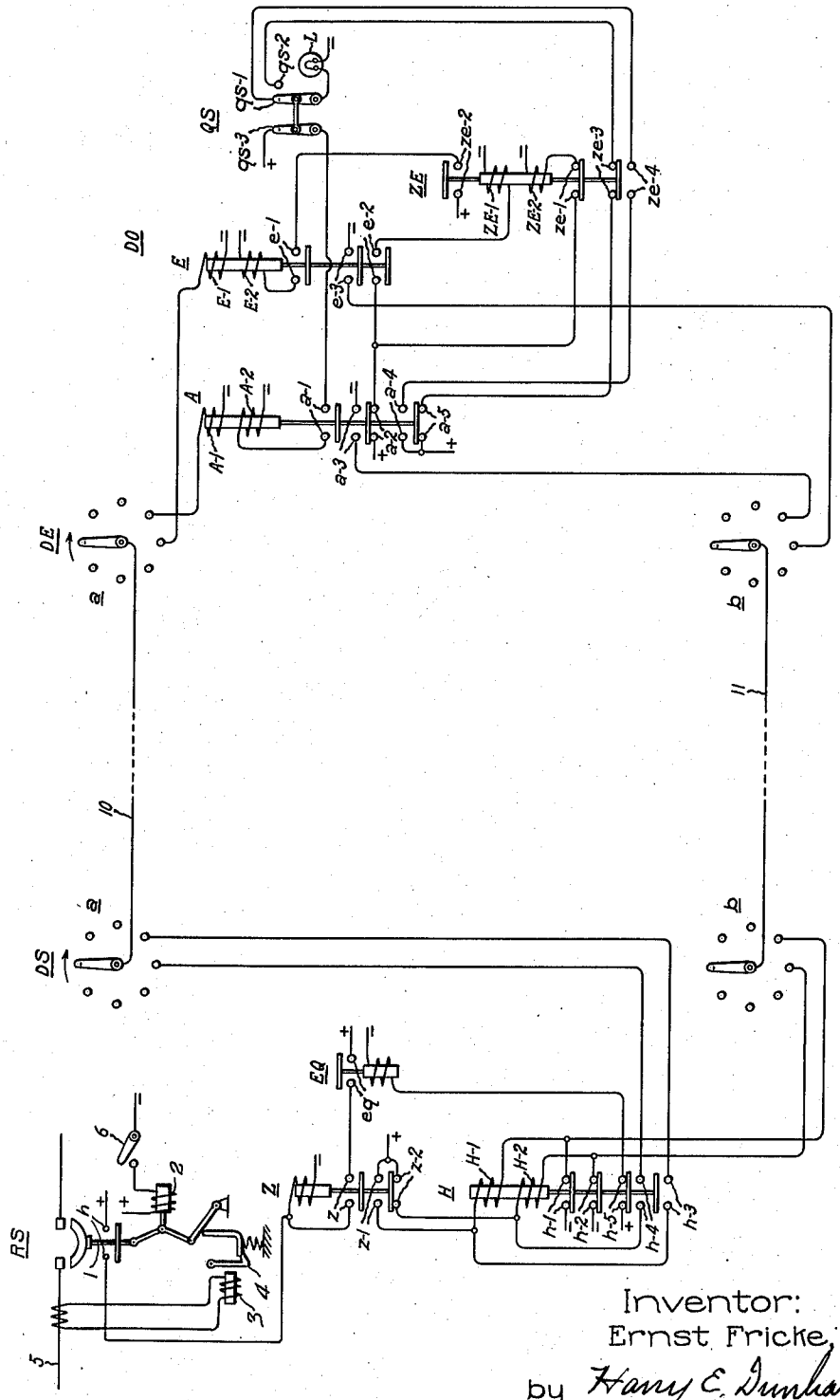
Aug. 30, 1938. E. FRICKE 2,128,812

REMOTE SIGNALING SYSTEM

Filed Oct. 16, 1936



Inventor:
Ernst Fricke,
by Harry E. Dunham
His Attorney.

