Dec. 10, 1963 R. E. LOCHER 3,114,023

THERMAL ELECTRIC CIRCUIT BREAKER

Filed Sept. 22, 1959 2 Sheets-Sheet 1

FIG. 1.

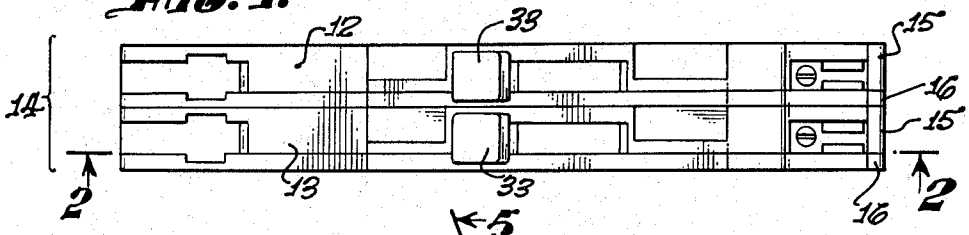


FIG. 2.

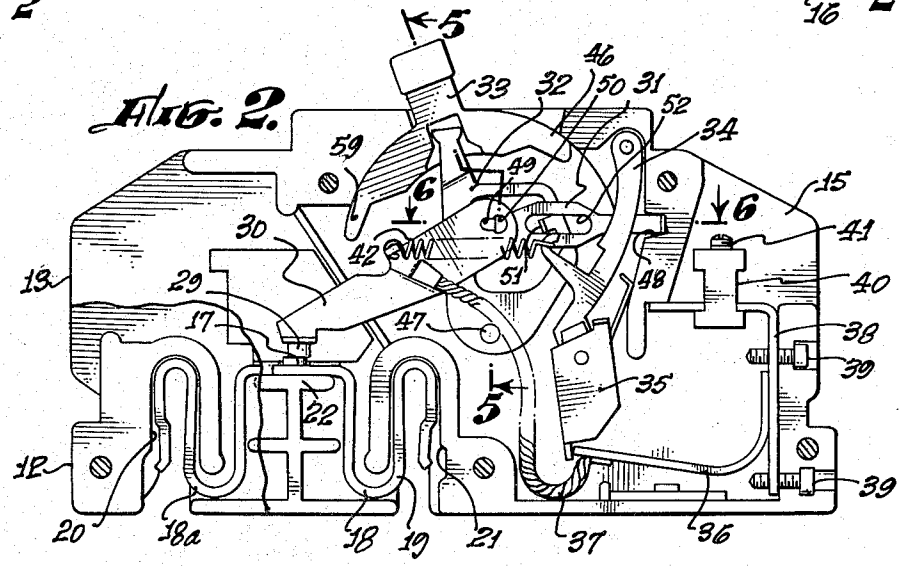
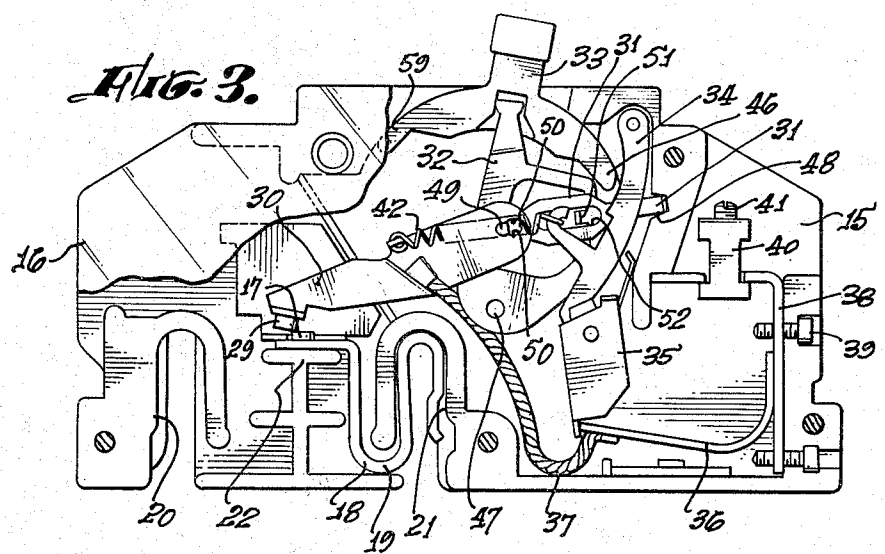


FIG. 3.



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FIG. 4.

