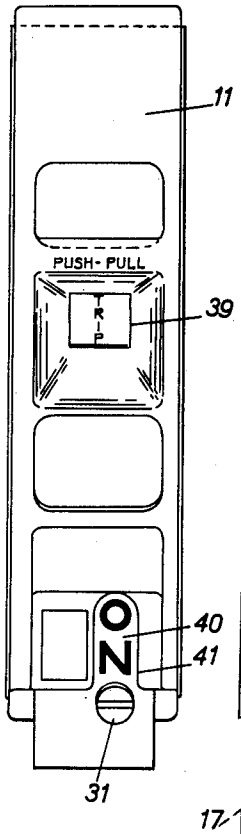
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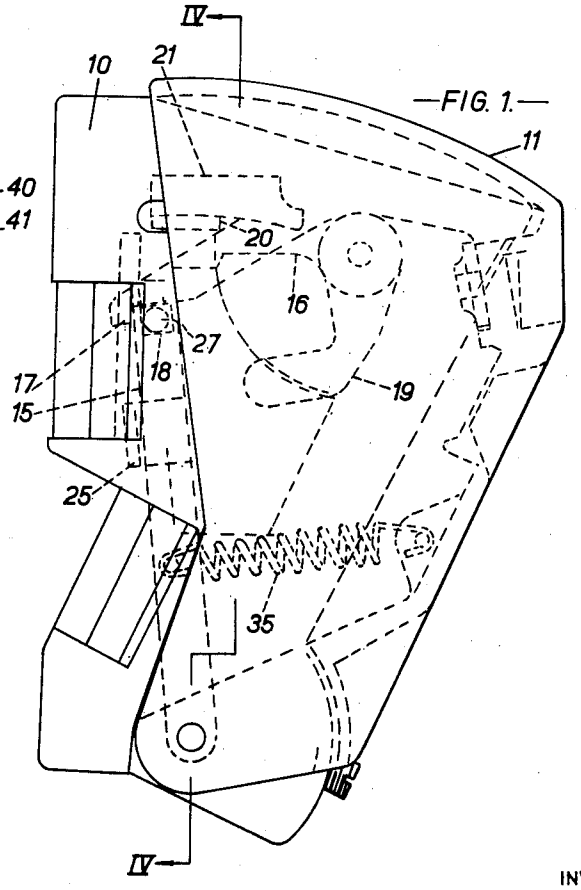
AUTOMATIC ELECTRIC CIRCUIT BREAKERS

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—FIG. 2.—



—FIG. 1.—



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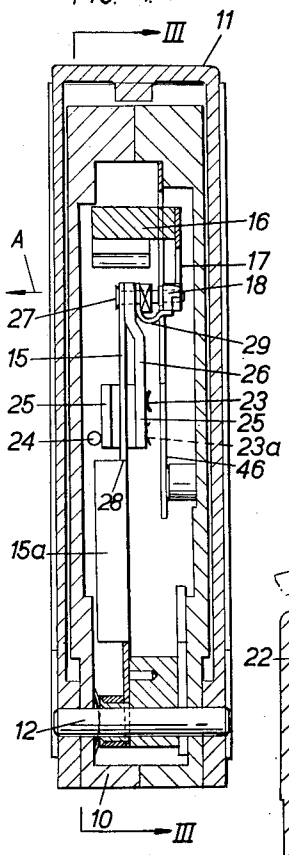
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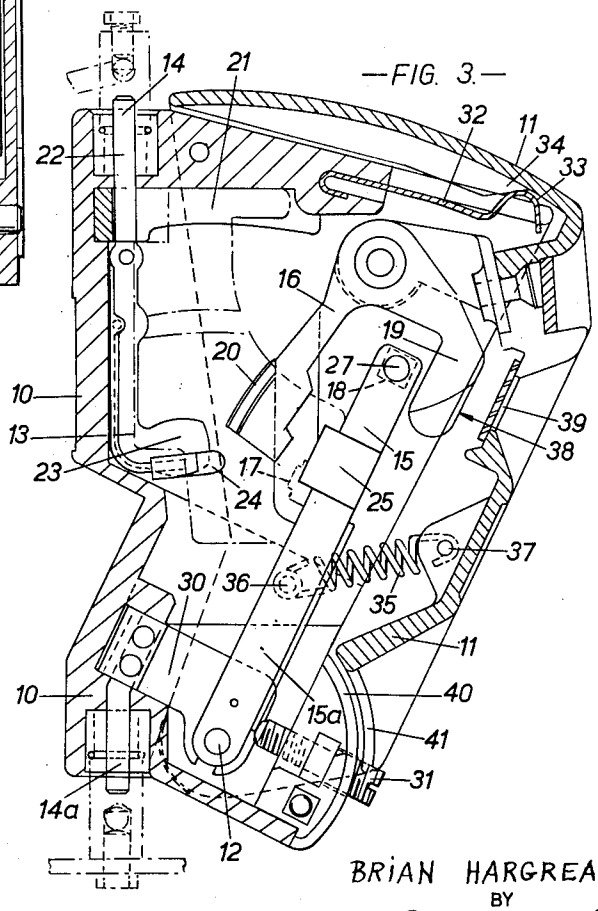
AUTOMATIC ELECTRIC CIRCUIT BREAKERS

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—FIG. 4.—



—FIG. 3.—

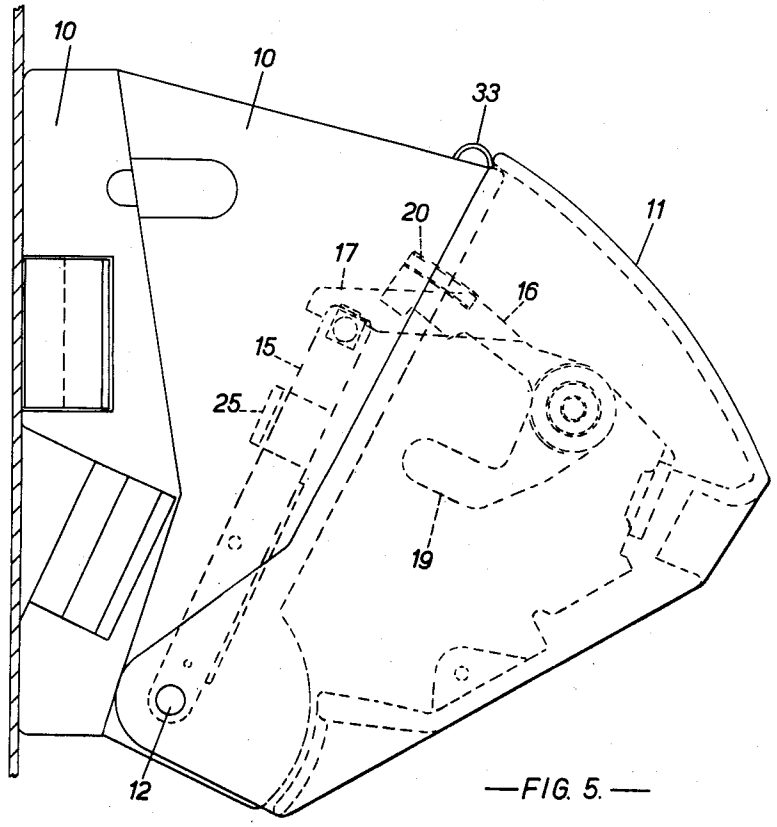


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AUTOMATIC ELECTRIC CIRCUIT BREAKERS

