

June 17, 1930.

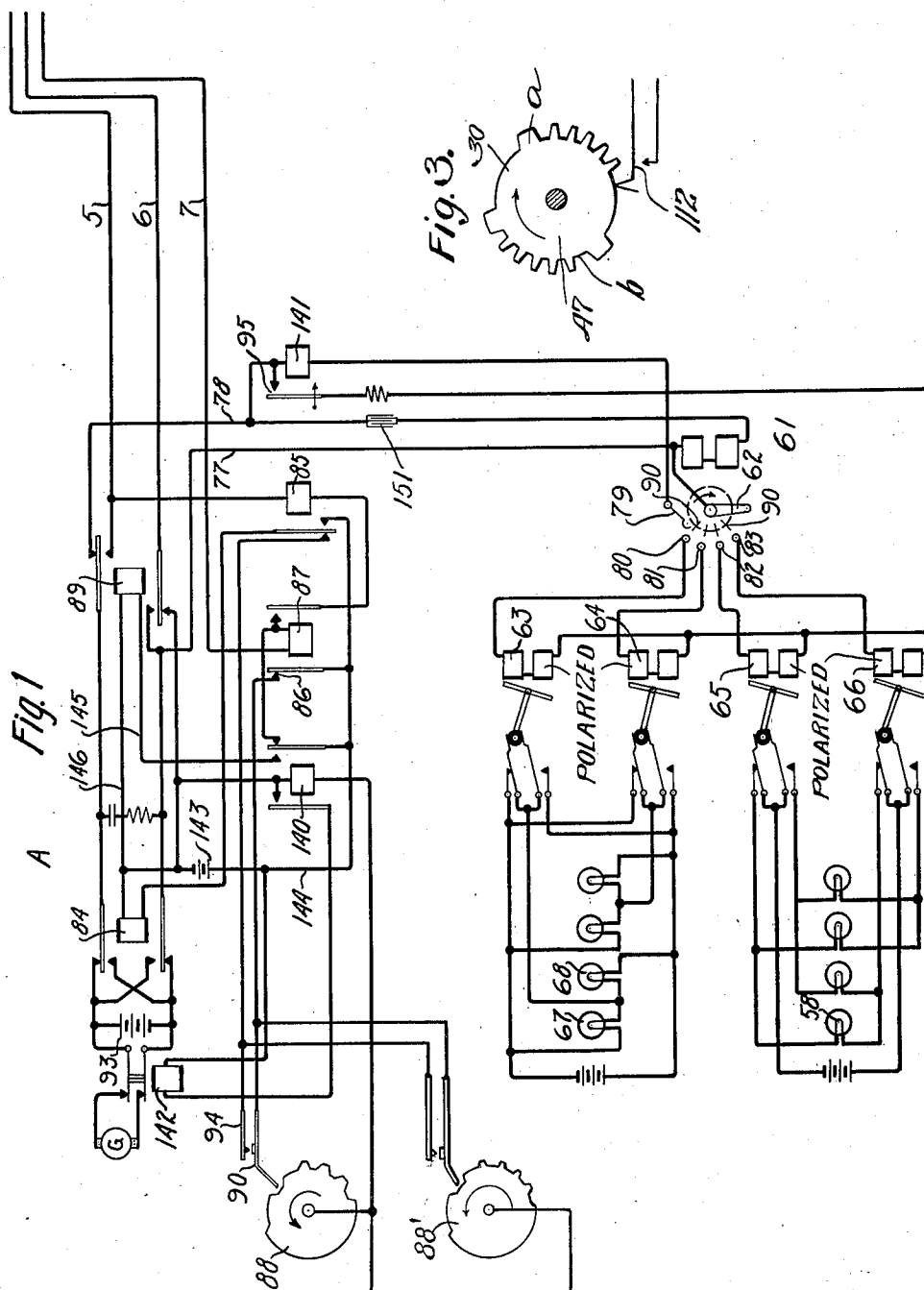
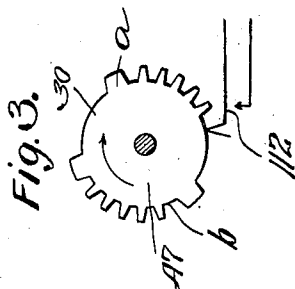
L. J. BURNS ET AL

1,763,879

SELECTOR SUPERVISORY SYSTEM

Filed Feb. 9, 1925

2 Sheets-Sheet 1



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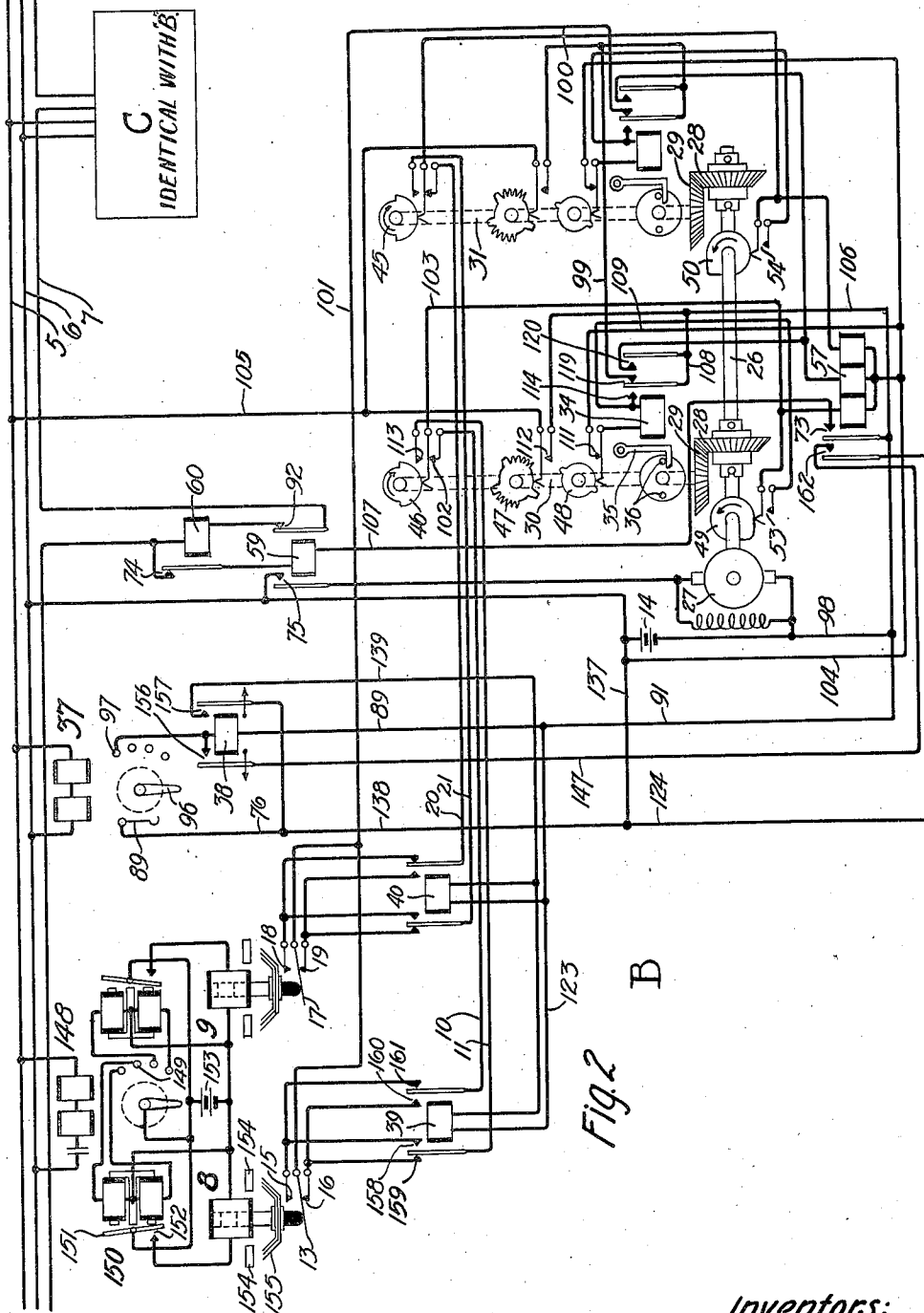
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UNITED STATES PATENT OFFICE

