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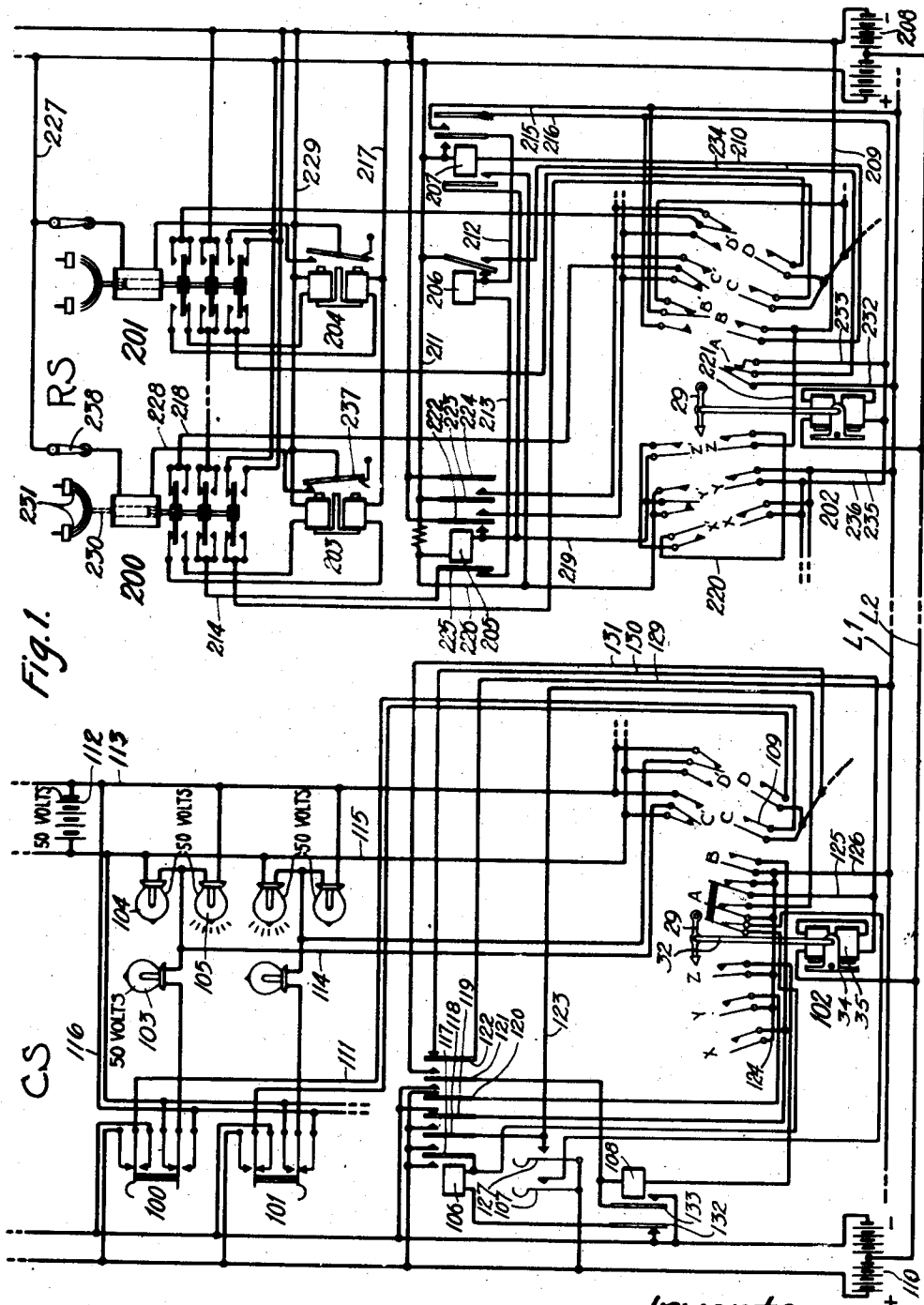
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REMOTE CONTROL AND INDICATING SYSTEM

Filed Nov. 27, 1925

2 Sheets-Sheet 1



Inventor:
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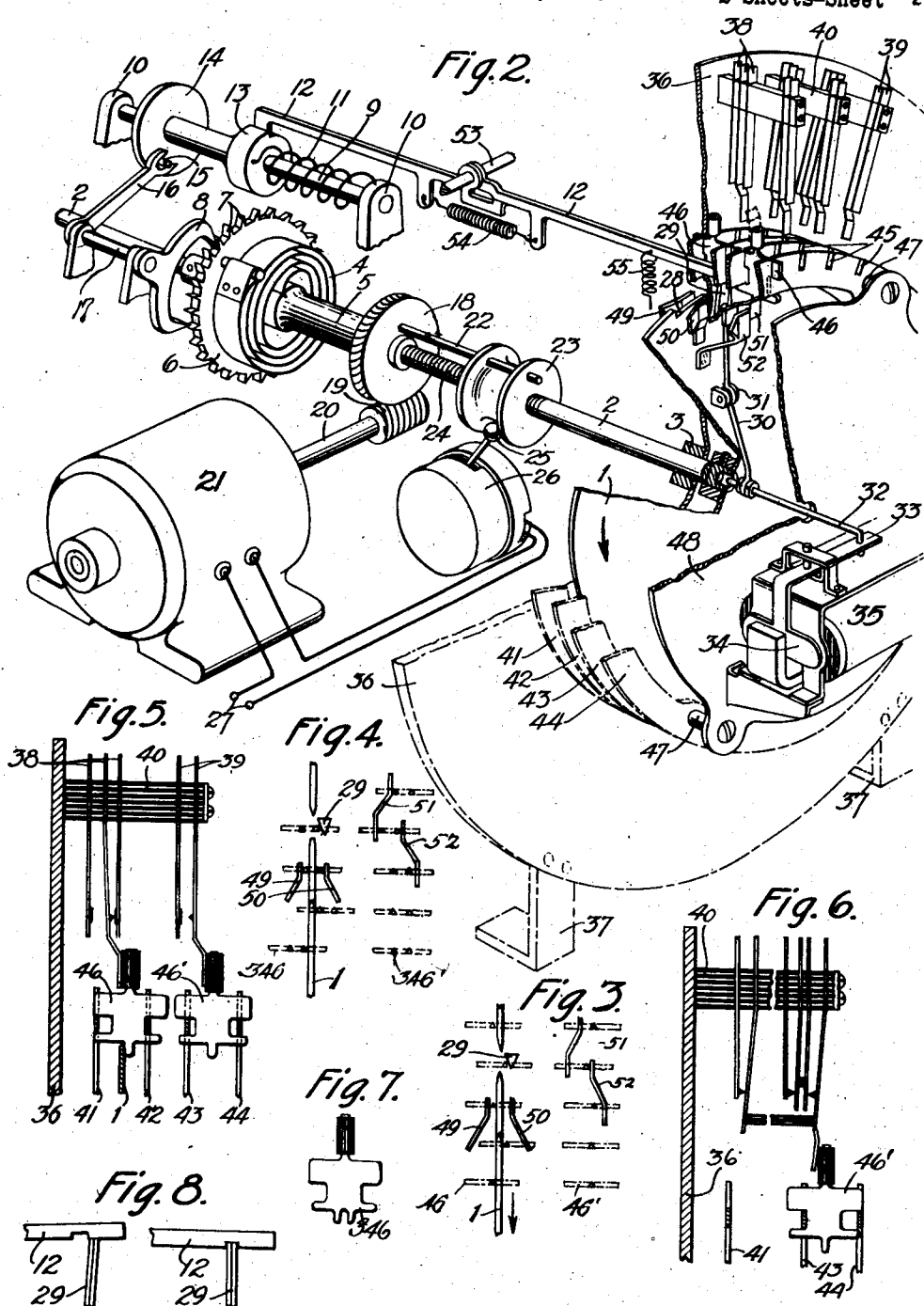
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UNITED STATES PATENT OFFICE.

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REMOTE CONTROL AND INDICATING SYSTEM.

Application filed November 27, 1925. Serial No. 71,873.

This invention relates to remote control and supervisory systems.

The object of this invention is to provide a system of this character in which all the required operations are taken care of with a minimum of equipment and which practically eliminates the false operation of the devices, such as power switches, at the remote station.

In accordance with this invention only a single pair of conductors is provided between the control and remote stations and a novel type of distributor is employed, one at each station synchronously operated, each distributor having only one electromagnet which is common to all the sets of switch contacts on the distributor; these contacts being associated with the various devices at the remote station under control. This electromagnet is polarized to selectively operate a shutter in either of two directions, which shutter is carried by a rotating member of the distributor in such a way that the shutter passes in operative relation to the contact sets in succession. This shutter when adjacent the desired set is actuated by an impulse delivered to the magnet, which magnet shifts the shutter to actuate such set of springs in one of two ways, depending upon the character of the impulse which is, in turn, dependent upon the position of a control key previously set by the dispatcher. The contact set when actuated is held in such position and prepares a circuit to shift the device, such as a power switch, under control, to its alternate position. This circuit is closed by the distributor near the completion of its movement by a relay which is operated by a code of impulses transmitted from the distributor at the control station. This code is preferably made up of a set of impulses of different polarity and since the relay can only operate on the receipt of such code, the chance of false operation of the power switch is minimized, if not absolutely prevented. When the device shifts its position, it sets up a certain electrical condition on its set of contact springs on the distributor at the remote station and when the actuating device on the distributor reaches this set of springs and actuates it, it transmits back to the polarized magnet of the distributor at the central station an impulse the character of

which is dependent upon the position the device has assumed. This magnet in operating shifts the shutter of the central station distributor in the corresponding direction which closes a circuit to operate a signal before the dispatcher indicating to him that the device has responded properly.

This and other features of this invention will be apparent from the following description taken in connection with the attached drawings in which

Fig. 1 is a schematic diagram of a control and supervisory system embodying this invention using two of the above mentioned distributors.

Fig. 2 is a schematic diagram of the distributor.

Fig. 3 shows in detail means for actuating the contact springs of the distributor in all but the last three positions.

Fig. 4 is similar to Fig. 3 for the last three positions of the distributor.

Fig. 5 shows in detail the contact spring arrangement and the operating means at the majority of positions.

Fig. 6 shows the spring arrangement at the stopping position.

Fig. 7 shows the operating slide used in the last three positions, and

Fig. 8 shows the method of operating the stopping lever.

Referring particularly to Fig. 2 a rotating disc 1 is fixed to a shaft 2 supported in suitable bearings only one of which is shown at 3. The shaft is driven by a spring motor consisting of spring 4 one end of which is attached to hollow shaft 5 which is free to rotate around shaft 2. The other end of spring 4 is attached to an escapement wheel 6 fixed to shaft 2 by pins or other equivalent means. Wheel 6 is provided with teeth 7 with which pawl 8 is adapted to cooperate. A shaft 9 is supported in frame members 10, equipped with a spring 11 one end of which is fixed to one of the frame members 10, the other end being fixed to a cam member 13 permanently fixed to shaft 9. Shaft 9 is restrained from moving under the tension of spring 11 by means of lever 12 cooperating with the raised portion of cam 13. Spring 11 is so tensioned as to oscillate shaft 9 rather

than cause it to make a complete revolution. Also fixed to shaft 9 is a disc 14 on which is a fixed pin 15. Pin 15 is embraced in the forked or yoke portion of a lever 16, the other end of which lever is fixed to one end of shaft 17 which at its other end carries pawl 8. Shaft 17 is supported by bearings carried by frame members not shown.

When lever 12 is moved out of engagement with the raised portion of cam 13 the system is released and shaft 2 is rotated step-by-step under the influence of spring 4 through the train just described, in substantially the same manner as the second hand of a watch.

Attached to hollow shaft 5 at the end opposite spring 4 is a wheel 18 cooperating with worm 19 on shaft 20 of electric motor 21. A rod 22 fixed in wheel 18 passes freely through the flanges of a member 23 in turn threaded to cooperate with the threaded portion 24 of shaft 2. Shaft 20 is normally stationary thereby holding wheel 18, shaft 5, rod 22 and member 23 against rotation. As shaft 2 rotates member 23 is moved longitudinally of the shaft due to the cooperating threads. The arm 25 of an electric snap switch 26 is actuated by the movement of member 23. Snap switch 26 controls the current supply through wires 27 for operating motor 21.

The location of switch 26 is such that when spring 4 is approximately unwound, switch 26 is operated by member 23 to supply current to motor 21 causing it to rotate, which, through worm 19 and wheel 18 will tension spring 4. As wheel 18 rotates member 23 is also rotated by means of rod 22 and if shaft 2 is also rotating since it rotates at a speed less than that of wheel 18, member 23 will in any case be moved longitudinally of the shaft and when spring 4 has been sufficiently tensioned, switch 26 will be operated to open the motor circuit and hence bring the motor to rest.

Disc 1 is equipped with a shutter 29 capable of being moved to either side of the disc. This shutter 29 is of the same thickness as the disc so that when it is in its mid position it becomes in effect a part of the disc. The shutter, however, extends radially somewhat beyond the periphery of the disc so as to engage arm 12. Adjacent the shutter and to the left thereof, as seen in Fig. 2, disc 1 is provided with a notch 28.

The movement of shutter 29 is caused by lever 30 pivoted to the disc at 31. At the end of the lever away from the shutter it is attached to a rod 32 positioned at one end in a hole in the end of shaft 2. The other end of rod 32 is pivotally attached to an extension 33 of armature 34 of polarized electromagnet 35.

A stationary disc 36 supported by frame members 37 carries two series of contact spring pile-ups represented generally by 38

and 39 supported on extension pieces 40. The main operating springs of these pile-ups are biased to move to the right as shown in Figs. 5 and 6 when unrestrained. Four rings 41, 42, 43 and 44 are positioned relative to disc 1 substantially as shown in Fig. 5 and are provided with slots 45 (Fig. 2) in which the slides 46, 46', 346, 346' are adapted to move. These rings are supported by bolts 47 which extend between stationary discs 36 and 48.

Adjacent the notch 28 in disc 1 and attached to the disc are two converging pieces 49 and 50. Offset from the disc somewhat further but in the same general location and also attached to the disc are two other converging pieces 51 and 52. The shape and general location of these pieces may be more readily seen by referring to Figs. 3 and 4. Piece 49 (Fig. 2) has a raised portion as shown on which lever 12 will ride before it is engaged by the shutter to stop the oscillations of the cam 13 and hence the rotation of disc 1.

The slides 46, 46' are shaped generally as shown in Fig. 5. On the upper edge the slides are provided with a projecting piece adapted to actuate the main spring of the contact spring pile ups. On the lower edge of slide 46 there is also provided a projecting piece adapted to cooperate with shutter 29 for the actuation of the row of springs near the disc while pieces 51 and 52 engage the projection of slide 46' for the series of springs more distant from the disc. The lower horizontally extending portion of the slides extend under the rings 41, etc., while the upper horizontally extending portions fit into the notches 45 of the rings. These portions act as guides and positioners. In Fig. 7 is shown one of the slides 346 in which a forked projection is provided at the lower edge instead of a single projecting piece. These slides 346 and a similar slide 346' are used only in the last three positions for a reason to appear later.

Lever 12 (Fig. 2) is made up of two parts pivoted on a rod 53 supported by the frame, the two parts being held as one by spring 54 in the well known manner. That portion of the lever which cooperates with shutter 29 is shown in detail in Fig. 8. When shutter 29 is moved to the left (Fig. 8) it enters the slot provided for that purpose in the lever 12 thereby permitting this end of the lever to be drawn down under the tension of spring 55 which causes the lifting of that end of the lever in engagement with cam 13. Cam 13 is thereby released which, as pointed out above, will cause the rotation of disc 1. The movement of the shutter 29 is caused by impulses of either positive or negative direct current through magnet 35. As the disc rotates the shutter is moved to one side or the other of the disc in accordance with the po-

larity of pulses actuating magnet 35. If, however, no pulse is received the armature 34 of magnet 35 will remain in its neutral position and hold shutter 29 in line with the disc.

It will be seen from Fig. 3 that as disc 1 rotates in the direction of the arrow, slides 46 associated with springs 38 may be moved or retained in the same position depending upon the position taken by shutter 29. That is, if shutter 29 is in the neutral position (aligned with the disc) there will be no motion of the slide and hence no change in the position of the associated contact spring. If, however, the shutter is moved to the right of the disc as shown in Fig. 3, a slide which has its lower projection to the right of the disc will be moved to the left of it. Also if the shutter is at the left of the disc, a slide having its projection also to the left will be moved to the right of it. Again, if the shutter is at the right of the disc no change will be made in the contact springs by a slide if the projection is at the left of the disc and in the same way no change occurs if the shutter is to the left of the disc and the projection is to the right of the disc. It will also be seen in Fig. 3 that slides 46' associated with spring pile ups 39 are always moved to make contact by means of piece 52. Arm 51 serves to restore slide 46'. The normal position of these contacts is open. Arms 49, 50 do not operate slides 46 but come into play only with the type of slides used in the last three positions and shown in Fig. 7. The forked projections of the slides 346, 346' permits the disc to pass through them instead of to one side of the projection as in the other slides. Notch 28 is provided in disc 1 to allow the forked projections on slides 346 to pass across the disc 1 when positioned by arms 49, 50. This modification is made necessary because of the code of values mentioned above, one pulse of which is zero. Fig. 4 illustrates in a manner similar to that of Fig. 3, how the slides may be moved to the right or left of the disc or remain in the neutral position. In the neutral position no springs in the associated pile-up make contact. These slides, however, are always brought to neutral position by arms 49, 50 and then moved in accordance with the position of the shutter.

In the stopping position the contact spring arrangement is somewhat different from those in the other positions, since when the disc is not rotating, it is necessary for reasons which will appear later, to have three pairs of contact springs holding three different circuits closed. In this position there are no springs corresponding to those in the series designated generally by 38 and hence no slide corresponding thereto. This contact spring arrangement is shown in

Fig. 6, the contacts being held closed through the corresponding slide 46' by means of arm 52. As soon as the disc starts to rotate these contacts are all opened.

Referring now to Fig. 1, the central station is referred to generally as CS and the remote station as RS having two line conductors L—1 and L—2 connecting them.

Keys 100 and 101 at the central station control respectively switches 200 and 201 at the remote station. Only two keys and two switches with the associated apparatus are shown in order to simplify the drawing but the number of switches that may be operated is limited only by the capacity of the distributors.

The distributor at the central station is designated by 102 and that at the remote station by 202. These distributors are the same as those described above but it will be noted that the contact spring arrangement of the distributor at the central station is somewhat different from that of the distributor at the remote station, the reason for which will appear later.

Associated with key 100 are three signal lamps 103, 104 and 105. Lamp 103 is white and is lighted only when a switch is being operated. If, for any reason, the switch does not operate or the proper indication is not sent back, lamp 103 will continue to be lighted thereby notifying the operator of such failure. Lamp 104 is green and is lighted when the corresponding switch 200 at the remote station is open while lamp 105 is red and when lighted indicates that the switch is closed. Each key and switch has a corresponding arrangement of lamps.

At the remote station are two mechanically locking relays 203 and 204 to control, respectively, the action of switches 200 and 201. Relay 205 is the main control relay at the remote station and is only actuated when the proper code of pulses is received in the last three distributor positions to close circuits to operate the power switches. Relay 206 controls the starting of the distributors for giving the indication or answer-back signals. Relay 207 shortcircuits relays 205 to insure its deenergization after it has been energized upon the reception of a code of pulses. It also insures the energization of relay 206.

A relay 106 at the central station which is operated when the contacts of key 107 are closed starts the system to send controlling impulses. This relay locks up when operated and remains locked up while the distributors are rotating, its locking circuit being broken upon the completion of rotation of distributor 102 upon the operation of relay 108.

The distributors 102 and 202 are shown in the stopping position. In each distributor the contacts in positions A, B, C, D . . .

X, Y and Z are always actuated by arm 52 (Figs. 2 and 4) while the contacts in positions B', C', D' . . . X', Y', and Z' are operated by the shutter 29 when pulses are received by the magnet. In the stopping position A, the contacts are closed and there are no contacts operated by the shutter. In the last three positions of distributor 102 at the central station, there are no contacts actuated by the shutter. This simplification may be had in the system represented since after a power switch operates automatically at the remote station, the operation of the particular switch will be indicated at the central station and the key at the central station corresponding to such switch will have to be operated by the dispatcher. By having the system so arranged, it then becomes necessary upon the automatic operation of a remote switch for the dispatcher to perform a manual operation which will impress upon him such operation more pronouncedly than if there were merely a change in signal lamps. This manual operation has been found to be of considerable importance.

It is understood that the representation of shutter 29 of distributors 102 and 202 of Fig. 1 is not to be taken literally and that this shutter actuates only the middle spring of the contact springs in positions B', C', D', etc.

To illustrate the operation of the system let it be assumed that switch 200 at the remote station is to be opened. To do this, keys 100 and 107 at the central station are operated. Key 107 must always be operated when a switch is to be controlled from the central station.

When key 100 is operated, the upper group of contacts changes the polarity of spring 109 in position C of distributor 102 from positive to negative. This change will be readily apparent from the drawing since the upper spring of the upper group of key 100 is connected to the positive lead from battery 110 while the lower spring of the upper group is connected to the negative lead of the battery. The middle spring of the upper group is directly connected by means of conductor 111 to spring 109. Key 101 is similarly arranged with its middle spring connected to a corresponding spring in position D.

The lower group of contact springs of key 100 controls the 50-volt lamps 103, 104 and 105. With the springs in the position shown, lamp 105 (red) is the only one lighted over a circuit from 50-volt battery 112, conductor 113, lamp 105, conductor 114, middle and left springs in position C' of the distributor, conductor 115 to the battery. When key 100 is operated, lamp 105 remains lighted and lamp 103 becomes lighted over a circuit from battery 112, conductors 113, 116, lower and middle springs of the lower group of key 100,

lamp 103, conductor 114, middle and left springs in position C' of the distributor, conductor 115, to battery. The lighting of lamp 103 indicates that key 100 has been operated and that the corresponding remote switch is to be operated.

When key 107 is operated to close its contacts relay 106 is energized over a circuit from positive lead of battery 110, contacts of key 107, left pair of contacts in position A of the distributor, winding of relay 106, outer armature and contact of relay 108 to negative lead of battery. Upon energizing relay 106 it attracts its armatures 117 to 122, inclusive.

Armature 117 closes a locking circuit over an obvious path. Armature 118 closes a circuit to put positive current through the magnets of distributors 102 and 202 in parallel to start them rotating by the release of arm 12 as explained above in connection with Fig. 2; that is to say, the magnets 102, 202 in moving the shutters 29 into the notches in the levers 12 permit the springs 55 to draw these levers down causing the lifting of the other ends of the levers which engage the cams 13. These cams are thus released to cause the rotation of discs 1, as previously explained in detail. This circuit may be traced from positive lead of battery 110, through associated contact and armature 118, conductor 123, middle pair of springs in position A of distributor 102, conductor 124, right pair of contacts in position A, conductor 125, magnet of distributor 102, line conductor L-2 to battery 110. The parallel circuit for distributor 202 is traceable from conductor 124, conductor 126, line conductor L-1, conductor 232, left, middle and right springs in position A of distributor 202, conductor 233, through the magnet of distributor 202, line conductor L-2 to battery 110. Armature 119 changes the polarity on right springs in positions B and X of distributor 102 from negative to positive while armature 120 removes positive polarity from right spring in position Y leaving it at zero potential and armature 121 puts negative potential on right spring in position Z through relay 108 over obvious circuits. Armature 122 in opening its back contact opens the circuit from line L-1 through conductors 129 and 130 to the magnet of distributor 102 so that this magnet will not be actuated by impulses impressed on line conductor L-1 by distributor 102. At its front contact armature 122 connects common conductor 131 from springs in positions C, D, etc. to line L-1 to actuate the magnet and shutter of distributor 202 at the remote station which in turn operates the middle spring of group C', D', etc. as explained above.

As the distributor disc starts rotating and arms 52 (Figs. 2 and 4) leave the contacts in position A of both distributors, these contacts

will open so that no further control can be exercised until a full revolution has been made and key 107 again operated.

When position B is reached, contacts of distributor 102 will be closed by arm 52 and a positive pulse is sent through conductor 126, to the line conductor L—1. At the same instant, contacts B of distributor 202 at the remote station will be likewise closed thereby energizing relay 207 over a circuit extending from the negative lead of battery 208, conductor 209, contact springs in position B, conductor 210, winding of relay 207, conductor 211, to positive lead of battery 208. In energizing the left armature of relay 207 shorts circuits relay 205 to insure that it is de-energized over an obvious circuit. At its right inner armature relay 207 closes a circuit to insure that relay 206 is energized. This circuit may be traced from the positive lead of battery 208, conductor 211, right inner armature and associated contact of relay 207, conductor 212, winding of relay 206, conductor 213, left armature and associated contact of relay 205, conductor 214, middle auxiliary contacts of switches 200 and 201 to the negative lead of battery 208. At the right outer armature of relay 207, a circuit is closed from line conductor L—1, conductor 215, right outer armature and associated contact of relay 207, conductor 216, magnet of distributor 202 to line conductor L—2.

From the above, it will be seen that the positive pulse sent by contacts in the B position of distributor 102 to line conductors L—1 traverses the magnet of distributor 202 and returns to battery 110 over line conductor L—2.

As the magnet of distributor 202 is energized, the shutter of the distributor is actuated and the middle spring in position B' of distributor 202 is moved out of contact with the right spring and into contact with the left spring. This arranges a direct and permanent circuit from line conductor L—1 through the magnet to line conductor L—2. The right outer armature and contact of relay 207 serves merely to insure the connection from line conductor L—1 through the magnet until the B' contacts are changed.

It will be recalled that when key 100 was operated, the polarity of the right spring 109 of position C of the distributor 102 at the central station was changed from positive to negative. As the distributor disc rotates contacts in position C, distributor 102, are closed, and a negative pulse is sent through the magnet of distributor 202 at the remote station over a circuit which may be traced from the negative lead of battery 110, lower and middle springs of upper group of key 100, conductor 111, right spring 109 and left spring in position C of distributor 102, conductor 131, contact and armature 122 of relay 106, conductor 129, line conductor

L—1, conductor 215 at the remote station, middle and left springs in position B' of distributor 202, conductor 216, magnet of distributor 202, line conductor L—2 to battery 110 at the central station.

As the magnet of distributor 202 is energized by a current of negative polarity, the shutter will change the position of the middle spring in position C' from contact with the left spring to contact with the right spring. This connects positive side of battery 208 to the left spring over a circuit which may be traced from the positive lead of battery 208, conductor 217, lower winding of relay 203, upper springs of upper auxiliary contacts of switch 200, conductor 218, middle and right spring of position C'.

As the disc and shutter of distributor 102 continue to rotate, springs in positions D, etc., are operated but since only key 100 was changed, no change has occurred in these springs and hence no change will be made in the springs in position D' etc. of distributor 202 until the last three positions are reached. As explained above, when relay 106 at the central station was energized, its armatures closed contacts making the polarity of the right springs in positions X, Y and Z positive, zero and negative, respectively. Therefore, as distributor 102 actuates the springs in these positions, pulses will be transmitted over conductors 124, 126, line L—1, etc. as already traced to actuate the magnet and shutter of distributor 202 and hence move right spring in position X' of distributor 202 to contact with the left spring, move middle spring in position Y' from contact with the left spring to the middle position so that it does not contact with either the right or left spring, and move left spring in position Z' to contact with the right spring. When the springs in positions X', Y' and Z' have been so moved, a circuit will be established for energizing relay 205 which may be traced from the positive lead of battery 208, conductor 211, winding of relay 205, conductor 219, springs in position Z', springs in position X', conductor 220, springs in position Z which are momentarily closed, conductors 221 and 209, to negative lead of battery 208.

Relay 205 upon energizing attracts its armatures 222 to 225, inclusive. Armature 222 closes a locking circuit for the relay over an obvious circuit. Armatures 223 and 224 connect positive and negative leads, respectively, of battery to left and right springs in positions C', D', etc. Armature 225 opens the energizing circuit for relay 206.

The importance of the operating code is seen from what has just preceded. This is obvious as regards springs in positions X' and Z'. If the middle spring in position Y' had remained in contact with either the right or left springs and the springs in positions X' and Z' had functioned properly, the relay

205 would have been shunted by means of conductor 226 and the relay would not have been energized.

As stated above, armatures 223 and 224 of relay 205 connect positive and negative leads of battery 208 to left and right springs, respectively, in positions C' and D', etc. Therefore, since the middle spring of position C' is now in contact with the right spring, current will flow from positive lead of battery 208 through conductor 217, lower winding of relay 203, upper springs of upper auxiliary contacts of switch 200, conductor 218, middle and right springs in position C', associated contact and armature 224 of relay 205 to negative lead of battery. The lower winding of relay 203 is thereby energized and armature 237 is attracted towards the lower pole-piece thereby breaking the energizing circuit for the solenoid of switch 200 which circuit was maintained from positive lead to battery 208, conductor 227, solenoid of switch 200, conductor 228, associated contact and armature 237 of relay 203, conductor 229, to negative lead of battery.

Plunger 230 of switch 200 is therefore permitted to drop opening contacts 231 of power line (not shown); also changing contact spring arrangement of the auxiliary contacts. The upper group of contacts arranges a circuit for the energization of the upper winding of relay 203 for closing switch 200 when desired. The lower group changes the polarity on the right spring of position C from positive to negative to give the answer back signal. The function of the middle group of auxiliary contacts will be explained hereinafter in connection with the automatic operation of the power switch.

It was stated above that the negative lead of battery 110 at the central station was connected to the right spring in position Z of distributor 102 through the winding of relay 108. When contact is made at position Z to transmit the negative pulse, relay 108 is energized and closes its armatures 132 and 133. Armature 132 breaks the holding circuit of relay 106 thereby permitting it to release its armatures. Armature 133 now connects the negative lead from the battery through the winding of relay 108 to insure that the negative pulse transmitted to the remote station has the same duration as the other pulses. Upon the completion of a revolution of each distributor it is stopped by raised portions 49 on disc 1 which lifts lever 12 to engage cam 13 to stop the rotation of disc 1 as previously described in detail.

Referring again to the remote station, it was stated that when relay 205 attracted its armatures, the energizing circuit for relay 206 was opened permitting its armature to close its back contact. When the disc reaches its stopping position A a positive pulse will be transmitted to again start the distributors.

This pulse may be traced from positive lead of battery 208, conductor 211, armature and back contact of relay 206, conductor 234, middle spring of position A and in parallel through both distributor magnets, one path being through left spring of position A, conductor 232, line L—1, conductor 129, armature 122 and back contact of relay 106, conductor 130, through magnet of distributor 102, line L—2 to battery 208. The other path is from middle spring in position A of distributor 202, right spring in position A, conductor 233, the magnet of distributor 202, line L—2, to battery 208.

In position B of distributor 102 at the central station, the right spring is now connected to the negative lead of battery 110 through armature 119 of relay 106 and a negative pulse is sent over line L—1 as previously traced. This actuates the magnet of distributor 202 and returns middle spring in position B' of distributor 202 in contact with the right spring. At the same time, springs in position B of distributor 202 close a circuit through relay 207 which may be traced from positive lead of battery 208, conductor 211, winding of relay 207, conductor 210, springs in position B of distributor 202, conductor 209 to negative lead of battery.

Relay 207 upon energizing attracts its armatures and at its left armature closes a shunting circuit around relay 205 to deenergize it, at its inner right armature it closes an energizing circuit already traced for relay 206 which thereupon locks up; its other armature has no function during this operation. Distributor 202 is now in condition to transmit pulses and distributor 102 to receive.

In position C, distributor 202 transmits a negative pulse since the right spring is connected to negative lead of battery 208 as explained above. The middle spring in position C' of distributor 102 is therefore moved out of contact with the left spring and into contact with the right spring. This opens the circuit for lamps 103 and 105 which were traced above and closes a circuit for lamp 104 which may be traced from battery 112, conductor 113, right and middle springs in position C', conductor 114, lamp 104 to battery.

The distributors continue to rotate and in positions X, Y and Z of distributor 102 negative, positive and zero pulses are sent from the central station to actuate the magnet of distributor 202 to return the springs in positions X', Y' and Z' of distributor 202 to the original positions. These pulses pass from the respective leads of battery 110, through armatures 119 and 120 of relay 106 through common conductors 124, 126, line conductor L—1, conductor 235 at the remote station, springs in positions X and Y in sequence, conductor 236 through the magnet of distributor 202, line conductor L—2 to battery 110.

The distributors then stop in position A closing the contacts preparatory to the next operation.

The next operation for closing a switch such as 201 at the remote station is the same as above except that the springs in position D' of distributor 202 are changed and due to the position of the upper group of auxiliary contacts of switch 201, a circuit is closed through the upper winding of relay 204 upon the operation of relay 205 so that the armature of relay 204 closes a circuit through the solenoid of power switch 201.

In case of an abnormal line condition causing the permanent opening of a power switch, it is always necessary to send a man to ascertain the trouble and this man will be required to change the position of the armature of the controlling relay, such as 203, to again put the switch under the control from the central station after the abnormal condition has been removed.

This will be more clearly understood from the following: Let it be assumed that the abnormal condition on the line, controlled by power switch 200, continues long enough, so that a switch, such as 238 in conductor 227, is automatically opened. As such circuit breaker arrangements are well known in the art, they do not appear represented in the drawing. The actuating circuit for the solenoid of switch 200 is therefore opened and plunger 230 drops changing the auxiliary contacts.

The upper auxiliary group of contacts prepares a circuit through the upper winding of relay 203 and as explained above the armature 237 is changed in position, manually, to prepare it for control from the central station. When the switch changes, the middle group of contacts momentarily opens the energizing circuit for relay 206 which thereupon sends a positive pulse from the distributor, magnets starting the distributors, as explained above. The upper group changes the polarity on the right spring in position C of distributor 202 from positive to negative.

