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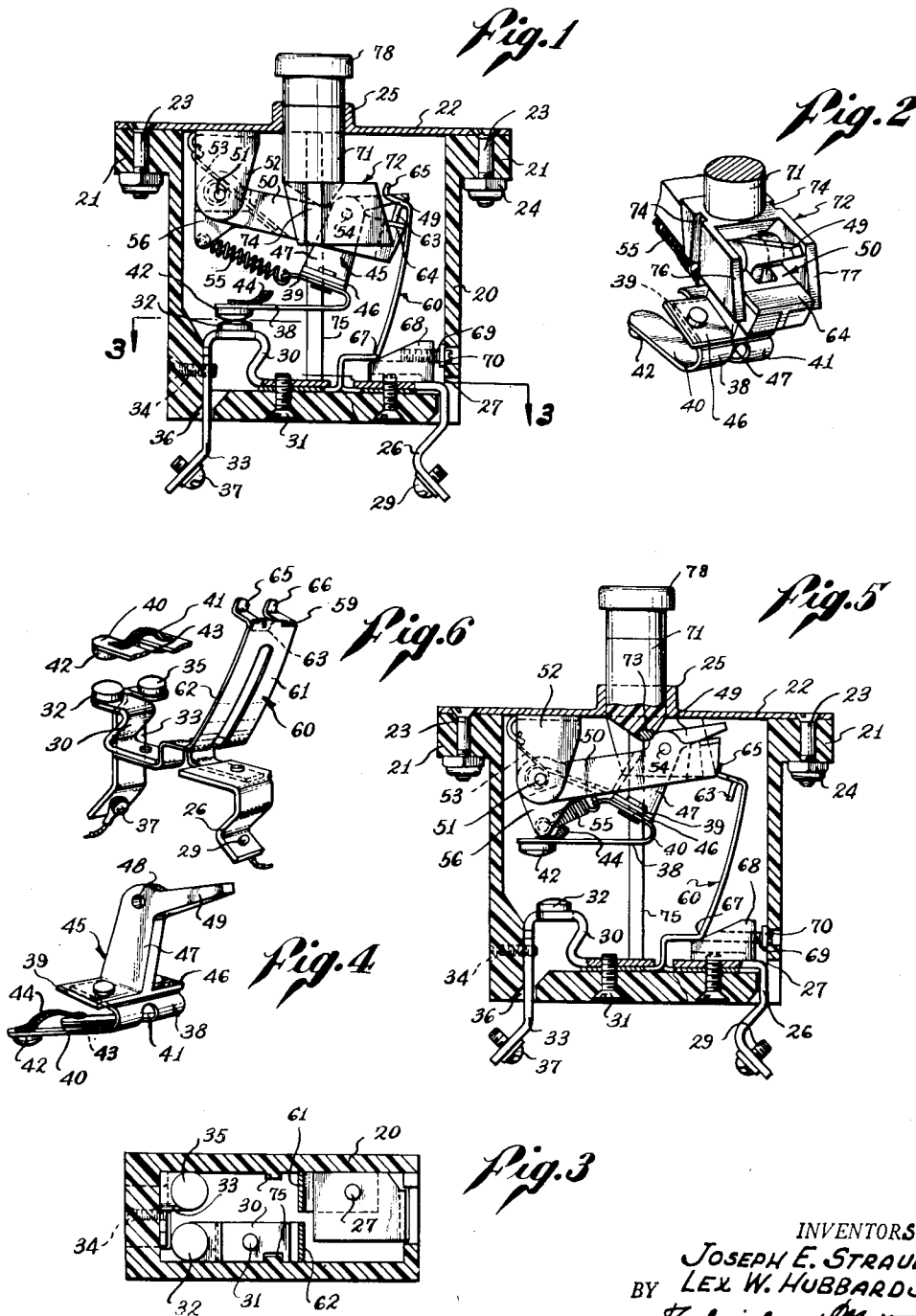
J. E. STRAUB ET AL

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THERMALLY OPERATED ELECTRICAL CIRCUIT BREAKER

Filed Oct. 13, 1951

2 Sheets-Sheet 1



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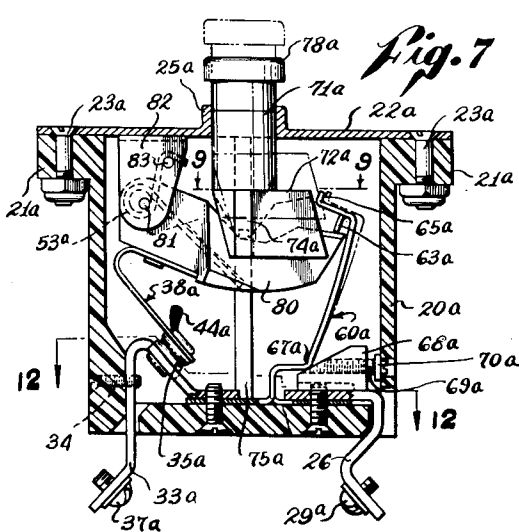
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UNITED STATES PATENT OFFICE

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THERMALLY OPERATED ELECTRICAL
CIRCUIT BREAKERJoseph E. Straub, Manhattan Beach, and Lex W.
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11 Claims. (Cl. 200—116)

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Our invention relates generally to electrical circuit protectors, and more particularly to thermally operated overload circuit breakers.

In providing a circuit breaker of the kind to which the invention relates, there are a number of special features which should be incorporated, depending somewhat upon the use or application to which the device is put. For example, the present circuit breaker is designed with the requirements of aircraft in mind, but it will be appreciated that the device is not restricted to this field, but may be used wherever its features are advantageous.

Among such features may be mentioned the arrangement of the parts in a housing of small dimensions which conform to military specifications, and may be interchangeably mounted with other similar standard components in military as well as civilian planes. In addition, the housing of our overload circuit breaker is substantially dust-proof, thus avoiding deterioration of the contacts from the deposit of dirt thereon, and minimizing fire hazards due to arcing during the opening of the breaker contacts.

Although the dimensions of the device should be small, the parts should be rugged so that long life and full efficiency in operation are ensured, and in addition the parts should be few in number to facilitate any repair or replacement of parts that may be necessary.

With the above-mentioned requirements in mind and with others later referred to, it is an object of our invention to provide a thermally-operated circuit breaker comprising relatively few parts of ample strength arranged in a small dust-proof case which can be very simply installed in place and as readily removed for repair or inspection.

It is a further object of our invention to provide, a circuit breaker having contacts that move together with a wiping action, thus ensuring that the contact surfaces remain clean and provide a low resistance path for the current. Additionally, with our design, we provide a snap opening of the contacts and wide separation thereof, while incorporating a double gap form of construction that has the advantage of affording additional air insulation between the contacts, particularly desirable at high altitude or wherever heavy currents are controlled.

It is another object of the invention to mount the movable contacts of the circuit breaker of our invention on individual resilient members so that proper engagement is assured between the fixed and movable contacts, the arrangement being such that there is no substantial current flow through the resilient mounting members, thus preventing the danger of deterioration of such members due to heat generated by the flow of electric current therethrough.

A further object of our invention is to provide

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a thermally-operated circuit breaker which also may be manually operated, and in at least one form, the manually operable means may be used to hold the device in closed circuit condition during emergency conditions, despite the overload that would normally trip the breaker.

A still further object of the invention is to provide a thermally-operated circuit breaker having various advantageous features, yet comprising relatively few parts adapted to be quickly and accurately assembled into a complete unit.

Further features and objects of our invention will hereinafter appear from the following specification describing preferred embodiments of our invention illustrated in the accompanying drawings, in which:

Fig. 1 is a vertical cross-section of a preferred form of the overload circuit breaker constructed according to our invention, the section being taken just within one side wall of a case in which the device is mounted, the parts being shown in the circuit closed position;

Fig. 2 is a fragmentary perspective view of the carrier mechanism for the movable contacts shown in Fig. 1;

Fig. 3 is a cross-section on the line 3—3 of Fig. 1;

Fig. 4 is a perspective view, drawn on a larger scale of the contact support shown in Figs. 1 and 2;

Fig. 5 is a view similar to Fig. 1, but showing the circuit breaker in open position, a portion of the inward end of the manual operating member being sectioned to show the shape thereof;

Fig. 6 is a perspective view of the current carrying members of our circuit breaker, with the fixed and movable contacts separated in open circuit position;

Fig. 7 is a vertical cross-section taken just within a side wall of the housing of a modified form of the invention, showing the circuit breaker in circuit closed position, the position of a bimetallic strip just before manual opening of the circuit breaker being shown in dotted lines;

Fig. 8 is a central vertical section through the device shown in Fig. 7, but showing the parts in open circuit position;

Fig. 9 is a fragmentary cross-section on the line 9—9 of Fig. 7;

Fig. 10 is a perspective view of the movable contact carrier shown in Figs. 7 and 8;

Fig. 11 is a perspective view of a bimetallic part utilized in all the illustrated embodiments of our invention;

Fig. 12 is a cross-section on the line 12—12 of Fig. 7;

Fig. 13 is a vertical sectional view through a second modified form of the device; and

Fig. 14 is a view similar to Fig. 13, but showing the device in an open-circuit position.

