parallel relation to the resistance 23. Also connected in parallel relation with the resistance 23 and condenser 26 by means of conductors 27 and 28 is a normally open contact 29. The contact 29 includes a stationary spring element 31 and a movable spring element 32. The spring element 32 tends to make contact with the spring element 31 but is normally held out of engagement therewith by an arm 33 of insulating material. The arm 33 is fixed to a collar 34 which in turn is attached by

means of a set screw 37 to a shaft 36 for rotation therewith.

The shaft 36, which is suitably supported by means not shown, has adjacent its upper end, as shown in Fig. 1, a toothed ratchet wheel 38, which is fixed to the shaft for rotation therewith. In operative relation with the ratchet wheel 38 is a yoke member 39 with arms 41 and 42 disposed on opposite sides of the ratchet wheel 38. The yoke member 39 is pivotally mounted on a pin 43 and has fixed thereto an armature 44 in operative relation with the magnet 21. A spring 46 attached to the yoke 39 tends to pivot the same in a counterclockwise direction to hold the arm 42 in engagement with the ratchet wheel 38.

On energization of the magnet 21 in the manner hereinafter pointed out, it effects pivoting of the yoke 39 a small amount in a clockwise direction to withdraw the arm 42 from engagement with the ratchet wheel 38 and move the arm 41 in engagement therewith. The design of the ratchet wheel 38 and the arms 41 and 42 is such that the engagement of the tip of the arm 41 with the ratchet wheel 38 causes the latter to advance or rotate a distance substantially equal to one-half the distance between two adjacent teeth. On the deenergization of the magnet 21, the spring 46 rocks the yoke 39 to withdraw the arm 41 from engagement with the ratchet wheel 38 and re-engage the arm 42 therewith whereby the ratchet is stepped the remaining distance between two consecutive teeth. Thus, for each energization and deenergization of the magnet 21, the ratchet wheel 38 and shaft 36 are stepped or rotated an amount equal to the distance between two consecutive teeth on the ratchet wheel.

Secured to the lower end of the shaft 36 by means of a set screw 45 is a collar 47 and extending from the collar 47 is an arm 48 rotative therewith which is preferably made of insulating material. By means of the set screw 45 the relative position of the arm 48 on the shaft may be changed. In operative relation with the arm 48 is a normally open set of contacts 49 including spring elements 51 and 52. The spring element 51 is relatively stiff, while the spring element 52 is more flexible, and by means of the arm 48 it may be moved into contact with the spring element 51. The spring element 52 is connected to a source of positive potential at 53, while the spring element 51 is connected by means of a conductor 54 to the starter anode 56 of a cold cathode type of vacuum tube 57. The tube 57 has a grounded filament 58 which is also connected by means of a conductor 59 through a condenser 61, in parallel relation with a resistance 62, to the conductor 54. The plate 63 of the tube 57 is connected through a normally closed key 64 and the coil of a signal relay 66 to positive potential at 67. The tongue of the signal relay 66 is grounded and the make stop thereof is connected by means of a conductor 68 through signaling or alarm means, such as a bell 69 and/or signal lamp 71, to a source of potential at 72.

The operation of the apparatus such as that disclosed in Fig. 1 is as follows, assuming station A, Fig. 2, at one end of the way-wire 11 desires to call station C at some other point on the way-wire. Each of the stations A, B and C, shown in Fig. 2, has equipment such as that shown in Fig. 1, the only difference in the equipment at the various stations being the relative positions of the arms 33 and 48 on the shaft 36 which, in a manner hereinafter pointed out, permits calling in of one station to the exclusion of the others,

or the successive calling in of a plurality of desired stations in response to a single general calling signal.

During normal operation of the way-wire circuit 11 for the transmission of regular intelligence, the open and closed line conditions, and particularly the open line conditions, are of short duration. The line relay 13 responds to all line signals, being energized on closed line conditions and deenergized on open line conditions with its tongue 18 being operated in accordance with the energization and deenergization thereof. With the arms such as 33 of all the selecting mechanisms in their normal positions, such as that shown in Fig. 1, the associated contact sets such as 29 are held open. While the contact sets 29 are open, the resistances 23 and condensers 26 at each station are in circuit with their associated magnets 21. The resistances such as 23 and condensers such as 26 at each station are of such value that with the condensers 26 fully charged, as they will be when the tongues 18 of the line relays 13 engage associated make stops, the condensers 26 do not have time to completely discharge through associated resistances 23 during the short open line conditions of normal signal intervals or while the tongue 18 of the line relay is away from its associated make stop.

When one station desires to call one or more other stations, the calling station opens the line 11 and keeps it open for at least a predetermined length of time. The opening of the line removes the grounded tongues 18 at all the stations from contact with associated make stops, thus opening the circuits to all the magnets 21. This allows the charges on the condensers 26 to be dissipated through associated resistances 23 and the values of the condensers and resistances 26 and 23, respectively, at each of the stations are such that the condensers are substantially completely discharged during the open line condition of at least the predetermined length. With the condensers 26 substantially completely discharged, the next closed line condition during which the circuits through the magnets 21 are completed permits a charging current to flow through the said circuit to charge the condensers 26 which is of sufficient value to operate the magnets 21. The normal short openings of the line 11 during normal transmission are of insufficient length to permit sufficient discharge of the condensers 26 to require a charging current sufficient to operate the magnets 21. Accordingly, the magnets 21 are only operated on a closed line condition following an open line condition of at least a predetermined length.

The closed line condition following an open line condition of the predetermined length causes the energization of the magnets such as 21 and the rocking of the yokes such as 39 which, as hereinbefore described, effect rotation of the shafts 36 a half a tooth of the ratchet wheels 38. The next deenergization of the magnet 21 in response to another open line condition which may be of short duration effects another half-tooth revolution of the shafts 36. This amount of rotation of the shafts 36 permits the arms 33 rotating therewith to move out of operative relation with associated contact sets 29 whereby the contacts are permitted to close. The closing of the contact sets 29 places a direct shunt around the condensers 26 and resistances 23, which in effect removes them from the circuits to their associated magnets 21. With the contact sets 29 closed the magnets 21 are responsive to all normal opera-

tions of the tongues 18 of the line relays 13, and hence the shafts 36 will be stepped one tooth for each subsequent opening and closing of the line 11. The shafts 36 rotate in synchronism with one another and at predetermined points in the revolutions thereof, a point being individual to each shaft, are effective in a manner hereinafter pointed out to operate a signaling and/or calling device at respective stations. Thus, the magnets 21 which are normally unresponsive to the normal intelligence transmitted over the way-wire 11 are rendered operative by an open line condition of at least a predetermined length and thereafter are responsive to all further line openings, up to a certain number, which may be considerably shorter in duration than the length of the predetermined opening and of substantially the same length as those sent in transmitting normal intelligence. The manner in which the different shafts 36 at the various stations are effective to operate associated signaling equipment at different points in the rotation thereof will be pointed out in the following paragraphs.

The arms 48 on the shafts 36 at the various stations are each positioned differently with respect to the arms 33 so that the arms 48 close their associated contacts 49 after various degrees of rotation of the shafts 36. Let it be assumed that the arm 48 at station A, Fig. 2, requires the shaft 36 to step substantially three teeth before closing its contact set 49 and the arms 48 at stations B and C require rotation of the shaft 36 five and eight teeth respectively before closing associated contact sets 49. With this arrangement, then station A in calling station C would effect rotation of the shafts 36 at all the stations on the way-circuit eight teeth and after the eighth step would hold the line open for an abnormal length of time so that the contact set 49 at station C and only station C would remain closed for a corresponding interval. When a contact set 49 is closed at one of the stations such as at C, which is after the shaft 36 has rotated eight steps, the source of positive potential at 53 is effective to begin charging the normally uncharged condenser 61. If the contacts 49 are maintained in the closed condition a sufficient length of time to substantially completely charge the condenser 61, thereafter the starter anode 56 of the associated tube 57 becomes increasingly positive with respect to the grounded filament 58. When the potential difference is sufficient between the starter anode 56 and the filament, the tube 57 becomes operative and this interval of time is dependent upon the capacity of the condenser 61, the value of the resistance 62 and the charging rate from the source potential at 53. The tube 57 in the preferred embodiment of the invention is of the type that when once put in a conductive condition remains in this condition until the circuit to the plate or filament is interrupted, and when once made conductive is independent of the starter anode 56.

The operation or conductive conditioning of the tube 57 effects energization of the signal relay 66, which through its grounded tongue completes a circuit through the associated make stop and the signaling or alarm mechanisms such as the bell 69 and the signal lamp 71 to potential at 72. The operation of the alarm mechanisms calls to the attention of the attendant at the associated station that some other station desires to communicate therewith whereupon he inserts the plug 17 of his answer set into the associated line jack 12 and sends an acknowledg-

ment signal. The operator at the answering station also operates the key 64 to open the circuit through the tube 57 whereupon the tube becomes non-conductive and the alarm circuit is restored to its normal open condition as the acknowledgment signal effects rotation of the shaft 36 from the position in which it closed the contact set 49.

In order to call station C which requires the shaft 36 to rotate eight teeth before the arm 48 closes the contact set 49, the contact set has to remain closed for a sufficient length of time to allow the condenser 61 to become charged and the starter anode 56 sufficiently positive with respect to the filament 58 to start the tube 57 into operation. Accordingly, a calling operator when calling a station such as C leaves the line open a sufficient length of time after the contact set 49 at station C has been closed to permit the associated condenser 61 to become charged. Thus in calling station C which requires its shaft 36 to rotate eight teeth, eight open line conditions are transmitted which are separated by closed line conditions with the eighth open condition of sufficient length to permit the charging of condenser 61. The first precalling long open line condition which is transmitted prior to the following calling signal removes the resistances 23 from the circuits of the magnets 21 in the manner hereinbefore described and the operating characteristics of the magnets 21 are such that the following operating impulses of the calling codes need not be of such prolonged length. The values of the resistances 23 and condensers 26 are such that the predetermined precalling open line condition may be in the neighborhood of eight to ten seconds while the open line and closed line conditions of the calling signal may be in the neighborhood of a small fraction of a second. The last open line condition of a calling signal may be in the neighborhood of three or four seconds, depending upon the characteristics of the tubes 57 and the value of the condensers 61 and resistances 62.

When calling a station such as C which requires eight steps of the shaft 36 to close its contact set 49, other stations such as station B which may require only five steps of its shaft 36 to close its contact set 49 are not called because of the fact that the contact sets 49 at a station such as B are only closed momentarily by one of the short open line conditions in stepping the shafts 36. The brief closing of the contact set 49 at station B is not of sufficient length to permit the charging of the condenser 61 thereat so that the starter anode in tube 57 is not rendered sufficiently positive to make the tube operative. Thus station A may call in a station such as C to the exclusion of another station such as B having a calling code of a lesser number of signals.

At times it may be desirable for a station such as A to call in a plurality of other stations such as stations B and C substantially simultaneously, as station A may have intelligence which should be received at both stations B and C. In order to effect the calling in of two or more stations, the calling operator need not send a separate calling signal for each station called as the calling signal for one station may be employed as part of the calling signal for another station. If, for example, station A were calling stations B and C simultaneously, station A would leave the line 11 open for three or four seconds on the fifth opening after the first precalling open signal which would call in station B, and then send two more short openings followed by a prolonged

opening to call station C. The tubes 57 at stations B and C would become operative on the fifth and eighth openings of the line circuit which were of longer length than the other calling signals. The tubes 57 at stations B and C becoming operative would operate associated alarm devices and in this manner any number or all of the other stations on the way-wire may be called substantially simultaneously by any one of the stations. Thus the calling operator does not have to send a separate calling signal to call in each station when desiring to call in more than one at a time.

After a station or a number of stations have been called, the intelligence signals transmitted over the way-wire 11, which may be an acknowledgment, are effective to operate the magnets 21 which in turn step the shafts 36. The normal intelligence impulses step the shafts 36 until the arms 33 thereof engage and open associated contacts 29. The opening of the contacts 29 removes the shunts around the resistances 23 whereupon further intelligence impulses, which are of short duration, are ineffective on the magnet 21 and accordingly the shafts 36 remain in their normal positions. The rotation of the shafts 36 to the normal positions also rotates the arms 48 whereupon the particular arm operating its associated contact 49 permits the same to open whereupon the charged condenser 61 is permitted to discharge through its associated resistance 62. Thus all the selectors are returned to their normal positions and will not be started into operation until an open line condition of considerable length is transmitted. In the event an open line condition of sufficient length to start the selectors into operation in the manner hereinbefore set forth is accidentally transmitted, none of the stations on the circuit would be called unless another open line condition of considerable length were transmitted shortly after the transmission of the first long open line condition. Normal message impulses transmitted following the accidental long open line condition would step the shafts 36 and the arms 48 would only close their associated contacts 49 for a short interval of time which would be less than that required to render their associated tubes 57 operative.

Thus in accordance with the invention a selector is provided which normally does not respond to signals transmitted over the line and such an arrangement has the advantage in that wear on the selectors is lessened and they are always at their normal positions ready to respond to a calling signal. The above arrangement also has an advantage in that any leakage in the condensers 26 during the short openings of the circuit 11 and the transmission of normal intelligence is not effective on the magnets 21 as the normal openings are of short duration and the condensers are recharged on the subsequent closing of the line. Instead of the above described arrangement wherein a calling signal is terminated by a long open line condition, a closed line condition could be employed by changing the position of the arms 48 on the shafts 36 a slight amount or the distance of approximately one-half tooth of the ratchet wheels 32. Similarly, the calling signal to which a particular selector mechanism selectively responds may be changed by changing the relative positions of the arms 33 and 48 on the shaft 36.

It is obvious that various modifications of the apparatus and circuits shown and described

herein may be made without departing from the spirit or essential attributes of the invention, and it is desired, therefore, that only such limitations be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

What is claimed is:

1. In a telegraph system of the type described, a line circuit, means for transmitting signals over said circuit, a line relay responsive to said signals, an electromagnet having the coil thereof connected to contacts controlled by said line relay, a condenser in said electromagnet circuit, a resistance permanently connected in shunt relation with said condenser, means including said condenser and resistance for rendering said electromagnet unresponsive to the operation of said line relay in response to line signals of less than a predetermined length, and means responsive to a line signal of at least said predetermined length for disabling said last mentioned means to render said electromagnet unresponsive to operations of said line relay whereby said electromagnet is responsive to all operations of said line relay up to a predetermined number.

2. In a telegraph system, a line circuit, a line relay responsive to signals transmitted over said line, an electromagnet, a first control means for said electromagnet including contacts operated by said line relay, a second control means for said electromagnet including a condenser and a resistance permanently connected in shunt relation with said condenser, means including both of said control means for operating said electromagnet a first time only after the existence of a predetermined condition of said first control means for at least a predetermined length of time wherein said condenser assumes a substantially stable condition, and means controlled by the first operation of said electromagnet to place the control thereof solely under said first control means.

3. In a telegraph system, a line circuit, a line relay controlled by signals transmitted over said line circuit, an electromagnet, means including contacts controlled by said line relay for completing a circuit to said electromagnet, a condenser and a resistance in shunt relation therewith in said electromagnet circuit, said resistance being of such a value as to prevent sufficient current to normally flow in said circuit to operate said electromagnet, means including said resistance to substantially discharge said condenser on the opening of said electromagnet circuit for at least a predetermined length of time, means including the charging of said condenser to permit the passage of sufficient current through said electromagnet circuit to operate said electromagnet on the closing of said circuit by said line relay contacts following the substantial discharge of said condenser, normally open shunting contacts for said condenser and resistance, and means controlled by the operation of said electromagnet to control said shunting contacts to shunt said condenser and resistance in said electromagnet circuit whereupon said electromagnet follows the operation of said line relay contacts.

4. A telegraph system, a line circuit, a line relay controlled by signals transmitted over said line circuit, an electromagnet, means including contacts controlled by said line relay for completing a circuit to said electromagnet, a condenser and a resistance in shunt relation therewith in

said electromagnet circuit, an armature associated with said electromagnet, means including said resistance to normally limit the flow of current in said electromagnet circuit to such a low value as to prevent the operation of said armature by said electromagnet on the closing of the circuit thereto by said line relay controlled contacts, means including said resistance to effect substantial discharge of said condenser on the opening of said line relay controlled contacts for at least a predetermined length of time, means including said condenser in a substantially discharged state to permit the passage of sufficient current through said electromagnet circuit for said electromagnet to operate said armature on the closing of said line relay controlled contacts following the opening of the same for at least said predetermined length of time, and means controlled by operation of said electromagnet armature to shunt said condenser and resistance whereby the armature of said electromagnet is operative thereby under the direct control of said line relay controlled contacts.

5. The combination as set forth in claim 4 and including a normally inoperative alarm device and other means controlled by the armature of said electromagnet for rendering said alarm device operative.

6. The combination as set forth in claim 4 and including a normally inoperative alarm device and other means controlled by a predetermined number of operations of said armature following the said first operation thereof for rendering said alarm device operative.

7. In a telegraph system, a line circuit, a line relay controlled by signals transmitted over said line circuit, an electromagnet, means including contacts controlled by said line relay for completing a circuit to said electromagnet, a condenser and a resistance in shunt relation therewith in said electromagnet circuit, an armature associated with said electromagnet, means including said resistance to normally limit the flow of current in said electromagnet circuit to such a low value as to prevent the operation of said armature by said electromagnet on the closing of the circuit thereto by said line relay controlled contacts, means including said resistance to effect substantial discharge of said condenser on the opening of said line relay controlled contacts for at least a predetermined length of time, means including said condenser in a substantially discharged state to permit the passage of sufficient current through said electromagnet circuit for said electromagnet to operate said armature on the closing of said line relay controlled contacts following the opening of the same for at least said predetermined length of time, a rotatable member having a normal position and rotated a predetermined amount on each operation of the armature of said electromagnet, a set of normally open contacts in shunt relation with said condenser and resistance and means controlled by the rotation of said rotatable member in rotating from said normal position to effect closure of said condenser and resistance shunting contacts whereby after the closing thereof the armature of said electromagnet is operative under the direct control of said line relay controlled contacts.

8. In a telegraph system, a line circuit, a line relay controlled by signals transmitted over said line circuit, an electromagnet, means including contacts controlled by said line relay for completing a circuit to said electromagnet, a condenser and a resistance in shunt relation therewith in said electromagnet circuit, an armature asso-

ciated with said electromagnet, means including said resistance to normally limit the flow of current in said electromagnet circuit to such a low value as to prevent the operation of said armature by said electromagnet on the closing of the circuit thereto by said line relay controlled contacts, means including said resistance to effect substantial discharge of said condenser on the opening of said line relay controlled contacts for at least a predetermined length of time, means including said condenser in a substantially discharged state to permit the passage of sufficient current through said electromagnet circuit for said electromagnet to operate said armature on the closing of said line relay controlled contacts following the opening of the same for at least said predetermined length of time, a rotatable member having a normal position and rotated a predetermined amount on each operation of the armature of said electromagnet, a set of normally open contacts in shunt relation with said condenser and resistance, means controlled by the rotation of said rotatable member in rotating from said normal position to effect closure of said condenser and resistance shunting contacts whereby on the closing thereof the armature of said electromagnet is operative under the direct control of said line relay controlled contacts, a second set of contacts controlled by said rotatable member, an alarm device controlled by said second set of contacts and means including said second set of contacts for rendering said alarm device operative following a predetermined amount of rotation of said rotatable member from normal position.

9. The combination as set forth in claim 8 and including means for varying the predetermined amount of rotation of said rotatable member from said normal position to operate said second set of contacts to render said alarm device operative.

10. The combination set forth in claim 8 and including a time delay device and means including said time delay device and said second set of contacts for rendering said alarm device operative only on the operation of said second set of contacts at least a predetermined length of time by said rotatable member, said prolonged operation of said second set of contacts being effected by the cessation of operation of the armature of said electromagnet for said last predetermined length of time.

11. In an impulse receiver for a remote control system, the sub-combination of a relay, electrical circuits adapted to operate said relay in response to signal impulses received by said receiver, a condenser associated with said circuits and normally arranged to be charged at each signal impulse and to delay operation of said relay while being charged, whereby said relay is normally unresponsive to an impulse of less than a predetermined duration, and switching means connected to said condenser and controlled by operation of said relay to disconnect said condenser from said circuits when said relay is once energized, whereby said relay then becomes responsive to impulses of shorter duration.

12. In an impulse receiver for a remote control system, the sub-combination of a relay, electrical circuits adapted to operate said relay in response to impulses of variable length effective to change the normal condition of said circuits for variable periods of time, a condenser associated with said circuits in a manner to have its state of charge controlled variably by the variable time conditions of said circuits and to in turn effect by its variable state of charge the response of said circuits to the

time duration of said changes and thereby prevent the operation of said relay in response to short changes in the condition of said circuits in response to short impulses and switching means operated by said relay after it responds to a long change in condition of said circuits effective to disassociate the condenser from said circuits in

a manner to render the state of charge on the condenser independent of the changing conditions of the circuits and to render the state of condenser charge ineffective upon the operation of the relay in response to following changes in the condition of the circuits.

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