Nov. 8, 1932. W. S. MAYER 1,887,274

COMBINED SWITCH AND CIRCUIT BREAKER

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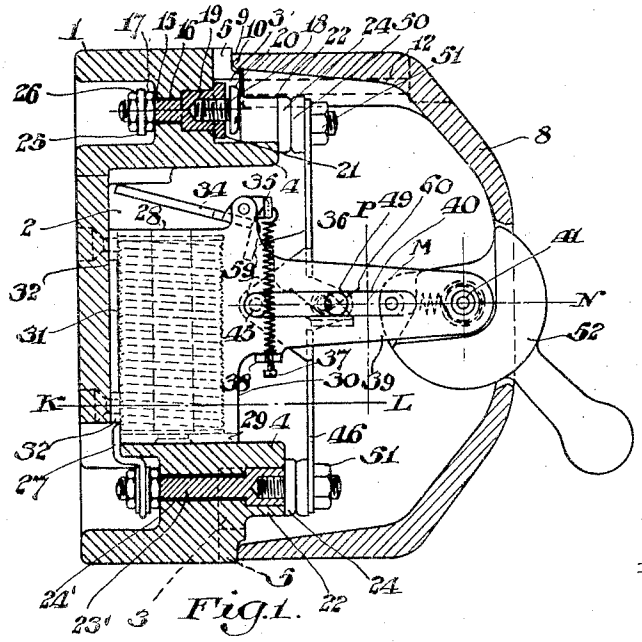


Fig. 1.

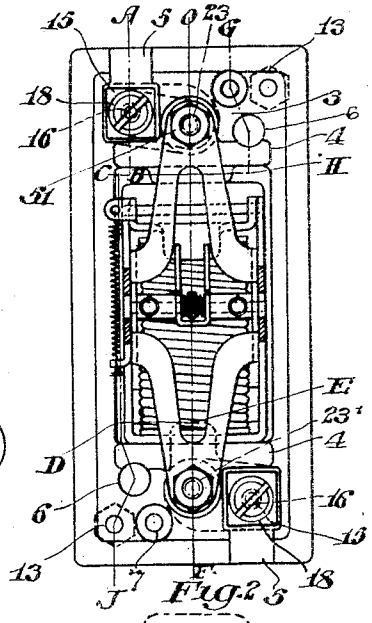


Fig. 2

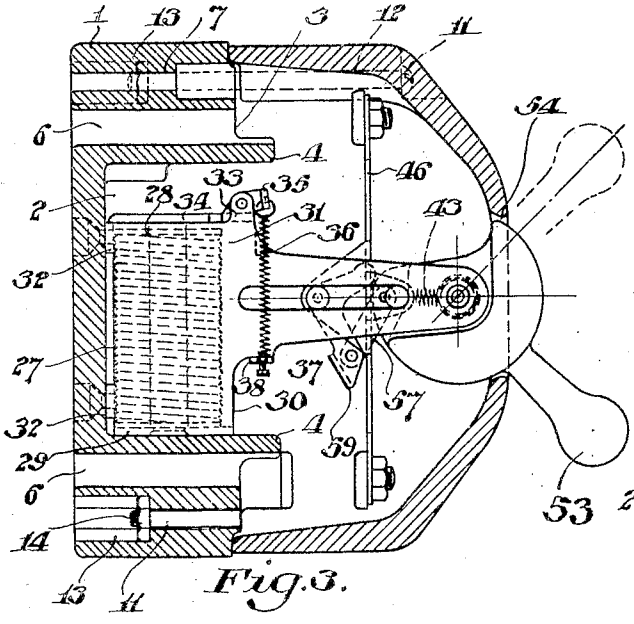


Fig. 3.

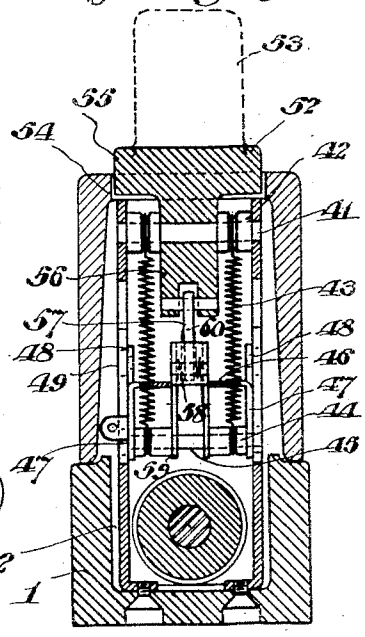


Fig. 4.