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SELECTOR SUPERVISORY SYSTEM

Application filed February 9, 1925. Serial No. 7,757.

This invention relates to remote control and indicating systems, and more particularly remote control power systems wherein the devices such as power switches at isolated sub-stations are controlled by a central station attendant.

The object of the invention is the provision of an arrangement whereby the central station attendant may check the condition of the devices at the remote stations to see if they are in the proper positions.

In accordance with this invention each of the pieces of apparatus, such as power switches, under supervision, is provided with means, such as a relay, which, upon operating, switches the connections of battery to the contacts which are operated when the power switch is shifted. These relays are under control of the central station attendant by means of circuits including code impulse keys and selectors so that they are operable at the will of the attendant when he desires to check up on the positions of the power switches. Since these relays upon operating simulate the actual condition which prevails at the sub-station when the power switches change position, the central station attendant is informed by means of lamp signals in his cabinet in what position the power switches are, and by means of his different impulse keys can check the sub-stations in succession, the usual selector being provided at each sub-station to selectively operate only the apparatus of one sub-station at a time.

Other features will appear from the following description, together with the accompanying drawings.

Fig. 1 and Fig. 2 of the drawings placed end to end with Fig. 1 at the left illustrate diagrammatically one embodiment of the invention, in which Fig. 1 represents the central or control station, while Fig. 2 represents the remote station. Fig. 3 represents one of the impulse wheels for transmitting the answer-back signals.

Referring to the drawings, central station A in Fig. 1 is connected with a plurality of substations B and C of Fig. 2 by means of line conductors 5, 6 and 7. At each substation are located power switches, etc. but to avoid

confusion only the apparatus at substation B is shown in detail and at this station only power switches 8 and 9 are shown.

The movable member of power switch 8 is provided with a contact arm 13 adapted to be connected with a battery 14 in a manner hereinafter to be described and which is designed to make contact with either contacts 15 or 16, depending upon whether power switch 8 is closed or open. Power switch 9 is provided with corresponding contact 17, designed to engage with either contacts 18 or 19. These contacts are provided to establish a circuit momentarily to start the operation of the indicating mechanism, which will be described more in detail hereinafter.

The operation of the system is as follows: The switch 8 at the remote station is considered open as shown and the green light 68 at the control station lighted, the red light 67 being short-circuited. Supposing it is desired to close switch 8, the operator at the central station causes impulse wheel 88 to be rotated in the direction of the arrow causing relay 140 to operate over a circuit which may be traced from battery 143 to relay 140, impulse wheel 88, contact arm 90, contact 86 and left armature of relay 87 to battery 143. Relay 140 in operating closes a circuit at its left armature from battery 143 through relay 142. Relay 142 upon operating disconnects the charging generator from battery 93 so that this battery is free from grounds or other potentials which may arise from the charging generator during the transmission of impulses from wheel 88. Upon the operation of relay 140, its right armature is also attracted closing a circuit for relay 89 which circuit may be traced from battery 143, conductor 144, right armature and right front contact of relay 140, conductor 145, relay 89, conductor 146 to battery 143. Relay 89 upon energizing attracts both of its armatures and connects battery 93 to line conductors 5 and 6.

As impulse wheel 88 continues to rotate, contact is made and broken between contact arms 90 and 94 and relay 84 is energized and deenergized over a circuit which may be traced from battery 143, conductor 144, left armature and back contact 86 of relay 87,

contact arms 90 and 94, back contact and armature of relay 85, relay 84 to battery 143.