Patented Aug. 30, 1938 2,128,812

UNITED STATES PATENT OFFICE

2,128,812

REMOTE SIGNALING SYSTEM

Ernst Fricke, Berlin-Pankow, Germany, assignor to General Electric Company, a corporation of New York

Application October 16, 1936, Serial No. 106,047
In Germany October 31, 1935

3 Claims. (Cl. 177—353)

My invention relates to remote signaling systems for remotely indicating changes in the position of a movable device such as a circuit breaker, relay, switch, etc. There exists at the present time remote signaling systems in which synchronously operated multiple switches, such as rotary selector switches, relay chains, etc., are used to transmit periodically to a remote point an indication corresponding to the position of an apparatus unit. In such systems, however, there is the possibility that an apparatus unit may be operated so quickly that by the time the synchronously operated switches have reached the position corresponding to the operated apparatus unit, this unit has been restored to its original position and therefore the dispatcher at the remote station receives no indication of the operation of the apparatus unit. One object of my invention is to provide in such remote signaling systems an arrangement whereby the dispatcher is informed of any such rapid change in the position of the remote apparatus unit.

My invention will be better understood from the following description when taken in connection with the accompanying drawing, the single figure of which illustrates a remote signaling system embodying my invention, and its scope will be pointed out in the appended claims.

Referring to the drawing, RS represents a station where the apparatus units 1 are located, the positions of which are to be indicated at the dispatcher's office DO. In order to simplify the disclosure, only one apparatus unit and its associated apparatus is shown in detail. The apparatus unit 1 is shown as an overload circuit breaker of the latched-in type 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 which is controlled by the circuit breaker 1 so that when the current in the circuit 5 exceeds a predetermined amount, the latch 4 is released to allow the circuit breaker 1 to open. Associated with the circuit breaker 1 is a control switch 6 which, when closed, completes an energizing circuit for the closing coil 2 of the circuit breaker 1. Preferably the circuit breaker 1 is of the well known trip free type so that when the circuit breaker is closed under fault conditions the circuit breaker will open and remain open notwithstanding the fact that the closing coil 2 may still be energized.

Associated with each apparatus unit 1 at the remote station RS is a quick-acting relay Z which varies its position in accordance with the position of the associated apparatus unit. This relay Z is controlled by an auxiliary contact *h* on the associated apparatus unit 1 that is closed when the unit 1 is closed. When the relay Z is energized, it completes a locking circuit for itself through its contacts *z* and the contacts *eq* of the relay EQ, which are closed until the signal corresponding to the energized position of the relay Z has been transmitted to and received by the dispatcher's office DO. Associated with each relay Z is a change relay H, which has two windings, H—1 and H—2. One terminal of the winding H—1 is arranged to be connected to the negative terminal of a suitable source of control current by the contacts *h*—1 when the relay H is in its energized position and the other terminal of the winding H—1 is arranged to be connected to the positive terminal of the source of control current by the contacts *z*—1 when the relay Z is energized. One terminal of the winding H—2 is arranged to be connected to the negative terminal of the control source by the contacts *h*—2 when the relay H is in its energized position and the other terminal of the winding H—2 is arranged to be connected to the positive terminal of the control source by the contacts *z*—2 when the relay Z is de-energized. Also the contacts *z*—1 and *z*—2 are respectively connected through the contacts *h*—3 and *h*—4 of the relay H, when it is de-energized, to different contacts of the bank *a* of a rotary switch DS of a synchronous selector type of supervisory system. The contacts *h*—1 and *h*—2 are also respectively connected to corresponding contacts of another bank *b* of the switch DS.

At the dispatcher's office DO a switch DE of the same type as switch DS is provided. While I have shown the switches DS and DE as being of the rotary type, it will be obvious to one skilled in the art that they may be of any other suitable type, examples of which are well-known in the art, and may be synchronously operated in any well-known manner. For the purpose of this description, it will be assumed that the movable wipers of the switches DS and DE are continuously rotated in synchronism in a step by step manner. Since the details of the particular means for synchronously operating the switches DS and DE form no part of my present invention and are well-known in the art, they have been omitted in order to simplify the disclosure.