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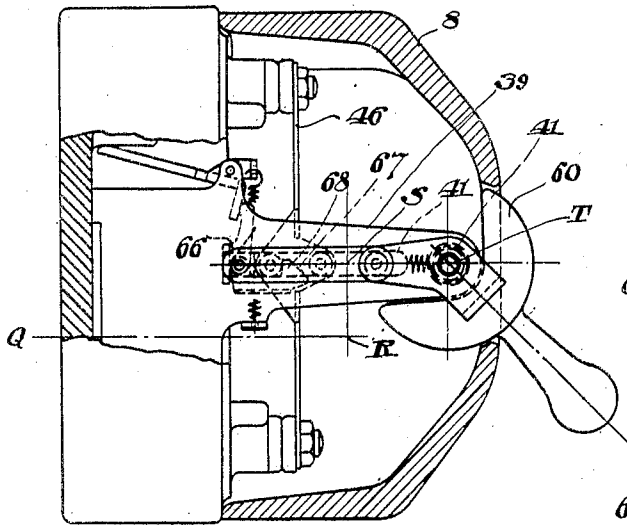


Fig. 5.

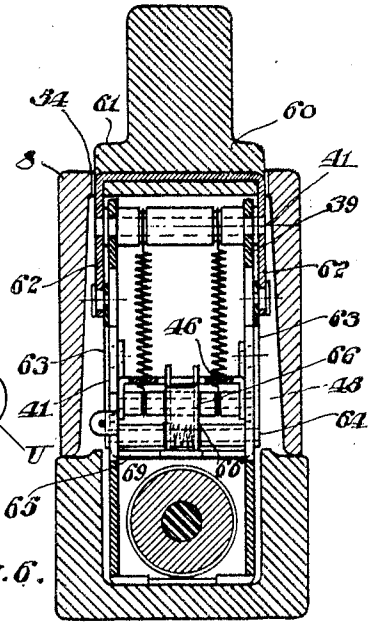


Fig. 6.

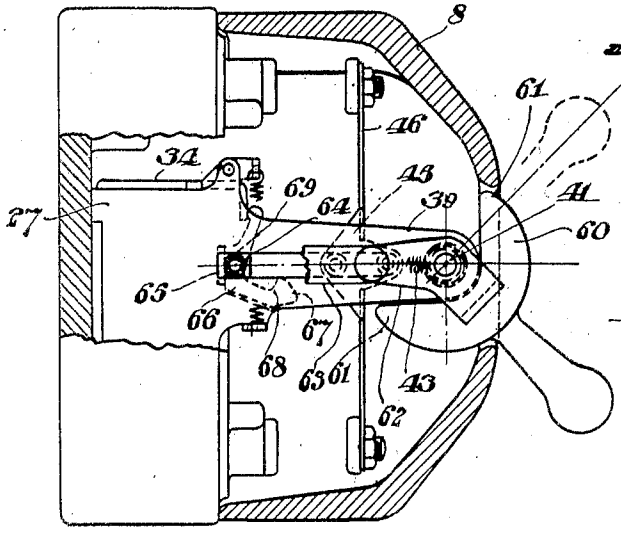


Fig. 7.

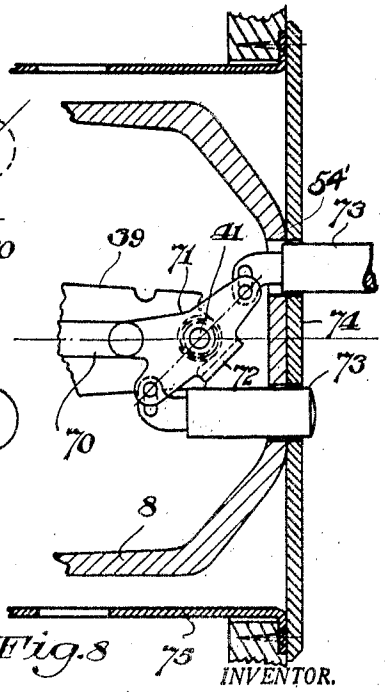


Fig. 8

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UNITED STATES PATENT OFFICE

WALTER S. MAYER, OF PHILADELPHIA, PENNSYLVANIA

COMBINED SWITCH AND CIRCUIT BREAKER

Application filed August 19, 1925. Serial No. 51,102.

The object of my invention is to provide maximum safety, efficiency, compactness and simplicity of construction, in a device for manually controlling and for automatically breaking a circuit upon the passage therethrough of a current differing from that which it is designed to carry.

In accordance with my improvements, the switching mechanism for connecting the electrodes comprised in the circuit breaker is automatically operated by the flow of abnormal current, is non-closable while abnormal conditions persist, and during such period is entirely disconnected from both sides of the line; hence there is no danger of causing a short circuit by contact with the switching mechanism, and either electrode may be the anode of the device connected with the live line or generator or the cathode of the device connected with the dead line or load.

In the preferred embodiment of my invention, a plurality of electrodes, adapted for connection respectively with the live line and load line of the circuit, are spanned by reciprocable switching mechanism operable by a toggle and normally held in contact with brushes or seats of the electrodes by latching mechanism, which is released by the thrust of an electro-magnetic armature operable by the flow of abnormal current to permit disengagement of the switch blade or conductor from the electrode brushes by spring mechanism. When normal conditions in the circuit are restored, the switch blade may be again reengaged with the electrode brushes through the toggle mechanism, which is operable by a handle preferably of the tumbler or push button type, projecting from a housing in which the conducting parts of the device are inclosed. The several operating parts of the mechanism are so disposed within the housing that they preferably have their longitudinal median planes normal to the base coincident with one another and with the longitudinal median plane of the housing normal to its base and lie within an area bounded by the largest extent of a part in any direction.

My improved device is compact in size, symmetrical in form, and substantially all the metallic parts thereof may be made from sheet metal stampings or screw machine parts; the brushes through which the switch and electrodes are connected being preferably interchangeable and readily replaceable when pitted by arcing.

The characteristic features and advantages of my improvements will further appear from the following description and the accompanying drawings in illustration of prefered embodiments of my invention.

In the drawings, Fig. 1 is a longitudinal sectional view of apparatus embodying my improvement; the section of the housing cover being taken on the line OF of Fig. 2 and the section of the housing base and its connected parts being taken on the line AB CD EF of Fig. 2; Fig. 2 is a front elevation of the device shown in Fig. 1, with the cover removed and parts sectioned along the line PL of Fig. 1 for clearer illustration; Fig. 3 is a longitudinal sectional view of the device shown in Figs. 1 and 2, the section through the housing cover being taken along the line OF of Fig. 2 and the section through the housing base and its connected parts being taken along the line GH CD J of Fig. 2; Fig. 4 is a transverse sectional view of the device shown in the preceding figures taken along the line KL MN of Fig. 1; Fig. 5 is a part sectional side elevation of my improved device illustrating a modified form of switch operating mechanism; Fig. 6 is a transverse sectional view taken along the line QR STU of Fig. 5; Fig. 7 is a part sectional side elevation similar to that shown in Fig. 5 but with the switch disengaged from the electrodes and with parts broken away for clearer illustration; and Fig. 8 is a fragmentary view illustrating the operation of the switch toggle by push buttons and the enclosure of the device in a wall box.

As illustrated in the drawings, a symmetrical housing base 1, preferably molded from non-conducting material, contains a median chamber 2 and end channels 3 separated from the chamber 2 by insulating spacers or barriers 4. Diagonally opposite grooves 5 and diagonally opposite bores 6, extending through the base composition, afford ingress

to the channels 3 for line wires of the circuit to be controlled.

The base may be seated in a usual wall box or attached to a panel, switch board, or other foundation by passing bolts or screws through countersunk apertures 7 formed in the base parallel with the bores 6. A symmetrical housing cover 8 may be fastened to the base with its edge 9 in the rabbet 10 along the outer edge of the base by means of diagonally opposite bolts 11 passing through countersunk cover slots 12 and countersunk base slots 13 into engagement with nuts 14 seated in the base.

Diagonally disposed terminal posts 15, 15' are seated in the base apertures 16, adjacent to the grooves 5, and have their shoulders drawn tightly against complementary abutments on the base by nuts 17. Contact screws 18 are threaded into the post sockets 19 and have expanded heads 20 for engaging the line wires against the faces 21 of the posts.

Bosses 22, projecting upward from the channel 2, are counterbored to provide abutments for the shoulders of electrode posts 23, 23' disposed in apertures 24' having their axes substantially coincident with the longitudinal plane O—F normal to the base.

The electrode posts 23 contain threaded sockets for the reception of threaded shanks of detachable brushes or switch seats 24, having heads overlying the post 23 and bosses 22. A plate 25, held by a nut 26 on the post 15, electrically connects it with the electrode 23. The post 15' and electrode 23' have connected therewith the opposite ends of a solenoid coil 27 wound upon a core 28 fixed in the end web 29 of a paramagnetic housing or cage 30. This cage has its flux-conducting sides 31 bent at right angles to the web 29 and provided with ears 32 attached to the bottom of the chamber 2. Apertured lugs 33 on the cage 30 have pivoted therein a flanged armature 34 having a knuckle extension 35 containing an eye for the engagement of a coiled spring 36, the opposite end of the spring being anchored on an adjustable screw 37 threaded in a lug 38 on one of the guide ways or extensions 39 projecting from the side members 30 in planes normal to the base and parallel to the plane O—F.

The guide ways 39 contain slots 40 and support a pintle 41 having thereon bushings 42 to which are fixed coiled springs 43 having their opposite ends fixed on bushings 44 on the pintle 45 of switching mechanism for electrically connecting the seats 24.

The switching mechanism comprises a stamped out skeleton blade spanner or bridge 46 having oppositely bent lugs 47 and 48, and end apertures in which are secured the shanks of contact brushes 50 secured in place by nuts 51 screwed on the shanks. The parts 24 and 50 are similar screw machine parts and interchangeable.

The lugs 47 are engaged on the pintle 45, which projects therefrom into the slots 40, and the lugs 48 have fixed therein shouldered rivets 49 projecting into the slots 40 to guide the blade or bridge 46.

As illustrated in Figs. 1 to 4 of the drawings, a tumbler handle 52 is journalled on the pintle 41 between the bushings 42, and has a finger piece 53 projecting through the housing aperture 54 which is closed by a flange 55 in either position of the finger piece. The flange also limits the movement of the handle by engaging the guides 39. An arm 56 on the handle is pivotally connected through a link 57 with the pintle 58 between the legs of an L-shaped trigger or bell crank 59 pivoted on the pintle 45 between the bushings 44. A light spring 60, wound on the pintle 58 and having a loop engaging the link 57, tends to normally straighten the toggle formed by the link 57 and the adjacent arm of the trigger 59. The free arm of the trigger 59 has a curved head disposed adjacent to the flange of the armature 34 and operable thereby to break the toggle and release the switch blade when the armature 34 is attracted by the magnet 27.

As illustrated in Figs. 5, 6, and 7, a tumbler handle 60 is journalled on the pintle 41 outside the guide ways 39 and comprises a yoke moulded in a non-conducting finger piece projecting through the housing aperture 54, which is closed by flanges 61 in either position of the handle. The flanges 61 limit the movement of the handle by engaging the guides 39. Arms 62 of the handle yoke have pivoted thereto the links 63 having their ends connected by a pintle 64 on which is journalled a U-shaped member or yoke 65 whose legs are engaged in the slots 41 to prevent the turning of the yoke.

A bell crank shaped trigger 66, pivoted on the pintle 64, has an inclined face 67 causing the deflection of the trigger when brought into engagement with a roller on the pintle 45 to permit the engagement of this roller by the trigger tooth 68. The trigger is normally pressed so that its tooth will engage the pintle 45 by a spring 69 wound on the pintle 64, the rotary movement of the trigger in either direction being limited by the cross member of the yoke 65.

The free arm of the trigger has a curved head disposed adjacent to the flange of the armature 34 and operable thereby to disengage the tooth 68 from the pintle 45 and release the switch when the armature is attracted by the magnet 27.

As illustrated in Fig. 8, the link 70, corresponding either to the link 57 or to the link 63, is pivotally connected with a lever 71 journalled on the pintle 41 and having a stop 72 engaging the guideways 39. Push buttons 73 are pivotally connected with the laterally

extending arms of the lever 71 and project through the apertures 54' of the cover 8 and through registering apertures of a face plate 74 covering the wall box 75 in which the device is housed.

The devices described when mounted in a box, on a switch board or elsewhere may have their binding posts 15, 15' connected with the circuit by wires introduced from the front of the housing through the grooves 5 or from the rear of the housing through the bores 6, as convenience may dictate. The line wire of the circuit may be connected with either binding post 15 or 15' and the turns and thickness of the solenoid winding are so proportioned that the armature 34 is not operated when normal current flows. But should abnormal current flow, the armature 34 is attracted to the solenoid 27 and rocks the trigger 59 or the trigger 66 to release the spanner 46.

In the construction illustrated in Figs. 1 to 4, the kick of the trigger 59 may break the toggle connecting the handle 52 and the switching mechanism or may, without breaking the toggle, throw the handle from its position shown in Fig. 1 over dead center to the dotted line position shown in Fig. 4. In either event, the switch blade 46 is instantly lifted from its seat by its springs 43 and the circuit is broken; the switch blade being fully disconnected from the source of power and from the load. When the toggle connecting the handle and switching mechanism is broken by the kick of the trigger 59, the upward movement of the switching mechanism brings the curved head of the trigger into forceful contact with pivoted member 52 at one side of a radius drawn from the pintle 41 to the pivot connecting the link 57 with the member 52. This blow and the action of the spring 60 tending to straighten the toggle normally rotates member 52 so that the finger piece thereof is thrown to the position shown in dotted lines in Fig. 3. To reestablish the circuit, the tumbler 53 is manually thrown to the dotted line position of Fig. 3, if it has not been so thrown electrically, to straighten the toggle, which when operated by returning the tumbler 53 to its full line position (Fig. 3) depresses the switch into engagement with its seat. Should the abnormal conditions not have abated, the circuit is again immediately broken as before described.

In the construction illustrated in Figs. 5 to 7, the kick of the trigger 66 disengages the tooth 68 from the pintle 45 and the switch spanner 46 is immediately lifted by its springs 43 away from the brushes 34. To reengage the switching mechanism against its seat, the finger piece of the handle 60 is thrown to its dotted line position (Fig. 7), which lifts the pintle 64 and trigger 66 and snaps the trigger tooth 68 over the pintle 45. By throwing the finger piece to the full line position (Fig. 7), the pintle 64 will be moved toward the base, carrying with it the switch blade or bridge 46 into contact with the electrodes. If conditions remain abnormal, the trigger will be again tripped by the armature flange as above described. But if conditions have been restored to normal, the pintle 64 and switch mechanism connected therewith by the trigger 66 are held in position by the toggle members 62, 63 which are beyond dead center position.

When it is desired to operate the switching mechanism of Figs. 1 to 4 or of Figs. 5 to 7 by push buttons instead of tumblers, the toggle members are connected with such buttons as shown in Fig. 8.

The bridge or spanner 46 may be operated manually to break, as well as to make the circuit, by manipulating the tumblers or switch buttons.

Having described my invention, I claim:

1. A switch and circuit breaker comprising a plurality of spaced contacts, switching mechanism normally biased away from both said contacts and including a rectilinearly movable blade adapted for bridging said contacts, means for moving said blade toward said contacts and including a toggle positioned adjacent to a section of said blade intermediate the ends thereof when the latter is in closed position, and a current responsive device for breaking said toggle and releasing said blade upon the flow of an abnormal current.

2. An automatic circuit breaker as set forth in the next preceding claim wherein a finger piece is connected with an end of said toggle and oscillatable on an axis substantially in alignment with said toggle when straightened.

3. A switch and circuit breaker comprising a plurality of spaced contacts; a conducting blade normally biased away from both said contacts and adapted for bridging the same, means for moving said blade toward said contacts and including a toggle, a rectilinearly reciprocable member connected with an end of said toggle, a guide for said member disposed approximately equidistantly from said contacts; and means for releasing said blade from said contacts and including an arm fulcrumed on said member and a current responsive device for operating said arm.

