T. E. BARNUM.

CIRCUIT BREAKER.

APPLICATION FILED FEB. 21, 1907.

1,018,547. Patented Feb. 27, 1912.

3 SHEETS—SHEET 1.

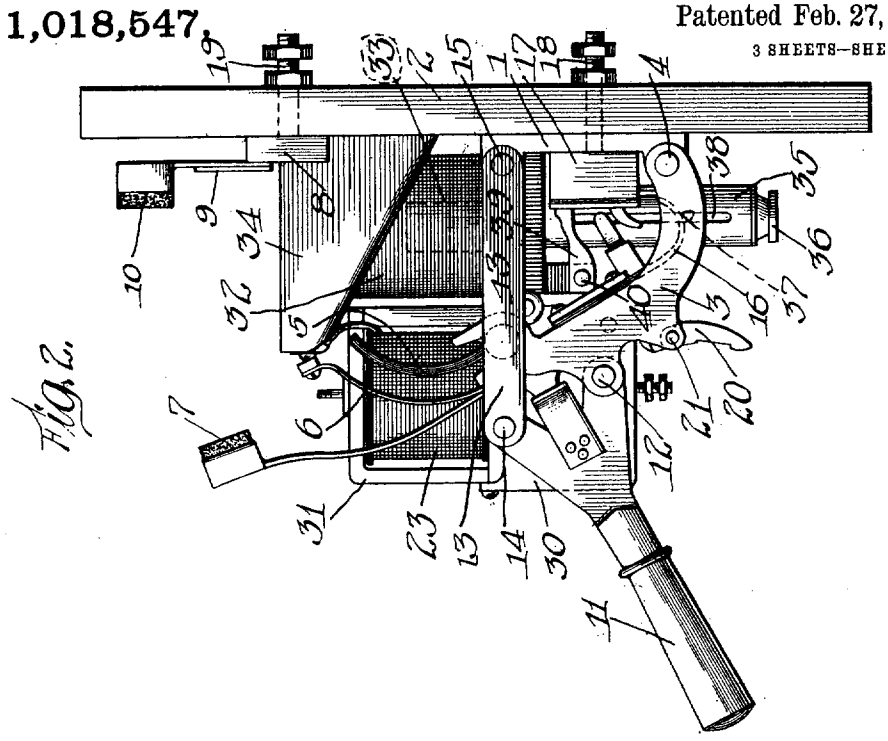

FIG. 2.

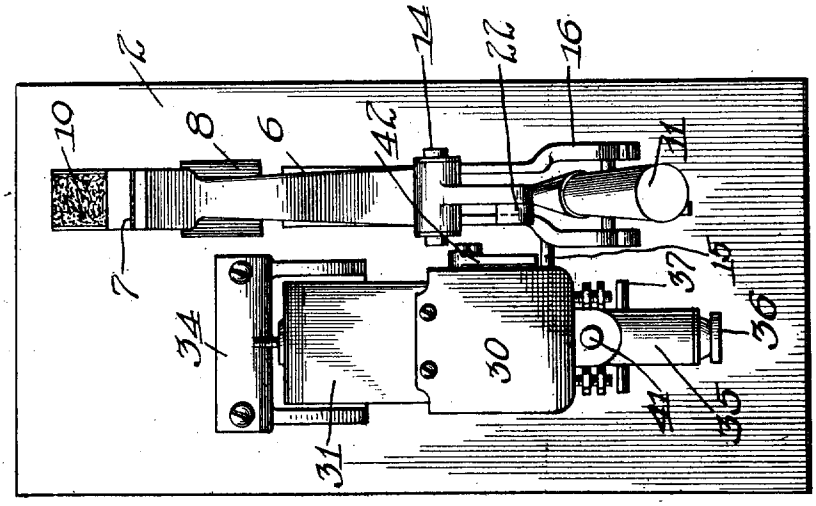

FIG. 1.

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3 SHEETS—SHEET 2.

FIG. 3.