As shown, the switch DE includes the banks of contacts *a* and *b*, the movable wipers of which are respectively connected to the movable wipers of the banks *a* and *b* of the switch DS by con-

ductors 10 and 11. The energizing winding A—1 of a relay A and the energizing winding of E—1 of a relay E are connected respectively to the contacts of bank *a* of the switch DE, which correspond to the contacts of the bank *a* of switch DS, to which the contacts *h*—3 and *h*—4 are respectively connected. The relays A and E are provided with the holding coils A—2 and E—2 respectively. There is also provided at the dispatcher's office DO a relay ZE which has an energizing winding ZE—1 and a holding winding ZE—2. The energizing circuit of the winding ZE—1 includes the contacts *e*—2, which are closed when the relay E is energized and the contacts *a*—2, which are closed when the relay A is de-energized. The circuit of the holding winding ZE—2 includes the contacts *ze*—1, which are closed when the relay ZE is energized and the contacts *a*—2. The contacts *ze*—2, which are closed when the relay ZE is de-energized, are connected in the circuit of the holding winding E—2 of the relay E.

Each change in the position of the circuit breaker 1 is indicated at the dispatcher's office DO by suitable signaling means, such as a lamp L, individual to the circuit breaker 1. Normally the lamp is not lighted and a change in the position of the circuit breaker is indicated by the lighting of the lamp. Associated with this lamp L is a disagreement key QS, which, together with the relays A, E and ZE, control the circuit of the lamp L. The key QS has two positions, each corresponding to a different position of the circuit breaker 1. The contacts of the relays A, E and ZE and of the switch QS are so interconnected that when the key QS is in either of its positions and the lamp is not lighted, the dispatcher knows that the circuit breaker is in the position corresponding to the position occupied by the key. If, however, the light is lighted, it indicates to the operator that the circuit breaker has moved to the position opposite to the position occupied by the key QS. The movement of the key QS to its other position when the light L is lighted interrupts the circuit of the light and it remains unlighted if the circuit breaker has remained in its other position. If, however, the circuit breaker has operated in the meantime so that it is back to its original position, the light L will be lighted again to inform the dispatcher of this movement of the circuit breaker.

The operation of the arrangement shown in the drawing is as follows: As long as the circuit breaker 1 remains open, the signaling apparatus is in the condition shown in the drawing. At the remote station RS, a holding circuit is completed for the winding H—2 through the contacts *z*—2 of the relay Z and the contacts *h*—2 of the relay H, and the circuit of the relay EQ is completed through the contacts *h*—5 of the relay H. At the dispatcher's office DO, the circuit of the holding coil ZE—2 of relay ZE is completed through contacts *ze*—1 of relay ZE and contacts *a*—2 of relay A, and the key QS is in its position corresponding to the open position of the circuit breaker 1. Under the conditions assumed, the continuous rotation of the movable wipers of the switches DS and DE does not effect the operation of any of the control devices of the signaling apparatus.

It will now be assumed that the switch 6 at the remote station RS is closed to complete the energizing circuit for the closing coil 2 to effect the closing of the circuit breaker 1. If the circuit 5 is normal, the circuit breaker will remain closed, but if there is a fault on the circuit, sufficient current will flow to cause the trip coil 3 to release the latch 4 and effect the immediate opening of the circuit breaker 1. It is evident that the closing and the subsequent opening of the circuit breaker 1 may both occur during the operating period of the switches DS and DE when they are not in a position to transmit an indication of the position of the circuit breaker 1.

When the circuit breaker 1 closes, its auxiliary contacts *h* complete an energizing circuit for the winding of relay Z, which, by opening its contacts *z*—2, opens the holding circuit for the winding H—2 of relay H so that this relay becomes de-energized. By opening its contacts *h*—5, the relay H opens the energizing circuit of the relay EQ, which, in turn, by closing its contacts *eq*, completes a holding circuit for relay Z through its contacts *z*. Therefore, the relay Z remains energized, although the circuit breaker 1 may be opened substantially immediately after it is closed.

When the selectors DS and DE reach their respective positions corresponding to the closed position of the circuit breaker 1, after the relay Z is energized, a circuit is completed through the contacts *z*—1 of relay Z, contacts *h*—3 of relay H, wiper of bank *a* of switch DS and the contact thereof allotted to the closed position of the circuit breaker 1, conductor 10, wiper of bank *a* of switch DE and the contact thereof alloted to the closed position of circuit breaker 1, and winding A—1 of relay A. By closing its contacts *a*—1, relay A completes a circuit for the holding winding A—2 through contacts *qs*—3 of the key QS. By closing its contacts *a*—3, relay A completes a circuit through the wiper of bank *b* of switch DE and the contact thereof allotted to the closed position of the circuit breaker 1, conductor 11, wiper of bank *b* of switch DS and the contact thereof allotted to the closed position of the circuit breaker 1, winding H—1 of relay H, and contacts *z*—1 of relay Z. By closing its contacts *h*—1, relay H completes a locking circuit for its winding H—1, and this locking circuit remains completed as long as the relay Z remains in its energized position. By closing its contacts *h*—5, the relay H completes an energizing circuit for relay EQ, which in turn, by opening its contacts *eq*, interrupts the holding circuit of the relay Z. If the circuit breaker 1 is still closed at this time, the opening of the contacts *eq* does not effect the de-energization of relay Z because its circuit is still maintained through the contacts *h* of the circuit breaker 1. If, however, the circuit breaker 1 is in its open position at this time, the opening of the contacts *eq* effects the de-energization of the relay Z.

At the dispatcher's office, the opening of the contacts *a*—2 when the relay A is energized interrupts the circuit of the holding winding ZE—2 of the relay ZE, so that this relay moves to its de-energized position. By closing its contacts *ze*—4, the relay ZE completes through the contacts *a*—4 of the relay A and the contacts *qs*—1 of the key QS a circuit for the lamp L. The lighting of the lamp L while the key QS is in the position corresponding to the open position of the circuit breaker 1 informs the dispatcher that the circuit breaker 1 has been closed. The lamp L continues to be lighted until the dispatcher acknowledges the receipt of this signal by moving the key QS to its position corre-

sponding to the closed position of the circuit breaker 1.

When the key QS is moved to its position corresponding to the closed position of the circuit breaker 1, the opening of the contacts *qs*—1 interrupts the circuit of the lamp L and the opening of the contacts *qs*—3 interrupts the circuit of the holding winding A—2 so that the relay A becomes de-energized. If the lamp L remains unlighted with the key QS in its new position, the dispatcher knows that the circuit breaker 1 remained closed.

It will now be assumed that the circuit breaker 1 opens immediately after it is closed. The opening of the auxiliary contact *h* on the circuit breaker 1 however does not effect the de-energization of the relay Z until the signal indicating the closure of the circuit breaker 1 has been transmitted to the dispatcher's office DO and the acknowledging signal has been transmitted back to the remote station and has effected the energization of the relays H and EQ. When the relay Z becomes de-energized, the opening of its contacts *z*—1 interrupts the holding circuit of the winding H—1 so that the relay H is again de-energized. When the switches DS and DE next reach their respective positions corresponding to the open position of the circuit breaker 1, a circuit is completed through the contacts *z*—2 of relay Z, contacts *h*—4 of relay H, wiper of bank *a* of switch DS and the contact of this bank allotted to the open position of the circuit breaker 1, conductor 10, wiper of bank *a* of switch DE and contact of this bank allotted to the open position of the circuit breaker 1, and winding E—1 of relay E. By closing its contacts *e*—1, relay E completes a circuit for its holding winding E—2 through contacts *ze*—2 of relay ZE, which is now de-energized if the dispatcher has not yet acknowledged the signal indicating that the circuit breaker has been closed. By closing its contacts *e*—3, the relay E completes a circuit through the wiper of bank *b* of switch DE and the contact of this bank allotted to the open position of the circuit breaker 1, conductor 11, wiper of bank *b* of switch DS and the contact of this bank allotted to the open position of the circuit breaker 1, winding H—2 of relay H and contacts *z*—2 of relay Z. By closing its contacts *h*—2, relay H completes a locking circuit for its winding H—2, which remains completed as long as the circuit breaker 1 remains open.

