Aug. 10, 1965

E. BULLIS, JR

3,200,217

CIRCUIT BREAKER WITH THERMAL AND MAGNETIC TRIP MEANS

Filed March 27, 1962

2 Sheets-Sheet 1

Fig. 1.

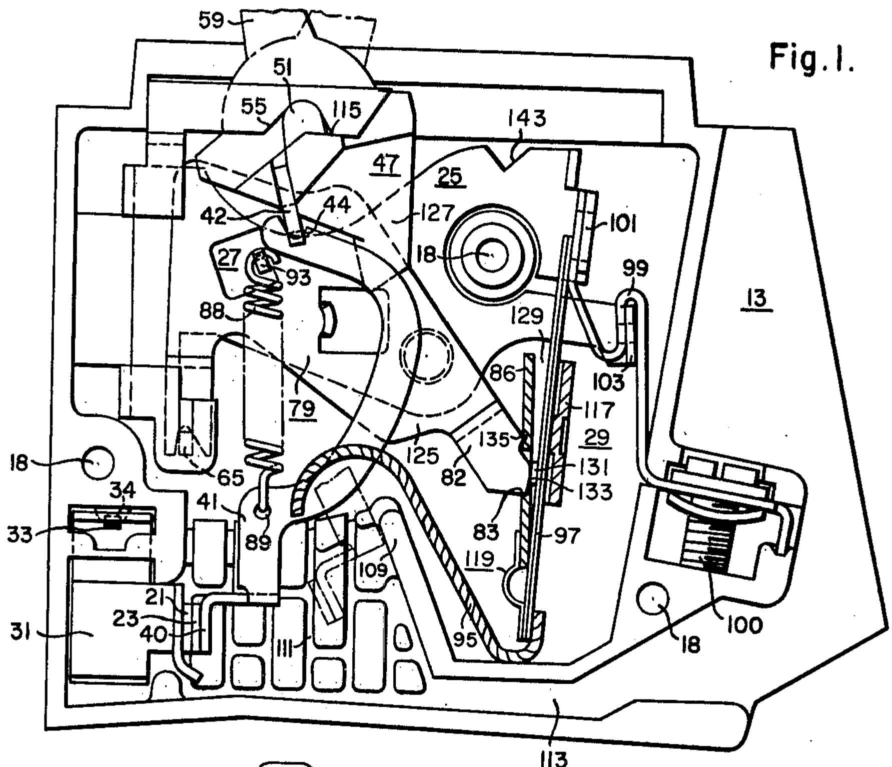
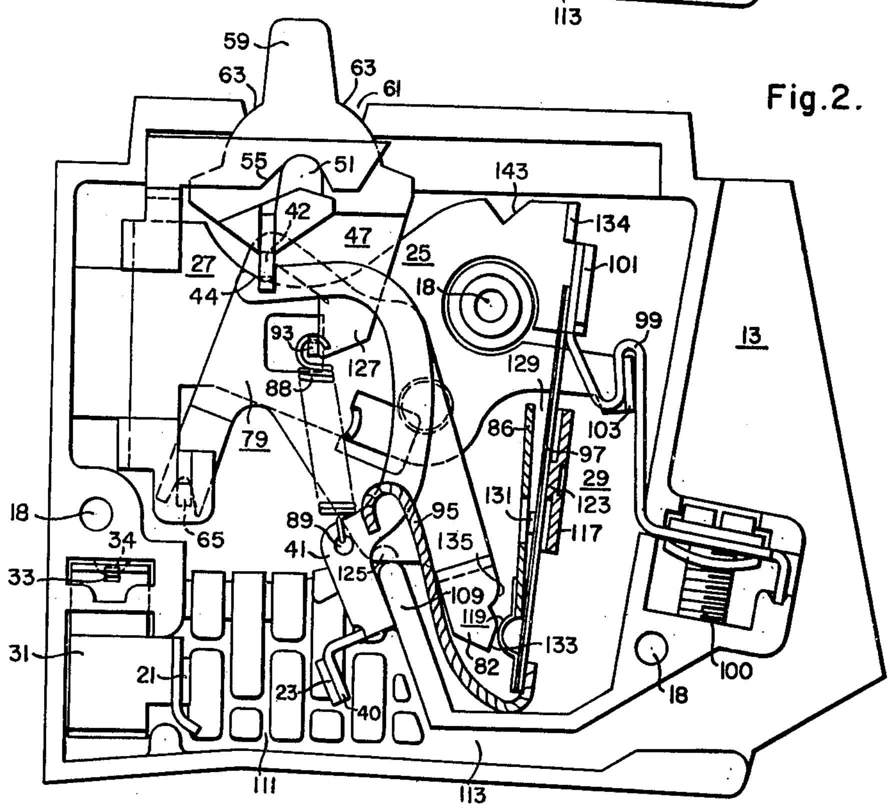


Fig. 2.



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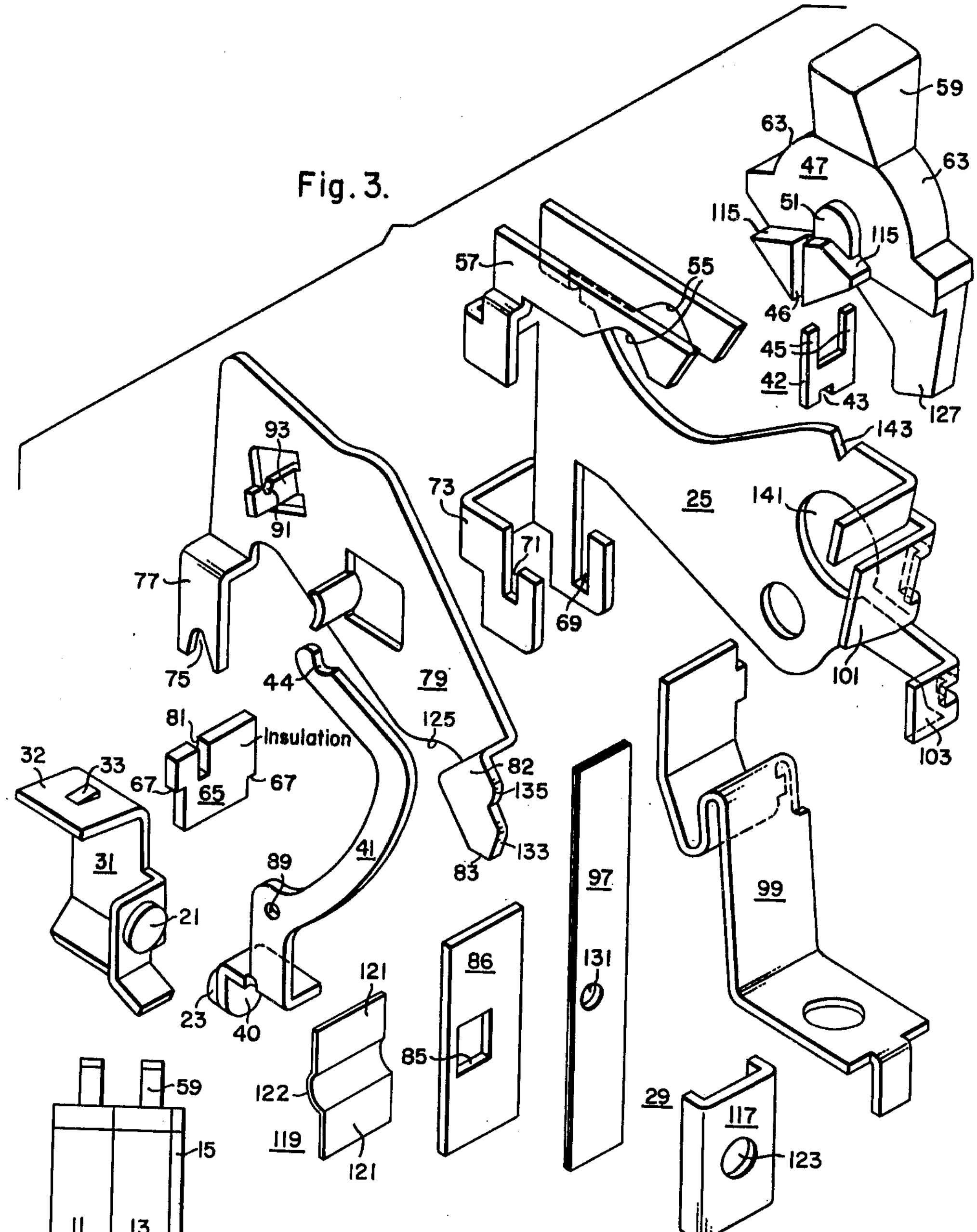
2 Sheets-Sheet 2

Fig. 3.



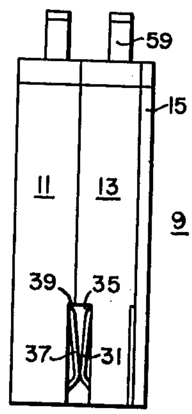


Fig. 4.

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CIRCUIT BREAKER WITH THERMAL AND MAGNETIC TRIP MEANS

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This invention relates generally to electric circuit breakers and, more particularly, to tripping means for effecting automatic opening of circuit breakers.

An object of this invention is to provide an improved circuit breaker embodying a thermal-magnetic trip mechanism that trips magnetically upon the occurrence of relatively low overload currents.

Another object of the invention is to provide a circuit breaker that can be manufactured in quantity with the advantage that, as between breakers, there will be no substantial variance in the amount of current that will be necessary for magnetic tripping.

Another object of this invention is to provide an improved circuit breaker embodying an improved thermal-magnetic trip mechanism having an air gap between the armature and magnetic core member, which air gap will remain substantially constant under normal current conditions over a long period of continued use of the circuit breaker.

Another object of this invention is to provide an improved circuit breaker embodying an improved thermal-magnetic trip mechanism that is dependable, relatively inexpensive, and relatively easy to manufacture and assemble.

Certain features of the subject circuit breaker are described and claimed in the copending patent applications of Francis L. Gelzheiser, Serial No. 850,650, now Patent No. 3,088,008, and Serial No. 850,651, now Patent No. 3,110,786.

The novel features that are considered characteristic of this invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description when read in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a circuit breaker embodying principles of this invention. The breaker is shown with the cover removed, and in a closed position, with the open position of the movable contact and operating handle being shown in dot-and-dash lines;

FIG. 2 is a view similar to FIG. 1; except that the parts are shown in the tripped position;

FIG. 3 is an exploded perspective view on an enlarged scale relative to FIGS. 1 and 2, of parts of the circuit breaker mechanism; and

FIG. 4 is an end view on a smaller scale relative to the other figures, of the assembled duplex circuit breaker.

Referring to FIG. 4 of the drawings, a duplex type circuit breaker 9 is shown therein comprising an insulating housing that is composed of two parts, 11 and 13, forming two compartments. Each of the parts 11 and 13 is composed of a back portion molded integral with four sides forming an open front. The open front of the part 11 is covered by the back portion of the part 13, and the open front of the part 13 is covered by a cover 15. The three portions 11, 13 and 15 of the housing are held rigidly together by three rivets (not shown) which extend through three openings 18 (FIGS. 1 and 2) in each of the three housing parts.

The housing parts 11 and 13 form two independent compartments housing two circuit breaker mechanisms which, except for a line terminal structure that will be hereinafter described, are of identical construction and operation, each operating independently of the other. For this reason, only the mechanism enclosed by the housing part 13 will be specifically described, it being understood that, unless otherwise mentioned, the description applies to both mechanisms of the duplex circuit breaker.

Referring to FIG. 1 of the drawings, the circuit breaker mechanism which is enclosed by the housing part 13 comprises a stationary contact 21, a cooperating movable contact 23, a supporting metal frame 25, an operating mechanism 27 and a trip device 29.

The stationary contact 21 is welded, or otherwise attached, to a line terminal 31 that has a flanged upper portion 32 (FIG. 3) that fits into a slot in the housing part 13. The line terminal 31 is held firmly in place by a stamped out resilient clip portion 33 that biases against a projection 34 (shown by broken lines in FIGS. 1 and 2) which is molded integral with the housing part 13. A portion of the line terminal 31 protrudes through an opening 35 (FIG. 4) in the housing part 13. A similar portion of a symmetrically constructed line terminal 37 protrudes through an opening 39 in the housing part 11. The line terminals 31 and 37 are independent in that each is a part of a separate independently functioning circuit breaker mechanism. The parts 31 and 37 are resiliently biased to engage opposite sides of a blade in a load center when the duplex breaker is mounted in operating position.

Referring to FIGS. 1–3, the stationary contact 21 cooperates with the movable contact 23 that is welded or otherwise attached to a small flange 40 of a flat metallic generally C-shaped contact arm or switch arm 41. A bearing 42 is provided with a slot 43 that is complementary with a V-shaped slot 44 in the upper portion of the movable contact arm 41. Two upper leg portions 45 of the bearing 42 fit into two slots 46 in a molded insulating operating member 47. The bearing 42 transmits motion from the operating member 47 to the movable contact arm 41 when the breaker is manually operated, and, as will be hereinafter explained, from the movable contact arm 41 to the operating member 47 when the breaker is tripped automatically in response to an overload current condition.

The operating member 47 has an arcuate trunnion 51 molded at each side thereof. The trunnions 51 fit and rotatably ride within two arcuate surfaces 55 on the frame 25, one of which surfaces 55 is part of an extension 57 projecting out from the frame 25. The operating member 47 is supported between the surfaces 55 of the frame 25 and the bearing 42 which is supported by the contact arm 41. The operating member 47 has a handle portion 59 molded integral therewith which extends through an opening 61 (FIG. 2) in the housing to permit manual operation of the circuit breaker. Arcuate surfaces 63 on opposite sides of the handle 59 substantially close the opening 61 in all positions of the operating member 47.

The frame 25 supports an insulating pivot 65 (FIG. 3) having shoulders 67 at opposite ends thereof, which shoulders rest within a slot 69 in the frame 25 and a slot 71 in a projection 73 of the frame 25. A metallic trip member 79 is pivotally supported at one end 77 by means of a bight portion 75 which is pivotally supported in a slot 81 in the insulating pivot 65. The other end 82 of the trip member 79 has a latch point 83 which rests on a ledge 85 on an armature 86 to support the trip member in the latched position seen in FIG. 1. The armature 86 is part of the trip device 29 which will be hereinafter specifically described. As best illustrated in FIG. 3, the ends 77 and 82 of the trip member 79 are offset and disposed in a plane which is parallel to a plane in which the main body portion of the trip member 79 is disposed. An overcenter spring 88 (FIGS. 1 and 2) is connected, under tension, at one end in an opening 89 in the contact arm

41 and at the other end in a slot 91 (FIG. 3) in a projection 93 extending from the trip member 79.

The movable contact arm 41 is connected by means of a flexible conductor 95 (FIGS. 1 and 2) to the free end of a bimetal 97 which is attached, at its other end, to a load terminal conductor 99. A load terminal connecting screw 100 is provided at the outer end of the conductor 99. The load terminal conductor 99 is welded or otherwise attached to a projection 101 extending out from the supporting frame 25, and it is given additional support by being looped over and welded to another projection 103 extending out from the supporting frame 25. Thus, the load terminal conductor is rigidly held in place within the housing part 13.

The closed electrical circuit through the breaker extends from the line terminal 31 (FIG. 1) through the stationary and movable contacts 21, 23, the contact arm 41, the flexible conductor 95, the bimetal element 97 and the load terminal conductor 99. Since the movable contact arm 41 extends downwardly from its pivot, the arc is established adjacent the bottom of the housing in an arc chute 111, one end of which is connected by a vent passage 113 to an opening in the end of the housing beneath the load terminal screw 100.

The circuit breaker may be manually operated to open and close the contacts by operation of the insulating handle 59. Movement of the handle 59 clockwise from the full-line position (FIG. 1) to the position in which it is shown in dot-and-dash lines, carries the upper end of the contact arm 41 to the left of the line of action of the spring 88 whereupon the spring acts to move the contact arm 41 with a snap action to the open position shown partially in dot-and-dash lines in FIG. 1. A projection 109, molded integral with the housing part 13, acts as a limit stop for the movable contact arm 41 during an opening operation. Movement of the operating handle 59 in a counterclockwise direction from the dot-and-dash position (FIG. 1) to the full-line position, moves the upper end of the movable contact arm 41 to the right of the line of action of the spring 88 which spring thereupon acts to move the contact arm to the closed position with a snap action. Movement of the handle 59 in either direction is limited by the surfaces 115 (FIG. 3) which strike the frame 25 at either side of the pivot 51.

The improved trip means 29 is provided for effecting automatic opening of the circuit breaker upon the occurrence of overload currents. The trip device 29 comprises the armature 86, the bimetal 97, a U-shaped magnet 117 and a spring 119. The upper end of the bimetal 97 is welded or otherwise secured to the terminal conductor 99 which is secured to the projection 101 on the metal frame 25. The flexible conductor 95 is welded or otherwise suitably secured to the lower or free end of the bimetal 97, and it electrically connects the bimetal 97 with the movable contact arm 41. The armature 86 is movably mounted on the bimetal 97 by means of the spring 119 which comprises a flat member having a straight portion 121 at each end thereof and a generally U-shaped portion 123 intermediate the straight portions 121. The portion 123 could also be stepped-shaped, or V-shaped or any of a number of shapes that will permit the desirable pivotal and lateral type motion of the armature that will be hereinafter described. One of the straight portions 121 is welded or otherwise suitably secured to the armature 86, and the other straight portion 121 is welded or otherwise suitably secured to the bimetal 97. Thus, the armature 86 is supported on the spring member 119 which in turn is supported on the bimetal 97. The U-shaped magnet 117 is welded or otherwise suitably attached to the bimetal 97. A stamped projection 123 on the magnet 117 engages the bimetal 97 to enable the provision of longer leg portions of the U-shaped magnet 117.

Upon the occurrence of an overload current below a predetermined value, the bimetal element 97 becomes heated, and when it is heated a predetermined amount, it deflects to the right as seen in FIG. 1 to effect a time delayed thermal tripping operation. The armature 86 which is supported on the bimetal 97 by means of the spring 119 is carried to the right with the bimetal to release the trip member 79. When the trip member 79 is released, the spring 88 acts to rotate the trip member clockwise about the pivot 65 until this motion is arrested when a stop portion 125 on the trip member 79 strikes the projection 109 of the housing part 13 (FIG. 2). During this movement, the line of action of the spring 88 moves to the right of the pivot 44 of the contact arm 41 whereupon the spring biases the contact arm in an opening direction and moves it so that the line of action of the force exerted by the spring on the operating member 47 shifts across the pivot 51, whereupon the spring 88 actuates both the contact arm 41 and the operating member 47 to the tripped position in which these parts are shown in FIG. 2. The movements of the trip member 79 and contact arm 41 are arrested by the projection 109. In order to provide a visual indication that the breaker has been automatically tripped open, movement of the operating member 47 is stopped in an intermediate position (FIG. 2) when a projection 127, molded integral with the operating member 47, strikes the projection 93 which extends from the trip member 79. The parts are shown in the tripped open position in FIG. 2. The circuit breaker is trip-free in that the breaker will trip upon the occurrence of an overload even if the handle 59 is held in the "on" or closed position.

Before the contacts can be closed following an automatic opening operation, it is necessary to reset and relatch the mechanism. This is accomplished by moving the operating handle 59 clockwise from the tripped position (FIG. 2) to a position slightly beyond the full open position in which it is shown in dot-and-dash lines in FIG. 1. During this movement, due to the engagement of the projection 127 of the operating member 47 with the projection 93 of the trip member 79, the trip member is moved counterclockwise until the latch point 83 is again supported in the latched position on the ledge 85 of the armature 86.

The circuit breaker is magnetically tripped automatically and instantaneously in response to overload currents above the predetermined value. Upon the flow of current through the bimetal 97, a magnetic flux, which is induced around the bimetal, takes the path of least reluctance through the magnet 117, across an air gap 129, and through the armature 86. When an overload current above the predetermined value occurs, the pull of the magnetic flux is of such strength that the armature 86 is attracted to the magnet 117 whereupon the spring 119 flexes permitting the armature to move laterally as well as pivotally toward the magnet 117. This movement releases the trip member 79, and the contacts are opened in the same manner hereinbefore described with respect to the thermal tripping operation.

To calibrate the circuit breaker, the frame 25 and the mechanism supported thereby are mounted in a nesting fixture, and a circuit, having a predetermined amount of current, is established from a stationary contact member that is part of the nesting fixture, through the circuit-breaker mechanism. A tapered pin is then driven through an opening 141 (FIG. 3) in the frame 25 enlarging the opening 141 by narrowing a slot 143 in the metal frame 25, and stretching the metal adjacent the slot. As the opening 141 is enlarged, the bimetal 97 and armature 86 are moved to the right as viewed in FIG. 1 until the breaker trips. The tapered pin is then driven through the opening 141 an additional distance to compensate for spring back of the frame 25. The frame and calibrated mechanism are then removed from the nesting fixture and assembled in the circuit breaker housing.

The circuit breaker is constructed so that the predetermined amount of magnetic air gap 129 will be constant under normal current conditions. As seen in FIG. 1, the bimetal 97 is supported at its upper end by the projection 101. The unrestrained position of the lower or free end of the bimetal 97 is farther to the left than the position in which it is shown, and it is being stressed slightly to the right by the engagement of a stamped projection 131 on the bimetal 97 with a stop portion 133 on the trip member 79. The bimetal does not deflect when heated by an overload current until this stress is relieved. It can be understood that under normal current conditions the relative latched positions of the trip member 79 and the bimetal 97 will always be the same. The armature 86 is biased to the left by the spring 119 to a constant position where the armature 86 engages a stop portion 135 on the trip member 79. Because the relative positions of the trip member 79 and bimetal 97 are constant under normal current conditions, and because the relative positions of the trip member 79 and armature 86 are constant under normal current conditions, the air gap 129, between the armature 86 and the magnet 117 which is fixedly supported on the bimetal 97, must be constant under normal current conditions. This positive positioning also provides that the amount of latching engagement between the latch point 83 of the trip member 79 and the latching surface 85 of the armature 86 will also be constant under normal current conditions.

The stop portions 133 and 135 on the trip member 79 are formed from positive die cuts which will remain constant during the life of the die. By controlling the air gap 129 with stop portions 133 and 135, therefore, circuit breakers can be produced in quantity with each having the predetermined amount of magnetic air gap 129.

The air gap 129 is small in dimension so that the breaker will trip open magnetically upon the occurrence of relatively low overload currents without requiring the use of an expensive coil or a relatively large iron-mass magnetic core member. The bimetal 97 is stressed against the stop 133 not only to provide a definite positioning of the parts; but also to enable the construction of a trip device with a small air gap 129 and still permit calibration of the trip device during assembly of the breaker. If the bimetal 97 were not stressed, in some instances, a circuit breaker with a magnetic air gap small enough to permit the required low magnetic tripping, could not be properly calibrated for thermal tripping. This problem can be understood from the following hypothetical case:

Assume that FIG. 1 represents, for example, a 15 ampere circuit breaker and that the bimetal 97 is not stressed in the latched position. For the desired low magnetic tripping it is required that the air gap 129 be no more than a certain maximum, for example, .02 of an inch. For proper thermal calibration, it is required that the amount of bimetal deflection necessary for a thermal tripping operation be a certain minimum, for example, a dimension slightly more than .03 of an inch. If the bimetal 97 must move the armature 86 slightly more than .03 of an inch in order to release the trip member 79, then the amount of latch engagement, between the latch point 83 on the trip member 79 and the latch surface 85 on the armature 86, must be at least .03 of an inch, and the armature 86 must move at least .03 of an inch during a magnetic tripping operation in order to release the trip member 79. It can be understood that if the magnetic air gap 129 is a maximum of .02 of an inch, the armature 86 can not move the necessary .03 of an inch for a magnetic tripping operation. As was previously explained, however, the unrestrained position of the lower or free end of the bimetal 97 is in fact further to the left than the position in which it is shown in FIG. 1 and it is being stressed slightly to the right when the parts are in the latched position. When the bimetal 97 is heated by an overload current, this stress is first relieved before the bimetal starts to deflect in a tripping direction. The bimetal is so stressed, in a cold position, that the total amount of thermal reaction necessary to move the bimetal, for example, .02 of an inch, in order to thermally trip the breaker, is at least equivalent to the minimum total amount of thermal reaction that would deflect the bimetal for example, .03 of an inch if it were not stressed in a cold position. Thus, in the trip device with the stressed bimetal, there is enough bimetal thermal reaction during a thermal tripping operation to enable accurate thermal calibration, and the magnetic air gap 129 is small enough to enable magnetic tripping upon the occurence of relatively low overload currents.

The spring 119 serves not only to movably support the armature 86 on the bimetal 97; but it also biases the armature 86 into engagement with the stop portion 135 on the trip member 79 in order to positively position the armature with respect to the trip member and, therefore, with respect to the magnetic member 117. During a magnetic tripping operation the spring member 119 flexes permitting the armature to move with a pivotal and lateral motion toward the magnet 117. This freedom of movement of the armature enables the construction of a breaker with lower magnetic tripping characteristics. The trip device 29 is made up of relatively few parts that are easily manufactured in quantity and easily assembled during a manufacturing operation.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details and arrangement of parts thereof may be made without departing from some of the essential features of the invention. It is desired, therefore, that the language of the appended claims be given as reasonably broad an interpretation as is permitted by the prior art.

I claim as my invention:

1. A circuit breaker comprising, in combination, a pair of operable contacts, latched means releasable to effect opening of said contacts, a trip structure comprising an elongated bimetal member stationarily supported at one end thereof and having the other end free, a magnetic member fixedly supported on said bimetal member intermediate the ends of said bimetal member, an armature, said bimetal member comprising a support part positioned between said magnetic member and the free end of said bimetal member, a resilient support member supported on said bimetal member at said support part, means supporting said armature on said resilient support member, upon the occurrence of an overload current below a predetermined value said bimetal member flexing to move said support part to thereby move said resilient support member and said armature to effect release of said latched means, and upon the occurrence of an overload current above said predetermined value, said armature being attracted to said magnetic member sufficiently to effect a flexing of said resilient support member and movement of said armature relative to said bimetal member to effect release of said latched means.

2. A circuit breaker comprising, in combination, a stationary contact and a movable contact cooperating with said stationary contact to open and close a circuit, a trip member releasable to effect automatic opening of said contacts, a trip structure comprising an elongated bimetal member stationarily supported at one end thereof and having the other end free, a magnetic member fixedly supported on said bimetal member intermediate the ends of said bimetal member, said bimetal member comprising a support part positioned between said magnetic member and the free end of said bimetal member, an armature, a spring member fixedly secured to said armature and also fixedly secured to said bimetal member at said support part to thereby support said armature on said bimetal member, upon the occurrence of an overload current below a predetermined value, said bimetal member flexing and moving said support part to thereby move said spring member and armature to effect release of said trip member, and upon the occurrence of an overload current above said predetermined value said arma-

ture being sufficiently attracted to said magnetic member to effect a flexing action of said spring and movement of said armature relative to said magnetic member and bimetal member to effect release of said trip member.

3. A circuit breaker comprising separable contact means, latched means releasable to separate said contact means to cause interruption of a circuit, a trip structure comprising a stationary support, an elongated bimetal member secured at one end thereof to said stationary support and having the other end free, a magnetic member fixedly supported on said bimetal member intermediate the ends of said bimetal member, an armature, said bimetal member comprising a support part positioned between said magnetic member and the free end of said bimetal member, a spring comprising a flat resilient member having a generally straight portion at each of its opposite ends and a generally U-shaped portion between said generally straight portions, one of said generally straight portions being connected to said armature and the other generally straight portion being connected to said support part to thereby movably support said armature on said bimetal member, upon the occurrence of an overload current below a predetermined value, said bimetal member moving to move said support part to thereby move said spring and armature to effect release of said latched means, upon the occurrence of an overload current above said predetermined value, said armature being sufficiently attracted to said magnetic member to move relative to said bimetal member and magnetic member to effect release of said latched means, and said spring flexing to permit said movement of said armature relative to said bimetal member and magnetic member.

4. A circuit breaker comprising, in combination, a stationary contact and a movable contact cooperating with said stationary contact to open and close a circuit, a latched trip member having a first stop means and a second stop means thereon and being releasable to effect automatic opening of said contacts, a bimetal member, a magnetic core member fixedly supported on said bimetal member, said first stop means positively positioning said bimetal member relative to said trip member, an armature, spring means connecting said armature to said bimetal member, said spring means biasing said armature away from said magnetic core member and into engagement with said second stop means whereby said second stop means positively positions said armature relative to said magnetic core member, said bimetal member bending and moving said armature and spring means in response to an overload current below a predetermined value to effect release of said releasable means, and upon the occurrence of an overload current above said predetermined value, said armature being attracted toward said magnetic core member to effect release of said releasable means.

5. A circuit breaker comprising, in combination, a stationary contact, a movable contact cooperating with said stationary contact to open and close said circuit breaker, a latched trip member releasable to effect opening of said contacts, said trip member having a first stop portion and a second stop portion thereon, a current-carrying bimetal member, a magnetic core member fixedly supported on said bimetal member, an armature, a spring member fixedly secured to said armature and also fixedly secured to said bimetal member to movably support said armature on said bimetal member, when the current flowing through said bimetal member is below a first predetermined value, said first stop portion serving to positively position said bimetal member relative to said trip member and said second stop portion serving to positively position said armature relative to said bimetal member whereby an air gap between said armature and said magnetic member remains constant, upon the occurrence of an overload current higher than said first predetermined value and lower than a second predetermined value, said bimetal member flexing and moving said armature and spring member therewith to effect release of said trip member, and upon the occurrence of an overload current above said second predetermined value, said armature being attracted to said magnetic member and moving relative to said magnetic member and bimetal member to effect release of said trip member.

6. A circuit breaker comprising, in combination, a stationary contact, a movable contact cooperating with said stationary contact to open and close said circuit breaker, a latched trip member releasable to effect automatic opening of said contacts, said trip member having a first stop portion and a second stop portion thereon, a bimetal element having a projection thereon engaging said first stop portion to position said bimetal element relative to said trip member, a magnetic core member attached to said bimetal element, an armature, a spring member, said armature being fixedly attached to and supported on said spring member, said spring member being fixedly attached to and supported on said bimetal element to movably support said armature on said bimetal element, said armature being movable to effect release of said latched trip member, said spring member biasing said armature into engagement with said second stop portion to position said armature relative to said magnetic core member, said bimetal element bending and moving said armature and spring member in response to overload currents below a predetermined value to effect release of said releasable means, and said magnetic core member upon being energized sufficiently by overload currents above said predetermined value attracting said armature causing said armature to move relative to said bimetal element to effect release of said latched trip member.

7. In a circuit breaker having separable contacts and latched means releasable to effect separation of said contacts, a bimetal member heated in response to current flow, a magnet supported on said bimetal member, an armature, a spring member attached to said armature and also attached to said bimetal member to movably support said armature on said bimetal member, said armature being movable by movement of said bimetal member to effect release of said latched releasable means, a stop against which said bimetal member is stressed in its cold condition, said bimetal member remaining against said stop during the initial part of its heating while said stress is relieved and said bimetal member then moving after said stress is relieved to move said armature and spring member in response to overload currents below a predetermined value to effect release of said latched releasable means, and said armature being attracted to said magnet and moving relative to said bimetal member in response to overload currents above said predetermind value to effect release of said latched releasable means.

8. A circuit breaker comprising separable contact means, releasable means for causing interruption of a circuit at said contact means, a bimetal member, a magnet fixedly supported on said bimetal member, an armature, a spring member, said armature being supported on said spring member, said spring member being supported on said bimetal member to movably support said armature on said bimetal member, a first stop against which said bimetal is stressed when traversed by normal rated current, a second stop, said spring member biasing said armature into engagement with said second stop to positively position said armature relative to said magnet when said bimetal is traversed by normal rated current, said bimetal when heated by low overload currents below a predetermined value first relieving the stress against said first stop without effective movement of said armature and spring member and then moving away from said first stop and moving the armature and spring member to a tripping position to effect release of said releasable means, and when said bimetal is traversed by overload currents above said predetermined value, said magnet being energized sufficiently to attract said armature whereupon said

armature moves relative to said bimetal and said magnet to a tripping position to effect release of said releasable means.

9. A circuit breaker comprising separable contact means, a releasable trip member releasable to effect interruption of a circuit at said contact means, a bimetal member, a magnet supported on said bimetal member, an armature, a spring member, said armature being attached to and supported on said spring member, said spring member being attached to and supported on said bimetal member to movably support said armature on said bimetal member, said trip member having a first stop portion and a second stop portion thereon, said first stop portion being positioned to effect a stressing of said bimetal member under normal current conditions, said spring member biasing said armature away from said magnet into engagement with said second stop portion, said first and second stop portions being fixed on said trip member whereby a constant air gap is maintained between said magnet and said armature under normal current conditions, upon the occurence of overload current conditions below a predetermined amount, said bimetal member moving and moving said armature and spring member with it to effect release of said trip member, and upon the occurence of overload current conditions above said predetermined amount, said armature being attracted to said magnet whereupon said spring member flexes and said spring member and said armature move relative to said bimetal member and said magnet to effect release of said trip member.

10. A circuit breaker comprising, in combination, a stationary contact, a movable contact coperating with said stationary contact to open and close said circuit breaker, a latched trip member releasable to effect automatic opening of said contacts, said trip member having a first stop portion and a second stop portion, a bimetal member having a projection thereon and being stressed against said first stop portion under normal current conditions to position said bimetal member relative to said trip member, a magnetic core member attached to said bimetal member, an armature, a spring, said armature being fixedly attached to said spring, said spring being fixedly attached to said bimetal member to movably support said armature on said bimetal member, said armature having an opening therein defining a ledge, said trip member resting on said ledge in a latched position, said spring member biasing said armature into engagement with said second stop portion under normal current conditions to positively position said armature relative to said magnetic core member, said armature being movable to release said latched trip member, said bimetal member bending and moving said armature with it in response to overload current conditions below a predetermined value to release said releasable means, and upon the occurrence of overload current conditions above said predetermined value, said magnetic core member being energized sufficiently to attract said armature whereupon said armature moves relative to said bimetal member and said magnetic core member to release said latched trip member, and said spring flexing to permit said movement of said armature relative to said bimetal member and said magnetic core member.

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