

Oct. 13, 1942.

C. E. STEWART

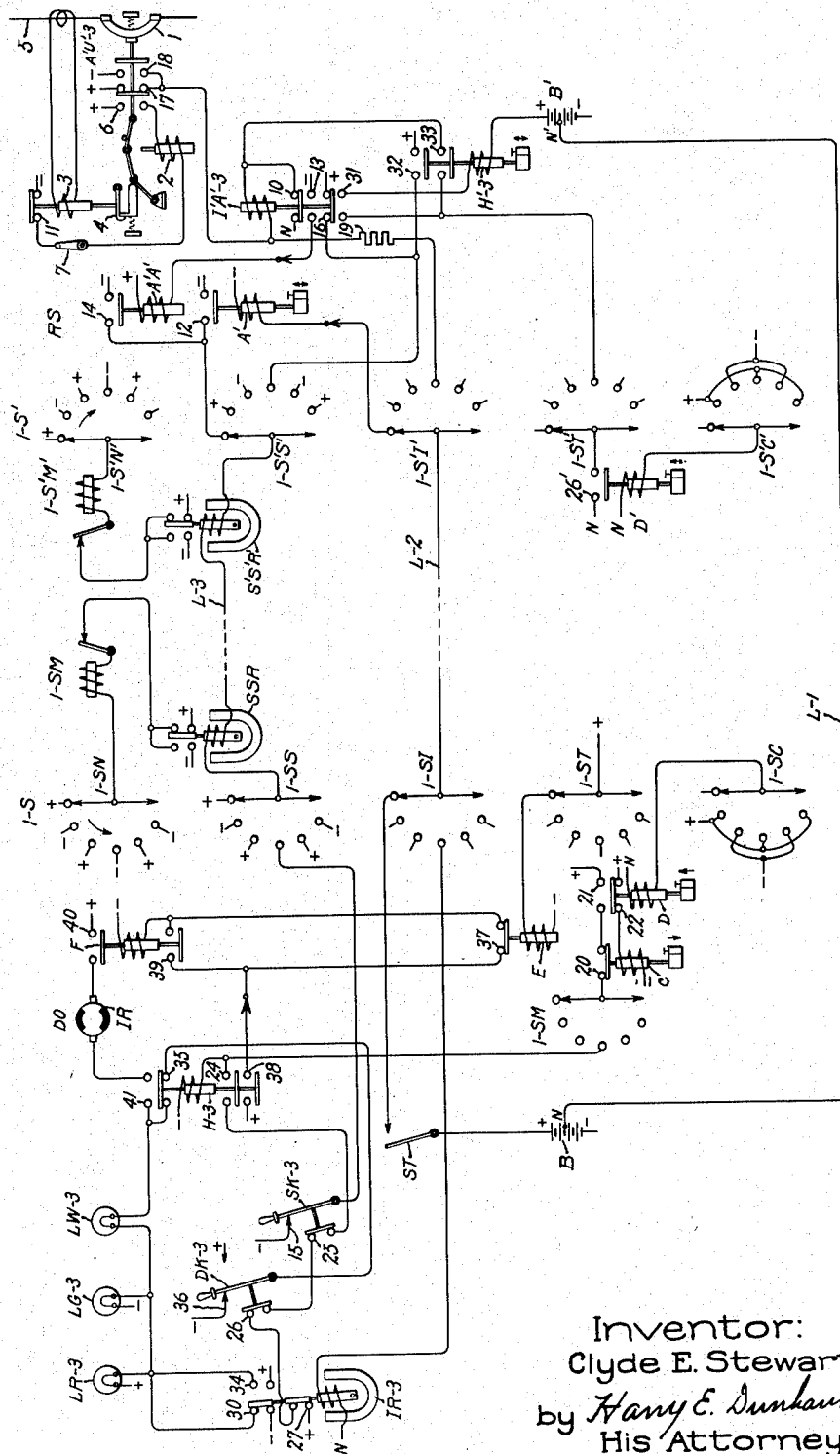
2,298,907

SUPERVISORY SYSTEM

Filed Feb. 1, 1941

2 Sheets-Sheet 1

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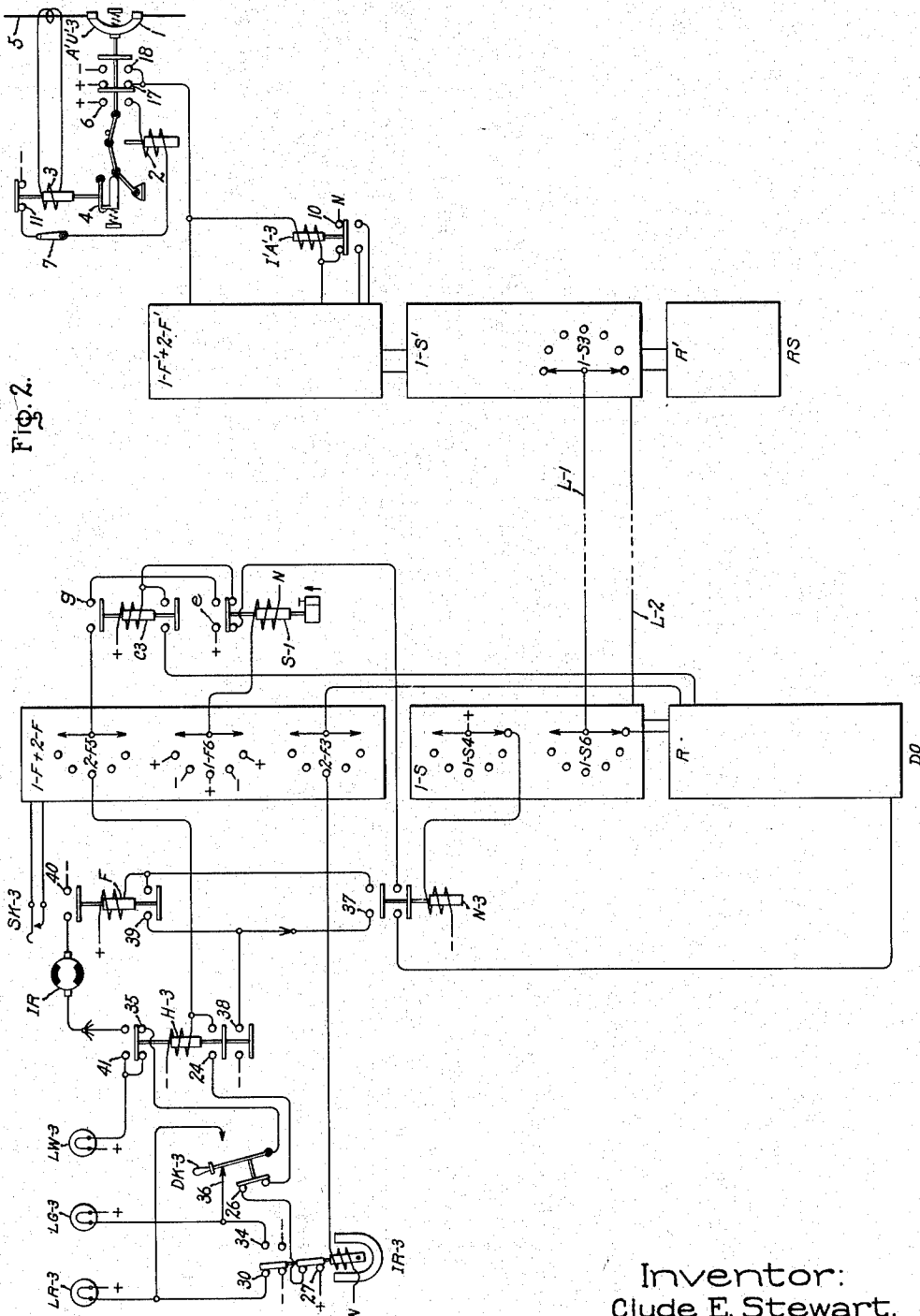
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UNITED STATES PATENT OFFICE

2,298,907

SUPERVISORY SYSTEM

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32 Claims. (Cl. 177—353)

My invention relates to supervisory systems and particularly to supervisory systems in which means are provided whereby a current impulse of a character depending upon the position of a movable apparatus unit at a remote station is transmitted to a dispatcher's office after a connection has been established between an apparatus unit and the corresponding signalling means at the dispatcher's office. When the apparatus unit is a device which is adapted to be restored quickly to its normal position, when it is moved out of that position, such, for example, as an automatically reclosed circuit breaker, there is the possibility that the apparatus unit may be restored to its normal position before the supervisory apparatus can function to transmit a current impulse corresponding to the out-of-normal position of the operated unit. Consequently, when an indicating impulse is finally transmitted, it is of the character corresponding to the normal position of the unit and, therefore, no change in the signalling means at the dispatcher's office is effected to inform the dispatcher that the apparatus unit has changed its position.

One object of my invention is to provide in a supervisory system an improved arrangement of apparatus whereby any change of an apparatus unit at the remote station from its normal position is permanently indicated at the dispatcher's office until acknowledged by the dispatcher notwithstanding the fact that the apparatus unit may be restored to its normal position so quickly that no indicating impulse corresponding to the unit is transmitted while it is out of its normal position.