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—FIG. 5.—

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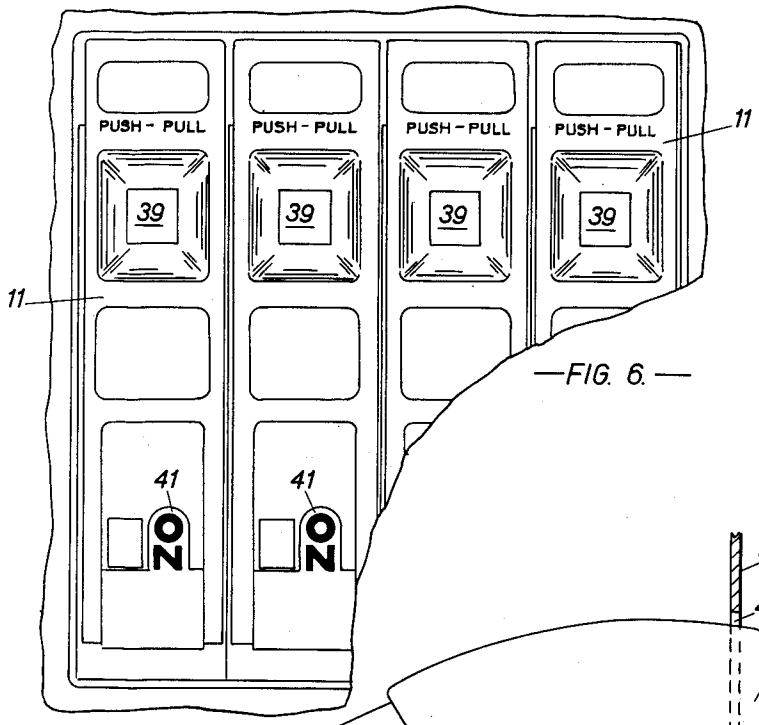
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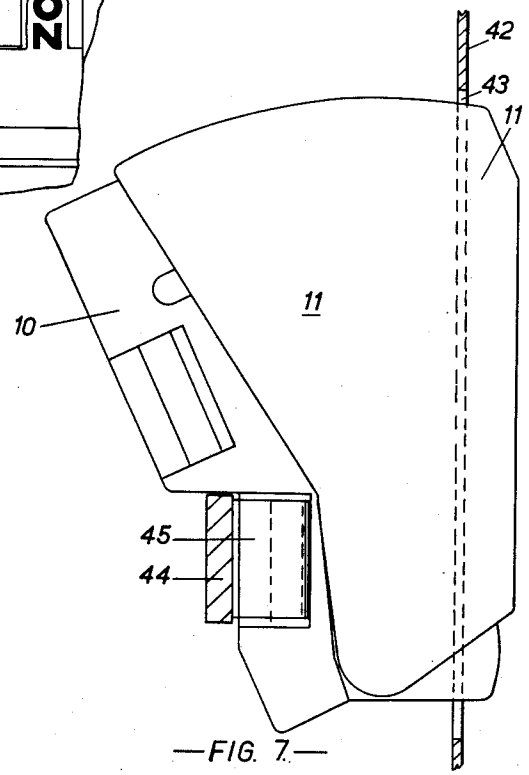
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—FIG. 6.—



—FIG. 7.—

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United States Patent Office 3,030,470 Patented Apr. 17, 1962

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AUTOMATIC ELECTRIC CIRCUIT BREAKERS

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Filed Sept. 29, 1959, Ser. No. 843,233
7 Claims. (Cl. 200—88)

This invention is for improvements in or relating to electric circuit breakers and temperature responsive electric switches.

One object of the invention is to provide a particularly compact or miniature circuit breaker.

A further object of the invention is to provide a fixed contact arrangement which will ensure good and reliable conductivity through the circuit breaker or switch.

According to one feature of the present invention there is provided an electric circuit breaker comprising a base part and a relatively movable lid or cover, relatively fixed and moving contacts, a latch or the like movably supported on the cover or lid and adapted to hold the moving contact in engagement with the fixed contact, and means responsive to overload conditions for releasing the moving contact from said latch or the like so as to allow the contacts to separate without movement of the cover (e.g. manually) to its open position also opening the circuit breaker.

According to a further feature of the present invention there is provided a temperature responsive electric switch comprising a temperature sensitive member carrying a contact adapted to be engaged between a pair of members, at least one of which is a contact, when the switch is closed, said temperature sensitive member being adapted to flex laterally, with respect to said pair of members, so as to release itself from a holding member or detent when the switch is required to open, the pair of members being arranged and/or constructed so that they do not interfere with said flexing movement of the temperature sensitive member.