Referring now to Fig. 1 of the drawings, the

numeral 20 indicates a case or housing, preferably of insulating material in which all the mechanism of the device is enclosed. The illustrated case is in the form of a narrow box having an open side or top with flanges 21 at the upper ends thereof. The open side of the case is closed by a plate 22 secured to flanges 21 by suitable tamper-proof means such as a hollow rivet 23, and the plate is formed with a central opening surrounded by an upstanding flange 25.

A lug 26 is secured toward one end of the bottom of the case 20, the lug projecting outwardly of the casing through a slot 27 to provide one terminal of the circuit breaker to which a wire or lead of an electrical circuit may be connected. A second lug 30, having a generally Z-shape, is secured to the opposite end of the bottom of the case, and a fixed contact 32 is mounted on the upper horizontal arm of the lug 30.

A third lug 33, best seen in Figs. 3 and 6, has a vertical portion secured to the adjacent end wall of the case and its upper end extends horizontally to receive second fixed contact 35 in lateral alignment with fixed contact 32. The lower end of lug 33 projects through a slot 36 in the bottom of the case 20 to provide the other terminal 37 of the circuit breaker. To reduce the opportunity for dust to enter the case or housing 20, the slots 27 and 36 may be closed with a sealing compound (not shown) in any well-known manner.

A movable contact member, generally indicated at 38, and best shown in Fig. 4, is adapted to bear against fixed contacts 32 and 35 and complete a circuit from one to the other. Member 38 preferably consists of a plate 39 having resilient arms 40 and 41, at the ends of which are mounted movable contacts 42 and 43, respectively, adapted to engage against fixed contacts 32 and 35. A flexible conductor 44 extends between movable contacts 42 and 43 to provide a bridging connection, while permitting limited independent movement of the movable contacts.

Plate 39 is mounted on a movable contact support, generally indicated at 45, which comprises a plate-like base 46 to which plate 39 is attached. A lug 47 extends upwardly from the base 46 and has a hole 48 in its upper end, while an arm 49 projects laterally from the upper end of the lug in a manner similar to a bell-crank.

The movable contact support 45 is attached to a movable contact arm 50, preferably formed of insulating material, which is pivoted at one end on a pin 51 passed through the arms of a small bracket 52 secured to the top plate 22. A spring 53 has one end secured to the bracket 52 and the other end attached to the arm 50 to snap the free end of the contact arm upwardly when freed from a bimetallic latching member described hereinafter which holds the arm in downward position when the circuit breaker is closed.

The contact support lug 47 is pivotally attached to arm 50 near the free end of the arm by a pin 54, and a tension spring 55 is connected between the projection of plate 39 and a projection 56 at the pivoted end of the contact arm. The action of the spring 55 is to urge the contact support 45 carrying the movable contacts 42 and 43, about the pin 54 in a manner to separate the movable contacts from the fixed contacts 32 and 35. As seen in Figs. 1 and 5, this rotation of the contact support is in a clockwise direction.

A bimetallic member, generally indicated at 60 and best shown in Figs. 6 and 11, is of generally

inverted U shape, having one arm 61 that is turned backward near its end and secured to lug 26, while arm 62 is bent forwardly and connected to lug 30. This connection of the bimetallic strip is identical in all the illustrated embodiments and provides an electrical path, when the device is in circuit-closed position, from one lead-in lug, through one arm of the bimetallic member, through a bridge portion 59 connecting the arms, through the other arm and through the double movable and fixed contacts 42, 43, and 32, 35, respectively, and the other lead-in lug. As an additional safety precaution, independently of the normal operation of the circuit breaker, the bimetallic member 60 may be so proportioned as to fuse at a predetermined point under a current overload greater than the normal current-interrupting setting of the device.

At its free end, the bimetallic member 60 is provided with an intumed catch or tang 63 which engages the upper end surface of contact arm 50, where a metal plate or sear 64 is preferably located to reduce the wear on the softer arm. The free end of the bimetallic member is also provided with fingers 65, 66 which are bent forwardly and then backwardly and upwardly for cooperation with a manually operable member by which the circuit breaker may be manually tripped. The horizontally extending arm 49 of the movable contact support 45 is of a length to bear against the upper end of the bimetallic member between fingers 65 and 66, above the tang 63, when the member is in its normal condition adapted to hold the contact arm 50 in lowered position. Under these conditions, the arm 49 engages the bimetallic member 60 before the tang 63 engages the sear 64, and continued downward movement of the arm to latched position will rotate contact support 45 and bring the movable contacts into position to engage with the fixed contacts.

In order to adjust and calibrate the action of the circuit breaker after it has been assembled, we form the bimetallic member 60 with a re-entrant portion toward its fixed end, affording an angular knee 67. A heat-resistant slidable wedge 68 is located on the surface of lug 26 and may be adjustably forced against the knee 67 to stress it to a greater or less degree, thereby controlling the amount of heating of the bimetallic member 60 required to release the contact bar 50.

The wedge 68 is adjusted by a small threaded rod 69 working in a threaded hole provided in the wedge and provided with a collar 70 bearing against the adjacent end wall of the case. The outer end of the rod 69 projects into a hole formed in said wall and is slotted so that the position of the wedge may be adjusted from the exterior of the case by the use of a small screw driver. After adjustment, the hole in the case may be filled with sealing wax or the like, thus preventing tampering with the setting of the device. The further the wedge is forced under the knee 67 of the bimetallic member, the greater is the force required to free the catch 63 from the contact arm 50 and therefore the greater is the current that will be carried by the bimetallic member before tripping the circuit breaker.

The manual operating member of the device comprises a plunger 71 having a head 72 (Fig. 2) whose undersurface is channeled to receive the contact arm 50 without interfering with the operation of arm 49, the inner face of the head 71 preferably being formed to afford line contact

with the upper surface of the contact arm as shown in Fig. 5. If desired, a wear piece 73 of suitable material may be inserted in the head at the area of contact with arm 50. The side faces of the head 72 are formed to interfit slidably with the inner faces of the side walls of the case and are thereby guided for vertical movement. As shown in the drawings by way of example, the side faces of the head 72 are formed with vertical grooves 74 (Fig. 2) that receive ribs 75 on the walls of the case. In order to provide a visual signal that the device is tripped, we prefer to have that portion of the plunger 71 that is always visible colored black, for example, while that portion which is hidden from sight when the circuit is closed, colored red, for example. In this manner, when the circuit breaker is tripped and the plunger 71 is extended upwardly, a red portion will be visible.

The edge of head 72 is provided with cam faces 76 and 77 that engage with fingers 65 and 66 of the bimetallic member, the cam faces 76, 77 sloping backward, toward the pin 51, from their lower to their upper ends. In this manner, upward movement of the head 72 causes the cam faces 76 and 77 to force the fingers 65 and 66 away from the contact arm 50 until the latter is released from the catch 63. An enlarged cap 78 may conveniently be applied to the outer end of the plunger 71 to enable the plunger to be more easily grasped and moved. The manually operable parts are preferably made of insulating material, as are the contact arm 50 and case 20 so that there is no danger of current flow to exterior parts of the device. Further, there is no substantial current flow through any primarily resilient or spring members and consequently deterioration of such parts due to heating by the electric current is prevented.

In the operation of our device, the circuit is closed by pressing inwardly on the cap 78 on plunger 71, thereby pivoting the contacts arm 50 against the urging of the spring 53, in a clockwise direction as seen in Figs. 1 and 5. The arm 49 of contact support, originally held in its released position by spring 55, as seen in Fig. 5, engages the upper end of the bimetallic member 60 as the contact arm 50 pivots, and the contact support rotates about the pin 54 in a counterclockwise direction as the plunger 71 continues its inward travel. Shortly before the tang 63 snaps over the sear 64, the movable contacts 42 and 43 engage the fixed contacts 32 and 33 and are thereafter wiped across the fixed contacts by reason of the pivoting of the contact support 45, thereby ensuring good electrical connection.

To open the circuit manually, the cap with attached plunger 71 is pulled outwardly, thus moving the head 72 upwardly so that the cam faces 76 and 77 force the fingers 65 and 66 of the bimetallic member 60 away from the contact arm 50. This disengages the tang 63 from the sear 64, and the contact arm 50 snaps upwardly, in a counterclockwise direction, as seen in Figs. 1 and 5, separating the movable contacts 42 and 43 from fixed contacts 32 and 33.

When the circuit breaker is closed and an overload occurs, the bimetallic member 60 is heated by the passage of current through it, the heat being sufficient to distort the member temporarily, causing it to move away from the contact arm 50 and disengage the tang 63 from the sear 64. The movable contacts 42 and 43 thus separate from the fixed contacts 32 and 33, as described in the manual opening of the breaker.

Should an attempt be made to keep the circuit breaker closed by pressing inwardly on the cap 78 on plunger 71 while an overload occurs, the breaker will still open. This "trip-free" operation is very desirable where it is essential that an overload not be permitted to exist for any length of time. In our breaker, such operation is provided by the action of the contact support 45 which is pivotally mounted on the contact arm 50. It will be appreciated that when the bimetallic member 60 is moved away from the contact arm 50 to release the latter, the end of the arm 49 of the contact support 45 is also released from engagement with the upper end of the bimetallic member. The spring 55 immediately snaps the contact support 45 about the pin 54, in a clockwise direction as seen in Figs. 1 and 5, separating the movable contacts 42 and 43 from the fixed contacts 32 and 33 and opening the circuit. This action of the movable contacts will occur whether the contact arm 50 is held against movement or not, since it is only the movement of the contact support 45 that is necessary to open the circuit.

The embodiment of our invention shown in Figs. 7 through 12 differs from that shown in Figs. 1 through 6 in that the movable contacts are mounted directly on the contact arm.

It is not thought necessary to again describe parts identical with, or immaterially different from, those already described and such parts are indicated by the same numerals as in Figs. 1 through 6, with the addition of the letter "a," and in Figs. 13 and 14, by the addition of the letter "b."

The contact arm 30, preferably formed of an insulating material, is pivoted at one end on a pin 81 secured in the arms of a small bracket 82 mounted on the case plate 22a. A spring 53a is connected to the contact arm 30 in a manner to snap the arm upwardly, away from the fixed contacts 22a and 35a, when the arm is released from engagement with the bimetallic member 60a. In this connection, the latching and release of the contact arm 30 by the bimetallic member 60a is similar to the corresponding operations as performed by the contact arm 50 and the bimetallic member 60 of the form previously described. However, in the form of circuit breaker shown in Figs. 7 through 12, the movable contacts 42a and 43a are carried by a movable contact member 32a that is attached directly to the contact arm 30. Consequently, the circuit breaker can be opened or closed only by movement of the contact arm 30, since there is no element corresponding to the movable contact support 45.

In the forms of the invention shown in Figs. 1 through 6, and 7 through 12, both forms including the bimetallic member shown in Fig. 10, the circuit through the device can be broken by pulling out the plunger 71 since by so doing the cam face on the head 72 or 72a will engage the fingers 65, 66 on the free end of the bimetallic member and push the catch 63 off the end of the contact arms.

In the form of the invention shown in Figs. 7 through 12, in distinction to the form shown in Figs. 1 through 6, the circuit breaker contacts can be held closed, although the bimetallic member may have released the contact arm, by manually pressing down the operating plunger cap 78a. Such a procedure would obviously only be used when an emergency arises that requires the closing of an electrical circuit regardless of the possible damage to equipment that may be con-

nected thereto. As an example, emergency operation of certain equipment on an airplane is sometimes necessary to prevent a crash.

In the embodiment of the invention illustrated in Figs. 13 and 14, a pivotable handle 102 is employed instead of the plunger operating means of the other embodiments illustrated. The circuit breaker is mounted in a case 86 that may be open on one side and covered by a plate (not shown) secured to the case by any suitable means. The case 86 is formed with an outwardly angled side 88 on which are supported the fixed contacts 89, which are double but in which only the one nearest the observer is seen in the Figures 13 and 14.

The bimetallic member 60b is attached to the bottom of the case and a lead-in lug 91 is connected to one leg 61b of the bimetallic member, and extends outwardly through a slot 92 in the wall of the case. A screw or terminal 93 is provided on the end of the lug 91 for securing an electrical lead to said lug. The other arm 62b of the bimetallic member 60b is secured to the bottom of the case, and a lug 95 is also connected to the latter arm, one fixed contact 89 being mounted on this lug.

A third lug 96 is secured to the angularly positioned wall 88, and the second fixed contact is mounted on lug 96, which is extended through the wall of the case and fitted similarly to lug 91.

The movable contact assembly, generally indicated at 38b, is mounted directly on a contact arm 97 pivoted at one end on a pin 98 secured in the case. A spring 99 is connected to the contact arm 97 to snap the arm upwardly about its pivot when released by the bimetallic member 60b.

The manual operating member comprises a molded member 100 with a body portion 101 having an arcuate periphery fitting in an arcuate recess in the top of the case 86. A finger piece 102 projects through a slot in the wall of the case and communicates with the recess. The operating member 100 is pivoted on a pin 103 mounted in the side wall 104 of the case 86, the operating member being arranged to substantially close the slot through the wall of the case in all positions. The surface of the body portion 101, opposite the finger piece 102, is formed to provide a cam 105 engaging against the surface of the contact arm 97, the lobe of the cam bearing against the contact arm at all times. In circuit-open position, the finger piece 102 will be held to one end of the slot in the case as shown in Fig. 14, and is moved to the opposite end of the slot to close the breaker contacts.

In order to manually trip the device, the body portion 101 is provided with further cam portions formed on the edges of a pair of plates 106 lying against the sides of the contact arm 97 with their edges contacting the fingers extending from the free end of the bimetallic member. The contour of cam plates 106 is such that in the circuit-open position shown in Fig. 14, the fingers are pushed away from the contact arm so that catch 63b is pushed off the contact arm. In the circuit-closed position, the cam plates 106 permit the fingers to move toward the contact arm and the catch 63b to engage over the end thereof if the bimetallic member is in normal condition and has not been flexed away from the contact arm by the effects of heat due to an overload current.

It will be seen that in the embodiment of the invention described with reference to Figs. 13 and 14, the contacts of the circuit breaker may be held closed manually in emergency.

It will be noted that the circuit breaker of our invention, although of simple construction, may be produced in forms adapted to various conditions, and preferably is mounted in a completely closed case. In the form shown in Figs. 1 through 12, the fixed contacts and bimetallic member and initial adjustment or preloading means for the latter, are mounted in the case, while the movable contacts, contact arm, spring or springs, and manually operable means are mounted on a cover plate. This arrangement makes for rapid production since one production line can assemble the parts carried by the case and another line can assemble the parts mounted on the plate secured to the case.

In the form shown in Figs. 13 and 14, all parts are mounted on the case, but can be easily positioned through the open side of the case. Adjusting or preloading means for the bimetallic member, such as the slidable wedge 68 shown in the preferred form, may be readily incorporated in this embodiment if desired.

Each form of the invention may be used as an "on-off" switch, though they are not designed primarily for this purpose. A wiping contact between fixed and moving contacts is provided by mounting the movable contacts on a pivoted contact arm so that the movable contacts are dragged over the fixed contact surfaces in reaching finally engaged position.

It will be appreciated that while we have described the various forms of our circuit breakers as having a "top," "bottom," "side," etc., these words, as well as the descriptions "upper," "lower," etc. are used for convenience in describing the devices as shown in the drawings. Since the circuit breakers are not dependent upon the force of gravity for their operation, but instead rely upon resilient means such as springs, the breakers will operate satisfactorily in any position, in addition to that shown in the drawings.

While we have particularly described and shown embodiments of our invention at present considered preferable by us, it is to be understood that various changes and modifications may be made in said embodiments by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

We claim:

1. A circuit breaker including: a mounting member supporting the circuit breaker parts; a bimetallic member having a pair of arms connected together at one end, and secured at their other ends to the mounting member in series in an electric circuit; means projecting from the connected together ends of said arms; fixed contact means secured to said mounting member; a movable contact arm; movable contact means mounted on said contact arm; a catch mounted on said bimetallic member and adapted to engage with said contact arm when the latter is in circuit-closed position to hold the movable contact means against the fixed contact means and to release said arm when the bimetallic member is distorted by heat generated by an electric current exceeding a predetermined value; means tending to snap said contact arm and movable contact means carried thereby away from the fixed contact means when the contact arm is released by said catch on the bimetallic member; and manually operable means having a part engaging against the contact arm and a cam face formed on said part adapted to engage with the means projecting from the bimetallic member to force the catch on the latter member off the contact

arm when said manually operable member is moved in one direction, and to engage said contact arm with said catch when moved in the opposite direction and the bimetallic member is in undistorted condition.

2. A circuit breaker including: a bimetallic member having a pair of arms connected together at one end, one arm being connected at its other end to a lead of an electric circuit in which the circuit breaker is incorporated; a first fixed contact connected to the other arm of the bimetallic member; a movable contact arm guided for movement toward said fixed contact; a pair of movable contacts mounted on the contact arm and connected together by a conductive member, one of said movable contacts being arranged to make and break circuit with the first fixed contact; a second fixed contact insulated from the first fixed contact and connected to a lead of the electric circuit, the second movable contact being arranged to make and break contact with said second fixed contact; a catch mounted on said bimetallic member and adapted to engage with said contact arm when the latter is in circuit-closed position to hold the movable contact means against the fixed contact means and to release said arm when the bimetallic member is distorted by heat generated by excessive electric current, the current path being provided through said bimetallic member and said contacts; resilient means tending to move said contact arm and movable contact means carried thereby away from the fixed contact means when the contact arm is released by the catch on said bimetallic member to break the current path; and manually operable double-acting means effective when moved in one direction to release said contact arm from said catch and when moved in the opposite direction to engage said contact arm with said catch.

3. A circuit breaker as set forth in claim 2 which also includes a pair of resilient arms connected to the movable contact arm at one end and each supporting a movable contact at its other end, thereby assuring accurate engagement of the movable contacts with the fixed contacts.

4. A circuit breaker including: a case in which the circuit breaker mechanism is enclosed; a removable cover closing said case; a bimetallic member having a pair of arms connected together at one end; a first electrical lead member secured within the case and connected to the other end of one arm of the bimetallic member and extending through a wall of the case; a first fixed contact secured within the case and connected to the other end of the other arm of the bimetallic member; a second fixed contact secured within the case in spaced relation to the first fixed contact; a second electric lead member connected to the second fixed contact and extending through a wall of the case; a movable contact arm guided for movement in said case; movable contact means mounted on said movable contact arm; a catch mounted on said bimetallic member and adapted to engage with said contact arm when the latter is in circuit-closed position to hold the movable contact means against the fixed contact means and to release said arm when the bimetallic member is distorted by heat generated by an electric current exceeding a predetermined value, the current path being provided through said bimetallic member and said contacts; resilient means tending to snap said contact arm and movable contact means carried thereby away from the fixed contact means when

the contact arm is released by the catch on said bimetallic member to break the current path; an operating member extending through, and in dust-excluding relation with, an opening in a wall of the case; and means effective, when actuated by movement of the operating member in one direction to release said contact arm from said catch, and when moved in the opposite direction to engage said contact arm with said catch when the bimetallic member is in undistorted condition.

5. A circuit breaker including: a case in which the circuit breaker mechanism is enclosed; a removable cover adapted to close said case; a bimetallic member having a pair of arms; a first electrical lead member connected to one arm of the bimetallic member and extending through a wall of the case; a first fixed contact connected to the other arm of the bimetallic member; a second fixed contact in spaced relation to the first fixed contact; a second electric lead member connected to said second fixed contact and extending through a wall of the case; a movable contact arm guided for movement in said case; movable contact means mounted on said movable contact arm; catch means mounted on said bimetallic member and adapted to engage with said contact arm when the latter is in circuit-closed position to hold the movable contact means against the fixed contact means and to release said arm when the bimetallic member is distorted by heat generated by an electric current exceeding a predetermined value, the current path being provided through said bimetallic member and said contacts; resilient means tending to snap said contact arm and movable contact means carried thereby away from the fixed contact means when the contact arm is released by said catch means to break the current path; an operating member extending through, and in dust-excluding relation with an opening in a wall of the case; means effective, when actuated by movement of the operating member in one direction to release said contact arm, and when moved in the opposite direction to engage said contact arm with said catch means when the bimetallic member is in undistorted condition; and adjusting means for said bimetallic member extending into an opening in the wall of said case, whereby said adjusting means may be operated from the exterior of said case to adjust the operation of said bimetallic member.

6. A circuit breaker as set forth in claim 5, in which the bimetallic member is provided toward its fixed end with a re-entrant portion affording an angular knee, and the adjusting means comprise a wedge of insulating material supported for sliding engagement with said knee and a threaded rod engaging in a threaded hole in said wedge; a collar on said rod engaging against the adjacent wall of the case; and an end of said rod projecting into a hole in said wall and formed for engagement with a tool whereby the threaded rod may be turned to vary the position of the wedge.

7. A combined thermally-operated circuit breaker and switch including: a case; a plate secured to close the latter and provide a dust-proof enclosure for the parts of the circuit breaker; a bimetallic member and fixed contact means mounted within the case, having electrical leads connected to said bimetallic member and fixed contact means, said leads projecting through a wall of said case; a contact arm movably mounted within said enclosure; movable contact means

mounted on said contact arm; catch means mounted on said bimetallic member and adapted to retain the contact arm in a position with the movable contact means engaged against the fixed contact means of the circuit breaker in the circuit-closed position of the parts; a manually operable member extending through the plate and engaging against the contact arm and bimetallic strip, whereby the contact arm may be operated to reset the breaker and when desired, to release the contact arm from the bimetallic member to manually break the circuit; and resilient means positioned within the case and urging the contact arm away from the fixed contacts so that when the contact arm is released by the bimetallic member due to distortion of the latter from normal position caused by a current overload, the movable contacts are snapped away from the fixed contact means.

8. A combined thermally-operated circuit breaker and switch as set forth in claim 7 in which said contact arm comprises: a movable contact support pivoted to the contact arm, the movable contact means being mounted on said support at a point spaced from the pivotal axis thereof; an arm projecting from said support and positioned to engage and rest upon the bimetallic member when in position to engage the contact arm, said arm acting to rock the movable support about its axis to bring the movable contact means against the fixed contact means; and a resilient means connected between the contact arm and movable contact support and stressed by said rocking movement of the support so that when the contact arm is released from the bimetallic member, the movable contact means are snapped out of engagement with the fixed contact means to break the circuit and cannot again be brought into engagement with the fixed contact means until the bimetallic member returns into position to engage the contact arm.

9. A combined thermally-operated circuit breaker and switch including: a case open on one side; a plate secured on said case over the open side and providing a dust-proof enclosure for the parts of the circuit breaker; a bimetallic member and fixed contact means mounted within the case having electrical leads connected to said bimetallic member and fixed contact means and projecting through a wall of the case; a contact arm movably mounted in said case; movable contact means mounted on said contact arm; catch means mounted on said bimetallic member and adapted to maintain the contact arm with the movable contact means in engagement with the fixed contact means; a manually operable member extending through a wall of the case and engaging against the contact arm and the bimetallic strip whereby the contact arm may be operated to reset the breaker and when desired, to release the contact arm from the bimetallic member to manually break the circuit; and resilient means positioned within the case and urging the contact arm away from the fixed contacts so that when the contact arm is released by the bimetallic member due to distortion of the latter from normal position caused by a current overload, the movable contacts are snapped away from the fixed contact means.

10. A circuit breaker including: a mounting member supporting the circuit breaker parts; a bimetallic member having a pair of arms con-

nected together at one end, and secured at their other ends to the mounting member in series in an electric circuit; fixed contact means secured to said mounting member; a contact arm pivotally secured at one end to said mounting member; resilient means secured to said contact arm; movable contact means mounted on said resilient means and positioned so as to be brought into wiping engagement with said fixed contacts when the contact arm is rocked upon its pivotal axis to bring the movable contact means against the fixed contact means; a catch mounted on said bimetallic member and adapted to engage with said contact arm when the latter is in circuit closed position to hold the movable contact means against the fixed contact means and to release said arm when the bimetallic member is distorted by heat generated by an electric current greater than that which the bimetallic member is designed to carry without tripping, the current path being provided through said bimetallic member and said contacts; resilient means tending to snap said contact arm and movable contact means carried thereby away from the fixed contact means when the contact arm is released by the catch on said bimetallic member to break the current path; and manually operable double acting means effective when moved in one direction to release said contact arm from said catch and when moved in the opposite direction to engage said contact arm with said catch.

11. A circuit breaker which includes: a movable arm; a movable electrical contact mounted on said arm for movement therewith; a fixed electrical contact adjacent said arm and positioned to be engaged by said movable contact when said arm is in a first position, and separated from said movable contact when said arm is in a second position; resilient means urging said arm toward said second position; latch means positioned to engage said arm and retain it in said first position, said latch means including an element responsive to the flow of current therethrough and acting to move said latch means to release said arm upon the passage of current exceeding a predetermined value; a manually operable means selectively movable in either of two directions, and having a portion adapted to bear against said movable arm and a cam surface adapted to bear against at least a portion of said latch means, movement of said manually operable means in one direction causing said portion to bear against said movable arm and urge it toward said first position where it is engaged by said latch, and movement of said means in the opposite direction causes said cam surface to bear against said portion of said latch means and urge the same to a position releasing said movable arm; and means connecting said current-responsive element, said movable contact, and said fixed contact in series.

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