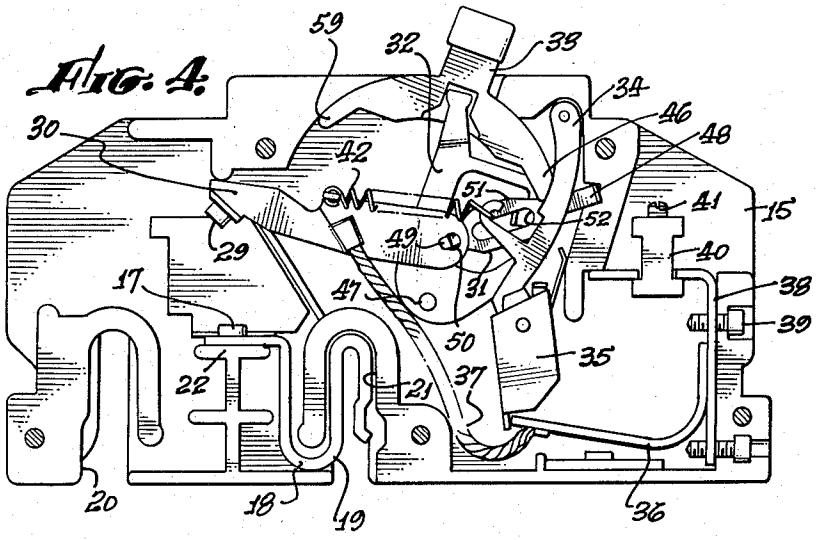


FIG. 6.

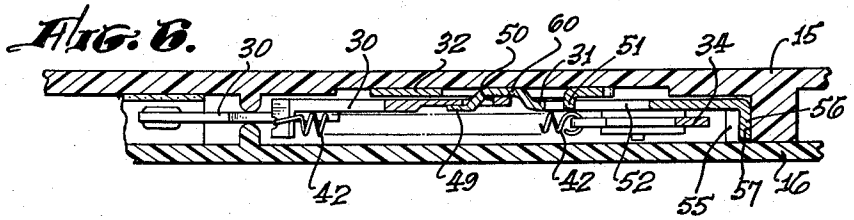


FIG. 5.

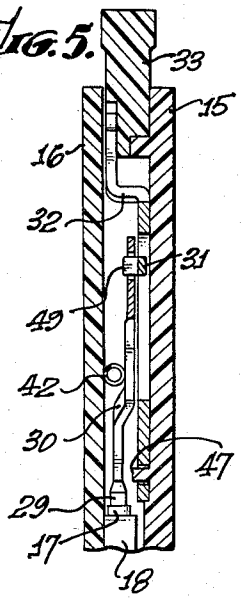


FIG. 7.

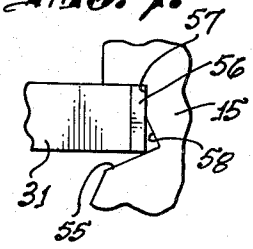
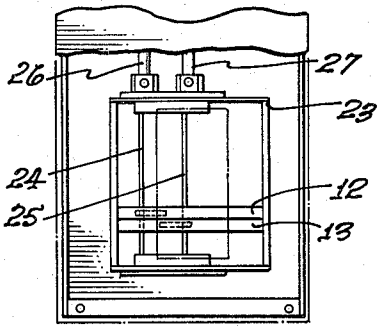


FIG. 8.



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3,114,023

THERMAL ELECTRIC CIRCUIT BREAKER

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Filed Sept. 22, 1959, Ser. No. 841,497
7 Claims. (Cl. 200—116)

This invention relates to electrical switches and, in particular, to manually operable switches suitable for use in distribution panels and the like.

In a distribution panel, a number of switches are mounted side by side for connecting the incoming lines to the various devices requiring electrical power. Usually, the switch will include automatic overload protection in the form of a thermal type circuit breaker and the present invention is adapted for use in circuit breaker type switches.

It is an object of the invention to provide a relatively small switch which meets the standard electrical and safety requirements such that two of the switches can be installed in the space normally required for a single switch. A further object is to provide such a switch which can be combined with a similar switch to form a switch unit with the switch unit being directly substitutable for a conventional switch and with each switch of the unit having a distribution panel buss-engaging conductor that may take one of two symmetrical positions such that the two switches of a unit may engage alternate busses while utilizing identical parts.

It is an object of the invention to provide a switch having an operating mechanism that occupies a very narrow space with the components assembled in layers. A further object of the invention is to provide a switch utilizing a toggle or overcenter mechanism which produces a translating motion in the contact carrier arm and hence a large wiping action at the engaging surfaces of the contacts. Another object is to provide a toggle mechanism having a moving center or pivot point producing a very fast acting switch with quick break and make characteristics while requiring only a very small arc of travel for the manually actuated lever.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. The drawings merely show and the description merely describes a preferred embodiment of the present invention which is given by way of illustration and example.