4. A switch and circuit breaker comprising a plurality of spaced contacts, a switch blade normally biased away from said contacts and adapted for bridging the same, means for moving said blade toward said contacts and including a toggle disposed between the ends of said switch blade when the latter is closed, said blade containing an opening for the passage of said toggle therethrough upon the movement of said blade toward and from said contacts, and a current responsive device for breaking said

toggle and releasing said blade from said contacts.

5. A switch and circuit breaker comprising a pair of guides, a pair of contacts on the opposite sides of said guides, an oscillatory device between said guides, a toggle having a link connected with said device and a bell crank connected with said link, a slide movable along said guides and pivotally connected with said bell crank, a switch blade carried by said slide and adapted for bridging said contacts, said blade being normally biased away from said contacts, and a current responsive device engaging said bell crank to break said toggle and throw said oscillatory device upon an abnormal current flow through said blades.

6. A switch and circuit breaker comprising a plurality of contacts, an apertured switch blade normally biased to open position but movable to closed position to close a circuit between said contacts, a toggle passing through the aperture of said switch blade and having one end connected with said switch blade, an oscillating device connected with the other end of said toggle and provided with a finger piece for operating said toggle and blade, and a current responsive device for breaking said toggle and permitting the opening of said blade.

7. A switch and circuit breaker comprising an electromagnetic coil, contacts adjacent to the opposite ends of said coil, a rectilinearly reciprocable switch blade spanning said coil and bridging said contacts, said switch blade being normally biased away from said contacts, guides projecting laterally from said coil between the ends thereof and guiding said blade, a toggle connected with said blade, means for operating said toggle to move said switch toward said contacts, and an armature operable by said coil for breaking said toggle and permitting movement of said switch away from said contacts.

8. A circuit controller comprising a cage of substantially U-shaped longitudinal section, an electro-magnetic device between the legs of said cage, an armature pivotally connected with the legs of said cage and operable by said device, said cage having guideways projecting therefrom, a switching device guided by said guideways, electrodes connected by said switching device, trigger mechanism carried by said cage and controlled by said armature for controlling said switching device, spring mechanism for operating said device, and means for manually operating said device.

9. A switch and circuit breaker comprising a housing having an electro-magnet therein, electrodes in said housing on opposite sides of said magnet, a switch blade movable as a unit toward and from said electrodes on a line substantially parallel with the plane thereof, guides projecting from said electromagnet and having a member pivotally connected therewith, a spring for moving said switch blade from said electrodes, means comprising a link connecting said pivoted member with said switch blade for moving it into contact with said electrodes, a latch movable with said link for securing said switch blade in contact with said electrodes, and an armature operable by said electro-magnet for unlatching said switch blade.

10. A circuit controller including a base forming a longitudinal chamber, a barrier located at each end of said chamber, a bolt extending through each of said barriers, arms projecting from said chamber, spring actuated mechanism disposed between said arms and adapted to operate a switch blade to close a circuit between said bolts, and electro-magnetic means disposed in said chamber for controlling said spring actuated mechanism.

11. An automatic circuit breaker comprising in combination, an insulating support, two stationary spaced arms extending from the support, two stationary spaced electric contacts carried by the support, a contact member guided in a fixed rectilinear path determined by the said arms and carrying two connected electric contacts adapted to respectively engage and disengage the two stationary contacts, a spring tending to move the contact member to circuit breaking position, a manually operable actuating member pivotally mounted on the arms, and a bodily movable electro-responsively releasable mechanical connection between the actuating member and the contact member enabling the former to effect the movement of the latter to open or close the circuit, the said mechanical connection being automatically released upon the passage of excess current to release the contact member from the actuating member and thus permit the said contact member to automatically move to its open-circuit position independently of the actuating member.

12. In a switch, the combination of a contact arm opening and closing the switch by its movement; a spring operating the arm to open the switch; a control lever; a latch on the arm between the control lever and the arm locking them to swing together against the spring; and electrically responsive means tripping said latch.

In testimony whereof I have hereunto set my name this 13 day of August 1925.

WALTER S. MAYER.