With the energization and deenergization of relay 84, the direction of current impressed on line conductors 5 and 6 is alternated. These alternating impulses actuate a selector device 148, Fig. 2 in the manner shown in Patent 1,378,943 of May 24, 1921 to J. C. Field. This selector device is provided with a code setting and is preferably of the type disclosed in Patent 1,343,256 granted to J. C. Field June 15, 1920 but any suitable selector may be used.

Impulse wheel 88 is arranged to give the proper number of impulses or alternations to step the contact arm of selector 148 around until it makes contact with stud 149. This closes a circuit for the upper winding of relay 150 from battery 153. Armature 151 is thereby attracted toward the upper winding of relay 150 and closes a circuit through contact 152 for energizing the operating winding of power switch 8. This circuit may be traced from battery 153 through armature 151, contact 152, winding of power switch 8 to battery 153. The movable armature of power switch 8 carrying brush 155 moves upward until brush 155 makes contact with blocks 154, closing a power circuit not shown. Contacts 90 and 94, Fig. 1, are held in engagement after the code of impulses is sent until the wheel 88 has returned to its initial position when the contact is broken. Upon the disengagement of these contacts, relay 84 is deenergized causing its armature to return to the unoperated position whereupon a pulse is transmitted to selector 148 of Fig. 2, having opposite polarity to that of the previous pulse. This last pulse steps the selector wheel one step to permit its release and return to normal as described in the above mentioned patent to Field 1,343,256.

Upon the closing of switch 8, the contact arm 13 engages contact 15, closing a circuit for relay 57 which may be traced from battery 14, conductors 98, 106, 108, contact 119 of release magnet 34, conductors 99, back contacts and left armatures of the other release magnets, conductors 100, 101, contact arms 13, 15, contact 161 and right armature of relay 39, conductor 10, contact 102, conductor 103, left hand winding of relay 57, conductor 104 to battery 14. Relay 57 when energized attracts its armatures and at the front armature makes contact at 73, closing a circuit through the windings of relay 59 at the substation and relay 87 at the control station. This circuit may be traced from battery 14, conductor 98, contact 73, conductor 107, winding of relay 59, left armature and contact of relay 60, line conductor 7, winding of relay 87, right back contact of relay 140, battery 143, lower contact and lower armature of relay 89, line conductor 6 to battery 14.

Relay 59 in energizing attracts both its

armatures. At the right armature it breaks contact 92 thereby disconnecting any other remote station such as "C" from the central station "A" over line conductor 7. No signals can then be transmitted from any other station until station B has completed its cycle and relay 59 is again deenergized as will be explained later. In the same way, if signals are to be sent from station "C", relay 60 will be energized over line conductor 7, which relay upon attracting its armature breaks contact at 74 so that no indications can be transmitted from station "B" until relay 60 releases.

Upon attracting its left armature, relay 59 makes contact at 75, for starting motor 27 from current supplied by battery 14.

Motor 27 drives a shaft 26 on which are frictionally mounted beveled gears 28. These gears mesh with beveled gears 29 which in turn drive auxiliary shafts 30 and 31.

On shaft 26, and associated with the auxiliary shafts are cams 49 and 50 arranged to actuate contacts 53 and 54 as shown and described in U. S. Patent to J. C. Field No. 1,709,067 of April 16, 1929. As the shaft 26 rotates, cam 49 closes contact 53, actuating release magnet 34 over a circuit from battery 14, conductors 98, 106, 108, contact 119, conductors 99, back contact of right front armature of release magnet associated with shaft 31, conductors 100, 101, contact arms 13, 15, right back contact 161 and right armature of relay 39, conductor 10, contact 102, conductor 103, contact 53, winding of release magnet 34, contact 111, conductors 109, 104 to battery 14. Cams 49 and 50 are set 90° apart on shaft 26 so that in case of simultaneous operation of two or more devices the indications will be sent in sequence and not confused.