In the drawings:

FIG. 1 is a top view of two switches joined to form a switch unit;

FIG. 2 is a side view with the cover removed showing the switch in the closed position;

FIG. 3 is a view similar to that of FIG. 2 showing the switch part way through the opening cycle;

FIG. 4 is a view similar to that of FIG. 2 showing the switch in the open position;

FIG. 5 is an enlarged sectional view taken along the line 5—5 of FIG. 2;

FIG. 6 is an enlarged sectional view taken along the line 6—6 of FIG. 2;

FIG. 7 is an enlarged view of a portion of FIG. 2 showing a detail of the pivot arm mounting; and

FIG. 8 is a view of a distribution panel with the switch unit of the invention mounted therein.

The electrical switch of the present invention is ordinarily used in conjunction with a circuit breaker and will be shown thus in the following description. Circuit breaker switches of this general type are shown in United States Letters Patent Nos. 2,502,537 and 2,878,332, both assigned to the same assignee as the present application.

The circuit breaker portion of the switch mechanism of the embodiment shown herein is essentially the same as that of these two patents and references may be made thereto for details of construction and operation.

The switch mechanism is mounted in a case consisting of a body 15 and a coverplate 16, the coverplate being removed in FIGS. 2, 3 and 4. A fixed contact 17 is mounted on a conductor 18 having a U-shaped buss clip 19 at the other end. Housings 20, 21 are formed in the body 15 for receiving the buss clip 19, with the housings being symmetrically positioned with respect to a support boss 22 for the fixed contact. The conductor 18 may be positioned in the body with the fixed contact on the boss 22 and with the buss clip in either of the housings 20, 21. Two switches 12, 13 of the invention may be joined together to form a switch unit 14 as shown in FIG. 1, with the conductor 18 of one switch having the buss clip in the housing 21 and with the conductor, indicated as 18*a* in FIG. 2, of the other switch having the buss clip in the housing 20. This construction permits the switch unit to be mounted in a distribution panel 23 having parallel busses 24, 25 connected to two hot lines 26, 27 with one switch connected to the buss 24 and the other switch connected to the buss 25, providing the desired "phasing" of adjacent circuits (FIG. 8). Furthermore, the switch mechanism of the invention permits the switch to be manufactured in a case that is one-half the thickness of the normal case so that two switches forming a switch unit of the invention can be installed in the space normally required for a single switch. For example, switches of the type shown in the two aforesaid patents are three-quarters of an inch thick whereas the switch of the invention may be made with the same height and length but with only a three-eighths inch wide case, with one switch being directly substitutable for the other in electrical circuits.

The switch mechanism includes a moving contact 29 carried on a contact arm 30, a pivot arm 31, a switch actuator 32, a finger member 33, a trigger arm 34, a latch lever 35 and a thermal trip member 36. A flexible conductor 37 is connected between the contact arm 30 and the thermal trip member 36 with the trip member being spot-welded to a conductor 38 fixed in the body by screws 39. A therminal member 40 is fixed to the conductor 38 for receiving an external wire which is fixed in the terminal by a screw 41.

The operation of the trigger arm 34, the latch lever 35 and terminal trip member 36 is the same as in the aforesaid patents. When the current through the switch exceeds a predetermined value for a predetermined time, the thermal member, which is ordinarily a bimetal strip, rotates in a counterclockwise direction, freeing the latch lever 35 for counterclockwise rotation which in turn frees the trigger arm 34.

A toggle or over center spring 42 is connected between the contact arm 30 and the trigger arm 34, with the trigger arm serving as a fixed reference for the toggle spring during normal operation of the switch. However, when the trigger arm 34 is released by the latch lever 35 under overload conditions, the trigger arm is rotated clockwise by the spring 42, moving the switch to the tripped, open circuit position. The circuit breaker is re-set by moving the finger member 33 to the extreme clockwise position as seen in FIG. 4, with an end portion 46 of the finger member engaging the trigger arm 34.

Turning now to the mechanism by which the switch is moved between the off and on positions, the actuator 32 is pivotally mounted on a boss 47 and the pivot arm 31 is supported in a pivot socket 48. The pivot arm 31 and contact arm 30 are joined at a pivot point formed by a tab 49 of the pivot arm projecting through an opening

50 of the contact arm. A cam engagement is provided between the actuator 32 and the pivot arm 31 so that when the actuator 32 is rotated by means of the finger member 33, the pivot arm will also be rotated. In the preferred embodiment of the cam arrangement shown herein, an arm 51 projects laterally from the actuator 32 into a slot 52 in the pivot arm.