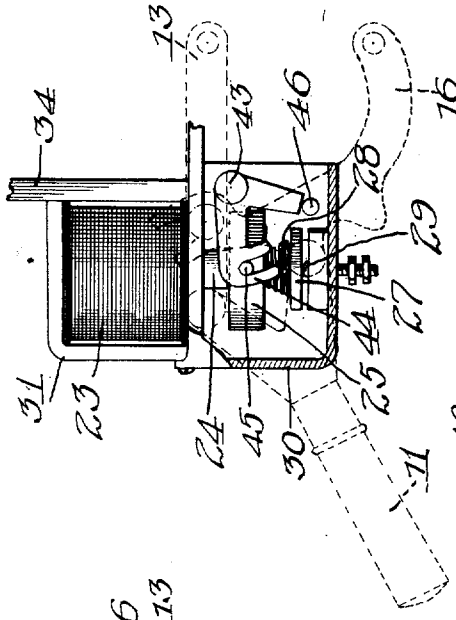


FIG. 6.

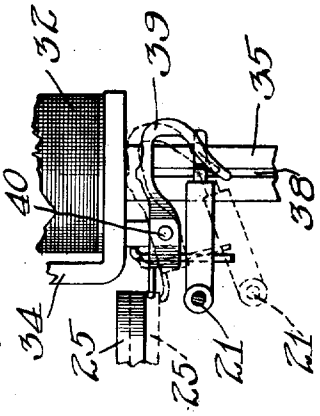
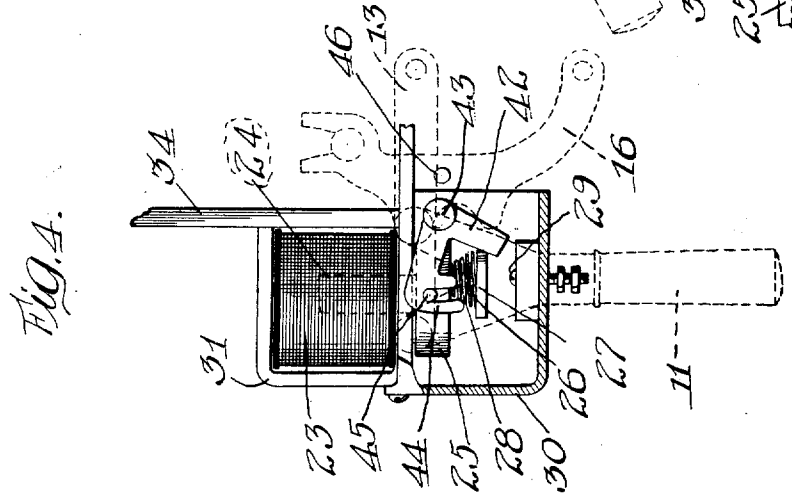


FIG. 4.



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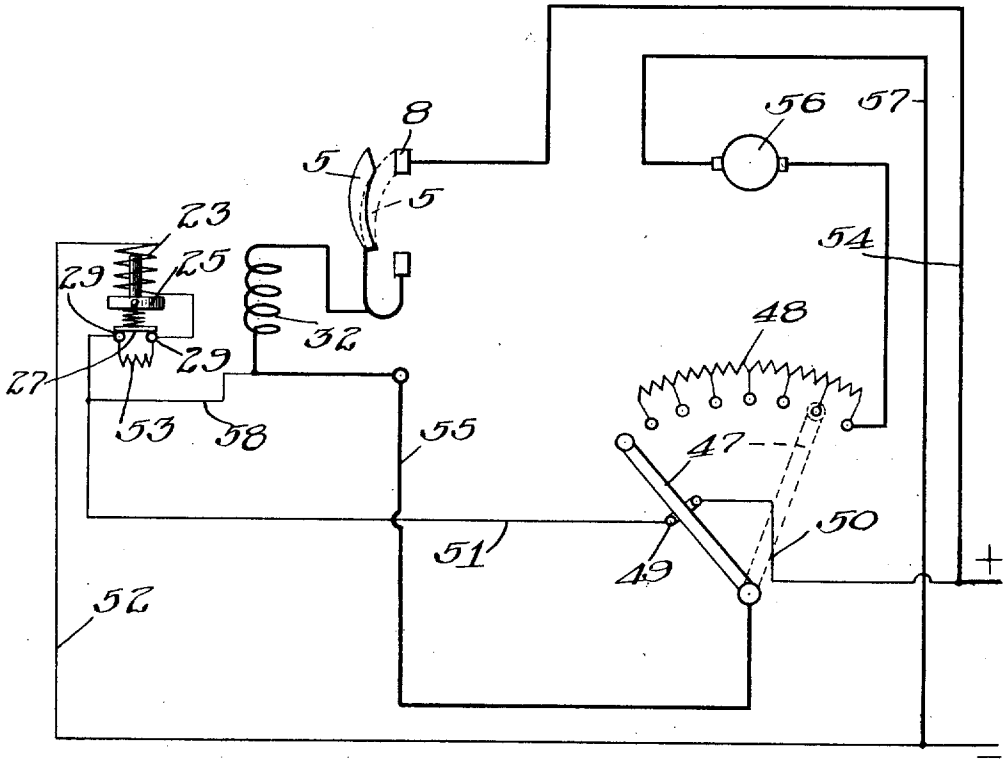
3 SHEETS—SHEET 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS E. BARNUM, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE CUTLER-HAMMER MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