In one embodiment of this feature of the invention the abutment members of said pair are arranged out of alignment one with the other. Alternatively or additionally one or both of the abutment members may be flexibly mounted.

In a preferred embodiment of the invention the circuit breaker includes a member or barrier of insulating material which, when the movable contact is released from the latch, takes up a position between the fixed and moving contacts. Conveniently this insulating member is a part of the latch.

The load sensitive means may comprise an electromagnet in the form of a loop located around a current-carrying member of the circuit breaker. Additionally or alternatively there may be a load sensitive means comprising a temperature responsive member through which current flows so that deflection of this temperature responsive member, at a predetermined overload current, will release the movable contact from the latch. Instead of passing the current through the temperature responsive member it may be located in proximity to a heater through which the current is arranged to flow.

The invention will be further described, by way of example, with reference to the accompanying drawings which show the invention applied to a miniature circuit breaker. In the drawings:

FIGURE 1 is a side elevation of the circuit breaker with the parts in the On position,

FIGURE 2 is a front view of the circuit breaker with the parts in the Tripped position but before the parts have been moved manually to an "isolated" position.

FIGURE 3 is a sectional view on the line III—III of FIGURE 4,

FIGURE 4 is a sectional view on the line IV—IV of FIGURE 1,

FIGURE 5 is a side view of the circuit breaker with the parts in the position they occupy when the circuit breaker is moved manually to an "isolated" position,

FIGURE 6 is a front view showing a series of circuit breakers according to the invention neatly and compactly arranged in side-by-side relationship, and

FIGURE 7 is a side view showing how a circuit breaker according to the invention can be recess-mounted.

Referring to the drawing, the circuit breaker comprises a hollow base part **10** and a cover or lid **11** which is hinged to the hollow base part as indicated at **12**. Conveniently the base part and lid are moulded to shape from insulating material. It will be noted from FIGURES 2 and 4 that the base part and lid are of relatively narrow form so that the circuit breaker as a whole is of compact construction.

Mounted in the base **10** is a fixed contact assembly **13** (to be hereinafter described in detail) which is adapted to be connected to the external circuit by, by example, a plug and socket connecting arrangement as indicated at **14**.

The movable contact assembly of the circuit breaker includes a bi-metallic arm **15** which is pivoted on the pivot pin **12** and is also adapted to be connected to the external circuit by, for example, a plug and socket type of connection as indicated at **14***a*.

The switch mechanism includes a latch **16** of insulating material and having a latch part proper **17** adapted to engage a catch or part **18** on the switch arm **15**, the latch being formed integrally with a tail part **19** for the purpose hereinafter to be described. The latch **16** carries an armature **20** adapted to be attracted by an electro-magnet formed by a split or open loop of magnetic material **21** arranged around the upper part **22** of the fixed contact assembly. Means may be provided for adjusting the air gap between the armature **20** and the loop of magnetic material **21**.

The fixed contact assembly comprises two contact members proper **23** and **24**. The member **24** may constitute a renewable arcing tip. The two contact members **23** and **24** are secured together towards the upper part of the fixed contact assembly.

The movable contact assembly of the circuit breaker comprises, in addition to the bi-metallic arm or blade **15** a resilient moving contact proper **25** which is of U-cross-section and is adapted to be engaged between the two members **23** and **24** of the fixed contact assembly. One of the limbs of the movable contact member **25** is extended upwardly as indicated at **26** in FIGURE 4 and attached at its extremity by a bolt **27** to the upper extremity of the bi-metallic arm **15**. The bi-metallic arm **15** is arranged so that an increase in its temperature will cause it to flex in the direction of the arrow A (FIGURE 4) about the point **28**. The lower part **15***a* of the arm **15** need not necessarily be of bi-metallic material and is more rigid than the part **15**.

Located on the bolt **27** is a nut, having chamfered "flats," which forms the catch or part **18**, previously referred to, adapted to be engaged by the latch proper **17**. The nut **18** may be adjusted along the bolt **27** to obtain a desired setting of the circuit breaker and is held in any position of adjustment by means of a leaf spring **29**.

The flow of current through the circuit breaker is by way of the fixed contact members **23**, **24**, the contact **25**, the arm **26**, the bi-metallic arm or member **15**, **15***a*, and a bracket **30** which carries the pivot **12** and is connected to the terminal point **14***a*.

Movement of the arm **15** automatically to the Off

position when the circuit breaker is tripped, is halted by a stop **31**, carried by the base part **10**, which stop is adjustable so that the blade can be positioned correctly with respect to the other operating parts of the circuit breaker.

The cover **11** is releasably held in the closed position by, for example, a leaf spring **32** secured to the base part and having a part **33** adapted to snap under an abutment part **34** on the cover or lid.

The arm **15** is held in the closed position of the circuit breaker against the action of a spring **35** anchored at **36** to the arm **15** and at **37** to the cover or lid **11**.

The operation of the circuit breaker above described is as follows:

In the closed position of the circuit breaker as shown in FIGURE 1 it will be noted that the latch **17** is in engagement with the catch **18** so as to hold the arm **15** and the moving contact assembly in the closed position against the action of the spring **35** which is under tension. It will also be noted that the armature **20** on the latch member **16, 17** lies immediately under, but spaced from the electro-magnet **21.**

On the occurrence of a short circuit or other condition resulting in a momentary very heavy current flow, the armature **20** will be attracted to the magnet **21** and as a result the latch **17** will release the catch **18** and the movable contact assembly, under the action of the spring **35**, will fly to the Off position as indicated in FIGURE 3. It will be noted that the pivoted latching member **16** in following movement of the movable contact means to the open position, takes up a position in which it tends to inhibit arcing, the weight of the latch proper **17** and of the armature **20** serving to bias the latching member to this position. The tail piece **19** of the latch member **16** may bear on its face **38** (see FIGURE 3) the inscription "Trip" which becomes visible through a window **39** in the lid **11.**

Under prolonged overload conditions of a relatively moderate character not sufficient to operate the electro-magnet **20, 21,** there will be an increase in the temperature of the bi-metallic arm **15** and eventually when these overload conditions approach a predetermined limit the arm **15** will have flexed in the direction of the arrow "A" (see FIGURE 4) to such an extent that the catch or nut **18** will release itself from the latch **17** and the movable contact assembly will then fly into the open position under the action of the spring **35** and the parts will again take up the position indicated in FIGURE 3.

It will be appreciated from what has just been stated that the circuit breaker above described takes care not only of sudden heavy overloads such as result from short circuit conditions but also prolonged moderate overloads if the period of such overloads becomes dangerous.

It will be noted from FIGURE 2 that even when the circuit breaker has tripped the indication "On" a part **40** of the base **10** is still visible through an aperture **41** provided on the lid **11** (see FIGURE 3). This is a safety precaution and in order to "isolate" the circuit breaker it is necessary to swing the lid member **11** outwardly as shown in FIGURE 5 against the action of its holding spring **33.** Even if the circuit breaker should accidentally have "stuck in" (due to having been used on more onerous loads than those to which it is intended), this will ensure that it is moved physically to the open position, having regard to the fact that the latch member **16, 17** is attached to the movable lid **11.**

In order to re-set the circuit breaker after it has tripped, it is necessary first to move the lid **11** to the position shown in FIGURE 5. In this position it will be noticed that the latch **17** has become re-engaged with the catch **18.** Consequently when the lid **11** is moved forwardly again into the closed position the latch will push the movable contact arm **15** into the closed position and will hold it in this position until released either by the operation of the electro-magnet **20, 21** or the bi-metallic arm **15.**

It will be noted that the actual contact surfaces of the contacts **23** and **24** (which are indicated diagrammatically in FIGURE 4) are located out of alignment with one another. This enables the arm **15** to flex about the point **28** without undue interference by the contact members **23, 24.** If these contact members were arranged in alignment by, for example, locating the contact **23** at **23*a*** as indicated in FIGURE 4, there might be serious interference with the movement of the bi-metallic arm **15** and the circuit breaker would probably fail to operate. This contact arrangement can be applied with advantage to temperature responsive switches other than circuit breakers.

A series of circuit breakers as above described may be assembled compactly side by side as shown in FIGURE 6 and conveniently they are attached to a common supporting bar by clips or the like so that any one circuit breaker can be removed easily when required. Preferably each circuit breaker or the several circuit breakers will be enclosed behind a front cover having a removable front plate with an opening just sufficiently large to enable the lid **11** to be pulled outwardly when required.

In the arrangement shown in FIGURE 7 the circuit breaker is mounted in a cavity or recess behind a front plate **42** and it will be noted that the lid **11** projects by only a small amount beyond the front plate. The latter has an opening **43** to permit the lid **11** to be moved from the closed to the open position and vice versa. The body of the circuit breaker **10** is supported on a bar **44,** which may carry several circuit breakers in side-by-side relationship by means of a clip **45** on each circuit breaker.

The circuit breaker can, of course, be operated manually by means of the lid **11** from the closed to the open position, i.e. the lid will be moved from the position shown in FIGURE 1 right through to the position shown in FIGURE 5. In this case the opening action will be relatively slow and the insulating part **16** of the trip member will not be interposed between the fixed and moving contacts. In the position shown in FIGURE 5 the "On" indication is covered by the lid. By having the "On" position showing when the contactor has "tripped" but not when it has been opened manually, it is possible to discriminate on rapid inspection of several circuit breakers between those which have opened automatically due to a fault or overload and those which have been opened by hand.

Whilst the invention has been described more particularly as applied to a single pole electrical circuit breaker, it will be appreciated that it can be applied to multi-pole circuit breakers.

The adjustable screw **31** also forms a stop for limiting outward movement of the cover **11** to its open position as shown in FIGURE 5.

The lid **11** may be provided with a recess or other device or devices to enable it readily to be gripped by the hand to facilitate movement of it to the open position.

It will be appreciated that the circuit breaker need not necessarily incorporate operation by both a temperature sensitive member and an electro-magnetic means. It may incorporate one or the other or both as desired. It will be appreciated, however, that where the circuit breaker is provided with both a temperature sensitive control and electro-magnetic operation, there will be an integrating effect between the two which has certain advantages. In this connection it should be noted that the catch-nut **18** is chamfered so that as it is moved laterally by the temperature sensitive member there can be, if desired, progressive decrease in the amount the latch **17** must lift under the action of the electro-magnet **21** in order to release said catch-nut and thereby the arm **15.**

An arc barrier **46** (see FIGURE 4) may be provided to protect the latch **17.**

The circuit breaker may include within its casing an early making late breaking neutral switch (i.e. a switch

in a neutral link through the circuit breaker) adapted to be operated by the main moving contact.

I claim:

1. An electric circuit breaker comprising a base part, fixed contact means on said base part, movable contact means having a pivotal support on said base part and operative to engage said fixed contact means, a spring acting to disengage the fixed contact means from the moving contact means, a cover enclosing said fixed and movable contact means, means pivotally supporting said cover on the base part, a latch pivotally supported on said cover, a catch on the movable contact means engageable by said latch so that the latter holds the movable contact means in engagement with the fixed contact means against the action of said spring so long as the cover is closed, said latch having a bias so that it follows movement of the movable contact means to an open position under the action of said spring, electric-load sensitive means operative to disengage said latch and catch on the occurrence of an overload, the latch, when following movement of the movable contact means to the open position, positioning itself so that when the cover is swung about its pivot to open the circuit breaker said latch and catch re-engage and the cover is operative when moved back to its closed position to re-engage the movable contact means with the fixed contact means, the cover also being operative when moved to its open position and if the latch and catch are engaged to open the circuit breaker.

2. An electric circuit breaker comprising a base part, fixed contact means on said base part, movable contact means having a pivotal support on said base part and operative to engage said fixed contact means, a spring acting to disengage the fixed contact means from the moving contact means, a cover enclosing said fixed and movable contact means, means pivotally supporting said cover on the base part, a latch including an arc barrier part of insulating material pivotally supported on said cover, a catch on the movable contact means engageable by said latch so that the latter holds the movable contact means in engagement with the fixed contact means against the action of said spring so long as the cover is closed, said latch having a bias so that it follows movement of the movable contact means to an open position under the action of said spring, electric-load sensitive means operative to disengage said latch and catch on the occurrence of an overload, the latch, when following movement of the movable contact means to the open position, positioning itself so that the arc barrier part lies between the fixed and movable contact means and when the cover is swung about its pivot to open the circuit breaker said latch and catch re-engage and the cover is operative when moved back to its closed position to re-engage the movable contact means with the fixed contact means, the cover also being operative when moved to its open position and if the latch and catch are engaged to open the circuit breaker.

3. An electric circuit breaker comprising a base part, fixed contact means on said base part, movable contact means having a pivotal support on said base part and operative to engage said fixed contact means, a spring acting to disengage the fixed contact means from the moving contact means, a cover enclosing said fixed and movable contact means, means pivotally supporting said cover on the base part, a latch pivotally supported on said cover, a catch on the movable contact means engageable by said latch so that the latter holds the movable contact means in engagement with the fixed contact means against the action of said spring so long as the cover is closed, said latch having a bias so that it follows movement of the movable contact means to an open position under the action of said spring, electric-load sensitive means comprising an electro-magnet in the form of a loop of magnetic material located around a current carrying member of the circuit breaker and a temperature responsive member and heating means therefor through which current through the circuit breaker flows and operative to disengage said latch and catch on the occurrence of an overload, the latch, when following movement of the movable contact means to the open position, positioning itself so that when the cover is swung about its pivot to open the circuit breaker said latch and catch re-engage and the cover is operative when moved back to its closed position to re-engage the movable contact means with the fixed contact means, the cover also being operative when moved to its open position and if the latch and catch are engaged to open the circuit breaker.

4. An electric circuit breaker comprising a base part, fixed contact means on said base part, movable contact means including a temperature responsive part and having a pivotal support on said base part and operative to engage said fixed contact means, a spring acting to disengage the fixed contact means from the moving contact means, a cover enclosing said fixed and movable contact means, means pivotally supporting said cover on the base part, a latch pivotally supported on said cover, a catch on the movable contact means engageable by said latch so that the latter holds the movable contact means in engagement with the fixed contact means against the action of said spring so long as the cover is closed, said latch having a bias so that it follows movement of the movable contact means to an open position under the action of said spring, a heater means in proximity to the temperature responsive part of the movable contact means and through which current through the circuit breaker flows and operative by flexing said part laterally to disengage the catch from the latch on the occurrence of a prolonged moderate overload, electric load sensitive means comprising an electro-magnet operative by moving the latch to disengage said latch and catch on the occurrence of a short-circuit overload, the latch, when following movement of the movable contact means to the open position, positioning itself so that when the cover is swung about its pivot to open the circuit breaker said latch and catch re-engage and the cover is operative when moved back to its closed position to re-engage the movable contact means with the fixed contact means, the cover also being operative when moved to its open position and if the latch and catch are engaged to open the circuit breaker.

5. An electric circuit breaker as claimed in claim 4 wherein the catch is chamfered.

6. An electric circuit breaker as claimed in claim 4 and having two fixed contact members which receive the movable contact between them, said fixed contacts being located out of alignment whereby they do not interfere with the flexing movement of the temperature responsive member.

7. An electric circuit breaker as claimed in claim 4 and having two fixed contact members which receive the movable contact member between them, at least one of said movable contact members having a flexible mounting so as not to interfere with the flexing movement of the temperature responsive member.

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