W. E. HARKNESS.

REMOTE CONTROL HIGH POTENTIAL SWITCH.

APPLICATION FILED APR. 28, 1913.

1,142,252.

Patented June 8, 1915.

2 SHEETS—SHEET 1.

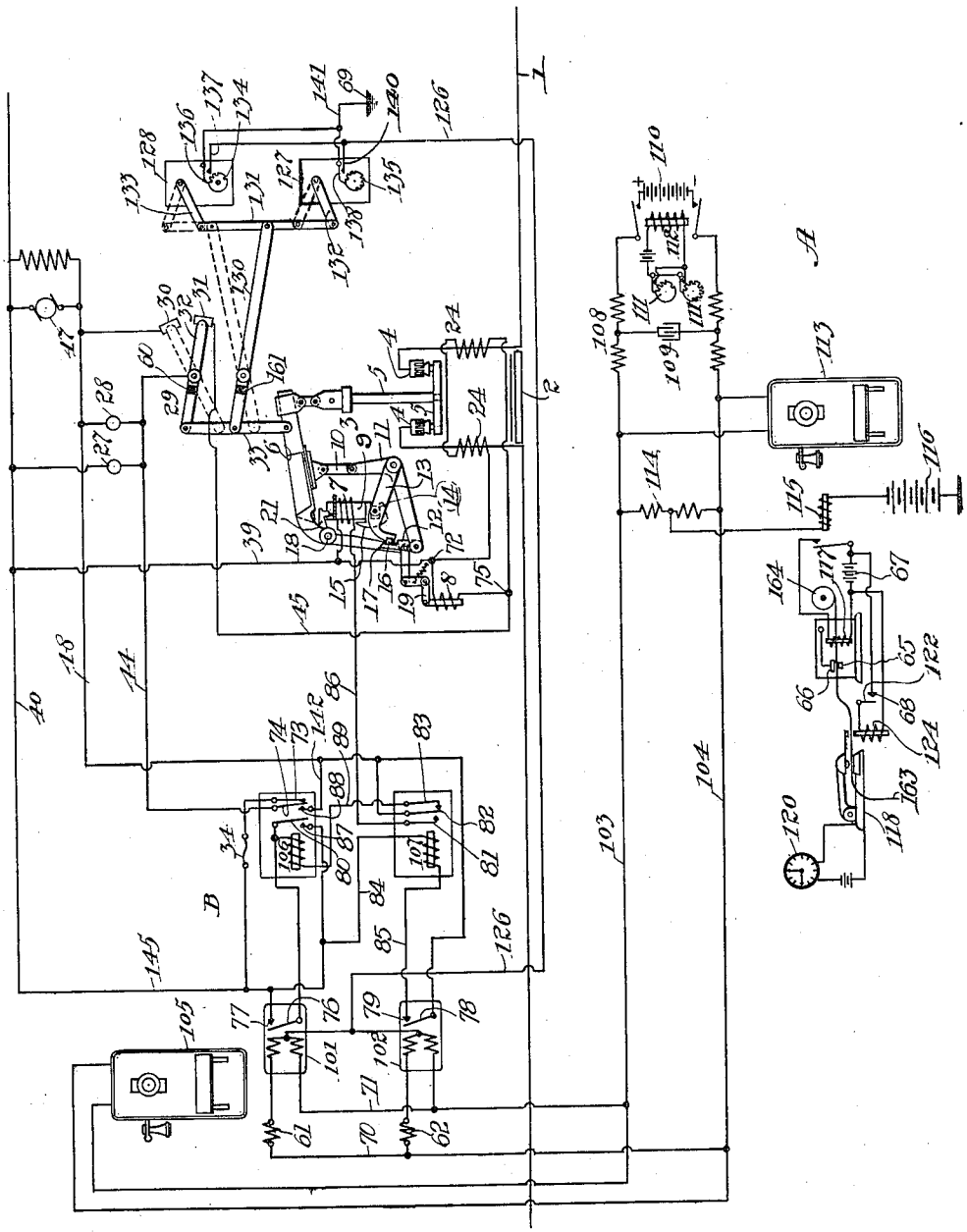


Fig. 1.

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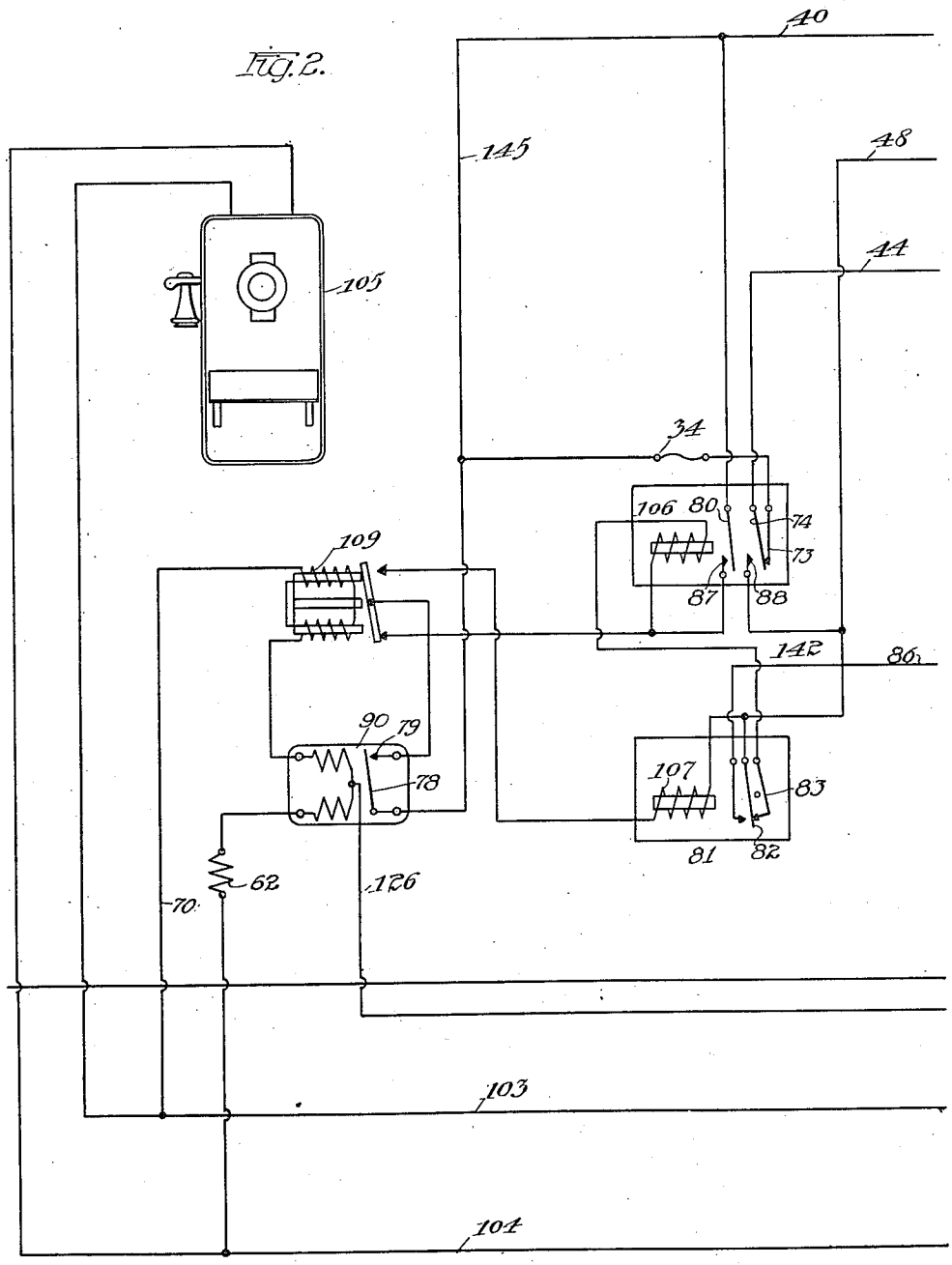
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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REMOTE-CONTROL HIGH-POTENTIAL SWITCH.