CIRCUIT-BREAKER.

1,018,547. Specification of Letters Patent. Patented Feb. 27, 1912.

Application filed February 21, 1907. Serial No. 358,564.

To all whom it may concern:

Be it known that I, THOMAS E. BARNUM, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Circuit-Breakers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in circuit breakers and other electric switches.

It applies especially to breakers which are provided with a low voltage release device as well as an overload release device.

My invention has for its object to provide means which will prevent the breaker from being set or closed save when a predetermined voltage prevails.

According to the preferred form of my invention, I provide an interlock between the breaker switch and the low voltage release device. When a predetermined voltage prevails, the low voltage release device operates the interlock to allow the breaker switch to be closed.

It will be understood that my invention may be embodied in various forms and applied to different types of circuit breakers and other switches.

In order to illustrate my invention, I have assumed the circuit breaker which is illustrated in the accompanying drawings.

Figure 1 is a front elevation of the circuit breaker, Fig. 2 is a side view thereof, Fig. 3 is a detail view of the low voltage release device with parts of the breaker in dotted lines, the interlock between the low voltage release device and the breaker switch being in the position to prevent said switch from being closed, Fig. 4 is a view of the same parts as Fig. 3, the breaker switch being closed, Fig. 5 is a diagrammatic view of the breaker and its circuit arrangements, as it may be used in practice, and Fig. 6 is a section showing the tripping lever in the normal position, the position of said lever when it is tripped being indicated in dotted lines.

The breaker which is illustrated in the drawing is provided with a frame 1 which may be mounted upon a suitable base or support 2. A switch arm 3 is pivoted to the frame by means of a pin or pintle 4. A main contact 5, an auxiliary contact 6 and a carbon contact 7 are carried by the switch arm. These contacts are adapted to engage respectively a contact block 8, a contact plate 9 and a carbon contact 10, which may be mounted in a stationary position upon the support 2.

The breaker is provided with an operating handle 11, the inner end of which is pivoted to the switch arm 3 by means of a pin 12. The inner end of said handle is also pivoted at the outer end of a link 13 by means of a pin 14. The inner end of the link is pivoted to the frame 1 by means of a pin 15. When the handle is pressed downwardly the switch arm 3 is thrown inwardly thereby bringing the movable contacts 5, 6, and 7 into engagement with the stationary contacts 8, 9, and 10, thus closing the switch or setting the breaker. The switch arm 3 is preferably normally pressed outwardly by a spring conducting strip 16 which serves to convey current from a terminal block 17 to the movable contacts 5, 6, and 7. The terminal block 17 may be provided with a bolt 18 for connecting a conductor thereto. The stationary contact block 8 may also be provided with a bolt 19 for connecting a conductor thereto. The switch arm 3 carries a latch 20 which is pivoted thereto by means of a pin 21. When the switch arm 3 is thrown inwardly, the outer end of the latch is adapted to engage a projection 22 on the handle 11 to keep the switch closed against the tension of the spring 16.

The low voltage release device is provided with an electromagnetic winding 23, which surrounds a movable plunger 24, the lower end of which carries a weight 25. When the winding 23 is subjected to a low voltage or to no voltage, the plunger 24 is down. A pin 26 extends downwardly from the lower end of the plunger and carries contact disk 27 which is pressed downwardly by a spring 28. When the plunger 24 is down, the contact disk 27 is adapted to engage contacts 29 to short-circuit a resistance in series with the winding 23, as shall be hereinafter explained. The contacts 29 are preferably carried by a casing 30 which is mounted upon a frame 31 carrying the winding 23.

The overload release device is preferably provided with a coil or winding 32 which surrounds a movable plunger 33. The coil 32 is preferably mounted in a frame 34,

which is mounted upon the base or support 2. The frame 31 is preferably mounted upon the frame 34.

The plunger 33 of the overload release device preferably extends downwardly into a tube 35, carried by the frame 34. The lower end of the tube is provided with a screw 36, by means of which the lower position of the plunger 33 may be adjusted. The plunger is provided with a pin or projection 37 which extends through the slot 38 in the tube 35. When the plunger is raised by the coil 32, the projection 37 strikes the inner end of the latch 20. A tripping lever 39 for the low voltage release device is preferably pivoted upon the frame 34 by means of a pin 40. The inner end of said lever forms a hook which is adapted to engage the inner end of the latch 20. The outer end of the tripping lever is arranged beneath the weight 25 and is adapted to be engaged thereby. The casing 30 preferably carries a push button 41, the inner end of which is adapted to engage a projection on the outer end of the tripping lever.

The interlock between the low voltage release device and the main switch may be formed by a bell-crank lever 42 which is pivoted to the frame 34 by means of a pin or other means 43. The bell-crank lever is provided with an outwardly extending arm and a downwardly extending arm. The outwardly extending arm is provided with a vertical slot 44 into which extends a pin 45 carried by the weight 25. When the plunger 24 is down, the downwardly extending arm of the bell-crank lever is adapted to engage a pin 46 carried by the switch arm 3 to prevent the breaker or switch from being closed. When the plunger 24 is up, the pin 45 moves the bell-crank lever to release the switch arm 3 so that the breaker may be set.

In order to describe the conditions under which the breaker will be automatically opened, it may be assumed that the breaker is closed and held by the latch 20. If an overload occurs, the coil 32 will raise the plunger 33, thereby causing the pin 37 to engage the inner end of the latch 20. The latch will then be tripped, thereby releasing the breaker and allowing the spring to open the switch. If the voltage to which the winding 23 is subjected falls to a predetermined degree, plunger 24 will descend and the weight 25 will strike the outer end of the tripping lever 39. The inner end of the tripping lever will thus be operated to strike the inner end of the latch 20. The latch will thus be tripped, thereby releasing the breaker and allowing it to open. The bell-crank lever 42 is provided with the slot 44 down which the pin 45 may run so that the plunger 24 may descend instantly upon being released, without being retarded by said bell-crank lever. The breaker may also be opened at will by pressing the button 41, which will operate the trip lever to release the latch. Fig. 5 shows the way in which the breaker may be applied in practice with a motor and a motor controller. The breaker may be arranged in circuit to control the motor circuit.

The motor controller may assume various forms. It is diagrammatically represented in the drawing as a switch arm 47 which is adapted to pass over a series of contacts to which a starting resistance 48 is connected. The switch arm 47 may be provided with an interlocking switch 49, which controls the circuit of the low voltage coil 23, to prevent said coil from raising its plunger save when the controller arm is in the "off" position. Assuming the arm 47 to be in the position shown in the drawing, current will flow from the positive line through conductor 50, switch 49, conductor 51, across switch contact 27, through low voltage coil 23, conductor 52 to the negative line. The low voltage coil 23 will then respond and raise its plunger, thereby operating the interlock 42 so as to permit the breaker to be set or closed. When the plunger of the coil 23 rises, it will lift the switch contact 27 from the contacts 29, thereby removing the short-circuit from around the resistance 53 so as to place the resistance in circuit to reduce the current in the coil 23 to a retaining current. If the switch 47 be moved to the right, it will first close the motor circuit with all the starting resistance in circuit and then remove said resistance from circuit step by step as it engages the successive contacts. The motor circuit will extend from the positive line through conductor 54, contact block 8, switch contact 5, overload coil 32, conductor 55, switch arm 47, resistance 48, armature 56 and conductor 57 to the negative line. When the switch 47 is moved to start the motor, the switch 49 will be opened. The circuit of the low voltage coil 23 will then extend from the positive line through conductor 54, contact block 8, contact 5, overload coil 32, conductor 58, resistance 53, low voltage coil 23, conductor 52 to the negative line. If the breaker be opened by either the low voltage device or the overload device, it will be impossible to close the breaker again until the switch arm 47 is returned to the "off" position to close the switch 49. It will thus be seen that the breaker is electrically interlocked with the motor controller to prevent the motor circuit from being closed save when all the starting resistance is in circuit.

Inasmuch as the low voltage device and the breaker switch are mechanically interlocked, as previously set forth, it will be impossible to close the breaker save when the low voltage device is subjected to a pre-

determined voltage. It will, therefore, be impossible to close the breaker while the voltage is low, and consequent damage, which might result if the condition were otherwise, will be avoided.

Inasmuch as the interlock between the low voltage device and the breaker switch is inclosed by the casing 30, it will be impossible to manually operate the interlocking lever to permit the breaker to be set.

It will be understood that while I have illustrated one form of my device and a system wherein the same is employed, various changes may be introduced in the arrangement, construction, and operation of the apparatus without departing from the scope of my invention.

Having thus described my invention, what I claim and desire to protect by Letters Patent is—

1. In a device of the type set forth, a switch, a low voltage device for causing the switch to open when the voltage is reduced, an electro responsive overload device for causing the switch to open when the current increases to a predetermined degree, means for preventing the switch from being closed until a predetermined voltage prevails, and means for setting the low voltage device.

2. In combination, a switch, a low voltage device, for causing the switch to open when the voltage is reduced, an overload device for causing the switch to open when the current increases to a predetermined degree, means positively actuated by the low voltage device to prevent the closing of the switch until a predetermined voltage prevails, and means for setting the low voltage device.

3. In combination, a switch, a low voltage device adapted to open the switch when the voltage is reduced, an overload device for causing the switch to open when the current increases to a predetermined degree, a mechanical interlock between the low voltage device and the switch for preventing the closing of the latter until a predetermined voltage prevails, means for setting said low voltage device, a latch for the switch, and a tripping lever adapted to be operated both by the low voltage and overload devices for actuating the latch to release the switch.

4. In a device of the type set forth, a switch, a low voltage device for causing the switch to open when the voltage falls, an overload device for causing the switch to open when the current increases to a predetermined degree, a mechanical interlock between the switch and the low voltage device for preventing the closing of the switch until a predetermined voltage prevails, and means for setting the low voltage device comprising a switch arm and an auxiliary contact member carried thereon adapted to close the setting circuit for the low voltage device.

5. In combination, a switch, an overload device for causing the switch to open when the current increases to a predetermined degree, a no-voltage device for causing the switch to open when the voltage is reduced, a pivotally mounted lever having a slotted portion, a pin carried on the no-voltage device engaging in a slot in the lever, a pin mounted upon the switch adapted to be engaged by one arm of said lever when a predetermined voltage prevails to prevent the closing of the switch, and means for causing the setting of the no-voltage device.

6. In combination, a switch, an overload device for causing the switch to open when the current increases to a predetermined degree, a low voltage device for causing the switch to open when the voltage is reduced, comprising a winding, a core provided with a weight and a disk mounted below said weight, a pin projecting from said weight, a pivotally mounted bell-crank lever provided with an open slot for receiving said pin, said lever in the set position of the low voltage device being normally elevated, a pin carried by the switch in the path of one arm of the lever when a predetermined voltage prevails in the overload device, means for setting the low voltage device, means for locking the switch, and means adapted to be manually operated and by means of either the overload or low voltage device for tripping the locking means to release the switch.

7. In combination, a switch, an overload device for causing the switch to open when the current increases to a predetermined degree, a low voltage device for causing the switch to open when the voltage is reduced, an interlock between the low voltage device and switch, and means for operating the low voltage device to actuate the interlock to release the switch.

8. In combination, a controlling switch, an auxiliary switch carried thereon, a main circuit controlled by the controlling switch, a circuit breaker on the main circuit, an overload device controlling the circuit breaker and connected in the main circuit, a low voltage device, an auxiliary circuit controlling the low voltage device, the last named circuit being controlled by the auxiliary switch, and an interlock between the low voltage device and circuit breaker for preventing the closing of the circuit breaker until a predetermined voltage prevails.

9. In combination, a controlling switch, an auxiliary switch carried thereon, a main circuit controlled by the controlling switch, a circuit breaker in the main circuit, an overload device controlling the circuit breaker and connected in the main circuit, a low voltage release device, an auxiliary circuit controlling the low voltage device, the last named circuit being controlled by

the auxiliary switch, and interlocks between the low voltage device, circuit breaker, and controlling switch to prevent the closing of the circuit breaker until the controlling switch is in "off" position.

10. In combination, a controlling switch, an auxiliary switch mounted thereon, a main circuit controlled by the controlling switch, a circuit breaker in the main circuit, an overload device controlling the circuit breaker, and connected in the main circuit, a low voltage device, an auxiliary circuit controlling the low voltage device and interlocks between the low voltage device, circuit breaker, and controlling switch whereby the circuit breaker is rendered inoperative until the circuit of the controlling switch is broken.

11. In combination, a main controlling switch, a main circuit controlled by the controlling switch, a circuit breaker in the main circuit, an overload device controlling the circuit breaker, and connected in the main circuit, a low voltage device, means controlling the low voltage device to permit of the setting of the same, and interlocks between the low voltage device, the circuit breaker, and the main switch to prevent the setting of the circuit breaker until the controlling switch is in a predetermined position.

12. In combination, a controlling switch, a circuit breaker, an overload device for causing the switch to open when the current increases to a predetermined degree, a low voltage device for causing the switch to open when the voltage is reduced, and interlocks between the low voltage device, circuit breaker, and controlling switch, and means adapted to operate the low voltage device to actuate the interlock for releasing the circuit breaker.

13. In combination with a circuit breaker, an overload device for causing the circuit breaker to open when the current increases to a predetermined degree, a low voltage device for causing the circuit to open when the voltage is reduced, means controlling the low voltage device, and interlocks between the last named means, the low voltage device and the circuit breaker.

14. In combination, a controlling switch, a circuit breaker, a main circuit controlled by the controlling switch and including the circuit breaker, an overload device controlling the circuit breaker, and connected in the main circuit, a low voltage device, an auxiliary circuit therefor controlled by the auxiliary switch, and interlocks between the low voltage device, circuit breaker, and controlling switch to prevent the closing of the circuit breaker until the main circuit of the controlling switch is broken and the controlling switch stands in a predetermined position, relative to its circuit.

15. In combination, a circuit breaker, an overload release therefor, an electromagnetically set underload release device therefor, means controlled by said underload device for preventing closure of the circuit breaker, controlling means for the circuit controlled by said circuit breaker, and an interlock between said underload device and said controlling means.

16. In combination, a circuit breaker, an overload release therefor, an electromagnetically set underload release device for said circuit breaker, means necessitating the setting of said device each time the circuit breaker is opened prior to reclosure thereof, and means necessitating the establishment of certain conditions in the controlled circuit prior to resetting said underload device.

17. In combination, a switch, an overload release and an underload release therefor, means tending to lock said switch in open position, and means necessitating the establishment of certain conditions in the controlled circuit prior to the release of said switch from said locking means.

18. In combination, a circuit breaker, overload release and underload release devices therefor, means tending to lock said circuit breaker in open position, and means necessitating the establishment of certain conditions in the controlled circuit prior to the release of said circuit breaker from said locking means, said locking means being controlled by said underload release.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

THOMAS E. BARNUM.

Witnesses:
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HENRY J. WIEGAND.