The switch is shown in the open position in FIG. 4, in the closed position in FIG. 2, and in the dead center position moving from closed to open in FIG. 3. When in the closed position, the spring 42 is below the pivot point of the contact and pivot arms, urging the pivot point upward and the moving contact 29 downward into engagement with the fixed contact. Clockwise rotation of the actuator 32 produces counterclockwise rotation of the pivot arm 31 and causes the pivot point to move downward. This movement of the pivot point causes the contact arm 30 to translate to the left producing a very great wiping motion between the fixed and moving contacts, as seen in FIG. 3. When the pivot point moves past the dead center position, the spring 42 causes the contact arm to rotate clockwise, moving the pivot point further downward and moving the moving contact upward to the position shown in FIG. 4. The reverse operation occurs when the member 33 is moved counterclockwise with the pivot point moving upward producing translation of the contact arm to the left until the dead center position is reached, after which the contact arm is rotated counterclockwise bringing the contacts together.

This switch mechanism provides a very fast contact make action and a very fast contact break action while requiring only a very short movement of the switch actuator. Also, there is a very large amount of translation of the contact arm during the initial part of the opening and closing cycle which produces a large wiping action at the contacts for keeping the contacts clean.

The pivot arm 31 may be mounted for pivoting movement in the body 15 in a pivot socket 55, best seen in FIGS. 6 and 7. A flat end section 56 of the pivot arm rests in the socket 55 and engages one of two contiguous flat surfaces 57, 58 when in the closed and open positions respectively. This socket support for the pivot arm provides a simple pivoting support which does not have a center position so that the pivoting mechanism does not tend to rest at dead center.

Another feature of the invention comprises the use of an end section 59 and/or the end section 46 of the finger member 33 for aiding the snap action of the switch. The end section 59 may be dimensioned so that as the switch is being moved toward the on position, the end section will engage the contact arm 30 just as the toggle mechanism arrives at dead center to push the mechanism past dead center to achieve maximum velocity for the quick make operation. Similarly, the section 46 may be dimensioned to engage the pivot arm 31 when the mechanism is at dead center moving from the on position to push the mechanism past dead center and achieve maximum velocity for quick break operation. Alternatively, the end section 59 could engage the spring 42 adjacent the contact arm 30, rather than the arm itself, with the same operative result.

As indicated previously, the switch of the invention may be assembled in a very thin package and an important feature of this slender package is the layer assembly of the components of the mechanism. This is best seen in FIGS. 5 and 6 showing the spring 42 positioned on one side of the contact arm 30 with the actuator 32 positioned on the opposite side. The pivot arm 31 moves in substantially the same plane as the contact arm 30 and is provided with an offset section 60 permitting the tab 49 to enter the opening 50. This novel construction permits manufacture of switches having the same mounting dimensions and the same mechanical and electrical characteristics while requiring only one-half the space width.

Although an exemplary embodiment of the invention has been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiment disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm for engagement with said fixed contact; a pivot arm mounted in said case for pivoting movement between contact closed and open positions during normal off-on operation of the switch, with said contact arm pivotally connected to said pivot arm at a pivot point spaced from said moving contact; an overcenter spring connected between said contact arm and a point fixed relative to said case for urging said contact arm to the closed position when said spring is on one side of said pivot point and to the open position when said spring is on the other side; and an actuating member mounted in said case for movement between contact closed and open positions, said actuating member including means for engaging said pivot arm to rotate said pivot arm and move said pivot point toward the overcenter condition as said actuating member is moved between contact closed and open positions, producing a translating motion of said contact arm as said pivot point approaches the overcenter condition.

2. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm for engagement with said fixed contact; a pivot arm mounted in said case for pivoting movement between contact closed and open positions during normal off-on operation of the switch, with said contact arm pivotally connected to said pivot arm at a pivot point spaced from said moving contact; an overcenter spring connected to said contact arm between said moving contact and said pivot point and to a point fixed relative to said case; and an actuating member pivotally mounted in said case for movement between contact closed and open positions, said actuating member and said pivot arm having mating cam surfaces for rotating said pivot arm relative to said case and moving said pivot point toward the overcenter condition as said actuating member is moved between contact closed and open positions, producing a translating motion of said contact arms as said pivot point approaches the overcenter condition.

3. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm member for engagement with said fixed contact; a pivot arm mounted in said case for pivoting movement between contact closed and open positions during normal off-on operation of the switch, with said contact arm pivotally connected to said pivot arm at a pivot point spaced from said moving contact; an overcenter spring member connected between said contact arm and a point fixed relative to said case for urging said contact arm to the closed position when said spring is on one side of said pivot point and to the open position when said spring is on the other side; and an actuator mounted in said case for movement between contact closed and open positions, said actuator including means for engaging said pivot arm to rotate said pivot arm and move said pivot point toward the overcenter condition as said actuator is moved between contact closed and open positions, producing a translating motion of said contact arm as said pivot point approaches the overcenter condition, said actuator having a tip portion for engaging one of said members adjacent their connection as said members approach the overcenter conditon moving from the open position for pushing said members over center.

4. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm member for engagement with said fixed contact; a pivot arm mounted in said case for

pivoting movement between contact closed and open positions during normal off-on operation of the switch, with said contact arm pivotally connected to said pivot arm at a pivot point spaced from said moving contact; an overcenter spring member connected between said contact arm and a point fixed relative to said case for urging said contact arm to the closed position when said spring is on one side of said pivot point and to the open position when said spring is on the other side; and an actuator mounted in said case for movement between contact closed and open positions, said actuator including means for engaging said pivot arm to rotate said pivot arm and move said pivot point toward the overcenter condition as said actuator is moved between contact closed and open positions, producing a translating motion of said contact arm as said pivot point approaches the overcenter condition, said actuator having a first tip portion for engaging one of said members adjacent their connection as said members approach the overcenter condition moving from the open position for pushing said members over center, and having a second tip portion for engaging said pivot arm as said members approach the overcenter condition moving from the closed position for pushing said members over center.

5. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm for engagement with said fixed contact; a pivot arm mounted in said case for pivoting movement between contact closed and open positions during normal off-on operation of the switch, with said contact arm pivotally connected to said pivot arm at a pivot point spaced from said moving contact; an overcenter spring connected between said contact arm and a point fixed relative to said case for urging said contact arm to the closed position when said spring is on one side of said pivot point and to the open position when said spring is on the other side, said spring being positioned to one side of said contact arm; and an actuator pivotally mounted in said case for movement between contact closed and open positions and positioned to the other side of said contact arm, said actuator and said pivot arm having mating cam surfaces for rotating said pivot arm relative to said case and said pivot point toward the over center condition as said actuator is moved between contact closed and open positions, producing a translating motion of said contact arm as said pivot point approaches the over center condition.

6. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm for engagement with said fixed contact; a pivot arm having a flat pivot surface adjacent one end and being pivotally connected to said contact arm at a pivot point spaced from said one end and from said moving contact; a pivot socket in said case for receiving said pivot surface of said pivot arm for pivoting

movement between contact closed and open positions during normal off-on operation of the switch, said pivot socket having first and second contiguous socket surfaces for engagement with said pivot surface when in said open and closed positions respectively; an overcenter spring connected to said contact arm and a point fixed relative to said case for urging said contact arm to the closed position when said spring is on one side of said pivot point and to the open position when said spring is on the other side; and an actuator mounted in said case for movement between contact closed and open positions, said actuator and said pivot arm having mating cam surfaces for rotating said pivot arm relative to said case and moving said pivot point toward the over center condition as said actuator is moved between contact closed and open positions.

7. In an electrical switch, the combination of: a case; a fixed contact mounted in said case; a moving contact carried on a contact arm for engagement with said fixed contact; a pivot arm mounted in said case for pivoting movement between contact closed and open positions, with said contact arm pivotally connected to said pivot arm at a pivot point spaced from said moving contact; a trigger arm pivotally mounted in said case; an overcenter spring connected between said contact arm and said trigger arm for urging said contact arm to the closed position when said spring is on one side of said pivot point and to the open position when said spring is on the other side; an overcurrent latch mechanism mounted in said case in locking engagement with said trigger arm for holding said trigger arm in position against the urging of said spring; a flexible conductor connecting said contact arm and said latch mechanism so that a high current through said switch will energize said latch mechanism and release said trigger arm moving said spring past said pivot point; and an actuator mounted in said case for movement between contact closed and open positions, said actuator and said pivot arm having mating cam surfaces for rotating said pivot arm and moving said pivot point toward the over center condition as said actuator is moved.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,114,023 December 10, 1963

Ross E. Locher

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 44, for "therminal" read -- terminal --; line 48, for "terminal" read -- thermal --; column 4, line 46, for "arms" read -- arm --.

Signed and sealed this 2nd day of June 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents