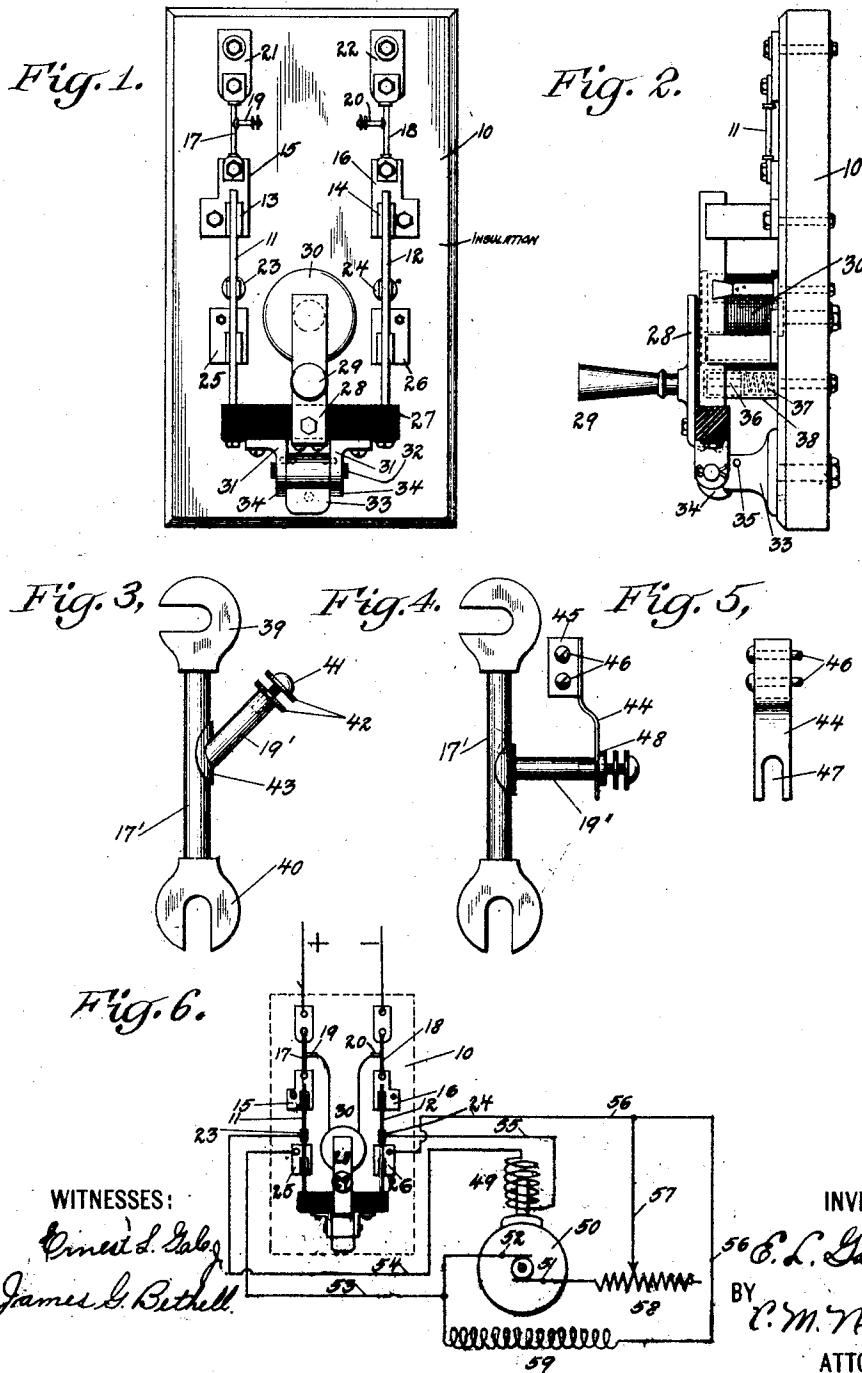


E. L. GALE, SR.
COMBINED POTENTIAL AND OVERLOAD SWITCH.
APPLICATION FILED JUNE 11, 1907.

1,058,296.

Patented Apr. 8, 1913.



UNITED STATES PATENT OFFICE.

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COMBINED POTENTIAL AND OVERLOAD SWITCH.

1,058,296.

Specification of Letters Patent.

Patented Apr. 8, 1913.

Application filed June 11, 1907. Serial No. 378,406.

To all whom it may concern:

Be it known that I, ERNEST L. GALE, SR., a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented a new and useful Improvement in Combined Potential and Overload Switches, of which the following is a specification.

My invention relates to improvements in electric switches in which the same is maintained in closed position by magnetic means and released upon excessive current flow or fall in potential; and has for its object to provide means for opening a switch by the heat generated by excessive current.

Another object of the present invention is the provision of an automatic circuit-interrupter comprising a simple and inexpensive element which may easily be replaced.

A further object is to prevent or reduce to a minimum any destructive arcing or flaming at the contact where the circuit is interrupted.

Further objects of my invention will appear more fully hereinafter.

In the accompanying sheet of drawing, which forms a part of this specification, Figure 1 is a front view of a preferred form of my invention in its closed position; Fig. 2 is a side view of Fig. 1; Figs. 3, 4 and 5 are modified detail parts of Figs. 1 and 2; and Fig. 6 is a diagrammatic representation of a motor-controlling system embodying my invention.

Similar reference characters designate similar parts throughout the various views.

10 designates a substantial base which may be of any desirable insulating material, such as slate or marble, upon which are mounted the various switch parts.

11 designates a knife blade contact element adapted when closed to place in intimate electrical connection the fixed contacts 13, 23 and 25. A similar knife blade contact element 12 performs a similar function with regard to the three fixed contacts 14, 24 and 26. These knife blade contact members are rigidly mounted upon an insulation piece designated by the numeral 27.

This latter piece 27 has also attached to it two brackets 31, 31 through which passes a pin 32, the latter serving as a hinge bearing between the brackets 31, 31 and a fixed bracket 33 which is rigidly mounted upon the insulating base 10.

28 designates a metallic piece firmly connected to the insulation 27 and it is preferably made of magnetic material. This piece 28 is arranged to cooperate with an electro-magnet 30, the core of which is firmly bolted to the switch base 10. A handle 29, by which the switch members 11 and 12 are closed, is mounted upon the metallic piece 28.

36 designates a spring-pressed detent and 37 is a spring, both of these are contained by the housing 38 which is firmly fastened to the switch base 10. The detent 36 is adapted to cooperate with the metallic piece 28 in such a way that when the knife contact members are in closed position, the detent 36 compresses the spring 37. The tendency of the spring 37 is to open the switch at all times and the spring is made sufficiently strong to cause the switch to open. The switch when closed, however, is prevented from opening by the magnetic attraction of the electro-magnet 30 when the latter is sufficiently energized by an electric current. The brackets 31, 31, are both provided with lips 34, 34 which cooperate with a pin 35, fastened to the bracket 33. They are for the purpose of limiting the movement of the switch when the same is in its open position.

Between the fixed contact blocks 21—15 and 22—16, where it is customary to place fuses, I provide a device which forms an important feature of my invention. This device, of which there are preferably two, one for each pole, comprises a metallic piece 17 which has an appreciable resistance and a high temperature of fusion, each end of which may be provided with a slotted terminal for convenience in fastening in place. At a proper point on this metallic resistance member 17 is soldered, or otherwise fastened by some fusible alloy, a connector or binding post 19 which is provided with a screw connection at one end so as to facilitate the fastening of a wire thereto.

Fig. 3 shows an enlarged modification of the device designated by 17 and 18 in Figs. 1 and 2. The main features of difference are in having slotted terminals 39 and 40 also in having the connection 19 fastened by the fusible alloy 43 to the resistance element 17 at an inclined position. A screw 41 and washers 42 are provided for wire connections. The object in having the con-

nection 19' at an angle to the resistance element 17' is for the purpose of causing the former, upon becoming unsoldered due to heat generated by excessive current flow in the resistance element 17', to fall away from the latter and thus break any electrical connection which may exist between the two.

In Fig. 4 the connector 19'' is soldered at right angles to the resistance member 17' and is provided with a shoulder 48 at one end. A flat spring 44 engages this shoulder and exerts a pressure upon the connector 19'', the tendency of which is to force the connector 19'' away from the resistance element 17' should the solder joining them become plastic or fused. The spring 44 may be of any desired construction or form, although I prefer the construction as shown on the drawing, in which the spring 44 has a U-shaped cut-away portion 47 at one end for the purpose of engaging the shoulder 48, and is fastened at its other end to a small block 45 which in turn is fastened by the screws 46 to the switch base 10. The spring 44 might advantageously be stamped out of a single piece of material.

The wiring diagram depicted in Fig. 6 shows one way in which my improved switch may be used in connection with a source of current supply and an electric motor, in conjunction with an electrically operated brake. Its operation is as follows: Assuming the switch is manually closed by means of the handle 29, the electro-magnet 30, which receives current from the mains + and - through the connectors 19 and 20, will maintain the switch in its closed position as long as there is sufficient potential in the main line circuit to properly energize it. Upon closing the switch the knife contact members 11 and 12 close a circuit to the motor-armature 50 through the wire 53, brush 52, starting resistance 58, and wires 57 and 56. A circuit is also closed to the shunt field 59 through the wires 53 and 56. At the same time the magnet winding of the electric brake 49 receives current from the mains + and - through the switch contacts 23 and 24. The effect of this is to release the brake and allow the motor to start, the adjustable resistance 58 may be operated in any desired manner to properly start or control the motor. Should the potential in the main supply + and - drop beyond a certain point, the electro-magnet 30 will become partially deenergized and the spring 37, (Fig. 2), will at once overpower the holding-in property of the magnet and thereby open the switch blades 11 and 12. The circuit to the motor is at once interrupted at the contact terminals 25 and 26. At the same time the circuit to the brake 49 is broken at the contacts 23 and 24. The brake is thereupon applied by a spring (not

shown) or gravity, or other means, and the motor speedily brought to rest. Should excessive current flow from the main line and to the system upon closing the switch blades, or after they are closed, the resistance elements 17 and 18 are heated by this heavy current to an amount sufficient to fuse or soften the connection between the resistance members 17, 18 and the connectors 19, 20, respectively, thereby causing the circuit to the retaining magnet 30 to be opened at these fused connections. The switch is thereupon opened and the motor brought to rest. It is the usual practice, where it is desired to make an electrical connection between a power circuit and some electrical device, to place a double pole switch of some description which is provided with fuses, either of an open or inclosed type. We will assume, for example, that such a switch connects an electric elevator system and a source of electrical supply, let it be further assumed that a heavily loaded elevator car is descending and the main line fuses "blow," due to excessive current or other causes. The result is that the heavy descending load will drive the hoisting motor as an open circuited generator, current at an increased voltage will keep the brake from being applied, and the machine will run away with more or less disastrous results. Or, should the main switch be provided with the ordinary type of no voltage release and the potential drops by an amount sufficient to open the main switch, the brake, with which every electric elevator is supplied, will remain partially energized by the counter-electro-motive force due to the rotating elevator motor and will remain inactive at just the time when it should be applied to stop the elevator machinery. These objectionable features are ever present in the usual type of so-called over-load and no voltage release switches, whether they be operated by magnetic or other means. A further objection to the usual type of over-load switch when used in connection with an electric motor, is that the tripping device used thereon is set to operate at a certain overload. In the operation of electric motors especially, it is frequently desirable to overload the motor for a short space of time sometimes as much as 50%. It would not be safe to set such a switch to operate at 50% overload for the reason that it would permit a 45% overload upon the motor for an indefinite time, which would most assuredly ruin the motor. These and other objectionable features ever present in the prevailing type of overload and no voltage release switches, are entirely overcome by using such a switch as I have described in connection with the drawing annexed to this specification, and for the following reasons: In the first place it will be recalled that in

the description of Fig. 6 the terminals of the electric brake 49 are connected to small terminals 23 and 24 on the switch, and it is clearly seen that should the switch be opened from any cause whatsoever, the releasing magnet of the electric brake 49 is immediately open-circuited at both terminals and the brake is applied with maximum power, there being no possibility of the brake-releasing magnet remaining energized and the brake held off. Another feature to be found in my improved switch is the property of allowing a certain overload to pass through the same to any desired electrical device for a short space of time without causing the switch to open its contacts; but, should this overload continue beyond a certain period of time, the switch would at once operate. This time element feature as applied to an overload switch I consider of the greatest value, for, although the switch I have described will open its contacts whenever the main current rises to a predetermined amount for a certain length of time, it also permits of a much greater flow of current for a short period only. This latter feature is very desirable in the operation of electric motors as applied to elevator service, although not confined to any one particular electrical device.

The resistance member which I use to accomplish the opening of my switch upon an overload, is very simple and cheaply constructed. As before stated, it has an appreciable resistance whereby a current is enabled to heat it, but this resistance is so very low that the loss of energy therein is negligible and does not have to be taken into account. The length of this resistance member bears a certain relation to its accuracy of operation owing to heat being conducted away by the terminals at either end. As soon as a resistance member has operated to open the switch it is only necessary to replace it with a similar one, and in the meanwhile the first one can be resoldered and used again, or as many times as desired.

Without limiting myself to the precise

form and construction herein described, and fully realizing that many changes and additions may be made by those skilled in the art without departing from the spirit and scope of my invention, what I claim as novel and desire to protect by Letters Patent of the United States is:

1. The combination of an electric switch, an electro-responsive device controlling the switch and having a circuit independent of the switch, and thermostatic means in circuit with said electro-responsive device and controlled by the current through the switch for controlling the operation of said electro-responsive device.

2. The combination with an electric switch, of an electro-magnet controlling said switch and having an electric circuit independent of the switch, and heat controlled means included in said circuit and dependent on the current flowing through the switch for controlling the operation of the electro-magnet.

3. The combination with a switch, of a conductor connected thereto and adapted to be connected to a source of current supply, an electro-magnet controlling said switch, and a heat responsive device connecting the electric circuit of said electro-magnet to said conductor and operable upon a rise in temperature of said conductor above a predetermined point to disrupt said circuit.

4. The combination with a two-pole switch, of conductors leading from a source of current supply, a holding electromagnet having its winding in a circuit across said conductors for holding said switch closed during the passage of normal current, and a thermostatic device normally in circuit with said magnet winding and operable upon the flow of excess current for a predetermined time to cause the opening of said switch.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

ERNEST L. GALE, Sr.

Witnesses:

ALFRED C. BECHET,
ERNEST L. GALE, Jr.