The distributors then operate as explained above in giving an indication except that in position C' of distributor 102, the middle spring will be moved into contact with the right spring, thereby causing both lamps 103 and 104 to be lighted over a circuit which may be traced from battery 112, conductor 113, right and middle springs in position C' of distributor 102, conductor 114, in parallel through lamp 104 to battery, and through lamp 103, middle and upper springs of lower group of key 100 to battery. With both the white and green lamps lighted the dispatcher knows that the corresponding switch has acted automatically. Keys 100 and 107 are therefore operated, key 100 extinguishing lamp 103 and the distributors again making

two revolutions for actuating and indicating, thereby leaving the system in condition for again closing switch 200 when required.

A checking key 127 is arranged at the central station to impress a positive pulse on both distributors to start them rotating. This operation is merely to check the system as to the indications.

When the contact of key 127 is closed positive lead of battery 110 is connected through conductor 123, middle and right pairs of contacts in position A of distributor 102, through the magnets of distributors 102 and 202 in parallel as traced above, through the line conductor L-2 to battery 110. Since relay 106 has not been energized, no impulses will be transmitted from distributor 102 in positions C, D, etc. but in position B, a minus impulse will be transmitted, in position X, a minus impulse, in position Y, a positive impulse, and in position Z, no impulse, and therefore contacts B' will be set for transmitting indication impulses and relay 205 will not be energized and hence only one revolution of the distributors will be made to check the indication.

If the indications are correct the polarity of the springs in positions C, D, etc. of distributor 202 will be the same as before. No change will occur in the springs in position C', D', etc. of distributor 102 and hence no change in the signal lamps.

If, however, a power switch such as 200 at the remote station has changed position without the proper indication having been given, or if for some reason the system has not functioned properly the indication lamps at the central station will not be lighted in accordance with the polarity of the springs in position C, D, etc. of distributor 202 at the remote station and they will now be changed to indicate correctly. In case the indication lamps change during the checking operation, the dispatcher is thereby notified to change his keys 100, etc., or take whatever steps may be necessary.

It is desired to point out that in the above system all the keys may be changed and hence all the power switches operated with one complete operation (two operations) of the distributors.

It is understood that modifications may be made in the system as outlined above and still be within the scope of this invention, which is to be limited only by the appended claims.

What is claimed is:

1. In a remote control system, a control station, a remote station, line conductors joining said stations, a pair of distributors one at each station associated with said conductors, devices at the remote station to be operated, circuits at the remote station controlling the operation of the same, keys at the control station for said devices, means

including said conductors whereby the distributor at the control station and said keys prepare the individual circuits jointly with the other distributor, means actuated by the distributor at the control station, after said circuits have been prepared, for transmitting a definite code of impulses to the other distributor, and means at said distributor actuated thereby to complete the prepared circuits.

2. In a remote control system, a control station, a remote station, line conductors joining said stations, a pair of distributors one at each station associated with said conductors, devices at the remote station to be operated, circuits at the remote station controlling the operation of the same, keys at the control station for said devices, means including said conductors whereby the distributor at the control station and said keys prepare the individual circuits jointly with the other distributor, contacts on the distributor at the remote station, means actuated by the distributor at the control station after said circuits have been prepared for transmitting a definite code of impulses to the other distributor to cause the same to actuate said contacts, means actuated thereby to close said prepared circuits, signaling devices at the control station, circuits for operating the same, means whereby the distributor at the remote station prepares the individual signaling circuits jointly with the other distributor, dependent upon the position of said devices, and means actuated by the distributors in completing the signaling cycle for resetting the code receiving contacts.

3. In a remote control system, a control station, a remote station, line conductors joining said stations, a pair of distributors one at each station associated with said conductors, control magnets and slides controlled thereby on said distributors, devices at said remote station to be operated, means including keys at the control station for said devices for changing the potential on contacts on said control distributor, means in-

cluding said distributor for connecting said contacts in succession to the remote distributor magnet to actuate slides thereof corresponding to the actuated keys, circuits prepared by the movement of said slides, means actuated by the control distributor for closing said prepared circuits to change the position of the devices corresponding to the actuated keys, signals at said control station, and means actuated by the devices in changing their positions for operating the corresponding signals through the medium of the magnet and slides on the distributor at the control station.

4. In a remote control system, a control station, a remote station, line conductors joining said stations, a pair of distributors one at each station associated with said conductors, control magnets and slides controlled thereby on said distributors, devices at said remote station to be operated, means including keys at the control station for said devices for changing the potential on contacts on said control distributor, means including said distributor for connecting said contacts in succession to the remote distributor magnet to actuate slides thereof corresponding to the actuated keys, circuits prepared by the movement of said slides, means actuated by the control distributor for closing said prepared circuits to change the position of the devices corresponding to the actuated keys, means actuated by the devices in shifting their positions for changing the potential on the corresponding contacts on the remote distributor, means including said distributor for connecting said contacts in succession to the control distributor magnet to actuate the slides thereof corresponding to the contacts whose potential has been changed, and circuits closed by the actuation of said slides to actuate signals corresponding to the position of said devices.

In witness whereof, I hereunto subscribe my name this 13th day of November, A. D. 1925.

LOUIS M. POTTS.