This application is a continuation-in-part of my copending application, S. N. 265,227, filed March 31, 1939, now abandoned.

My invention will be better understood from the following description when taken in connection with the accompanying drawings, Fig. 1 of which diagrammatically illustrates a supervisory system of the synchronous selector type embodying my invention, and Fig. 2 of which diagrammatically illustrates a supervisory system of the code selector type embodying my invention, and the scope of my invention will be pointed out in the appended claims.

In Fig. 1 of the accompanying drawings, I have shown only as much of a complete synchronous selector supervisory system of the type disclosed in U. S. Letters Patent 1,945,665, granted February 6, 1934, to the assignee of this application as is necessary for a complete understanding of the present invention because supervisory systems of

this type are well known in the art. As shown, the supervisory system includes three conductors L—1, L—2 and L—3 extending between a dispatcher's office DO and a remote station RS. The line conductors L—1, L—2 and L—3 are respectively called the common line, the indicating line, and the synchronizing line. The common line L—1 interconnects the neutral terminal n of a battery B at the dispatcher's office (DO) and the neutral terminal n' of a battery B' at the remote station (RS). The indicating line L—2 interconnects the movable contact of a bank of contacts I—SI of a switch I—S at the dispatcher's office DO and the movable contact of a bank of contacts I—S'I' of a switch I—S' at the remote station RS. The synchronizing line L—3 interconnects the movable contact of a bank of contacts I—SS of the switch I—S and the movable contact of a bank of contacts I—S'S' of the switch I—S' at the remote station. The switch I—S, as shown, is a selector switch of the well known rotary type comprising several banks of stationary contacts and indicated here as: I—SN, I—SS, I—SI, I—ST, I—SC, and I—SM, each of which has a movable contact mounted on a common rotatable member which is arranged to be rotated by a motor magnet I—SM in a manner well known in the art each time the magnet I—SM is deenergized. The switch I—S' is a similar switch comprising five banks of stationary contacts: I—S'N', I—S'S', I—S'I', I—S'T' and I—S'C', and a motor magnet I—S'M' for simultaneously rotating the cooperating movable contacts for the five banks of stationary contacts. In actual practice the switches I—S and I—S' usually have 25 positions, but in order to simplify the disclosure they are shown as having only 6 positions.

At the remote station RS there are a number of apparatus units, the positions of which are to be indicated at the dispatcher's office DO. Each of these apparatus units is allotted to different corresponding predetermined positions of the switches I—S and I—S', but in order to simplify the disclosure, only the apparatus unit A'U'—3, associated with the third off-normal positions of the switches I—S and I—S', is shown. This apparatus unit A'U'—3 is shown as an automatically reclosed circuit breaker having a closing coil 2, a trip coil 3, and a latch 4 for holding the circuit breaker in its closed position. The trip coil 3 is connected in series relation with an electric circuit 5 containing the circuit breaker A'U'—3 so that, when the current in the circuit 5 exceeds a predetermined value, the latch 4 is

released to allow the circuit breaker to open. As soon as the circuit breaker A'U'-3 has opened so that its auxiliary contacts 6 are closed and the latch 4 is restored to its latching position, a circuit is completed for the closing coil 2 to reclose the circuit breaker if a switch 7 associated therewith is also closed.

Associated with the apparatus unit A'U'-3 at the remote station is an indicating relay I'A'-3 which is normally in its energized position and which is arranged to be deenergized in response to any change in the position of the apparatus until A'U'-3 whenever the relay I'A'-3 is energized. The normally energized circuit for the relay I'A'-3 includes the contacts 10 of the relay I'A'-3 and either the contacts 17 or the contacts 18 of the circuit breaker 1 depending upon the position of the circuit breaker A'U'-3 when the last indicating impulse corresponding thereto was transmitted to the dispatcher's office.

At the dispatcher's office DO there is provided for each apparatus unit an individual set of three signal lamps such as LR-3, LG-3 and LW-3 for the apparatus unit A'U'-3. When the lamp LR-3 is lighted, it indicates that the circuit breaker A'U'-3 is closed, and when the lamp LG-3 is lighted, it indicates that the circuit breaker A'U'-3 is open. The lamp LW-3, when lighted simultaneously with either of the other two lamps, indicates that the position of a two-position disagreement key DK-3, which is individual to the circuit breaker A'U'-3, does not agree with the position of the circuit breaker A'U'-3 as indicated by the lamps LR-3 and LG-3. When the lamp LW-3 is lighted, it can be extinguished by moving the associated disagreement key DK-3 to its other position.

The lighting of the lamps LR-3, LG-3 and LW-3 is controlled by a two-position polarized indicating relay IR-3, which is individual to the apparatus unit A'U'-3, and the winding of which is interconnected between the neutral terminal *n* of the battery B and the third off-normal contact of bank I-SI. Since the third off-normal contact of the bank I-S'I' is arranged to be connected to the positive terminal of the battery B' at the remote station when the circuit breaker A'U'-3 is closed and to the negative terminal of the battery B' when the circuit breaker A'U'-3 is open, it is evident that the direction of the current flow through the winding of the polarized relay IR-3 when the circuit of this relay is completed over the indicating line L-2 in the third off-normal position of the switches I-S and I-S' depends upon the position of the apparatus unit AU-3 at that time.

Normally the switches I-S and I-S' are at rest in the positions in which they are shown in the drawings and synchronous operation of these switches from these normal positions may be started by either momentarily closing a manually operated start switch ST at the dispatcher's office or by any one of the apparatus units at the remote station changing its position and thereby effecting the deenergization of the associated indicating relay. When the start switch ST is closed, it completes through the normal contacts of banks I-SI and I-S'I' and the indicating conductor L-2 an energizing circuit for a start relay A' at the remote station which in turn by closing its contacts 12 completes through the normal contact of banks I-S'S' and I-SS and the synchronizing line L-3 an energizing circuit for the polarized selector synchronizing relays S'S'R' and SSR. These synchronizing relays

effect in a manner disclosed in the aforesaid Letters Patent 1,945,665 the synchronous operation of the motor magnets I-SM and I-S'M' to move the switches I-S and I-S' to their first off-normal positions.

When any one of the apparatus units at the remote station changes its position so that the associated indicating relay is deenergized, such as the indicating relay I'A'-3 associated with the apparatus unit A'U'-3, an energizing circuit is completed for a second starting relay A'A' at the remote station. By closing its contacts 14, which are in parallel with the contacts 12 of the start relay A', relay A'A' completes the energizing circuit of the selector synchronizing relays S'S'R' and SSR to start the synchronous operation of the switches I-S and I-S'. After being started, the synchronous operation of the switches I-S and I-S' continues until the switches either are restored to their normal positions or reach positions in which either the corresponding select key at the dispatcher's office is out of its normal position or the corresponding indicating relay at the remote station is deenergized. For example, if the select key SK-3, which is individual to the apparatus unit A'U'-3, is operated, the circuit through the synchronizing line L-3 is open when the switch I-S reaches its third off-normal position. If the indicating relay I'A'-3 is deenergized, the circuit through the synchronizing line L-3 is open at the contact 16 of the relay I'A'-3 when the switch I-S' reaches its third off-normal position. Therefore both of the switches I-S and I-S' will stop in their third off-normal positions if either the select key SK-3 is in its operated position or the indicating relay I'A'-3 is deenergized. However, if the select key SK-3 is in its normal position and the relay I'A'-3 is energized when the switches I-S and I-S' reach their third off-normal positions, the energizing circuit for the selector synchronizing relays SSR and S'S'R' is immediately completed to effect the movement of both of the switches to their fourth off-normal positions.

Whenever both of the switches I-S and I-S' are simultaneously in their third off-normal positions, a circuit is completed for the indicating relay IR-3 at the dispatcher's office through the indicating line L-2 and the resistor 19 to the positive terminal of the battery B' through contacts 17 of apparatus unit A'U'-3, if it is closed, or to the negative terminal of the battery B' through the contacts 18 of the apparatus unit A'U'-3, if it is open. Therefore, if the apparatus unit A'U'-3 is closed, the polarized relay IR-3 is operated to the position in which it is shown so as to effect the lighting of the lamp LR-3, whereas if the apparatus unit A'U'-3 is open, the relay IR-3 is operated to its other position in which it effects the lighting of the lamp LG-3. The lamp LW-3 is lighted in case the position of the disagreement key DK-3 does not agree with the position of the apparatus unit A'U'-3 as indicated by the lamps LR-3 and LG-3.

