Feb. 23, 1971 F. L. GELZHEISER ET AL 3,566,318

CIRCUIT BREAKER WITH IMPROVED TRIP MEANS

Filed Dec. 31, 1968 2 Sheets-Sheet 1

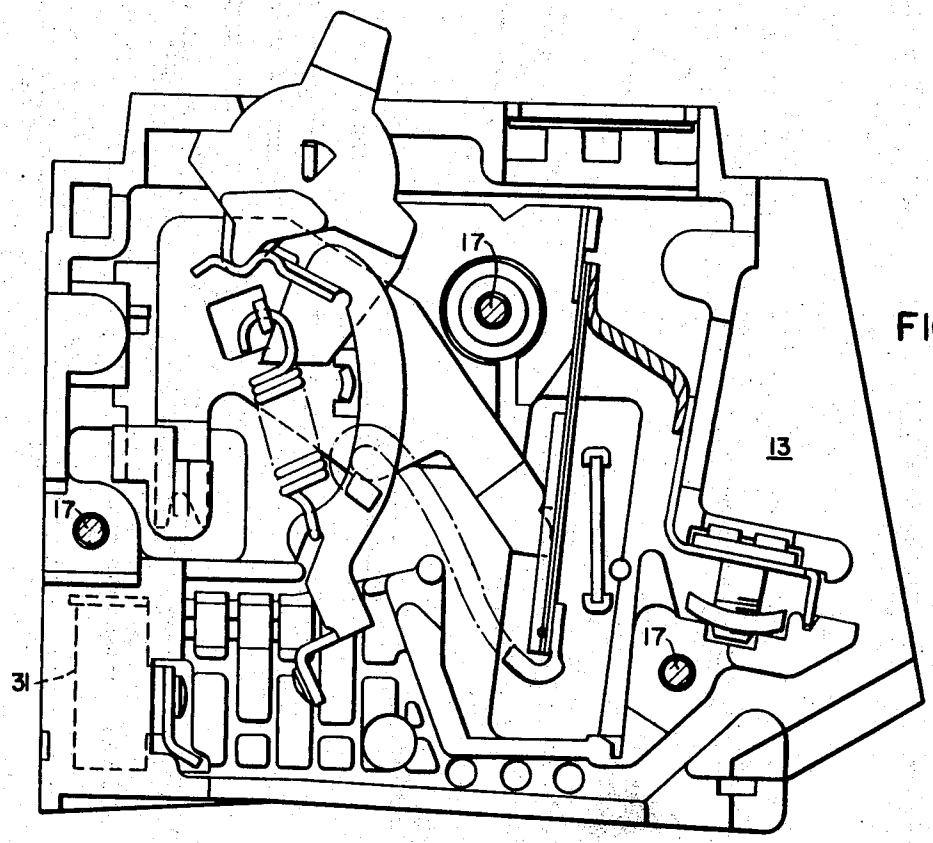


FIG. 3.

FIG. 1.

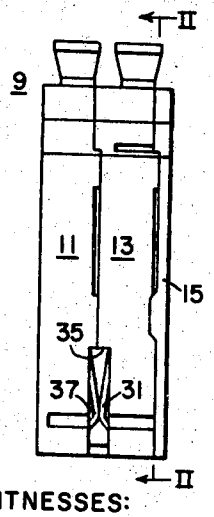


FIG. 5.

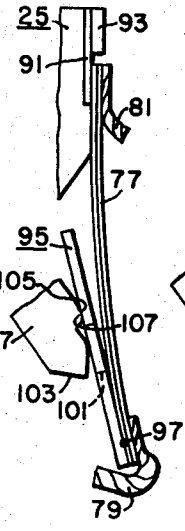


FIG. 6.

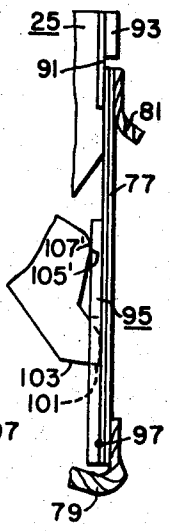


FIG. 7.

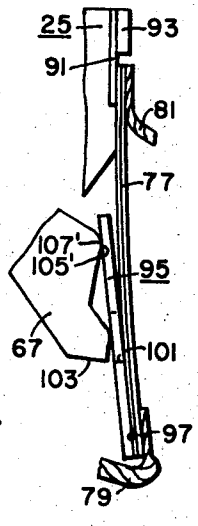
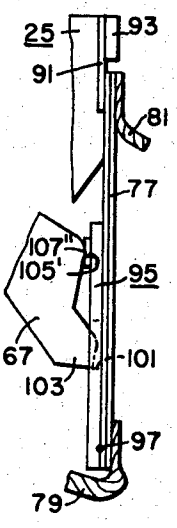


FIG. 8.



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CIRCUIT BREAKER WITH IMPROVED TRIP MEANS

Filed Dec. 31, 1968 2 Sheets-Sheet 2

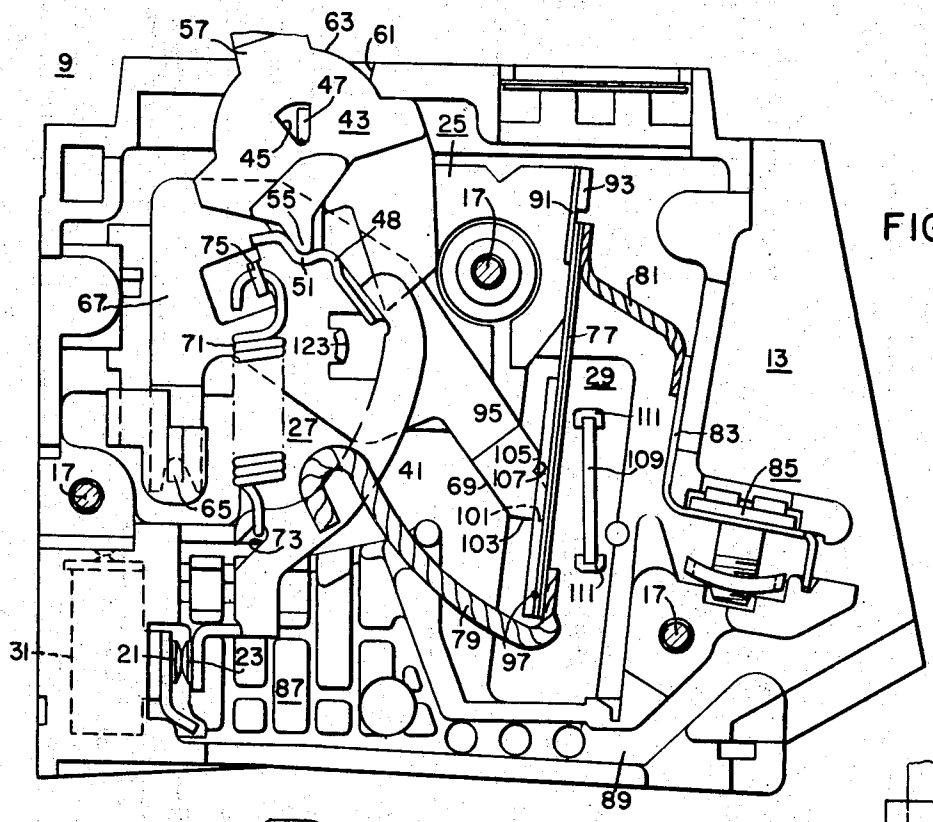

FIG. 2.

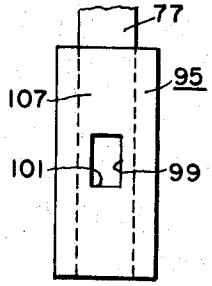

FIG. 9.

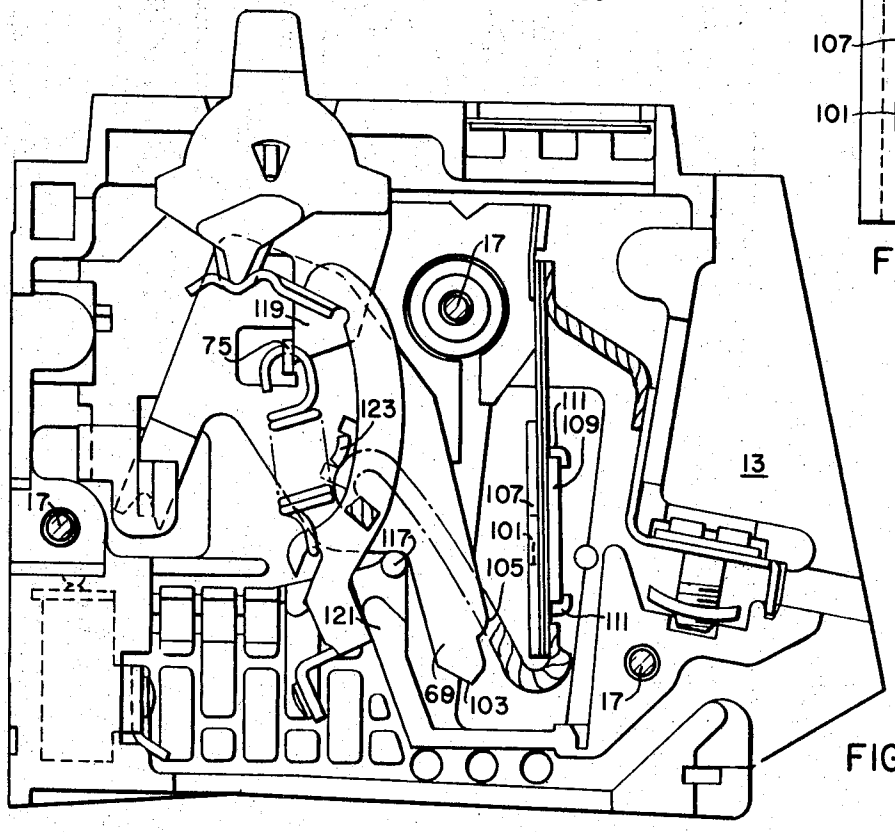

FIG. 4.

United States Patent Office 3,566,318
Patented Feb. 23, 1971

3,566,318

CIRCUIT BREAKER WITH IMPROVED TRIP MEANS

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Filed Dec. 31, 1968, Ser. No. 788,230
Int. Cl. H01h 73/48
U.S. Cl. 335—39 20 Claims

ABSTRACT OF THE DISCLOSURE

A circuit breaker comprises improved thermal and electro-magnetic trip means for automatically tripping the circuit breaker upon the occurrence of overload current conditions. Automatic thermal calibration is built into the construction whereby circuit breakers can be manufactured in quantity with predictable tripping characteristics. A lever latch member, which is secured to a bimetal member, is angled against a releasable member with a levering action, upon flexing of the bimetal member, to release the releasable member to thereby trip the circuit breaker.

BACKGROUND AND OBJECTS OF THE INVENTION

In the manufacture of circuit breakers, it is common practice to calibrate each individual breaker so that the breaker will predictably trip within a predetermined time span at a predetermined sustained overload current. In many cases each breaker is calibrated by adjustment of a calibrating screw or bending of a part to adjust the amount of latch engagement between a releasable member and the trip device. In some cases, a calibrated breaker can fall out of calibration under shock or other conditions that might vary the amount of latch engagement.

An object of this invention is to advance the art by providing a novel circuit breaker that is so constructed and arranged that the breaker is automatically calibrated merely by the assembly operation.

Another object of this invention is to provide an improved circuit breaker that is less likely to fall out of calibration during use of the breaker.

Another object of this invention is to provide a circuit breaker with improved dependable thermal tripping characteristics.

A further object of this invention is to provide a circuit breaker with improved thermal and magnetic trip means.

A general object of this invention is to provide an improved circuit breaker that is relatively easy to assemble and dependable in operation.

SUMMARY OF THE INVENTION

A circuit breaker comprises a pair of contacts and a latched releasable member movable when released from an initial latched position to a tripped position to effect opening of the contacts. The releasable member is latched by trip means which comprises an elongated bimetal that is supported at the upper end thereof on a flat spring member which is in turn supported on a fixed support. An elongated rigid member, having a window-opening therein to provide a latch surface thereon, is welded or otherwise fixedly secured to the bimetal inproximity to the lower or free end of the bimetal. The releasable member is movably supported at the one end thereof and comprises a latch part at the other end thereof that protrudes into the window-opening of the latch member to rest on the latch surface of the latch member. The supporting

spring biases the bimetal and latch member toward the releasable member with a fulcrum part or stop part on the releasable member engaging a stop part of the latch member above the window opening. With the spring member biasing the latch member into engagement with the releasable member at a predetermined angle, the amount of latch engagement between the latch member and the releasable member is predetermined and circuit breakers can be produced in quantity with each breaker having the predetermined amount of latch engagement. The latch member, which is fixed at the lower end thereof to the lower end of the bimetal, extends upward along the high-expansion side of the bimetal in a parallel relationship with the bimetal. The bimetal is connected to carry current in the circuit breaker. Upon the occurrence of a sustained lesser overload above a first predetermined value, the bimetal will flex carrying the lower end of the latch member away from the releasable member and, with the spring support biasing the bimetal and latch member toward the releasable member, this movement will produce a levering action between the stop part of the latch member and the fulcrum or stop part on the releasable member during which levering action the latch surface of the latch member will release the releasable member to effect a tripping operation. With the latch member levering against a fulcrum part on the releasable member, by properly positioning the angle of the latch member and bimetal relative to the releasable member and by properly selecting the bimetal, the amount of unlatching movement of the latch surface of the latch member can be predetermined so long as the supporting spring maintains a bias of the stop part of the latch member against the fulcrum part of the releasable member. The supporting spring member is selected such that it is strong enough to maintain the bias of the latch member against the fulcrum part of the releasable member yet not so strong as to flex the bimetal in the cold or normal position which flexing could affect the thermal tripping characteristics. With the amount of latch engagement between the releasable member and latch member predetermined and built into the breaker, and with the predetermined predictable amount of unlatching movement of the latch surface in response to predetermined currents built into the breaker, it can be understood that the breakers can be manufactured in quantity with predetermined thermal tripping characteristics built into the breakers. In the preferred embodiment, the elongated latch member is a magnetic armature, and a magneic member is supported in the breaker in a spaced relationship from the armature so that upon the occurrence of a severe overload current above the second predetermined value the armature will be instantaneously attracted to the other magnetic member to effect a magnetic tripping operation. During magnetic tripping operations, the supporting spring flexes to permit quick unitary movement of the bimetal and armature to the magnetically-tripped position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an end view of a double-type circuit breaker constructed in accordance with principles of this invention;

FIG. 2 is a sectional view, on an enlarged scale relative to FIG. 1, taken generally along the line II—II of FIG. 1. The circuit breaker is shown in FIG. 2 in the "on" or closed position.

FIG. 3 is a view similar to FIG. 2 with the breaker being shown in the "off" or open position;

FIG. 4 is a view similar to FIGS. 2 and 3 with the parts shown at the instant that a magnetic tripping operation is completed;

FIG. 5 is a view of parts of the breaker shown in FIGS. 2–4 with the parts being shown in a position reached during a thermal tripping operation;

FIG. 6 is a view similar to FIG. 5 illustrating another embodiment of the invention with the parts being shown in the latched position;

FIG. 7 is a view of the parts shown in FIG. 6 during a thermal tripping operation;

FIG. 8 is a view similar to FIG. 6 illustrating still another embodiment of the invention; and

FIG. 9 is an end view of the armature and part of the bimetal of FIGS. 2–4 illustrating the window-opening in the armature.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawings, there is shown therein a double-type circuit breaker **9** comprising a molded insulating housing that comprises two insulating parts **11** and **13** forming two compartments. Each of the parts **11** and **13** comprises 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 an insulating cover **15**. The three parts **11**, **13** and **15** of the housing are held rigidly together by three rivets **17** (FIGS. 2–4).

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 with each mechanism 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 double-type circuit breaker.

Referring to FIG. 2, 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 secured, to a line terminal **31** that is exposed at an opening **35** (FIG. 1) to cooperate with a symmetrically constructed line terminal **37** that is a part of the mechanism supported 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 terminals **31** and **37** are resiliently biased to engage opposite sides of a blade or stab in a load center when the double-type breaker is mounted in the operating position.

Referring to FIGS. 2–4, the stationary contact **21** cooperates with the movable contact **23** that is welded or otherwise secured to a small flange portion of a flat metallic generally C-shaped contact arm **41**. Means for operating the contact arm **41** to the open and closed positions comprises an operating member indicated generally at **43** having a V-shaped opening **45** therein, which opening receives a projection **47** of the stationary metallic frame **25**. The operating member **43** is biased outwardly or upward as seen in FIGS. 2–4, by means to be hereinafter described, to a position wherein the lower edges of the projection **47** pivotally engage the lower side walls of the V-shaped opening **45**. The contact arm **41** is bent over at its upper end at **48**, and a slot is provided in the part **48**. Depressions **51** are formed in the part **48** on opposite sides of the slot. When the parts are in operating position, a projection molded integral with the operating member **43** extends into the slot of the contact arm **41** to position the operating member **43** relative to the contact arm **41**, and pivoting portions **55** on opposite sides of the projection pivotally engage in the depressions **51** of the contact arm **41**. The operating member **43** has a handle portion **57** molded integral therewith which extends through an opening **61** in the housing whereby the mechanism may be manually operated to open and close the breaker. Arcuate surfaces **63** on opposite sides of the handle **57** substantially close the opening **61** in all positions of the operating member **43**. Motion is transmitted from the operating member **43** to the contact arm **41** when the breaker is manually operated and from the contact arm **41** to the operating member **43** when the breaker is automatically tripped.

The frame **25** supports an insulating pivot **65**. A releasable member **67** is pivotally supported at one end thereof on the pivot **65**. The other end **69** of the releasable member **67** is latched by the trip device **29** in a manner to be hereinafter specifically described. Except for the trip device **29**, the operating mechanism is more specifically described in the patent to F. L. Gelzheizer Pat. No. 3,254,176.

As is more specifically described in the above-mentioned Pat. 3,254,176, the ends of the releasable member **67** are offset and disposed along a plane which is parallel to a plane in which the main body portion of the releasable member **67** is disposed. A spring **71** is connected, under tension, at one end in a slot **73** in contact arm **41**, and at the other end in a slot in a projection **75** that extends from the main body portion of the releasable member **67**.

The contact arm **41** is electrically connected to the lower end of a bimetal **77** by means of a flexible conductor **79**. The bimetal **77** is part of the trip device **29** that will be hereinafter described. A flexible conductor **81** connects the upper end of the bimetal **77** with a terminal strap **83** that extends through an opening in the end wall of the circuit breaker. A terminal connector **85** is connected to the external end of the terminal strap **83** to permit connection of the circuit breaker in a circuit in a manner well known in the art. The closed circuit through the circuit breaker **9** extends from the terminal **31** through the stationary contact **21**, movable contact **23**, contact arm **41**, flexible conductor **79**, current-carrying bimetal **77**, flexible conductor **81**, terminal strap **83**, to a conducting line that would be connected to the terminal strap **83** by means of the terminal connector **85**. Since the movable contact arm **41** extends downwardly from its pivot, the arc is established adjacent the bottom of the housing in an arc chamber **87** which is connected by a vent passage **89** to an opening in the end of the housing beneath the terminal connector **85**.

When the releasable member **67** is in the latched position shown in FIGS. 2 and 3, the circuit breaker may be manually operated by operation of the operating member **43**. Movement of the operating member **43** in a clockwise direction from the "on" or closed position seen in FIG. 2 to the "off" or open position seen in FIG. 3 carries the upper end of the contact arm **41** to the left of the line of action of the spring **71** whereupon the spring acts to move the contact arm **41** with a snap action to the open position seen in FIG. 3. As can be understood with reference to FIGS. 2 and 3, the spring **71** biases the contact arm **41** upward into engagement with the operating member **43** to bias the operating member **43** against the lower edges of the projection **47** about which the operating member **43** pivots. Movement of the operating member **43** in a counterclockwise direction from the "off" position seen in FIG. 3 to the "on" position seen in FIG. 2 moves the upper end of the switch arm to the right of the line of action of the spring **71** to move the contact arm **41** to the closed position seen in FIG. 2.

The trip device **29** comprises the elongated bimetal **77**. The bimetal **77** is a flat member that is secured at the upper end thereof to a flat leaf spring **91** that is secured to a proejction **93** of the stationary frame **25**. The frame **25** is a flat member that is secured in place in the housing between projections of the molded insulating housing, and the projection **93** is bent over to

extend and in a direction generally normal to the plane of the flat supporting plate **25**. The flat spring is fixedly secured to the projection **93** to support the bimetal **77**. An elongated rigid magnetic armature latch member **95** is welded, at **97** to the high expansion side of the bimetal **77**. The armature **95** extends upward along the high expansion side of the bimetal **77** in a parallel relationship with the bimetal **77** when the bimetal is in the cold or straightened condition. As can be seen in FIG. 9, the armature **95** has a window opening **99** therein to form a latch surface **101** at the base of the opening **99**. As can be seen in FIGS. 4 and 5, the latch end **69** of the releasable member **67** is formed with a latch surface **103** thereon and a stop surface or fulcrum part **105** thereon. A surface portion **107** (FIG. 4) of the armature **95** serves as a stop part to engage the fulcrum part **105** of the releasable member **67** in the latched position of the releasable member. A rigid magnetic member **109** is supported in the housing **13**, **15** between insulating portions **111** of the housing **13** which form slots in which the magnetic member **109** is positioned. The projections **111** (FIG. 4) limit movement of the magnetic member **109** in the plane of the paper as seen in FIG. 4, and the housing parts **13**, **15** limit movement of the magnetic member **109** in a direction normal to the plane of the paper.

