Nov. 22, 1932. H. E. HERSHEY 1,888,268

REMOTE CONTROL SYSTEM

Filed May 5, 1928 2 Sheets-Sheet 1

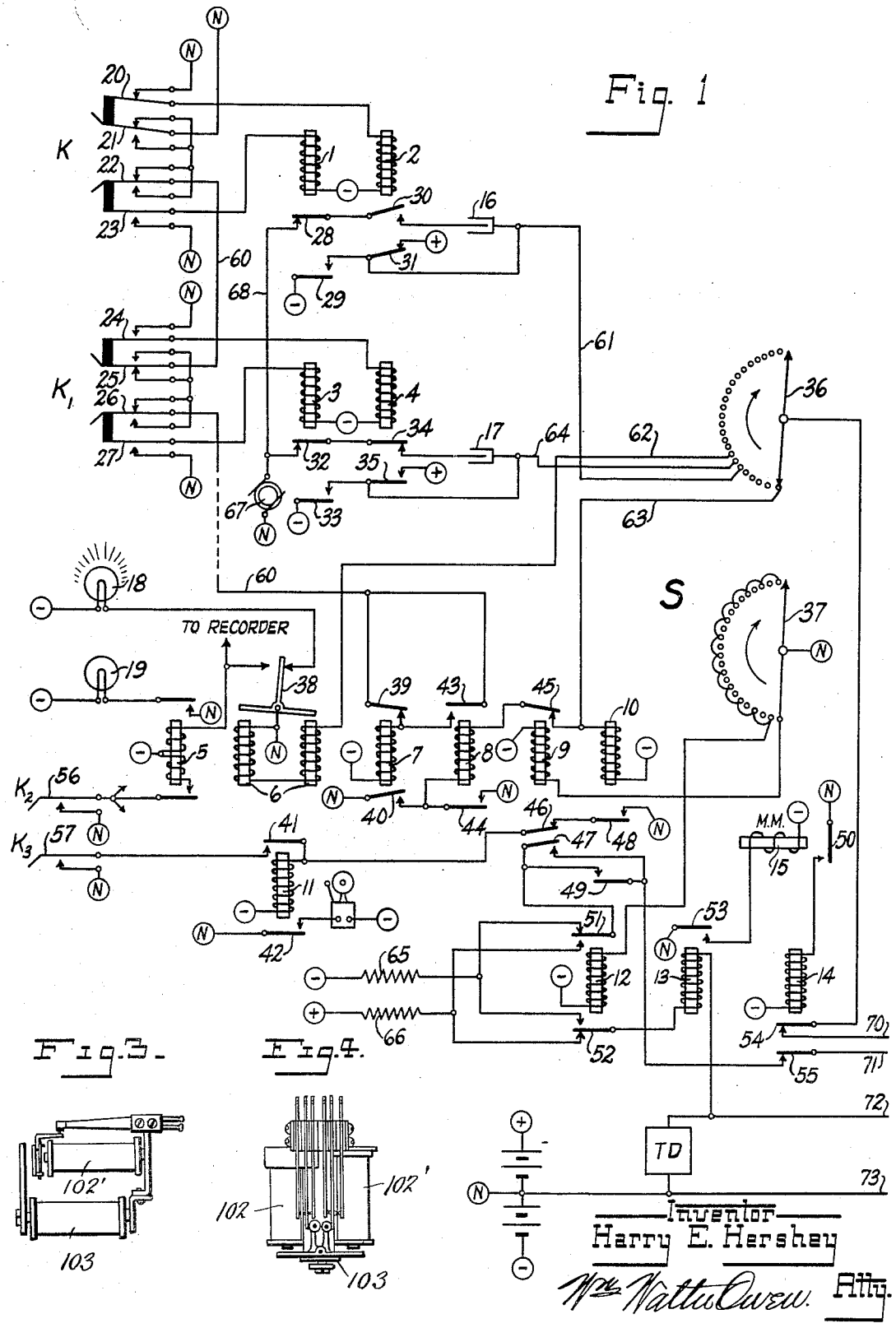


Fig. 3.

Fig. 4.