At the dispatcher's office DO, the relay E remains energized until the dispatcher acknowledges the receipt of the signal informing him of the closing of the circuit breaker 1 by moving the key QS to the position corresponding to the closed position of the circuit breaker 1. As soon as the relay A is restored to its de-energized position in response to this movement of the key QS, an energizing circuit is completed for the winding ZE—1 of relay ZE through contacts *e*—2 of relay E and contacts *a*—2 of relay A. By closing its contacts *ze*—1, relay ZE completes a circuit for its holding winding ZE—2 through contacts *a*—2 of relay A. By opening its contacts *ze*—2, relay ZE opens the circuit of the holding winding E—2 of relay E so that this relay becomes de-energized. By closing its contacts *ze*—3, the relay ZE completes a circuit for the lamp L through the contacts *qs*—2 of the key QS and the contacts *a*—5 of the relay A. The lighting of the lamp L while the key QS is in the position corresponding to the closed position of the circuit breaker 1 informs the dispatcher that the circuit breaker 1 has also opened. Therefore, it will be seen that irrespective of how quickly the circuit breaker 1 opens after it is closed, the dispatcher receives a separate indication of each of these circuit breaker operations.

By moving the key QS to its position corresponding to the open position of the circuit breaker 1, the circuit of the lamp L is interrupted at the contacts *qs*—2 and the signaling system is in a condition to operate in response to another closure of the circuit breaker 1.

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 remote signaling system, two stations, an apparatus unit at one station movable from one position to a second position and then back to said one position, means operative to transmit periodically from said one station to the other station an indication of the position of said unit, means for effecting the transmission by said transmitting means of a signal impulse indicating the movement of said apparatus unit from said one position to the second position and a subsequent signal impulse indicating the movement of said unit back to said one position when both of said movements of said unit occur during the same operating period of said transmitting means while it is inoperative to transmit an indication of the position of said unit, signaling means at said other station, means responsive to the transmission of said signal impulse indicating the movement of said apparatus unit from said one position to the second position for operating said signaling means, manually controlled means at said other station for rendering said signaling means inoperative after its operation has been initiated by said signal impulse indicating the movement of said apparatus unit from said one position to the second position, and means for storing at said other station said subsequent signal impulse and effecting the operation of said signaling means thereby after said signaling means has been rendered inoperative by the operation of said manually controlled means.

2. In a remote signaling system, two stations, an apparatus unit at one station movable from one position to a second position and then back to said one position, means operative to transmit periodically from said one station to the other station an indication of the position of said unit, means for effecting the transmission by said transmitting means of a signal impulse indicating the movement of said apparatus unit from said one position to the second position and a subsequent signal impulse indicating the movement of said unit back to said one position when both of said movements of said unit occur during the same operating period of said transmitting means while it is inoperative to transmit an indication of the position of said unit, signaling means at said other station, a manually controlled position indicator at said other station individual to said apparatus unit and movable to positions corresponding to the positions of said apparatus unit, means at said other station responsive to the transmission of said signal impulse indicating the

movement of said apparatus to said second position for operating said signaling means while said position indicator is in its position corresponding to said one position of said unit, and means for storing at said other station said subsequent signal impulse while said position indicator is in its position corresponding to said one position of said unit, and means responsive to the movement of said position indicator to its position corresponding to said second position of said unit while said subsequent impulse is stored at said other station for effecting the operation of said signaling means so as to indicate the movement of said unit to said second position.

3. In a remote signaling system, two stations, an apparatus unit at one station movable from one position to a second position and then back to said one position, means operative to transmit periodically from said one station to the other station an indication of the position of said unit, means for effecting the transmission by said transmitting means of a signal impulse indicating the movement of said apparatus unit from said one position to the second position and a subsequent signal impulse indicating the movement of said unit back to said one position when both of said movements of said unit occur during the same operating period of said transmitting means while it is inoperative to transmit an indication of the position of said unit, a signal at said other station individual to said apparatus unit, a manually controlled position indicator at said other station individual to said apparatus unit and movable to positions corresponding to the positions of said apparatus unit, means at said other station responsive to the transmission of said signal impulse indicating the movement of said apparatus unit to said second position for operating said signal in a predetermined manner while said position indicator is in its position corresponding to said one position of said unit, and means for storing at said other station said subsequent signal impulse while said position indicator is in its position corresponding to said one position of said unit, means responsive to the movement of said position indicator to its position corresponding to said second position of said unit while said subsequent impulse is stored at said other station for effecting the operation of said signaling means so as to indicate the movement of said unit to said second position and for restoring said storing means to normal, and means responsive to the movement of said position indicator to its position corresponding to said one position of said unit while said signaling means is indicating the movement of said unit to said second position for rendering said signaling means inoperative.

ERNST FRICKE.