When energized, magnet 34 attracts latch 35 which permits shaft 30 to rotate by the disengagement of latch 35 from one of the lugs 36 on a disc keyed to shaft 30. Magnet 34 in attracting its right armatures closes locking circuits for both itself and relay 57 and locks out the apparatus associated with the other auxiliary shafts by breaking the contact 119. The locking circuit for magnet 34 may be traced from battery 14, conductors 104, 109, contact 111, winding of magnet 34, contact 114, right front armature of magnet 34, conductors 108, 106, 98 to battery 14. The locking circuit of relay 57 may be traced from battery 14, conductor 104, middle winding of relay 57, contact 120 and outer right armature of magnet 34, conductors 108, 106, 98 to battery 14.

When shaft 30 rotates, cam 47 operates its associated contact arms to send a code of pulses back to the central station A. The pulses alternately energize and deenergize relay 85, Fig. 1, which in turn energizes and

deenergizes relay 84. Relay 84 being a pole changing relay impresses pulses of opposite polarity from battery 93 on the selector 61 to step its contact arm 62, around to one of the contacts 80, 81, 82 or 83 to energize with a current of a definite polarity, one of the controlling relays 63, 64, 65 or 66, as more fully explained hereinafter. These last mentioned relays, being of the polarized type, act in accordance with polarity of the current through their windings to control the lighting of the indicator lamps 67, etc. One of the pulsing cams such as 47 on shaft 30 is shown in more detail in Fig. 3. The cam is shown in its position of rest and as shaft 30 rotates contact is made at 112 due to the raised portions of the cam. It will be noticed that the last raised portion *a* is somewhat longer than the preceding ones and when this part causes contact at 112, relay 84, Fig. 1, is maintained operated for a longer period. This long pulse is impressed on selector 61 but due to condenser 151 becoming charged a pulse of the same length as the preceding one is given to the selector. This pulse being the final one of the code brings the selector wheel into such a position that upon the cessation of this pulse, spring 79 engages one of the pins 90 and holds arm 62 in engagement with contact 80 as described in detail in said Patent No. 1,343,256. Assuming that when contact 112, Fig. 2, is made a positive pulse is sent from battery 93, Fig. 1, through the selector, then when the long contact is made the selector gets its last step which is due to a positive pulse. When contact 112 is next opened as the code wheel comes to rest after making half a revolution, a negative pulse is sent by relay 84 retracting which steps the selector one step to remove spring 79 from engagement with pin 90, so that the selector arm 62 returns to its normal position.

Considering now the other half of the cam, it will be seen that the first contact made at 112 is long. Therefore, the selector wheel will be moved one step and upon the cessation of current flow due to the condenser 151, the arm will return to its original position. In this way the series controlled by this half starts the selector stepping movement with a negative pulse instead of a positive pulse. In the same way the final long pulse, due to part *b* of wheel 47, is negative instead of positive as in the other case, but in this case another positive pulse must be given in order to return the selector wheel to the starting position before shaft 30 comes to rest with contact 112 open.

It will therefore be seen that in one case when the arm 62 is in contact with contact 80 a positive pulse is sent through relay 63 and in the other case a negative pulse is sent through the relay. The same condition holds when arm 62 contacts with 81, 82 or 83 to send

either positive or negative current through relays 64, 65 or 66, respectively.

With the conditions as shown on the drawings, shaft 30 rotates, causing cam 47 to operate its associated contact arms intermittently operating relay 85 over a circuit which is traced from battery 14, conductors 98, 106, contact 112, conductor 105, line conductor 5, relay 85, right armature and front contact of relay 87, right back contact and armature of relay 140, conductor 144, battery 143, lower contact and lower armature of relay 89, line conductor 6, to battery 14. Relay 85 is thus alternately energized and deenergized and through its left back contact and armature energizes and deenergizes relay 84 over a circuit from battery 143, conductor 144, left front contact and armature of relay 85, relay 84 to battery 143. Relay 84 when operating alternates the polarity of the current from battery 93 to operate the selector 61 over conductors 77 and 78. Selector arm 62 is stepped around to contact 80 in accordance with the code for which cam 47 is arranged.