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REMOTE CONTROL SYSTEM

Filed May 5, 1928 2 Sheets-Sheet 2

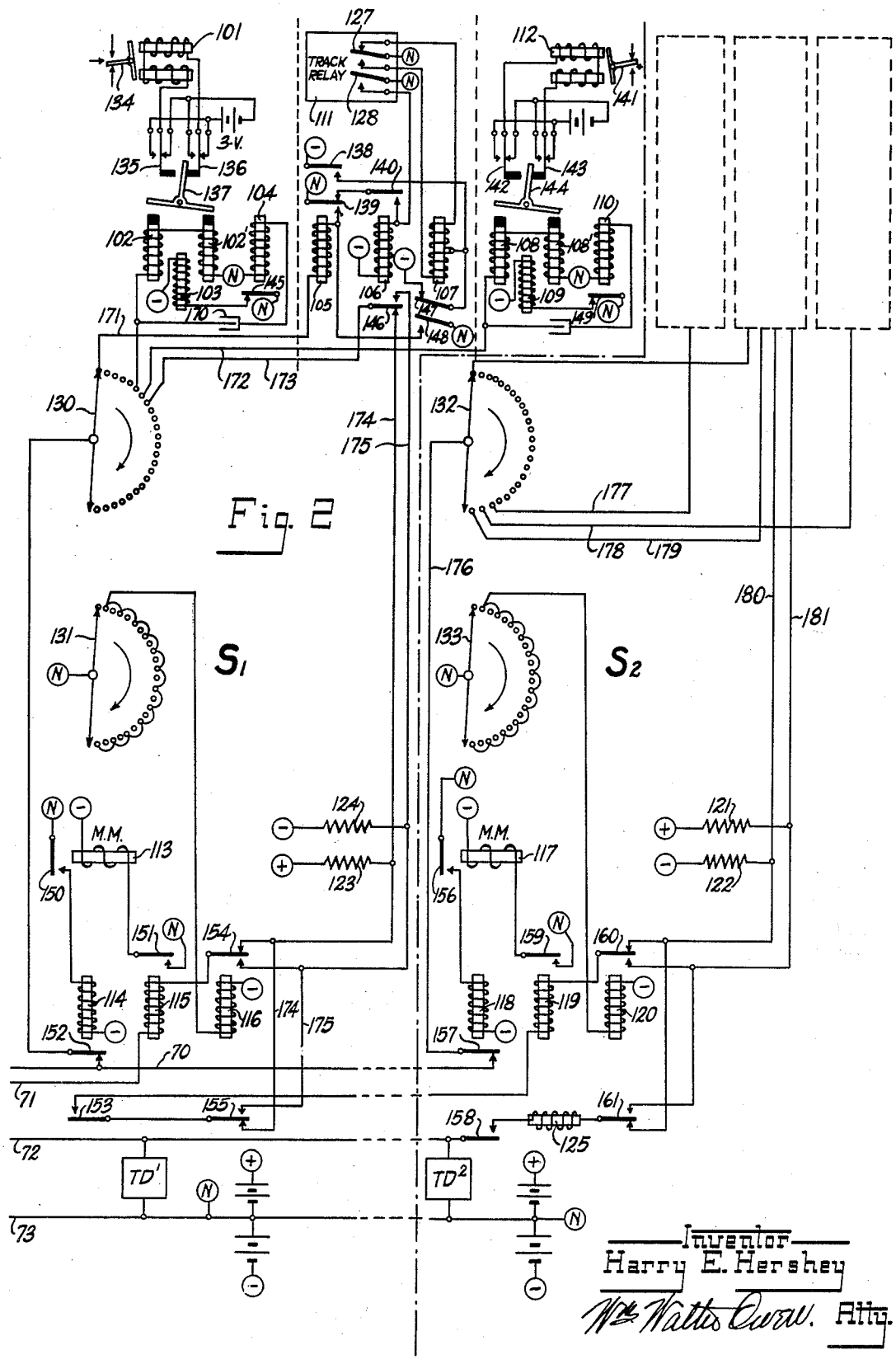


Fig. 2

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1,888,268

UNITED STATES PATENT OFFICE

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REMOTE CONTROL SYSTEM

Application filed May 5, 1928. Serial No. 275,304.

This invention relates in general to remote control systems, more particularly to such systems in which a plurality of selecting switches located in distant substations are operated synchronously from a central or despatcher's station, and the principal object of the invention, briefly stated, is the production of a new and improved system of this type, a system particularly adaptable for use in train despatching systems.

Tandem type remote control systems have been devised heretofore, and in such systems in which a step-by-step switch is used as a selector it has been standard practice to bring all of these selectors to rest upon a particular set of contacts to select a particular device, which is then operated and supervised before the selector switches are stepped on to the next contact set. Systems of this type have their greatest utility in the remote control of power switching equipment. In the remote control of railway equipment, it is disadvantageous to bring the selecting switches to rest prior to the operating of a particular device. In train despatching systems, it is preferable to operate the track side devices without stopping the selecting switches. Step-by-step switches are not designed for continuous operation, it being customary to provide a normal or home position in which the switches come to rest when not in use.

As a further object of my invention, I have provided a new and improved train despatching system of the semi-continuous type, in which step-by-step selecting switches are resting in a home position when not in use, and are stepped completely over their banks back to the home position without stopping when taken for use. During the stepping of the switches, one or more of the devices selectable by the switches may be operated, and all of the devices are supervised.

In train despatching practice, a three-position relay, responsive to current in one or the other directions or to no current at all, is used to control the motor-driven semaphores, switches, and the like. These relays are controlled by a manual switch having three positions, the switch being arranged to transmit current of one polarity to the relay when in one position, and to transmit current of the opposite polarity when in another position, and to transmit no current when in the third position. In equipping a system of this kind for remote control operation by a centralized despatcher's station, it is necessary to provide a system capable of transmitting current in either direction or no current to this existing three-position relay.

Accordingly, as a further object of my invention, I have provided a new and improved remote control system capable of transmitting current in either direction or no current at all to an existing three-position switch control relay.

Train despatching systems in use at the present time employ a station selector to ring the call bells of a particular station, which upon responding is thrown on to a common talking circuit over which telephone conversation may be had with the despatcher. In many instances, it is desirable, although not necessary, to maintain this service, and to equip the remote control system over which the switching devices are controlled so that the despatcher may call an attendant at any one of the substations on the trunk line.

Further objects of my invention, not specifically mentioned here, will be apparent from a reading of the detailed description and claims which follow.

The drawings comprising Figs. 1, 2, 3, and 4 when arranged with Fig. 2 to the right of Fig. 1 with correspondingly numbered lines in alignment, show sufficient details of one embodiment of my invention to enable a clear

understanding of it, while Figs. 3 and 4 show a detailed side view and a front view of the mechanical construction of the electro polarized relay shown in Fig. 2. This embodiment, designed to meet particular requirements, is shown by way of example only, as there are many modifications and adaptations which can be made by one skilled in the art.

Fig. 1 shows the equipment at the despatcher's station. The equipment in the despatcher's station comprises the key shelf containing keys K to K3, inclusive. Key K is associated with one circuit, K1 with another, etc., there being a key of this type for each of the circuits controlled from this station. Keys K2 and K3 are special operating keys, the purpose of which will be brought out in detail hereinafter. The despatcher's station is also equipped with a stepping switch S, which is of the type of the well-known rotary line switch whose wipers are moved when the magnet deenergizes. This switch contains a bank having twenty-five contacts in a row. The despatcher's station also comprises relays 5 to 14, inclusive, through the operation of which the devices at the substation are controlled and supervised. In Fig. 1, I also show train despatching keyboard TD, which may be of the type shown in my co-pending application Serial No. 236,301, filed November 28, 1927, or it may be a key sender of the type employed in the well-known Western Electric train despatching system.

In Fig. 2, I show the equipment in two substations, the one including selecting switch S1 being shown in full and the other including the selecting switch S2 being shown in skeleton form only. The various substations on the trunk are duplicates of each other, and it is not deemed necessary to show more than one of these in any great detail. The selecting switches S1 and S2 are mechanically similar to the switch S of the despatcher's station, and are moved in synchronism with the switch S to rotate their wipers over their banks to connect up the substation devices simultaneously with the connecting up of the supervisory devices by the switch S. The circuit arrangement for stepping the switches in synchronism is disclosed and claimed in my co-pending application, Serial No. 275,027, filed May 4, 1928. The upper part of Fig. 2 may show a three-position switch control relay 101, which is shown as a simple polarized relay. This relay would preferably be an existing three-position control relay in a train despatching system, the relay which is energized by the operation of the system under the control of the despatcher. A second polarized relay, comprising the energizing winding 103 and the operating windings 102 and 102′, is associated with a particular bank contact in the bank of switch S1 and operated by the despatcher to control the application or non-application of current to the control relay 101. The iron cores of windings 102 and 102′ are magnetically connected at one end by a heel piece which is also magnetically connected to the core of winding 103. The armature of the relay is pivoted over the cores of windings 102 and 102′ on the magnetic member extending from the core of winding 103. This latter polarized relay takes the place of the manual three-position key or lever with which the tower man now controls the control lever or relay 101 in a train despatching system. A diagrammatic design of this relay is shown in Figs. 3 and 4, showing how the magnets 102, 102′, and 103 and armature 137 are mounted.

Associated with the polarized relay 102 is an alternating current relay 104 which is operated under certain conditions to control the operation of the polarized relay 102.

Relay 112 is also a switch control relay, and it in turn is controlled by polarized relay 108 and the alternating current relay 110. This equipment is duplicate of the relays 101, 102, and 104, and need not be explained in greater detail at this time.

The track relay 111 and the associated relays 105, 106, and 107 are utilized to report to the despatcher the movement of a train through the block or siding containing the track relay. Relay 111 may be any well-known track circuit relay such as is commonly found in railway signalling practice.

Each substation on the trunk line is equipped with a train despatching selector such as TD1 and TD2, these selectors being either of the type shown in the aforementioned co-pending application or the well-known Western Electric train despatching selector.

In each substation and in the despatcher's station is a battery, preferably a storage battery, having a terminal voltage of about 110 volts. The mid-point of this battery is connected to the neutral bus-bar N and to the common conductor 73 extending between stations. The one half of the battery terminates on the negative bus-bar, which is at about 55 volts potential below the neutral bus. The other half of the battery terminates on the positive bus-bar, which is about 55 volts above the neutral bus. On the drawings the neutral bus is indicated by an N within a circle, the positive by a plus sign within a circle, and the negative by a minus sign within a circle. This showing eliminates a lot of unnecessary commons and simplifies the drawings considerably.

In the system shown in the drawings, which is a specific embodiment of my invention designed to meet the requirements at a particular location, the following results are accomplished:

In this particular embodiment, the selecting switches when once started out of their

normal position continue stepping at a uniform rate until the wipers have been brought into engagement with each of their contacts and their banks, at which time the wipers are back in their normal position where they remain. The devices to be selected, operated, and supervised are operated during the stepping of the switches, the circuits being arranged so that the device can be operated during the interval that the switch remains upon a particular contact, the interval during which the other switches of the train are making preparations to take a step. The control relays 101, 112, etc., are employed to control a motor-driven railway switch and the semaphores or lamp signals associated therewith. In this particular embodiment, it was not desired to include any supervision of the operation of the railway switches and signals; since the signals were lamps, their operation could be relied upon as long as the elements remained intact, and in case of a burned-out lamp and the resulting dark semaphore, the trainmen are under orders to stop and report to the despatcher. Moreover, in this particular embodiment, the movement of the trains on the main line is not reported to the despatcher, and the track relay 111 is associated with a siding to report to the despatcher the occupied or non-occupied condition of the siding. In this particular embodiment of the invention, the main line is protected by an automatic block system, over which the despatcher need exercise no supervision, and his attention is directed to the passing tracks and siding.

This particular embodiment of my invention is shown by way of example only, and obviously the track relay 111 could be in the main line circuit as in the siding circuit, and the supervisory control exercised by this track relay could also be applied to the semaphore and track switch, if desired, so that the despatcher could be advised of the successful operation of these devices.

If the despatcher desires to operate polarized relay 101 to control a switching device, he throws the key K to the position shown in the drawings and energizes the relay 2. Operation of the key K momentarily breaks the chain circuit over which relay 7 is energized, permitting that relay to fall back to start the switches S, S1, S2, etc., stepping over their bank contacts. When wiper 36 engages its fifth working contact, it encounters positive potential placed on there through the energized relay 2, and since wiper 130 is simultaneously resting on its fifth bank contact, a circuit is completed through the operating windings 102 and 102′ of the polar relay 102, operating that relay into the position shown in the drawings. Operation of relay 102 closes circuit for the relay 101 in such a direction that that relay operates into the position shown in the drawings. In this position, relay 101 controls this associated device over circuits, not shown, to cause it to assume a particular position. The stepping switches S1 and S2 continue stepping over their banks, wipers on coming into engagement with their sixth bank contacts select circuit of relay 108′ and its associated controlling key K1, so that relay 108 is operated in a direction depending upon the position of the key K1. When the wipers have been positioned on their seventh bank contacts, the circuit of the polarized relay 6 is extended through to the control contacts of the relays 105 to 107, inclusive, and the polarized relay 6 is energized in one direction or another depending upon the energized or deenergized position of the track relay 111. Similarly, each of the other contacts in the banks of the switches are connected either to control relays or to supervisory relays, which are supervised as the wipers pass over them. These connections are not shown, because their inclusion would lead to unnecessary complication of the drawings, since it will be readily appreciated that these connections may be identical with those shown in connection with bank contacts 5, 6, and 7.

From the foregoing, it will be apparent that when wiper 36 picks up positive battery, the polarized relay will be energized to one position; when it picks up negative battery it will be energized to the opposite position. It is also necessary in a system of this kind to provide arrangement for a third or neutral position of the polarized relay. To accomplish this purpose, the circuits are arranged so that when the controlling key K for example, is in its neutral position, both positive and negative direct currents are removed from the bank contacts engaged by wiper 36, and a suitable source of alternating current, say 110 volts 60 cycles, is substituted therefor. The polarized relays in the substation are of the magnetically locking type, whose armatures remain in the position last set when the current through the coils is removed. Responsive to the receipt of alternating current over the control conductor, an alternating current relay is energized to open the circuit of the polarizing winding of these polarized relays, that winding being substituted for the usual permanent magnet such as shown in Patent No. 1,672,976, issued June 12, 1928 to F. C. Field with which most polarized relays are equipped. Responsive to the deenergization of the polarizing winding, 103 for example, the polarized relay 102 releases its armature which moves to its central position. In this position, the circuit of relay 101 is opened, that relay being of the type which restores to a neutral position when the current flow through its coil is eliminated, assumes its neutral position. By this arrangement, it is

possible to obtain three-position operation of the polarized relay 101 and to control operation over one contact in the bank of a selecting switch which contact is connected to the despatcher's station over a single wire.

Having thus described my invention in general, I will now proceed with a detailed description of its operation.

Assume now that the despatcher desires to control the relay 101 and that he throws the key K to the position shown in the drawings.

Responsive to the throwing of the key K, relay 2 is energized over a circuit from neutral through springs 20 to extend a circuit from positive through springs 31 and the conductor 61 to the fifth working bank contact over which wiper 36 travels. This prepares a circuit which will be subsequently closed to control the relay 101. The operation of key K, at springs 21, momentarily breaks the chain circuit extending from neutral through springs 21, 22, conductor 60, springs 25, springs 26, conductor 60, through springs 39, through the winding of the relay 7 to negative, permitting the relay 7 to deenergize. Relay 7 at springs 40 closes a circuit from neutral through the winding of relay 8, springs 45, the winding of relay 10, to negative. Relays 8 and 10 energize in this circuit, relay 8 locking itself from neutral through springs 44, in series with the relay 10. Relay 8 at springs 43 closes a circuit from the chain conductor 60 through the winding of the relay 7 to negative, energizing the relay 7, which locks itself through springs 39 independently of the relay 8.

Relay 10 at springs 48 closes a circuit from neutral through springs 46, through the winding of relay 11 to negative, energizing the relay 11. Relay 11 at springs 42 causes an alarm circuit to sound the alarm until the switch S has stepped out of its normal position. At springs 49, relay 10 closes the circuit which is traceable from negative through resistance 65, springs 51 and its break contact, springs 49, springs 55, conductor 71, through the winding of relay 115, spring 154 and its break contact, through resistance 123 to positive battery. Relay 115 energizes over this circuit, and at springs 151 closes circuit from neutral through the winding of motor magnet 113 to negative, energizing the motor magnet 113. The wipers of the switch S1 are not advanced when the magnet 113 energizes, but the armature engages in ratchet so that the wipers will be advanced when the magnet deenergizes and the armature is retracted. Magnet 113 upon energizing closes circuit for relay 114 at springs 150, energizing relay 114. A circuit may may now be traced from positive through resistance 123, conductor 174, spring 155 and its break contact, springs 153, through the winding of relay 119, spring 160 and its break contact, through the resistance 122 to negative. Line relay 119, which is the line relay of the next substation on the trunk line, is energized over this circuit. If there are intervening substations between the intermedate substation S1 and the last substation S2, the relay corresponding to 119 will be energized in the substation adjacent to S1. As many substations as are desired can be added in the switch train, care being taken so that when spring 155 is in its normal position and projecting positive battery out over the trunk wire, the spring 160 of the next substation must lead to negative battery so that the circuit of the line relay 119 will be complete.

Relay 119 upon energizing closes a circuit for the motor magnet 117, which energizes preparatory to advancing the wipers of S2 one step and to close the circuit of relay 118 at springs 156. Relay 118 energizes, closing at springs 158 a circuit traceable from negative through resistance 122, spring 161 and its break contact, through choke coil 125, springs 158, conductor 72, through the winding of relay 13 at the despatcher's station, spring 52 and its break contact, through the resistance 66, to positive. Relay 13 energizes over this circuit and closes a circuit for the motor magnet 15 at springs 53. The motor magnet 15 energizes preparatory to advancing the wipers of the switch S one step and to close the circuit for the relay 14 at springs 50. Relay 14 energizes, and at springs 55 opens the circuit over which line relay 115 of the intermediate substation was energized. When relay 115 falls back, it opens the circuit of the motor magnet 113, which falls back and advances the wipers 130 and 131 of the switch S1 one step. The deenergization of the magnet 113 opens the circuit of relay 114, which falls back and at springs 153 opens a point in the circuit over which line relay 119 of the next substation was energized. When relay 119 falls back, it opens the circuit of motor magnet 117 to permit that magnet to deenergize and advance the wipers 132 and 133 of the switch S2 one step and to deenergize the relay 118. Relay 118 opens the circuit of the relay 13 at the despatcher's station, permitting that relay to fall back and open the circuit of the motor magnet 15 to advance the wipers 36 and 37 of the switch S one step and to open the circuit of relay 14. Relay 14 falls back and prepares a point in the circuit of relay 15 at springs 55, prepares a point in the control or supervisory circuit at springs 54. Since in the drawings the first bank contact engaged by the wiper 36 of the switch S is not shown connected to a control relay, description of the operation of the control and supervisory circuit will be made subsequently.

Wiper 37 upon moving to its first working bank contact closes a circuit from neutral through that contact, through the winding of relay 12, energizing the relay 12. Wiper

37 upon moving away from its normal contacts opens a circuit of relay 9, permitting that relay to fall back and at spring 45 break a locking circuit over which relays 8 and 10 were maintained energized. These relays restore, relay 10 opening a circuit of relay 11 to silence the alarm, and relay 8 opening the energizing circuit over which relay 7 was energized. Relay 9 at springs 47 closes a point in the impulsing circuit in lieu of the circuit closed through springs 49 of the relay 10. Line relay 115 is now energized over a circuit traceable from positive battery through resistance 66, spring 51 and its make contact, springs 47, springs 55, conductor 71, relay 115, spring 154 and its make contact, through the resistance 124 to negative battery. When the switch S1 is stepped to its first working contact, wiper 131 closes a circuit through the relay 116 to energize that relay, and wiper 133 of the switch S2 closes a circuit for relay 120 when S2 steps into engagement with its first working bank contact. Line relay 115 energizes over this circuit, closing circuit of motor magnet, which again closes circuit of relay 114 to complete the circuit of relay 119, which is now traceable from negative battery through resistance 124, conductor 175, springs 155, springs 153, relay 119, spring 160 and its make contact, through resistance 121 to positive battery. Relay 119 closes a circuit of the motor magnet, which energizes and closes a circuit of relay 118, which operates and again closes a circuit of the relay 13, the circuit now being traceable from positive battery through resistance 121, springs 161 and its make contact, the choke coil, springs 158, conductor 72, through the winding of relay 13, through springs 52 and its make contact, resistance 65, to negative battery. The energization of relay 13 again closes the circuit of motor magnet, which energizes and closes circuit of relay 14, which energizes and opens a circuit of relay 115 as before, and an other impulse is transmitted first to the switch S1, then to each succeeding switch until S2 is moved, then back to the switch S. When the wipers 37, 131, and 133 engage their respective second working contacts, relays 12, 116, and 120 are deenergized and the third impulse to be transmitted is transmitted over the circuit traced in connection with the first impulse.

Thus it will be seen that the switches S, S1 and S2 are stepped, each depending upon the preceding switch both energizing and deenergizing, and moreover the polarity of the pulse sent over the trunk line between switches is reversed on each step. When five steps have been taken, wipers 36, 130, and 132 are resting on their respective fifth working bank contacts, wiper 130 engages relay 102. Wiper 132 engages an open contact and need not be considered. Since the relay 2 is energized, and positive battery is placed upon the fifth working contact engaged by wiper 36, as soon as the relay 14 and the relay 114 restore, a circuit may be traced from this positive battery and wiper through springs 54, conductor 70, springs 152, wiper 130 and its fifth working contact, through the windings 102 and 102′ of the polar relay 102 to neutral, energizing the polar relay which operates its armature 137 in the direction to move the spring 136 against its right-hand contact, the position in which it is shown on the drawing. A circuit from the low voltage local battery is now completed from the positive pole of the battery through spring 136 and its make contact, the winding of relay 101, spring 135 and its break contact, to the negative pole of battery. Relay 101 is energized over this circuit, its armature being moved into the position in which it is shown on the drawings, and the local control circuits of the track siding device, not shown, are closed by the springs engaging armature 134.

If the despatcher had thrown the key K to close springs 22 and 23 instead of 20 and 21, relay 1 would have been energized and relay 2 would have been deenergized. This operation would have connected negative battery through springs 29 and conductor 61 to the fifth bank contact, so that relay 102 would have been energized in the opposite direction over the circuit just traced, armature 137 would have closed springs 136 and opened springs 135, thereby connecting the local battery to the polar relay 101 in the opposite direction, to operate that polar relay into the position opposite that in which it is shown on the drawings.

If the despatcher operates the key K to its middle position, so that both springs 20 and 21 and 22 and 23 are resting against their respective break contacts, neither relay 1 nor relay 2 will be energized. When wiper 36 engages its fifth working bank contact, it will complete a circuit from neutral through the alternating current generator 67, springs 28 and 30, condenser 16, and conductor 61, through the polar relay 102, to the neutral, with a multiple circuit through the condenser 107, and the alternating current relay 104 to neutral. Polar relay 102 is not effected by this alternating current because of the copper slugs on the armature ends of the cores of windings 102 and 102′ but the relay 104 is energized. Relay 104 at springs 145 opens a circuit of the energizing winding 103 of the polar relay 102. This polar relay is of the type which magnetically locks itself into the position in which it was last set, remaining there after the current decreases in its coils. The magnetism for locking the armature 137 and for polarizing the relay is furnished by the electro-magnet 103. Therefore, when the relay 104 energizes and opens the circuit of relay 103, the magnetism which

holds armature 137 in its energized position will die away and the armature will restore to its middle position. In the middle position, springs 135 and 136 both engage their break contacts, which contacts are connected together and connected to the negative pole of the local battery. Relay 101 will not receive any current, and since it is a relay of the type which restores to its neutral position when the current is removed from its coils, the armature 134 assumed a neutral position and closes contacts associated with that position.

Thus it will be seen that through one conductor 70, one bank contact of the selecting switch, the relay 102 is controlled to assume any one of its three positions, as result of which the operating relay 101 is positioned in any one of its three positions.

When the switches S1 and S2 have completed their energizing and energize the relay 13 in the hereinbefore explained manner, motor magnet 15 energizes and energizes the relay 14 which at springs 54 opens a circuit of the conductor 70, thereby removing whatever one of the three potentials has been applied to the relays 102 and 104. If alternating current has been applied and relay 104 is energized, it deenergizes and again closes the circuit of polarizing winding 103. However, since the armature 137 is in its neutral position, re-application of magnetism to the relay will not move the armature, and it will remain in that position until the coils 102 and 102′ are energized in one or the other directions. Stepping is resumed and the switches are moved on to their sixth working bank contacts. In this position wiper 132 again engages an open contact, and wiper 130 engages contact leading to the polarized relays 108 and the alternating current relay 110, which relays jointly control the operating relay 112. If the key K1 is in its normal position, as shown on the drawings, alternating current will be projected over the conductor 70 to operate the relay 110 to release the polar relay 108 to its neutral position. This operation is identical with that which has already been explained and will not be repeated. The switches take another step, bringing the wiper 130 into engagement with the supervisory circuit controlled by the track relay 111, and simultaneously bringing the wiper 36 into engagement with the contact to which conductor 62 is connected, which contact leads to the supervisory polar relay 6. When the track relay is in the position shown in the drawings and relay 106 is deenergized, circuit may be traced from positive battery through the resistance 123, conductor 174, spring 146 and its break contact, conductor 173, wiper 130, springs 152, conductor 70, springs 54, wiper 36, conductor 62, through the winding of relay 6 to neutral. Relay 6 energizes over this circuit, attracting the armature 38 to the position shown in the drawings, to close a circuit for the lamp 18, which lights to indicate to the despatcher that the track relay 11 is in its energized position.

When a train enters the siding across which relay 111 is bridged, that relay falls back, springs 127 and 128 move downward against their lowermost contacts. This operation momentarily breaks the circuit of relay 107, permitting that relay to deenergize. The deenergization of relay 107 prepares the circuit for starting the switches S, S1, S2, etc., these circuits being held open elsewhere if the switches are out of their normal position at the moment. The deenergization of track relay 111 closes a circuit from neutral to springs 128, and the relay 106 to negative, energizing the relay 106, which locks itself to springs 140 and springs 139 to neutral independent of the track relay 111. The deenergization of relay 106, alters at springs 146 the circuit just traced for relay 6, so that instead of wiper 130 picking up positive battery it picks up negative battery and the relay 6 is operated in the opposite direction to move the springs 38 to the left into engagement with the other set of contacts. This closes a circuit from neutral through the armature 38 and at the upper winding of relay 5 negative, energizing relay 5 which lights the signal lamp 19 to indicate to the despatcher that the track relay 111 is in its deenergized position.

If the switches are out of their normal position and the wiper 130 does not happen to be resting on the contact to which conductor 173 is connected at the time that the relay 106 energizes, the energization of relay 106 produces no instant result. The relay is locked energized, and as soon as the switches get back into their normal position, stepping is again started over a circuit traceable from neutral through spring 148 and its break contact, the winding of relay 105, conductor 171, the normal position contact and wiper 130, springs 152, conductor 70, springs 54, wiper 36 in its normal position, conductor 63, through the winding of relay 10 to the negative. Relay 10 energizes, again closing the circuit of alarm relay 11 to sound the bell for an instant to indicate that a supervisory signal is coming in. Relay 10 at springs 49 closes the hereinbefore traced impulsing circuit to start stepping of switches over their banks. Relay 105 energizes over this circuit, locking itself energized through spring 139 and its make contacts independent of the relay contacts 148, and at armatures 138 re-applies negative to the midpoint of relay 107, energizing that relay. Relay 107 upon energizing locks itself to springs 147 and its lower winding through springs 127 to neutral, it being remembered that track relay now is assumed to be deenergized.

When the track relay 111 reenergizes, the circuit of relay 107 is again momentarily broken, and that relay falls back to store up another supervisory signal, and the relays 105, 106, and 107 prepare circuits for starting the stepping switches from their normal position when those switches reach that position. Associated with the relay 6 is a recorder, not shown, which may be any kind of a pen register or printing recorder which will register the time during which the armature 38 is resting against its left-hand make contact. Since the armature 38 is moved to that position when track relay de-energizes by the entrance of the train upon the siding, the record made by the recorder will in this case be the length of time that that particular siding is occupied; that is, the length of time that a train lays on the siding.

The switches continue stepping in the same manner as previously described until the wipers are returned to their normal position. When the wiper 37 reaches its normal position relay 9 energizes and opens the pulsing circuit to stop further rotation of the switches.

Under certain circumstances the despatcher may desire to lock in all supervisory signals, such as 19, to do which he operates key K2 to close springs 56. It will be obvious that when the relays, such as relay 5, are once energized by the movement of armatures 38, they lock themselves through their lower windings, and will remain in energized positions until the despatcher restores key K2 independent of the armatures 38.

The dispatcher may wish to leave his position for a short time and by operating the key K2 which is common to all of the supervisory lamps, will know by the condition of the lamps on his return the distance the train has travelled and in which block the train is at present located. When the train enters a certain block, the lamp 18 associated therewith is extinguished and lamp 19 is lighted, and when the train leaves this block the lamp 18 is again illuminated, and if the key K2 should be thrown at this time then both lamps are illuminated to indicate to the dispatcher on his return that the train has entered this block and has passed into the next. The dispatcher will know, upon observing the condition of the lamps, just which block the train is in because the lamp 18 associated with this block will not at this time be illuminated because the train is still in this block.

Having thus described my invention, what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. In a remote control system, switching mechanism having wipers and bank contacts accessible thereto, a plurality of three-position polarized relays each associated with a certain one of said contacts, an armature for each of said relays having three positions, means for operating the wipers of said mechanism to select one of said relays and to place, positive, negative battery or alternating current on the contact associated with said relay, means responsive thereto for operating the armature of the relay to one of its three positions in accordance with the potential placed on its associated contact when the wipers of said mechanism reach such contact, and means for maintaining the armature of said relay in the position to which it is operated after the wipers of said mechanism have passed beyond its associated contact.

2. In a remote control system, a plurality of step-by-step switches having wipers, a plurality of three-position relays each having an armature, a bank contact individual to each of said relays and accessible to the wiper of the first of said switches, other bank contacts each corresponding to a contact in the first switch bank and accessible to the wiper of the second of said switches, a three-position control key associated with each of said other contacts, means associated with each of said keys for placing positive, negative battery or alternating current on its associated contact dependent upon the position of said key, means responsive to an operation of one of said keys to any of its three positions for operating said switches to step their wipers to successively engage corresponding contacts in their respective banks, circuits completed between said wipers for each of said relays responsive to the wipers engaging corresponding contacts in both switch banks for operating the armatures of some of said relays to one of their free positions in accordance with the potential on said other contacts in case the associated key has been operated, and the armatures on other of said relays remaining in their operated positions responsive to said potential in case the associated key has not been operated, and means for maintaining the armatures of said relays in their operated positions after the wipers of said switches have passed their corresponding contacts.

3. In a control system, a plurality of three position circuit closers, a pair of magnets for each circuit closer, a circuit for each pair of said magnets, means for selecting one of said circuits and for connecting alternating current or direct current of different polarity over said circuit, said magnets responsive to direct current of one polarity to move said circuit closer to one position and responsive to direct current of another polarity to move said circuit closer to another position, another magnet for each circuit closer, magnetic circuits for each of said last magnets includ-

ing its associated circuit closer, means for energizing said last magnets to induce a magnetic flux in either one of their associated magnetic circuits to maintain said associated circuit closer in either position, means responsive to alternating current connected over said circuit for deenergizing the last magnet associated with said selected circuit, and means responsive to the deenergization of said last magnet and the dissipation of the magnetic flux therein for moving said selected circuit closer to its third position.

4. In a control system, a plurality of relays each comprising three magnets and an armature having three positions, a circuit for each relay including the windings of the first and second magnets in series, a plurality of different kinds of current sources, means for momentarily selecting one of said circuits and for momentarily connecting said different sources to said circuit, means for operating the armature of the selected relay to its first position in case the first magnet is energized in response to one kind of current connected to said circuit and for operating said armature to its second position in case the second magnet is energized in response to another kind of current connected to said circuit, a normally closed circuit individual to each relay for energizing the winding of the third magnet, magnetic circuits for maintaining the armatures of said relays in the positions to which they were last operated when said third magnets are energized over their individual normally closed circuits, a second relay associated with each of said first circuits for individually controlling the normally closed circuits of the third magnets, means for energizing the associated second relay over said selected circuit in case a third kind of current source is connected to said circuit, and contacts on said second relay for opening the normally closed circuit of the third magnet to deenergize said third magnet to dissiplate the magnetic flux in said magnetic circuit to move the armature of the selected relay to its third position.

5. In a control system, a manually operated key having three positions, two relays associated therewith, a single contact individual to said key and relays, a plurality of different kinds of current sources, a circuit including normally closed contacts on said relays in a series for connecting one kind of current to said single contact in case said key is operated to one position, a second circuit for the first relay, means responsive to the operation of said key to its second position for completing said second circuit to energize the first relay, means operated by the energization of the first relay for connecting another kind of current to said single contact and for opening said first circuit, a third circuit for the second relay, means responsive to the operation of said key to its third position for completing the third circuit to energize the second relay, means operated by the energization of the second relay for connecting a different kind of current to said single contact and for opening said first circuit, and means operated to three different positions in response to the three different kinds of current connected to said single contact.

In witness whereof, I hereunto subscribe my name this 2d day of May, A. D. 1928.

HARRY E. HERSHEY.