1,142,252. Specification of Letters Patent. Patented June 8, 1915.

Application filed April 28, 1913. Serial No. 764,211.

To all whom it may concern:

Be it known that I, WILLIAM E. HARKNESS, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Remote-Control High-Potential Switches, of which the following is a full, clear, concise, and exact description, reference being had to the acompanying drawings, forming a part of this specification.

My invention relates to selective control systems and has for its object the provision of a system in which switches or other devices may be selectively remotely controlled.

My invention may be of particular utility, for instance, in connection with automatic switches or circuit breakers used in connection with feeders for electric railroads, for instance.

In systems of this kind there may be a plurality of these switches throughout the course of the circuit, and my invention contemplates the provision of means whereby suitable selecting instruments are placed in association with such circuit breakers or switches so that any one of these circuit breakers or switches may be opened or closed at will by the operator at the central station. The circuit over which these selective devices are operative is also so arranged as to provide telephonic intercommunication between the various stations.

I will describe my invention more in detail by referring to the accompanying drawings in which—

Figure 1 represents diagrammatically a system arranged in accordance with my invention; and Fig. 2 sets forth a modification thereof.

The particular specific embodiment of the invention as shown in the drawings relates to the selective control of automatic circuit interrupters from a distance so that the one in charge of such a system may open or close any one or group of such interrupters and receive back an indication of suitable form indicating the position occupied by said interrupter.

Any suitable form of interrupter, of course, may be employed or any other suitable device subject to control may be employed and I have chosen for illustration herein a circuit interrupter of the kind set forth in the patent to Ford W. Harris, No. 1,017,052, issued Feb. 13, 1912. This particular current interrupter is designed to open or close circuit through a main feeder 1, an insulating block 2 being provided to hold the ends of the feeder, the said feeder herein being designed for overhead transmission. The interrupter 3 has contact members 4, 4 and contact member 5. An operating lever 6 is employed as well as an actuating magnet 7 and a release magnet 8. This lever 6 is pivoted to the stationary shaft 18 and also has a link 10 and a bell crank lever 11, which bell crank lever 11 is pivoted to a further link 13 carrying a roller 14 adapted to engage the slotted portion of a hooked projection 15 forming part of the core 9 controlled by the coil 7. A latch 12 is provided which engages a projection 16 carried by the link 13. There is also pivoted to the shaft 18 a downwardly extending catch portion 17 adapted to engage said projection 16.

When the parts are as shown in the illustration the switch is closed and the projection 16 holds them all together. A release magnet 8 is provided which through the agency of a bell crank lever 19 and its associated link is pivoted to the link 12. Thus whenever the magnet 8 is energized the links are disconnected from the projection 16 so that the switch arm 6 may fall and open the circuit. The downwardly extending portion 17 is in the form of a crank lever having the extension 21 which is adapted to be struck by the lever 6, thus to permit the arm 6 when moving downwardly to strike this arm 21 to release this arm 17 from the catch 16 and permit the core member 9 to fall from the coil 7.

The specific construction of the interrupter of course is not to limit my invention, but it is merely set forth to make the disclosure herein intelligible. The switch arm 6 is connected to a link 33 which carries two arms respectively the arm 32 and the arm 130. The arm 32 in connection with the switch contacts 30 and 31 forms the switch 29. The arms 32 and 130 have insulating breaks 60 and 61 respectively. The arm 32 contacts either with the switch contact 30 or 31 depending upon the position occupied by the switch arm 6. The arm 130 is connected to a bar 131, which bar is connected to two arms 132 and 133 associated respectively with answer back devices 127 and 128 re-

spectively. These answer back devices have impulse sending wheels 135 and 134 respectively, the device 127 having switch contacts 138 and 140, and the device 128 having switch contacts 136 and 137. Whenever the switch lever 6 is moved from one position to its alternative position, one of the arms 132, 133 through the agency of any suitable device releases the particular answer back mechanism desired to be released from that particular position of the switch arm 6. This movement of the arms 132 and 133 may also serve to wind the answer back mechanism. The switch arm 32 which engages one of the contacts 30, 31, depending upon the position occupied by the lever 6 is for the purpose of operating the signals 27 and 28 selectively in accordance with the position occupied by the switch arm 6 so that the attendant at the substation knows what is the condition of the device 3 at or near the substation.

A source of current 47 is used to energize the magnets 7 and 8 and the control of the device 3 in addition to the automatic control thereof by the magnet 8 is accomplished by suitable magnets 106 and 107. These magnets 106 and 107 are controlled respectively by selectors 101 and 102, which selectors may be of any suitable step-by-step or selective variety, the one herein indicated diagrammatically being more particularly of the character illustrated in the patent issued to Edwin R. Gill, No. 906,523, dated December 15, 1908. These selectors 101 and 102 are to be controlled over the line wires 103 and 104 from the central station A, it being assumed that all the devices hitherto mentioned are at or near the substation B, it being understood that there are a plurality of such substations adapted for control over said line circuit 103, 104. This line circuit 103, 104 is also designed for telephonic communication, for which purpose instrument 105 at substation B and instrument 113 at central station A are indicated for purposes of illustration. At the substation a pair of resistances 61 and 62 are provided for equalizing purposes. At the central station a bridged resistance 114 is provided from the central point of which a relay 115 is connected through battery 116 to ground. This said relay 115 is designed to receive answer back impulses from the devices 127 and 128 and to record them on a suitable tape 163. This tape may be on the ordinary storage roll 164 and operate between a pair of suitable punches 65 and 66 respectively, which punches are under the control of a magnet 117, which magnet through the agency of a battery 67 is actuated whenever the magnet 115 is actuated. Thus the number and character of the impulses transmitted by the devices 127 and 128 are accurately recorded on the tape 163. After an indication has been sent in and recorded on the tape, contact is closed between contact points 68 and 122, whereupon magnet 124 is energized which also receives its current from the battery 167 to operate a time stamp 118 which is controlled by the clock 120 to thereby record the time upon the tape at which the particular indication is received.

At the central station further I have individual selecting keys 111, 111, one for each selector 101, 102, there being as many individual keys preferably as there are selectors to be used on the line. These individual keys may be of the ordinary type and are so arranged as to send impulses over the line wires 103, 104 of a particular code through the agency of the magnet 110 and battery 112. An equalizing resistance 108 and a condenser 109 are employed to keep the circuit quiet for telephonic purposes. The selector 102 is designed, as will appear hereinafter to close the contacts of the device 3 and the selector 101 is designed to control the opening of the contacts at the device 3, and these functions are under the control of the central station through the agency of the keys 111 as stated.

The answer back circuit, by reason of which the magnet 115 is operated can be traced from the ground at 69 over conductor 141, contact 138, contact 140, conductor 126, windings of the selectors 101 and 102, over conductors 70 and 71 in parallel, conductors 103 and 104 in parallel, resistance 114, electromagnet 115, battery 116 to ground. Coils 24, 24 represent the secondary of a series transformer which maintains an energization of the winding of the electromagnet 8 when the current in the circuit is of the correct proportions, but bridged across this winding 8 is a fuse 34 whose circuit can be traced from the junction point 72 through conductor 39, conductor 40, conductor 145, fuse 34, contact springs 73 and 74, conductor 44, switch arm 32, conductor 45 to the junction point 75.

It will thus be seen that the fuse 34 is in parallel with the winding 8 and if the current in the circuit remains normal the fuse will not blow. If the current in the circuit however exceeds normal sufficiently, then the fuse 34 will blow and all of the current will go through the electromagnet 8, which will therefore increase its energization to permit it to attract its core, thereby releasing the catch 12 and permitting the arm 6 to drop, thus opening the contacts of the device 3. This action is of course automatic in its nature.

When the device 3 is closed the auxiliary switch arm 32 engages contact member 31 and the indicator 28 is energized, circuit being established from conductor 48, through the switch arm 32, conductor 45, tripping magnet 8, and conductor 39 to the auxiliary

conductor 40; and when the device 3 is open, the indicator 27 is actuated, circuit being established in the conductor 48, through contact member 30, switch arm 32, conductor 44, and the indicating device 27 to the auxiliary line conductor 40. The selector 101 is of course provided with circuit closing contacts 76 and 77 and the selector 102 with circuit closing contacts 78 and 79 which are respectively closed when the proper code has been received by the particular selector. This closure actuates the corresponding electromagnet respectively 106 or 107 as the case may be. The electromagnet 107 further has a contact spring 80 and the electromagnet 107 has contact springs 81, 82 and 83 respectively. Now in order to close the circuit through the device 3 after it has once been opened, the proper code is transmitted over the line wires 103, and 104 to effect a closure of the contacts 78 and 79 of the selector 102, to thereby operate the electromagnet 107. The circuit through this electromagnet 107 can be traced from the spring 78, conductor 48, source of current 47, conductor 40, conductor 145, conductor 84, electromagnet 107, conductor 85, to the contact 79. This breaks the circuit between the contact springs 82 and 83 upon the energization of the electromagnet 107, and likewise closing contacts 81 and 82. This establishes a circuit from the source of current 47 over conductor 40, conductor 39, coil of the electromagnet 7, conductor 86, contact element 81, contact element 82, conductor 48, to the other terminal of the source of current 47. This attracts the core of the device 3 and closes the circuit through its contacts 4 and 5.

The operation of the relay 107 does two things. First it closes its front contact 81 and thereby operates the actuating coil 7, and second, it breaks its back contact 83, thereby opening the circuit through the relay 106 and establishes a shunt circuit around the trip relay through the fuse 34. The establishment of this shunt circuit is due to the closure of the contacts 73 and 74 upon deënergization of the release relay 106. Now if it is desired to open the circuit through the device 3, the operator at the station A operates the corresponding key 111 to actuate the selector 101, thereby operating the relay 106. This completes the circuit from the generator 47 through the relay 106. The operation of this relay opens the shunt circuit including the fuse 34 by breaking contact through the contacts 73 and 74, thus permitting the trip relay to thereby release the catch 12 and permit the device 3 to open the circuit through its contacts. This action is assisted by the closing of the front contacts 80, 87, 74 and 88 respectively.

Closure of the contact through springs 74 and 88 closes a circuit from generator 47, conductor 48, contact 88, spring 74, conductor 44, arm 32, contact 31, conductor 45, magnet 8, conductor 39 to the other terminal of the generator 47. This it will be seen augments the action of the current supplied by the winding 24 and maintains the magnet 8 in its energized position even after the circuit breaker has opened, until such time as the electromagnet 106 is released or restored to its unactuated position. Closure of the circuit between contacts 80 and 87 completes a locking circuit through the winding of the relay 106, which may be traced from one terminal of the generator 47, conductor 40, conductor 145, contact 87, contact spring 80, winding 106, conductor 89, spring 83, spring 82, conductor 48 to the other terminal of the generator 47. It will thus be seen that the relay 106 will not be restored until relay 107 is actuated.

The circuit breaker 3 can thus not be set until the selector 102 is operated by the attendant at the station A. This is done to prevent accidents due to unauthorized actuation of selectors by attendants at the substations, and also to prevent the shunt circuit including fuse 34 being closed upon the opening of the selector contacts if other selectors on the circuit are operated, before it is desired to reset circuit breaker 3 by operating selector 107. The closing of the shunt circuit including the fuse 34 when the circuit breaker is in the open position would form a short circuit across the generator 47 and the fuse 34 would be blown. The breaking of the back contact of relay 106 also breaks the circuit of signal 28 and closes that of signal 27, thus indicating at the substation the change in the particular circuit breaker associated therewith. The control of these signals 27 and 28 it will be seen is in addition to the control thereof by the arm 32. The back contact of the relay 107 is adjusted so that it does not break until after the front contact has made and actuating relay 107 operated, and thereby rotate the contact between the arm 32 and contact point 31. This is necessary to prevent current from the generator 47 from being short circuited through the fuse 34, thus causing it to blow to thereby prevent closure of the circuit through the circuit breaker.

In Fig. 2, I show an alternative structure in which I use but one selector 90 as in association with a polar relay 109. And depending upon the polarity of the impulses sent over the line wires 103 and 104 either the relay 106 or the relay 107 is operated as will be readily apparent, thus saving the expense of an additional selector and thus having but one code signal for each particular substation and opening or closing of the device depending upon the polarity of the device used to transmit the code.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A device of the character described comprising a switch element, means controlled by circuit conditions to cause automatic actuation of said element, a remotely controlled step-by-step device to control operation of said element to effect both circuit closure and opening and a line circuit and means at the other extremity of said line circuit to control said step-by-step device.

2. A device of the character described comprising a switch element, means controlled by circuit conditions to cause automatic actuation of said element, a remotely controlled step-by-step device to control operation of said element to effect both circuit closure and opening, answer back mechanism controlled by said element, and a line circuit and means at the other extremity of said line circuit to control said step-by-step device.

3. A device of the character described comprising a switch element, means controlled by circuit conditions to cause automatic actuation of said element, indicating apparatus to indicate the condition of said element, a remotely controlled step-by-step device to control operation of said element to effect both circuit closure and opening, and a line circuit and means at the other extremity of said line circuit to control said step-by-step device.

4. A device of the character described comprising a switch element, means controlled by circuit conditions to cause automatic actuation of said element, indicating apparatus to indicate the condition of said element, a remotely controlled step-by-step device to control operation of said element to effect both circuit closure and opening, answer back mechanism controlled by said element, and a line circuit and means at the other extremity of said line circuit to control said step-by-step device.

5. A system of the character described comprising a switch element, a remotely controlled step-by-step device to control operation of said element to effect circuit closure, a remotely controlled step-by-step device to control operation of said element to effect circuit rupture, and a line circuit and means at the other extremity of said line circuit to control said step-by-step device.

6. A system of the character described comprising a switch element, a remotely controlled step-by-step device to control operation of said element to effect circuit closure, a remotely controlled step-by-step device to control operation of said element to effect circuit rupture, and means controlled by circuit conditions to cause automatic actuation of said element.

7. A system of the character described comprising a switch element, a remotely controlled step-by-step device to control operation of said element to effect circuit closure, a remotely controlled step-by-step device to control operation of said element to effect circuit rupture, and means controlled by one step-by-step device to render the actuation of the other step-by-step device ineffective.

8. A system of the character described comprising a switch element, a remotely controlled step-by-step device to control operation of said element to effect circuit closure, a remotely controlled step-by-step-device to control operation of said element to effect circuit rupture, and answer back mechanism controlled by said element.

9. A system of the character described comprising a switch element, a remotely controlled step-by-step device to control operation of said element to effect circuit closure, a remotely controlled step-by-step device to control operation of said element to effect circuit rupture, means controlled by circuit conditions to cause automatic actuation of said element, and answer back mechanism controlled by said element.

10. A system of the character described comprising a switch element, a remotely controlled step-by-step device to control operation of said element to effect circuit closure, a remotely controlled step-by-step device to control operation of said element to effect circuit rupture, means controlled by one step-by-step device to render the actuation of the other step-by-step device ineffective, and answer back mechanism controlled by said element.

In witness whereof, I hereunto subscribe my name this 17th day of January, A. D., 1913.

WILLIAM E. HARKNESS.

Witnesses:

JOHN W. BARNEY,

CHARLES S. RHOADS, Jr.