As arm 62 is being stepped around, selector arm 79 makes momentary contact with selector disc pins 90, but the time of contact is too short to permit actuation of slow acting relay 141. When contact arm 62 stops on contact 80, selector arm 79 remains in contact with one of the selector disc pins 90 sufficiently long to cause relay 141 to operate over the following circuit: battery 93, upper armature of relay 84, upper armature of relay 89, conductor 78, relay 141, arm 79, contact arm 62, conductor 77, lower armature of relay 84 to battery 93. In operating, relay 141 closes contact 95 which closes a circuit from battery 93, upper armature of relay 84, conductor 78, contact 95, relay 63, contact 80, arm 62, conductor 77, lower armature of relay 84 to battery 93. Since the polarity of the current is now opposite to that which actuated relay 63 on the previous operation of the power switch 8, it is again actuated, changing the contacts controlling the indicating lamps so that lamp 67 is lighted and lamp 68 short-circuited.

After shaft 30 has completed a quarter of a revolution, cam 46 has moved into a position where contact is made at 113 and broken at 102. This prepares the circuits associated with the contacts actuated by power switch 8, for again operating upon the opening of switch 8.

When the code of pulses just sent by cam 47 is completed, shaft 30 has rotated sufficiently to cause cam 48 to actuate its associated contact arm to open contact 111. This breaks the energizing circuit for release magnet 34 and permits latch 35 to engage one of the studs 36, thereby bringing shaft 30 to rest. In deenergizing, magnet 34 also breaks contacts at 114 and 120 and makes contact at 119. The breaking of contact 114, breaks the lock-

ing circuit for magnet 34 at another point while breaking contact 120 breaks the locking circuit for relay 57. In making contact 119, the system is prepared for the operation of the other power switch 9 or other apparatus which may be present at station B.

Relay 57 when deenergized, releases its armatures, breaking contact at 73 of the circuit through relay 59 at station "B" and relay 87 at the control station "A." Both armatures of relay 59 release when it is deenergized. The left armature breaks contact at 75, removing the current from motor 27 which then comes to rest. At its right armature, relay 59 makes contact at 92 which closes a circuit through line conductor 7 from any other sub-station, such as "C," to the control station "A."

At its left armature, relay 87 upon deenergizing makes contact at 86, preparing the circuit for the next operation of impulse wheel 88. The energizing circuit for relay 141 is broken by arm 79, disengaging from disc pin 90, as the selector restores, as already described. The energizing circuit for relay 63 besides being broken at the selector is broken at contact 95 of relay 141. Since relay 63 is of the polarized type as mentioned above, it remains in its operated position when the energizing current is removed and hence no change occurs in the indication lamp circuits.

The entire system is then prepared for the next operation, either from a remote station or from a control station and the operation upon the opening of switch 8 will be repeated as described above. A similar series of events will occur if the other power switch 9 is operated.

In systems of this nature it is desirable to have some arrangement by which the operator at the control station may check the position of the apparatus at the various outlying stations to determine if the indications given at the central station are correct. In this system, the checking is provided for with the arrangement shown in Fig. 2 which consists of adding auxiliary contacts to those contacts associated with the power switches etc., and changing these auxiliary contacts. This gives the same effect as if the contacts of the power switches themselves were changed.

In more detail, this arrangement comprises a selector 37 in addition to the selector 148. This additional selector will not be required if selector 148 has a contact which is not used for other purposes. Selector 37 controls a slow release relay 38 which in turn controls pole changing relays 39 and 40. The contacts of the pole changing relays are inserted in the circuit between the contacts associated with the power switches and the contacts associated with the first disc on the auxiliary shafts corresponding to the power switches.

The operation of this arrangement is as follows:

The operator at the central station turns a key 88' which causes the rotation of an impulse wheel similar to impulse wheel 88, Fig. 1. In the same manner as described above for selector 148, the impulses actuate selector 37 to step the contact arm 96 around to contact stud 97. This closes a circuit from battery 14, through conductors 137, 138, 76, selector arm 89, selector disc, contact arm 96, contact 97, winding of relay 38, conductors 89, 91, 98 to battery 14. Relay 38 is thereby energized and attracts both armatures, the left armature making contact at 156 and the right armature making contact at 157. At 157 a circuit is closed which energizes in parallel, pole changing relays 39 and 40. This circuit may be traced from battery 14, through conductors 137, 138, right armature of relay 38, contact 157, conductor 139, through the windings of relays 39 and 40 in parallel, conductors 123, 91, 98 to battery 14. Contact 156 prepares a locking circuit for relay 38.

Since the apparatus associated with power switch 8 is nearest to the source of power 14, it will probably be the first to operate. Assuming this to be the case, when relay 39 operates attracting both its armatures, contacts 159 and 161 are opened and contacts 158 and 160 are closed. It will readily be seen that the effect is the same as if contact 16 were opened and contact 15 closed, which would occur if power switch 8 operated.

A description of the events following such operation was given above. In this it will be recalled that shaft 30 was permitted to rotate upon the actuation of release magnet 34 and that contact 119 was opened locking out the apparatus associated with the other apparatus until shaft 30 has completed one half a revolution. It will also be recalled that relay 57 was operated.

When relay 57 operates, contact 162 closes a locking circuit for relay 38 over a circuit which may be traced from battery 14, through conductors 98, 91, 89, winding of relay 38, contact 156, left armature of relay 38, conductor 147, contact 162 of relay 57, conductors 124, 137, to battery 14. This is necessary since arm 96 of selector 37 remains on contact 97 only long enough to permit the above events to happen.

Upon the completion of the events connected with the actuation of relay 39, indication is given at the control station and shaft 30 is brought to rest as described above. Contact 119 is again closed and a series of events, similar to those just described, occurs in connection with power switch 9 since relay 40 is already operated.

It will be noted that relay 38 is a slow release relay and this is required to take care of the slight time lag in release magnets 34 etc.,

and also to take care of the possible opening of contact 162 of relay 57 when action is transferred from one set of devices to the next succeeding set.

5 When the events controlled by relay 40 are terminated relay 57 is deenergized, opening the holding circuit for relay 38 which in turn releases. This causes relays 39 and 40 to release so that the relation between con-
10 tacts associated with the power switches etc., and those associated with discs 46 and 45 is again reversed. This starts the same series of events again and upon completion of this second series, discs 46 etc., will return to the
15 positions occupied previous to the checking operation.

Thus it will be seen that if the indicating lamps show the correct indication, they will when the checking key is operated, change to
20 the opposite indication and then again change to the original indication. On the other hand if the lamps do not show the correct indication at first, they will not change the indication on the first operation but should
25 on the second operation.

Certain parts of the system disclosed in this application are claimed in Patent No. 1,709,067 hereinbefore mentioned.

What is claimed is:

30 In a signaling system, a central station, a remote station, a circuit connecting the same, a plurality of devices at said remote station capable of assuming different positions, selectors at the remote station, means at the central
35 station for controlling the same over said circuit to selectively actuate said devices, a pair of visual signals at the central station for each device to indicate its position, a code signal transmitter for each device for
40 selectively operating said visual signals and operated by the associated device changing its position, and means controlled from said central station and actuated by a single selecting operation for causing said transmitters
45 to successively operate independently of said devices first to render inert the visual signal displayed which indicates the position of the corresponding device and render the alternate signal of said device displayed and
50 then to restore the original indication.

In witness whereof, we hereunto subscribe our names this 29th day of January, A. D. 1925.

LOUIS J. BURNS.
LESLIE E. COON.