Since the apparatus unit A'U'-3 may open and reclose before the switches I-S and I-S' can reach their third off-normal positions after the relay I'A'-3 is deenergized in response to the opening of the apparatus unit, it is evident that, when the indicating impulse corresponding to the apparatus unit is transmitted after such an operation thereof, it will be of such a character as to effect no change in the lighting of the lamps LR-3 and LW-3 as the lamp

LR—3 will continue to indicate that the apparatus unit A'U'—3 is in its closed position and the disagreement key DK—3 is still in its position corresponding to the closed position of the associated apparatus unit. In order that the dispatcher may be informed of such an automatic operation of the apparatus unit A'U'—3, I provide in the embodiment of my invention shown in the drawings an arrangement for flashing one of the associated lamps, such as the lamp LW—3, after any such reclosing operation of the apparatus unit A'U'—3. This result is accomplished by providing at the dispatcher's office, for each apparatus unit at the remote station, an individual relay which is energized whenever the switches I—S and I—S' remain in the positions thereof allotted to the corresponding apparatus unit for a predetermined time which is longer than the time they remain in the same position when there has been no change in the position of the corresponding apparatus unit since the last indicating impulse thereof was transmitted. For the apparatus unit A'U'—3, this relay is H—3, the energizing circuit of which is arranged to be completed through the contacts 3 of I—SM, 20 of a relay C and the contacts 21 of a time relay D when the switch I—S remains in its third off-normal position for a predetermined length of time. The circuit of the time relay D is controlled so that, during the synchronous operation of the switches I—S and I—S', it cannot pick up and close its contacts 21, but whenever the switches remain in any one of their off-normal positions for a predetermined time, the relay D operates to close its contacts 21 and open its contacts 22 in an energizing circuit for the relay C which is arranged to open its contacts 20 a predetermined time after it is deenergized. Therefore, the original energizing circuit of the relay H—3 is completed for only a short period of time whenever the switches I—S and I—S' are stopped in their third off-normal positions. By closing its contacts 24 the relay H—3 completes a locking circuit for itself through contacts 25 of the select key SK—3 if it is in its normal position, contacts 26 of the disagreement key DK—3 if it is in its position corresponding to the closed position of the apparatus unit A'U'—3, and contacts 27 of the indicating relay IR—3 if it is in its position corresponding to the closed position of the apparatus unit A'U'—3. Relay H—3, therefore, is energized in case the switches I—S and I—S' are stopped in their third off-normal positions due to an automatic opening and reclosing of the apparatus unit A'U'—3 before an indicating impulse corresponding to the open position of the apparatus unit can be transmitted. If the apparatus unit A'U'—3 remains open long enough so that an indicating impulse corresponding to the open position of the apparatus unit is transmitted, the indicating relay IR—3 at the dispatcher's office is operated by this indicating impulse so that it occupies its other position and thereby opens the locking circuit for the relay H—3. Therefore, the relay H—3 becomes deenergized as soon as the relay C opens its contacts 20 after the switches I—S and I—S' have stopped in their third off-normal positions.

At the remote station a time relay D' is provided which is arranged to pick up and close its contacts 26 whenever the switch I—S' is stopped in any of its off-normal positions. Therefore, when the switch I—S' stops in its third off-

normal position due to an automatic operation of the apparatus unit A'U'—3, which also effects the deenergization of the associated relay I'A'—3, a circuit is completed for a time relay H'—3.

After being energized for a predetermined time, the relay H'—3 completes an energizing circuit for the deenergized indicating relay I'A'—3 and also completes a circuit for the synchronizing relays SSR and S'S'R' so that the synchronous operation of the switches I—S and I—S' is again started to restore them to their normal positions.

When the switch I—S is restored to its normal position, a circuit is completed through the normal contact of bank I—ST at the dispatcher's office for a control relay E. If the relay H—3 is energized when the relay E becomes energized, a circuit is completed for a relay F which in turn completes a flashing circuit for the lamp LW—3 through an interrupter IR so that the lamp LW—3 is intermittently lighted at the same time the lamp LR—3 is continuously lighted. This combination of lamps informs the dispatcher that the apparatus unit A'U'—3 has opened and automatically reclosed. By moving the disagreement key DK—3 to the position thereof corresponding to the open position of the apparatus unit A'U'—3, the dispatcher can effect the deenergization of the relay H—3 so as to stop the intermittent lighting of the lamp LW—3 and cause it to be lighted continuously. Then by moving the disagreement key DK—3 back to the position thereof corresponding to the closed position of the apparatus unit A'U'—3, the dispatcher can extinguish the lamp LW—3 completely.

The operation of the arrangement shown in the drawings is as follows:

When the switches I—S and I—S' are at rest in their normal positions and the apparatus unit A'U'—3 is closed, the various control devices of the supervisory equipment occupy the positions in which they are shown in the drawings. At the dispatcher's office an energizing circuit for the relay E is completed through the normal contact of bank I—ST and an energizing circuit is completed for the relay C through the contacts 22 of the deenergized relay D. A circuit is completed for the lamp LR—3 through the contacts 30 of the indicating relay IR—3 so that this lamp is continuously lighted thereby informing the dispatcher that the apparatus unit A'U'—3 at the remote station is closed. At the remote station the indicating relay I'A'—3 is energized by a locking circuit which includes the contacts 10 of the relay I'A'—3 and the auxiliary contacts 17 of the closed apparatus unit A'U'—3.

It will be assumed first that the start switch ST is closed momentarily to complete an energizing circuit for start relay A' through the normal contacts of bank I—SI and I—S'I' and the indicating line L—2. By closing its contacts 12, relay A' completes through the normal contacts of banks I—SS and I—S'S' and the synchronizing line L—3 an energizing circuit for the synchronizing relays SSR and S'S'R' which effect in a well known manner the synchronous operation of the switches I—S and I—S' until they again reach their normal positions in case all of the indicating relays at the remote station are energized and all of the select keys at the dispatcher's office are in their normal positions. When the switches I—S and I—S' reach their third off-normal positions, an energizing circuit for the synchronizing relays SSR and S'S'R' is

immediately completed through the contacts 15 of the select key SK—3 at the dispatcher's office and the contact 16 of the energized indicating relay I'A'—3 at the remote station so that the switches immediately move to their fourth off-normal positions. During the short time that the switches I—S and I—S' are in their third off-normal positions, an indicating impulse is transmitted over the indicating line L—2 to the indicating relay IR—3 at the dispatcher's office through the resistor 19 and the contacts 17 of the closed apparatus unit A'U'—3. This indicating impulse is of such a character, however, that the relay IR—3 remains in the position in which it is shown so that the lamp LR—3 remains continuously lighted.

It will now be assumed that, while the switches I—S and I—S' are at rest in their normal positions, the apparatus unit A'U'—3 automatically opens so that its contacts 17 interrupt the holding circuit for the associated indicating relay I'A'—3. By closing its contacts 13, relay I'A'—3 completes an energizing circuit for the start relay A'A' which in turn starts the synchronous operation of the switches I—S and I—S' by closing its contacts 14. Synchronous operation of the switches I—S and I—S' then continues until they reach their third off-normal positions where they stop because the synchronizing circuit is open at the contact 16 of the deenergized indicating relay I'A'—3.

A circuit is completed for a time relay D at the dispatcher's office to the opposite terminals of the battery B through alternate off-normal contacts of the bank I—SC, and a circuit is completed for the time relay D' at the remote station to the opposite terminals of the battery B' through alternate off-normal contacts of bank I—S'C' so that, during the synchronous operation of the switches I—S and I—S', the currents through the relays D and D' are reversed at such a rate that they cannot pick up. However, when the switches I—S and I—S' remain in any off-normal position for a predetermined time which is longer than the time they remain therein during normal synchronous operation, the relays D and D' have time to pick up. Therefore, when the switches I—S and I—S' reach their third off-normal positions due to the deenergization of the indicating relay I'A'—3, the relays D and D' are energized for a sufficient length of time pick up. By opening its contacts 22, relay D opens the circuit of relay C and by closing its contacts 21, relay D completes an energizing circuit for relay H—3 through contacts 20 of relay C and the third off-normal contact of bank I—SM. By closing its contacts 24, relay H—3 completes a locking circuit for itself through contacts 25 of the select key SK—3, contacts 26 of disagreement key DK—3 and contacts 27 of relay IR—3.

At the remote station the closing of the contacts 26' of the relay D' completes an energizing circuit for the relay H'—3 through the third off-normal contact of bank I—S'T' and contacts 31 of the deenergized indicating relay I'A'—3. After a time interval, relay H—3 closes its contacts 32 and 33. The closing of the contacts 32 reestablishes the synchronizing circuit so that the synchronizing relays SSR and S'S'R' are again energized to start the synchronous operation of the switches IS and I'S'. The closing of the contacts 33 of the relay H'—3 completes an energizing circuit for the indicating relay I'A'—3 through the contacts 26 of relay D', the third off-normal contact of bank I—S'T', and either con-

tacts 17 or 18 of the apparatus unit A'U'—3 depending upon the position of this unit. By closing its contacts 10, the relay I'A'—3 completes a holding circuit for itself. Since the contacts 33 of relay H'—3 reestablish the synchronizing circuit after the switches I—S and I—S' have remained in an off-normal position for a predetermined time due to the deenergization of the indicating relay associated with the off-normal position, it will be evident that the relay H'—3 prevents the supervisory equipment from becoming stalled in an off-normal position due to the auxiliary contacts 17 or 18 of the corresponding apparatus unit failing to close and complete the energy circuit for the associated indicating relay.

If the apparatus unit A'U'—3 is still open when the switches I—S and I—S' stop in their third off-normal positions in response to an automatic opening of the apparatus unit A'U'—3, a circuit is completed for indicating relay IR—3 through the third off-normal contact of bank I—SI, indicating conductor L—2, third off-normal contact of bank I—S'T', resistor 19, contact 18 of the open apparatus unit A'U'—3 to the negative terminal of battery B'. This indicating impulse is of such a character that the indicating relay IR—3 moves to its other position so that the contacts 27 and 30 are opened and the contacts 34 are closed. The opening of the contacts 27 interrupts the locking circuit of the relay H—3 so that this relay becomes deenergized as soon as the time relay C opens its contacts 20 in the original energizing circuit for relay H—3. The opening of the contacts 30 extinguishes the lamp LR—3, and the closing of the contacts 34 completes a circuit for lamp LG—3 directly across the terminals of the battery B and a circuit for the lamp LW—3 across the terminals of the battery B through contacts 35 of relay H—3 when it is in its deenergized position and contacts 36 of the disagreement key DK—3. The continuous lighting of the lamps LG—3 and LW—3 informs the dispatcher that the apparatus unit A'U'—3 has opened and is still in its open position. By moving the disagreement key DK—3 to its other position, the circuit of the lamp LW—3 is opened so that only the lamp LG—3 remains lighted.

It will now be assumed that, after the apparatus unit A'U'—3 opens, it is immediately reclosed and is in its closed position when the switches I—S and I—S' are stopped in their third off-normal positions in the manner above described. Under these conditions, the indicating circuit for the indicating relay IR—3 in the third off-normal positions of the switches I—S and I—S' is connected to the positive terminal of the battery B' by the auxiliary contact 17 of the closed apparatus unit A'U'—3. Therefore, when this indicating impulse is transmitted, it does not change the position of the indicating relay IR—3. Consequently, the locking circuit of the relay H—3 remains completed when the synchronous operation of the switches I—S and I—S' is again started by the energization of relay H'—3 at the remote station in the manner heretofore described.

As soon as the switches I—S and I—S' reach their normal positions and the relay E becomes energized, the closing of its contacts 37 completes through contacts 38 of the energized relay H—3 an energizing circuit for relay F. The closing of the contacts 39 of relay F completes a locking circuit for the relay F around the contacts 37 of relay E, and the closing of the contacts 40 of relay F completes a flashing circuit for the

lamp LW—3 through contacts 30 of relay IR—3, contacts 41 of relay H—3 and the interrupter IR. The continuous lighting of the lamp LR—3 and the flashing of the lamp LW—3 at the same time informs the dispatcher that the apparatus unit A'U'—3 has automatically opened and reclosed and is still in its closed position. By moving the disagreement key DK—3 to its other position and then back to the position in which it is shown, the dispatcher can extinguish the lamp LW—3 so that only the lamp LR—3 remains lighted.

In case the dispatcher fails to acknowledge the transmission of an indicating impulse corresponding to the open position of the apparatus unit A'U'—3, by moving the disagreement key DK—3 to the position thereof corresponding to the open position of the apparatus unit A'U'—3, before it is automatically reclosed and an indicating impulse corresponding to the closed position is subsequently transmitted, it is evident that the locking circuit of relay F is completed in response to the transmission of the indicating impulse corresponding to the closed position of the unit. Therefore, when the switches I—S and I—S' return to their normal positions, the lamp LW—3 is intermittently lighted until the dispatcher operates the disagreement key DK—3 in the manner above described.

In case the dispatcher desires to manually control from the dispatcher's office the apparatus unit A'U'—3, he opens the select key SK—3 before momentarily operating the start key ST. Therefore, when the switches I—S and I—S' stop in their third off-normal positions due to the opening of the select key SK—3, the relay H—3 becomes deenergized as soon as relay C opens its contacts 20 because the locking circuit of relay H—3 is open at the contacts 25 of select key SK—3. Therefore, there is no intermittent operation of the lamp LW—3 in response to the manual operation of the apparatus unit A'U'—3 by the dispatcher.

In Fig. 2 of the accompanying drawings I have shown my invention in connection with a code selector supervisory system of the particular type disclosed in United States Letters Patent 2,205,894, granted June 25, 1940, and assigned to the assignee of this application, but it will be obvious that my invention is not limited to this particular type of code selector supervisory system. In order to simplify the disclosure in the present application, only that portion of the supervisory system disclosed in the aforesaid patent is illustrated in detail in Fig. 2 as is deemed necessary for a complete understanding of the present invention.

In Fig. 2 the supervisory system includes two conductors L—1 and L—2 extending between a dispatcher's office DO and a remote station RS. At the dispatcher's office a group of control keys and indicating lamps is provided for each apparatus unit to be selected and controlled at the remote station. Only one such group of keys and lamps is shown in Fig. 2, and this includes a two-position select key SK—3, which is operated by the dispatcher when he wants to select the corresponding apparatus unit A'U'—3 at the remote station for operation and a two-position disagreement key DK—3 which controls the operation of the corresponding indicating lamps. The apparatus unit A'U'—3 is shown as an automatic reclosed circuit breaker which is similar in construction and operation to the circuit breaker A'U'—3 shown in Fig. 1.

The illustrated group of lamps includes a red lamp LR—3, which, when lighted, indicates that the corresponding apparatus unit A'U'—3 is in one position, such as its closed position; a green lamp LG—3, which, when lighted, indicates that the corresponding apparatus unit A'U'—3 is in another position, such as its open position; and a white lamp LW—3, which, when continuously lighted, indicates that the position of the corresponding apparatus unit A'U'—3 does not correspond with the position of the associated disagreement key DK—3. Each group of keys and lamps has associated therewith an individual indicating relay, such as IR—3, which determines by its position whether the associated red or green lamp is lighted and which cooperates with the associated disagreement key DK—3 so as to determine whether the associated white lamp LW—3 is lighted. The position of the indicating relay IR—3 is determined by the position of the corresponding apparatus unit A'U'—3 at the remote station.

As disclosed in detail in the aforesaid Letters Patent 2,205,894, when the dispatcher desires to select the apparatus unit A'U'—3 at the remote station RS, he operates the corresponding select key SK—3 at the dispatcher's office, and this effects the operation of various devices at the dispatcher's office including two finder switches I—F and 2—F which are operated to positions corresponding to the operated select key SK—3. The positions in which the finder switches I—F and 2—F stop determine the select code. As soon as the finder switches I—F and 2—F stop in the positions corresponding to the operated select key SK—3, the operation of a code finder I—S is initiated to transmit over the two line conductors L—1 and L—2 the code of impulses which has been set up by the operated finder switch I—F.

The finder switches I—F and 2—F and the code sender I—S are shown as being selector switches of the well known rotary type comprising a plurality of banks of contacts, each bank having associated therewith a cooperating wiper and means for simultaneously operating all of the wipers in a step by step movement. Only those banks of contacts are shown in Fig. 2 as are necessary for a clear understanding of the present invention. Consequently, I have shown only the banks I—F6 of the finder switch I—F, the banks 2—F3 and 2—F5 of the finder switch 2—F and the banks I—S4 and I—S6 of the code sender I—S.

At the remote station RS the code of impulses, which is transmitted over the line conductors L—1 and L—2, selectively controls a receiver R' so as to select the apparatus unit A'U'—3. At the termination of the transmission of the select code, two finder switches I—F' and 2—F' at the remote station are operated to positions corresponding to the apparatus unit selected by the receiver R'. As soon as the finder switches I—F' and 2—F', which are similar in construction to the finder switches I—F and 2—F at the dispatcher's office, have reached the positions corresponding to the selected apparatus unit, a code sender I—S', at the remote station RS and similar in construction to the code sender I—S, is started to effect the transmission to the dispatcher's office over the line conductors L—1 and L—2, a check code of current impulses, which depends upon the positions of the finder switches I—F' and 2—F'. This check code of impulses is followed by either a positive or a negative indi-

ating impulse depending upon the position of the selected apparatus unit.

At the dispatcher's office the check code of impulses selectively controls a receiver R so that it selects the group of indicating lamps and associated relays corresponding to the selected apparatus unit. If the check code agrees with the select code that has been previously transmitted, the proper connections are established so that the indicating relay associated with the operated select key is selectively operated in response to the polarity of the indicating impulses so that the indicating lamps associated therewith indicate the position then occupied by the selected apparatus unit. Also the necessary circuit connections are established at the dispatcher's office so that the dispatcher can operate the selected apparatus unit as many times as he desires and can release the connection whenever he so desires.

When the supervisory equipment is at rest and an apparatus unit at the remote station changes its position, the associated indicating relay, such as I'A'-3 associated with the apparatus unit A'U'-3, is deenergized and causes the finder switches 1-F' and 2-F' to move to the positions thereof corresponding to the apparatus unit which has changed its position. Then the code sender 1-S' operates to transmit select code of current impulses corresponding to the apparatus unit which has changed its position. This select code, however, is not immediately followed by an indicating impulse corresponding to the new position of the apparatus unit which has changed its position.

At the dispatcher's office this select code operates the receiver R so as to select the group of indicating lamps and associated relays corresponding to the apparatus unit which has changed its position. At the termination of the transmission of the select code the two finder switches 1-F and 2-F at the dispatcher's office are operated to the positions thereof corresponding to the group of indicating lamps and relays selected by the receiver R. As soon as the finder switches 1-F and 2-F have reached the positions corresponding to the selected group of indicating lamps and relays, the code sender 1-S operates to transmit to the remote station RS over the line conductors L-1 and L-2 a check code of impulses corresponding to the selected group of indicating lamps and relays.

At the remote station the check code of impulses selectively controls the receiver R'. If the select and check codes agree, the receiver R' effects, after the termination of the check code, the transmission over the line conductors L-1 and L-2 of an indicating impulse of a polarity corresponding to the position of the apparatus unit which has changed its position. At the dispatcher's office this indicating impulse selectively operates the selected group of lamps so as to indicate the position of the apparatus unit which has changed its position. As soon as the indication impulse has been transmitted, the selective apparatus automatically resets to normal.

As disclosed in detail in the aforesaid Letters Patent 2,205,894, there is provided at the dispatcher's office (DO) a relay N-3, which is energized only when the code sender 1-S is in its normal position; a relay S-1, which operates after the finder switch 1-F has stopped in any of its normal positions; and a relay C-3, which is energized in case the receiver R receives a code of impulses before the code sender 1-S is

operated to transmit a code of impulses, namely, only in case the operation of the supervisory equipment is initiated in response to one of the apparatus units at the remote station RS changing its position.

In the arrangement disclosed in the aforesaid patent, if an apparatus unit should move from its normal position to its off-normal position and then be restored to its normal position before the supervisory equipment has completed the connection to the corresponding indicating means at the dispatcher's office, the indicating impulse, which is transmitted after the connection has been established, will be of the polarity corresponding to the normal position of the apparatus unit. Consequently, there will be no change in the lighting of the corresponding red, green or white lamps at the dispatcher's office.

In order to obtain a permanent indication of such a change in the position of an apparatus unit, I provide each group of indicating lamps in Fig. 2 with a separate relay, which is arranged to be energized in response to the finder switch 1-F being moved to the position thereof allotted to the associated indicating means as a result of the corresponding apparatus unit changing its position. This is accomplished in the embodiment of my invention, shown in Fig. 2, by completing the circuit of each separate relay, such as relay H-3 corresponding to the apparatus unit A'U'-3, through the contacts g of relay C-3 and contacts e of relay S-1 after the finder switch has stopped in the position thereof allotted to apparatus unit A'U'-3. Since relay C-3 is energized only in case the receiver R receives the code before the sender 1-S transmits the code, relay H-3 is energized only in case the establishment of the connection between the apparatus unit A'U'-3 and its corresponding group of indicating lamps and relays is initiated in response to the apparatus unit A'U'-3 changing its position. By closing its contacts 24, relay H-3, when energized, completes a locking circuit for itself through contacts 26 of the disagreement key DK-3 if it is in its position corresponding to the closed position of the apparatus unit A'U'-3 and contacts 27 of the indicating relay IR-3 if it is in its position corresponding to the closed position of the apparatus unit A'U'-3. Relay H-3, therefore, is operated before the indicating impulse is transmitted.

If, when the apparatus unit A'U'-3 is opened, it remains in its open position long enough to allow an indicating impulse corresponding to the open position of the apparatus unit to be transmitted while the relay H-3 is energized then indicating relay IR-3 is moved to its other position and the locking circuit of the relay H-3 is opened so that, as soon as the supervisory apparatus is reset to normal after the indicating impulse is transmitted, the relay H-3 becomes deenergized.

When the code sender 1-S is restored to its normal position after the indicating impulse is transmitted, a circuit is completed through the normal contacts of bank I-S4 at the dispatcher's office for the control relay N-3. If the relay H-3 is energized when the relay N-3 becomes energized, a circuit is completed for relay F which in turn completes a flashing circuit for the white lamp LW-3 through an interrupter IR so that the lamp LW-3 is intermittently lighted at the same time that the red lamp LR-3 is continuously lighted. This combination of lighted lamps informs the dispatcher that the apparatus

unit A'U'-3 has opened and reclosed. The dispatcher can then extinguish the flashing white lamp LW-3 by operating the disagreement key DK-3 in the same manner it is operated in order to extinguish a flashing white lamp in the arrangement disclosed in Fig. 1.

The operation of the arrangement shown in Fig. 2 is as follows:

When the selective means is at rest and the apparatus unit A'U'-3 is closed, the various control devices of the supervisory equipment occupy the positions in which they are shown in the drawings. At the dispatcher's office an energizing circuit for relay N-3 is completed through the normal contact of bank I-S4. A circuit is completed for the red lamp LR-3 through the contacts 30 of the indicating relay IR-3 so that this lamp is continuously lighted and thereby informs the dispatcher that the apparatus unit A'U'-3 at the remote station is closed. At the remote station the indicating relay I'A'-3 is energized by a locking circuit which includes contacts 10 of the relay I'A'-3 and the auxiliary contacts 17 of the closed apparatus unit A'U'-3.

It will be assumed first that the selector switch SK-3 is moved to its off-normal position so as to cause the supervisory equipment to operate in a well known manner to establish a connection between the apparatus unit A'U'-3 at the remote station RS and its corresponding indicating means at the dispatcher's office after which an indicating impulse corresponding to the position then occupied by the apparatus unit A'U'-3 is transmitted over the line conductors L-1 and L-2 to the indicating relay IR-3. If the apparatus unit A'U'-3 is still in its closed position after the connection is established, the indicating impulse is of such a character that the relay IR-3 remains in the position in which it is shown so that the lamp LR-3 remains continuously lighted. If the apparatus unit A'U'-3 is in its open position when the connection is established, the indicating impulse is of such a character that the relay IR-3 is moved to its other position, so that the red lamp LR-3 is extinguished as the circuit of the green lamp LG-3 is completed at the contacts 34 of the relay IR-3. Also a circuit is completed for the white lamp LW-3 through the contacts 34 of the relay IR-3, the contacts 36 of the disagreement key DK-3 and the contacts 35 of the relay H-3. By moving the disagreement key DK-3 to the position thereof corresponding to the open position of the apparatus unit A'U'-3, the continuous lighting of the white lamp LW-3 is discontinued. The selection may be released at any time by restoring the select key SK-3 to its normal position.

It will now be assumed that, while the supervisory equipment is at rest, the apparatus unit A'U'-3 automatically opens so that its contacts 17 interrupt the holding circuit for the associated indicating relay I'A'-3. The deenergization of the indicating relay I'A'-3 then effects in a well known manner the establishment of a connection between the apparatus unit A'U'-3 and its corresponding group of indicating lamps and relays at the dispatcher's office after which an indicating impulse corresponding to the position of the apparatus unit A'U'-3 is transmitted over the line conductors L-1 and L-2 to the indicating relay IR-3. Since the receiver R receives code before the code sender I-S transmits code, the relay H-3 is energized in the manner heretofore described before the indicating im-

pulse is transmitted to the indicating relay IR-3.

If the apparatus unit A'U'-3 is in its open position at the time the indicating impulse is transmitted, this indicating impulse is of such a character that the indicating relay IR-3 moves to its other position so that the contacts 27 and 30 are opened and the contacts 34 are closed. The opening of the contacts 27 interrupts the heretofore described locking circuit of the relay H-3 so that this relay becomes deenergized as soon as the connection is released after the indicating impulse is transmitted. The opening of the contacts 30 of the relay IR-3 extinguishes the red lamp LR-3, and the closing of the contacts 34 completes a circuit for the green lamp LG-3 and a circuit for the white lamp LW-3 through contacts 35 of relay H-3 when it is in its deenergized position and contacts 36 of the disagreement key DK-3. The continuous lighting of the lamps LG-3 and LW-3 informs the dispatcher that the apparatus unit A'U'-3 has opened and is still in its open position. By moving the disagreement key DK-3 to its other position, which corresponds to the open position of the apparatus unit A'U'-3, the circuit of the white lamp LW-3 is opened so that only the green lamp LG-3 remains lighted.

It will now be assumed that, after the apparatus unit A'U'-3 opens, it is immediately reclosed and is in its closed position when the indicating impulse is transmitted. Under these conditions, the character of the indicating impulse is such that it does not change the position of the indicating relay IR-3. Consequently, the red lamp LR-3 remains lighted and the locking circuit of the relay H-3 remains completed after the supervisory apparatus has been restored to its normal condition. When the relay N-3 becomes energized by the finder IF being restored to its normal position, the closing of its contacts 37 completes, through contacts 38 of relay H-3, an energizing circuit for relay F. The closing of contacts 39 of relay F completes a locking circuit for relay F around the contacts 37 of relay N-3, and the closing of contacts 40 of relay F completes a flashing circuit for white lamp LW-3 through contacts 41 of relay H-3 and interrupter IR. The continuous lighting of the lamp LR-3 and the flashing of lamp LW-3 at the same time informs the dispatcher that the apparatus unit A'U'-3 has automatically opened and reclosed and is still in its closed position. By moving the disagreement key DK-3 to its other position and then back to the position in which it is shown, the dispatcher can extinguish the lamp LW-3 so that only the red lamp LR-3 remains lighted.

While I have, in accordance with the patent statutes, shown and described my invention as applied to a particular system and as embodying various devices diagrammatically indicated, changes and modifications will be obvious to those skilled in the art, and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a supervisory system in which selective means at two points are adapted to be operated to establish connections respectively between a plurality of movable devices at one of said points and corresponding indicating means at the other point, means responsive to any of said devices

changing its position for initiating the operation of said selective means so as to establish a connection between the device initiating the operation of said selective means and the corresponding indicating means and for transmitting between said points while said connection is established an indicating impulse of a character dependent upon the position then occupied by such device, and means controlled by the character of said impulse for operating the indicating means corresponding to the device which initiated the operation of said selective means so as to indicate which device has changed its position and whether at the time such an impulse is transmitted that device is in a different position than the position from which it moved to initiate the operation of said selective means or is in the position from which it moved to initiate the operation of said selective means.

2. In a supervisory system in which selective means at two points are adapted to be operated to establish connections respectively between a plurality of movable devices at one of said points and corresponding indicating means at the other point, means responsive to any of said devices changing its position for initiating the operation of said selective means so as to establish a connection between the device initiating the operation of said selective means and the corresponding indicating means and for transmitting between said points while said connection is established an indicating impulse of a character dependent upon the position then occupied by such device, and means for operating the indicating means corresponding to the device which initiated the operation of said selective means so as to indicate which device has changed its position and whether or not it has been restored to its original position at the time said impulse is transmitted including means dependent upon the character of said impulse for operating the indicating means in one manner when said current impulse is transmitted as a result of said device being in a different position than the position from which it moved to initiate the operation of said selective means and in a different manner when said current impulse is transmitted as a result of said device being in the same position from which it moved to initiate the operation of said selective means.

3. In a supervisory system in which selective means at two points are adapted to be operated to establish connections respectively between a plurality of movable devices at one of said points and corresponding indicating means at the other point, means responsive to any of said devices changing its position for initiating the operation of said selective means so as to establish a connection between the device initiating the operation of said selective means and the corresponding indicating means and for transmitting between said points while said connection is established an indicating impulse of a character dependent upon the position then occupied by such device, and means for operating the indicating means corresponding to the device which initiated the operation of said selective means so as to indicate which device has changed its position and whether or not it has been restored to its original position at the time said impulse is transmitted including means dependent upon the character of said impulse for operating the indicating means continuously when said current impulse is transmitted as a result of said device being in a different position than the position

from which it moved to initiate the operation of said selective means and intermittently when said current impulse is transmitted as a result of said device being in the same position from which it moved to initiate the operation of said selective means.

4. In a supervisory system in which selective means at two points are adapted to be operated to establish connections respectively between a plurality of two-position devices at one of said points and corresponding normally nonoperating indicating means at the other point, means responsive to any of said devices moving from one of its positions to another for initiating the operation of said selective means so as to establish a connection between the device initiating the operation of said selective means and the corresponding indicating means and for transmitting between said points when such connection is established an indicating impulse of a character dependent upon the position then occupied by such device, a disagreement key at said other point individual to each device at said one point and having two positions corresponding respectively to the two positions of the associated device, and means for operating the indicating means corresponding to the device that initiated the operation of said selective means so as to indicate which device has changed its position and whether or not it has been restored to its original position at the time said impulse is transmitted including means dependent upon the character of said current impulse and the position of the associated disagreement key for operating the corresponding indicating means in one manner when said device is in said other position to which it has been moved and in a different manner when it has been restored to said one position at the time said impulse is transmitted.

5. In a supervisory system in which selective means at two points are adapted to be operated to establish connections respectively between a plurality of two-position devices at one of said points and corresponding indicating means at the other point, means responsive to any of said devices moving from one of its positions to another for initiating the operation of said selective means so as to establish a connection between the device initiating the operation of said selective means and the corresponding indicating means and for transmitting between said points when such connection is established an indicating impulse of a character dependent upon the position then occupied by such device, a disagreement key at said other point individual to each device at said one point and having two positions corresponding respectively to the two positions of the associated device, and means for operating the indicating means corresponding to the device that initiated the operation of said selective means so as to indicate which device has changed its position and whether or not it has been restored to its original position at the time said impulse is transmitted including means dependent upon the character of said current impulse and the position of the associated disagreement key for operating the corresponding indicating means in one manner when said disagreement key is in a predetermined position and said impulse is of a predetermined character and in a different manner when said disagreement key is in said other position and said impulse is of said predetermined character.

6. In a supervisory system in which selective means at two points are adapted to be operated

to establish a connection between a predetermined two-position device at one of said points and corresponding indicating means at the other point and in which an indicating impulse of current of a character dependent upon the position occupied by said device is transmitted between said points while said connection is established, means dependent upon the movement of said device from one position to another for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, a disagreement key at said other point having two positions corresponding respectively to the two positions of said device, a control relay, means dependent upon the establishment of said connection being initiated by the movement of said device from one position to another for effecting the operation of said control relay, means dependent upon the character of said impulse and the position of said disagreement key for maintaining said relay in its operated condition, and means for operating said indicating means in one manner when said relay is in its normal position and in a different manner when said relay is in its operated position.

7. In a supervisory system in which selective means at two points are adapted to be operated to establish a connection between a predetermined movable device at one of said points and corresponding indicating means at the other point and in which an indicating impulse of current of a character dependent upon the position occupied by said device is transmitted between said points while said connection is established, means dependent upon the movement of said device from one position to another for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, manually controlled means at said other point for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, and means at said other point for controlling said indicating means in one manner in response to the transmission of an indicating impulse of a predetermined character when said connection is established as a result of an operation of said manually controlled means and in a different manner in response to the transmission of an indicating impulse of said predetermined character when said connection is established as a result of said device changing its position.

8. In a supervisory system in which selective means at two points are adapted to be operated to establish a connection between a predetermined movable device at one of said points and corresponding indicating means at the other point and in which an indicating impulse of current of a character dependent upon the position occupied by said device is transmitted between said points while said connection is established, means dependent upon the movement of said device from one position to another for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, manually controlled means at said other point for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, and means at said other point for operating said indicating means continuously in response to the transmission of an indicating impulse of a predetermined character when said connection is established as a result of an operation of said

manually controlled means and intermittently in response to the transmission of an indicating impulse of said predetermined character when said connection is established as a result of said device changing its position.

9. In a supervisory system in which selective means at two stations are adapted to be operated to establish a connection between an apparatus unit having a normal position and an off-normal position at one of said stations and indicating means at the other station comprising an indicating lamp for each position of said unit and a disagreement lamp and in which an indicating impulse of current of a character dependent upon the position occupied by said unit is transmitted between said stations while said connection is established, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, means dependent upon said unit moving from either of its positions to the other for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, and means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse and for operating said disagreement lamp continuously if said unit is in its off-normal position and said disagreement key is in its position corresponding to the normal position of said unit when said impulse is transmitted and for operating said disagreement lamp intermittently if said unit is in its normal position and said disagreement key is in its position corresponding to the normal position of said unit when said impulse is transmitted as a result of the establishment of said connection being initiated by said unit changing its position.

10. In a supervisory system in which selective means at two stations are adapted to be operated to establish a connection between an apparatus unit having a normal position and an off-normal position at one of said stations and indicating means at the other station comprising an indicating lamp for each position of said unit and a disagreement key and in which an indicating impulse of current of a character dependent upon the position occupied by said unit is transmitted between said stations while said connection is established, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, means dependent upon said unit moving from either of its positions to the other for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, and means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse and means at said other station controlled by the position of said disagreement key and the character of said impulse for lighting said disagreement lamp in different ways.

11. In a supervisory system in which selective means at two stations are adapted to be operated to establish a connection between an apparatus unit having a normal position and an off-normal position at one of said stations and indicating means at the other station comprising an indicating lamp for each position of said unit and a disagreement key and in which an indicating impulse of current of a character dependent upon the position occupied by said unit is transmitted between said stations while said connection is

established, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, means dependent upon said unit moving from either of its positions to the other for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, control means at said other station for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, a control relay at said other station, means for effecting the operation of said control relay only upon the establishment of said connection being initiated by the movement of said unit from one position to another, means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse, and means dependent upon the position of said disagreement key and the condition of said relay for operating said disagreement lamp in different ways in response to the transmission of an impulse of a predetermined character.

12. In a supervisory system in which selective means at two stations are adapted to be operated to establish a connection between an apparatus unit having a normal position and an off-normal position at one of said stations and indicating means at the other station comprising an indicating lamp for each position of said unit and a disagreement key and in which an indicating impulse of current of a character dependent upon the position occupied by said unit is transmitted between said stations while said connection is established, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, means dependent upon said unit moving from either of its positions to the other for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, control means at said other station for initiating the operation of said selective means to establish said connection and the transmission of said indicating impulse, a control relay at said other station, means for effecting the operation of said control relay only upon the establishment of said connection being initiated by the movement of said unit from one position to another, means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse, and means for operating said disagreement lamp continuously when said relay is in its normal position and said disagreement key is in its position corresponding to the normal position of said unit and the indicating impulse is of the character corresponding to the normal position of said unit and for operating said disagreement lamp intermittently when said relay is in its operated position and said disagreement key is in its position corresponding to the normal position of said unit and the indication impulse is of the character corresponding to the normal position of said unit.

13. In a synchronous selector supervisory system in which multiple position switches at two points are synchronously operated and in which means are provided whereby when said switches are simultaneously in predetermined positions corresponding to a predetermined movable device at one of said points an indicating impulse of current of a character dependent upon the position occupied by said device is transmitted between said points, means dependent upon the

movement of said device for causing said switches to remain in said predetermined positions corresponding to said device during the synchronous operation of said switches for one length of time if said device has not changed its position since the previous indicating impulse for said device was transmitted and for a different length of time if said device has changed its position since the previous indicating impulse for said device was transmitted, and means at the other of said points dependent upon the character of said impulse and the length of time said switches remain in said predetermined positions corresponding to said device for indicating whether said device has been operated so that it is in a different position than the position it was in when the previous indicating impulse for said device was transmitted or said device has been operated so that it has been restored to the same position it was in when the previous indicating impulse for said device was transmitted.

14. In a synchronous selector supervisory system in which multiple position switches at two points are synchronously operated and in which means are provided whereby when said switches are simultaneously in predetermined positions corresponding to a predetermined movable device at one of said points an indicating impulse of current of a character dependent upon the position occupied by said device is transmitted between said points, means dependent upon the movement of said device for causing said switches to remain in said predetermined positions corresponding to said device during the synchronous operation of said switches for one length of time if said device has not changed its position since the previous indicating impulse for said device was transmitted and for a different length of time if said device has changed its position since the previous indicating impulse for said device was transmitted, signalling means at the other of said points, and means dependent upon the character of said current impulse and the length of time said switches remain in said predetermined positions corresponding to said device for operating said signalling means in one manner when said current impulse is transmitted as a result of said device being in a different position than the position it was in when the previous indicating impulse for said device was transmitted and in a different manner when said current impulse is transmitted as a result of said device being operated in such a way that it has been restored to the same position it was in when the previous indicating impulse for said device was transmitted.

15. In a synchronous selector supervisory system in which multiple position switches at two points are synchronously operated and in which means are provided whereby when said switches are simultaneously in predetermined positions corresponding to a predetermined movable device at one of said points an indicating impulse of current of a character dependent upon the position occupied by said device is transmitted between said points, means dependent upon the movement of said device for causing said switches to remain in said predetermined positions corresponding to said device during the synchronous operation of said switches for one length of time if said device has not changed its position since the previous indicating impulse for said device was transmitted and for a different length of time if said device has changed its position since the previous indicating impulse for said device

was transmitted, signalling means at the other of said points, and means dependent upon the character of said current impulse and the length of time said switches remain in said predetermined positions corresponding to said device for operating said signalling means continuously when said current impulse is transmitted while said device is in a different position than the position it was in when the previous current impulses for said device was transmitted and intermittently when said current impulse is transmitted as a result of said device being operated in such a manner that it has been restored to the same position it was in when the previous current impulse for said device was transmitted.

16. In a synchronous selector supervisory system in which multiple position switches at two points are synchronously operated and in which means are provided whereby when said switches are simultaneously in predetermined positions a current impulse of one polarity is transmitted between said points if a predetermined two-position device is in a predetermined one of its positions and a current impulse of the opposite polarity is transmitted between said points if said device is in its other position, means for causing said switches during synchronous operation thereof to remain in said predetermined positions for one length of time if said device has not changed its position since the previous indicating impulse for said device was transmitted and for a longer length of time if said device has changed its position since the previous indicating impulse for said device was transmitted, signalling means at the other of said points, means responsive to the polarity of said current impulse for operating said signalling means in accordance with the position of said device, other signalling means at the other of said points, and means dependent upon the polarity of said impulse and the length of time said switches remain in said predetermined positions for operating said other signalling means in a manner to indicate whether said device has been operated so that it is in a different position than the position it was in when the previous current impulse for said device was transmitted or said device has been operated so that it has been restored to the same position it was in when the previous current impulse for said device was transmitted.

17. In a synchronous selector supervisory system in which multiple position switches at two points are synchronously operated and in which means are provided whereby when said switches are simultaneously in predetermined positions a current impulse of one polarity is transmitted between said points if a predetermined two-position device is in a predetermined one of its positions and a current impulse of the opposite polarity is transmitted between said points if said device is in its other position, means for causing said switches during synchronous operation thereof to remain in said predetermined positions for one length of time if said device has not changed its position since the previous indicating impulse for said device was transmitted and for a longer length of time if said device has changed its position since the previous indicating impulse for said device was transmitted, a non-operating signal at said other point, and means dependent upon the polarity of said indicating impulse and the length of time said switches remain in said predetermined positions for operating said signal continuously when said indicating impulse is of one of said predeter-

mined polarities and said switches remain in said predetermined positions for said longer length of time and for operating said signal intermittently when said indicating impulse is of the other polarity and said switches remain in said predetermined positions for said longer length of time.

18. In a synchronous selector supervisory system in which multiple position switches at two points are synchronously operated and in which means are provided whereby when said switches are simultaneously in predetermined positions a current impulse of one polarity is transmitted between said points if a predetermined two-position device is in a predetermined one of its positions and a current impulse of the opposite polarity is transmitted between said points if said device is in its other position, means for causing said switches during synchronous operation thereof to remain in said predetermined positions for one length of time if said device has not changed its position since the previous indicating impulse for said device was transmitted and for a longer length of time if said device has changed its position since the previous indicating impulse for said device was transmitted, a non-operating signal at said other points, means dependent upon the polarity of said indicating impulse and the length of time said switches remain in said predetermined positions for operating said signal continuously when said indicating impulse is of one of said predetermined polarities and said switches remain in said predetermined positions for said longer length of time and for operating said signal intermittently when said indicating impulse is of the other polarity and said switches remain in said predetermined positions for said longer length of time, and means at said other point for restoring said signal to its non-operating condition after it has been operated.

19. In a synchronous selector supervisory system in which normally idle multiple position selector switches are provided at two points and in which means are provided whereby when said switches are simultaneously in predetermined corresponding positions an indicating impulse of current of a character dependent upon the position occupied by a two-position device at one of said points is transmitted to the other of said two points, means for synchronously operating said switches through their corresponding positions, means for causing said switches to stop in said predetermined corresponding positions for a longer time when said device has changed its position than when it has not changed its position since the last time said switches were in said predetermined corresponding positions, a signal at the other of said points, a disagreement key at said other point having two positions corresponding respectively to the two positions of said device, a control relay, means responsive to said switches stopping in said predetermined corresponding positions for said longer time for effecting the operation of said control relay, means dependent upon the character of the indicating impulse transmitted while said switches are in said predetermined corresponding positions and upon the position of said disagreement key for maintaining said relay in its operated condition, and means for operating said signal in one manner when said relay is in its normal condition and in a different manner when said relay is in its operated condition.

20. In a synchronous selector supervisory sys-

tem in which normally idle multiple position selector switches are provided at two points and in which means are provided whereby when said switches are simultaneously in predetermined corresponding positions an indicating impulse of current of a character dependent upon the position occupied by a two-position device at one of said points is transmitted to the other of said two points, means for synchronously operating said switches through their corresponding positions, means for causing said switches to stop in said predetermined corresponding positions for a longer time when said device has changed its position than when it has not changed its position since the last time said switches were in said predetermined corresponding positions, a signal at the other of said points, a disagreement key at said other point having two positions corresponding respectively to the two positions of said device, a control relay, means responsive to said switches stopping in said predetermined corresponding positions for said longer time for effecting the operation of said control relay, means dependent upon the character of the indicating impulse transmitted while said switches are in said predetermined corresponding positions and upon the position of said disagreement key for maintaining said relay in its operated condition, and means for operating said signal in one manner when said relay is in its normal condition and in a different manner when said relay is in its operated condition and said switches are restored to their idle positions.

21. In a synchronous selector supervisory system in which normally idle multiple position selector switches are provided at two points and in which means are provided whereby when said switches are simultaneously in predetermined corresponding positions an indicating impulse of current of a character dependent upon the position occupied by a two-position device at one of said points is transmitted to the other of said two points, means for synchronously operating said switches through their corresponding positions, means for causing said switches to stop in said predetermined corresponding positions for a longer time when said device has changed its position than when it has not changed its position since the last time said switches were in said predetermined corresponding positions, a signal at the other of said points, a disagreement key having two positions corresponding respectively to the two positions of said device, a normally deenergized relay, means responsive to said switches stopping in said predetermined corresponding positions for said longer time for effecting the energization of said relay, means dependent upon the character of the indicating impulse transmitted while said switches are in said predetermined corresponding positions and upon the position of said disagreement key for completing a locking circuit for said relay, and means controlled by said relay for operating said signal continuously when the said relay is deenergized and the position of said disagreement key does not agree with the position of said device and for operating said signal intermittently when said relay is energized and the position of said disagreement key agrees with the position of said device.

22. In combination, a dispatcher's office, a remote station, a normally closed circuit breaker at said remote station, means for opening said circuit breaker, automatic means for reclosing said circuit breaker, a normally energized indicating

relay associated with said circuit breaker, means responsive to an opening of said circuit breaker for deenergizing said relay, indicating means at said dispatcher's office for indicating the position of said circuit breaker, a selector switch at each station having a normal position and a predetermined off-normal position individual to said circuit breaker, means for transmitting between said stations an indicating impulse of a character dependent upon the position of said circuit breaker when both of said switches are simultaneously in said predetermined off-normal positions, means for controlling said indicating means in response to the character of said indicating impulse and the length of time said switches remain in said predetermined off-normal positions, means independent of the length of said impulses for operating said switches in synchronism including means for initiating said synchronous operation in response to the deenergization of said relay, means controlled by said relay for stopping said synchronous operation when said switches are in said predetermined off-normal positions and said relay is deenergized, and means responsive to said switches remaining in said predetermined off-normal positions for a predetermined time when said relay is deenergized for initiating the synchronous operation of said switches.

23. In combination, a dispatcher's office, a remote station, a normally closed circuit breaker at said remote station, means for opening said circuit breaker, automatic means for reclosing said circuit breaker, a normally energized indicating relay associated with said circuit breaker, means responsive to an opening of said circuit breaker for deenergizing said relay, indicating means at said dispatcher's office for indicating the position of said circuit breaker, a selector switch at each station having a normal position and a predetermined off-normal position individual to said circuit breaker, means for transmitting between said stations an indicating impulse of a character dependent upon the position of said circuit breaker when both of said switches are simultaneously in said predetermined off-normal positions, means for controlling said indicating means in response to the character of said indicating impulse and the length of time said switches remain in said predetermined off-normal positions, means independent of the length of said impulses for operating said switches in synchronism including means for initiating said synchronous operation in response to the deenergization of said relay, means controlled by said relay for stopping said synchronous operation when said switches are in said predetermined off-normal positions and said relay is deenergized, and means responsive to said switches remaining in said predetermined off-normal positions for a predetermined time when said relay is deenergized for initiating the synchronous operation of said switches and the energization of said relay.

24. In combination, two stations, an apparatus unit at one of said stations having a plurality of positions, a normally energized relay associated with said unit, means responsive to a change in the position of said unit for deenergizing said

relay, indicating means at the other of said stations for indicating the position of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means independent of the length of said impulses and responsive to the deenergization of said relay for operating said switches to said predetermined positions, means controlled by said relay for effecting the movement of said switches out of said predetermined positions immediately when said relay is energized and after a predetermined time interval when said relay is deenergized, and means at said other station for controlling the operation of said signalling means in response to the character of said impulse and the length of time said switches remain in said predetermined positions.

25. In combination, two stations, an apparatus unit at one of said stations having a plurality of positions, a normally energized relay associated with said unit, means responsive to a change in the position of said unit for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, manually controlled means at said other station for initiating the operation of said operating means, and means at said other station for controlling said indicating means in one manner in response to the transmission of an impulse of a predetermined character when said switches are in said predetermined positions as a result of an operation of said manually controlled means and in a different manner in response to the transmission of an impulse of said predetermined character when said switches are in said predetermined positions as a result of a deenergization of said relay.

26. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, control means at said other station for initiating the operation of said operating means, and means at said other station for controlling said indicating means in response to the character of said impulse including means for

operating said indicating means in one manner in response to the transmission of an impulse of a predetermined character when said switches are in said predetermined positions as a result of a deenergization of said relay and said unit is in its normal position when the switches are in said predetermined positions and in a different manner in response to the transmission of an impulse of said predetermined character when said switches are operated to said predetermined positions as a result of an operation of said control means and said unit is in its normal position when said switches are in said predetermined positions.

27. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, and means at said other station controlled by said impulse for operating said indicating means continuously if said unit is in its off-normal position when said switches reach said predetermined positions in response to the deenergization of said relay and intermittently if said unit is in its normal position when said switches reach said predetermined positions in response to the deenergization of said relay.

28. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, said indicating means including an indicating lamp for each position of the unit and a disagreement lamp, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, and means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse and for operating said disagreement lamp continuously if said unit is in its off-normal position and said disagreement key is in its position corresponding to the normal position of said unit when said switches reach said predetermined positions in response to the deenergization

of said relay and for operating said disagreement lamp intermittently if said unit is in its normal position and said disagreement key is in its position corresponding to the normal position of said unit when said switches reach said predetermined positions in response to the deenergization of said relay.

29. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, said indicating means including an indicating lamp for each position of the unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, control means at said other station for initiating the operation of said operating means, a select key at said other station having a normal position and an off-normal position arranged when in its normal position to permit the operation of said operating means to move said switches out of said predetermined positions and when in its off-normal position to prevent said operating means from moving said switches out of said predetermined positions, means controlled by said relay for effecting the movement of said switches out of said predetermined positions immediately when said relay is energized and said select key is in its normal position and after a predetermined longer time interval when said relay is deenergized and said select key is in its normal position, and means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse and the length of time said switches remain in said predetermined positions.

30. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, said indicating means including an indicating lamp for each position of the unit and a disagreement lamp, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, control means at said other station for initiating

the operation of said operating means, a select key at said other station having a normal position and an off-normal position arranged when in its normal position to permit the operation of said operating means to move said switches out of said predetermined positions and when in its off-normal position to prevent said operating means from moving said switches out of said predetermined positions, means controlled by said relay for effecting the movement of said switches out of said predetermined positions immediately when said relay is energized and said select key is in its normal position and after a predetermined longer time interval when said relay is deenergized and said select key is in its normal position, means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse, and means at said other station controlled by the positions of said disagreement and select keys and the length of time said switches remain in said predetermined positions for operating said disagreement lamp in different ways.

31. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for deenergizing said relay, indicating means at the other of said stations for indicating the position of said unit, said indicating means including an indicating lamp for each position of the unit and a disagreement lamp, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, control means at said other station for initiating the operation of said operating means, a select key at said other station having a normal position and an off-normal position arranged when in its normal position to permit the operation of said operating means to move said switches out of said predetermined positions and when in its off-normal position to prevent said operating means from moving said switches out of said predetermined positions, means controlled by said relay for effecting the movement of said switches out of said predetermined positions immediately when said relay is energized and said select key is in its normal position and after a predetermined longer time interval when said relay is deenergized and said select key is in its normal position, means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse, and means at said other station controlled by the positions of said disagreement and select keys and the length of time said switches remain in said predetermined positions for operating said disagreement lamp continuously if said select key is in its normal position and said unit is in its off-normal position and said disagreement key is in its position

corresponding to the normal position of said unit when said impulse is transmitted and if said select key is in its off-normal position and the positions of said unit and disagreement key do not agree when said current impulse is transmitted and intermittently if said select key is in its normal position and said unit is in its normal position and said disagreement key is in its position corresponding to the normal position of said unit and said switches remain in said predetermined positions for said predetermined longer time interval when said impulse is transmitted.

32. In combination, two stations, an apparatus unit at one of said stations having a normal position and an off-normal position, means for moving said unit from each position to the other, a normally energized relay associated with said unit, means responsive to a change in the position of said unit while said relay is energized for de-energizing said relay, indicating means at the other of said stations for indicating the position of said unit, said indicating means including an indicating lamp for each position of the unit and a disagreement lamp, a disagreement key associated with said indicating means and having positions corresponding to the positions of said unit, a multiple position switch at each station having a predetermined position individual to said unit, means for transmitting between said stations a current impulse of a character dependent upon the position of said unit when both of said switches are simultaneously in said predetermined positions, means for operating said switches to said predetermined positions, means responsive to the deenergization of said relay for initiating the operation of said operating means, control means at said other station for initiating the operation of said operating means, a select

key at said other station having a normal position and an off-normal position arranged when in its normal position to permit the operation of said operating means to move said switches out of said predetermined positions and when in its off-normal position to prevent said operating means from moving said switches out of said predetermined positions, means controlled by said relay for effecting the movement of said switches out of said predetermined positions immediately when said relay is energized and said select key is in its normal position and after a predetermined longer time interval when said relay is de-energized and said select key is in its normal position, means at said other station controlled by said impulse for selectively operating said indicating lamps in accordance with the character of said impulse, means at said other station controlled by the positions of said disagreement and select keys for operating said disagreement lamp continuously if said select key is in its normal position and said unit is in its off-normal position and said disagreement key is in its position corresponding to the normal position of said unit when said impulse is transmitted and if said select key is in its off-normal position and the positions of said unit and disagreement key do not agree when said current impulse is transmitted, and means for operating said disagreement lamp intermittently when said switches are restored to their idle positions if said select key and units are in their normal positions and said disagreement key is in its position corresponding to the normal position of said unit and said switches remain in said predetermined positions for said predetermined longer time interval when said impulse is transmitted.

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