The circuit breaker is shown in FIG. 2 in the reset position wherein the releasable member **67** is latched on the armature **95**. The circuit breaker can be manually operated only when the releasable member **67** is in the reset or latched position. In the position seen in FIG. 2, the supporting spring **91** biases the bimetal **77** to the left toward the releasable member **67** which movement is limited by the engagement of the stop part **107** of the rigid armature **95** with the stop part or fulcrum part **105** of the rigid releasable member **67**. In this position, the latch surface **103** of the releasable member **67** rests on the latch surface **101** of the armature **95** to latch the releasable member **67** preventing clockwise movement of the releasable member **67** about the pivot **65**. The high expansion side of the bimetal **77** is on the left as seen in FIG. 2. Upon the occurrence of a sustained lesser overload current above a first predetermined value, the bimetal **77**, which is heated by the current flowing therethrough, deflects from the position seen in FIG. 2 to the thermally-tripped position seen in FIG. 5. The bias of the spring **91** of the complete bimetal **77** toward the left is such that the spring **91** maintains the bias of the part **107** of the armature **95** against the fulcrum part **105** of the releasable member **67** during the deflection of the bimetal **77** to the thermally-tripped position. The bimetal **77** deflects to a curvature such as that shown in FIG. 5 during which movement the rigid armature **95** is angled to the position seen in FIG. 5 with the lower end of the rigid armature **95** being carried by the lower end of the bimetal **77**, and the armature **95** moves about the fulcrum part **105** with a levering action to move the latch surface **101** of the armature **95** free of the latch surface **103** of the releasable member **67** to thereby release the releasable member **67**. When the releasable member **67** is released, the spring **71** acts to rotate the releasable member **67** in a clockwise direction about the pivot **65** until the releasable member **67** is stopped by engagement thereof with a molded projection **117** on the housing part **13**. During this movement, the line of action of the spring **71** moves to the right of the pivot **55**, **51**, whereupon the spring **71** biases the contact arm **41** in opening direction and moves the contact arm **41** so that the line of action of the force exerted by the spring on the operating member **43** shifts across the pivot **45**, **47** and actuates the operating member **43** to the tripped position shown in FIG. 4. The tripped position of the operating member **43** is intermediate the "on" and "off" positions. The operating member **43** is stopped in the intermediate or tripped position seen in FIG. 4 when an insulating projection **119** thereon engages the projection **75** on the releasable member **67**. The contact arm **41** is stopped in the open position seen in FIG. 4 when it engages an insulating projection **121** molded integral with the housing part **13**. Positive separation of the contacts is provided during a tripping operation by means of a projection **123** extending from the releasable member **67**. If the contacts are slow in opening due to sticking, drag or other reasons, the projection **123** engages the inner edge of the contact arm **41** to start the contact arm in opening direction.

The circuit breaker is trip-free in that the breaker will automatically trip open even if the handle **57** is held in the closed position.

Following a tripping operation, it is necessary to reset the breaker before the breaker can be operated. This is accomplished by moving the operating member **43** from the tripped position (FIG. 4) slightly beyond the full "off" position. During this movement, the projection **119** on the operating member **43** operates against the projection **75** of the releasable member **67** to move the releasable member **67** counterclockwise to a position wherein the latch surface **103** of the releasable member **67** is just above the latch surface **101** of the armature **95** whereupon the spring **91** moves the bimetal **77**, which cools and straightens when in non-current carrying tripped condition, and armature **95** toward the releasable member to latch the trip member in the initial operating position shown in FIG. 3. With the releasable member **67** reset in the operating position, the circuit breaker can be manually operated in the same manner as was hereinbefore described.

The circuit breaker is instantaneously tripped upon the occurrence of a short circuit or severe overload current above a second predetermined value, higher than the first predetermined value, by operation of the magnetic trip of the trip means **29**. As can be understood with reference to FIGS. 2 and 9, the current passing through the bimetal **77** generates magnetic flux which operates through the armature **95**, the air gaps between the armature **95** and the magnetic member **109**, and through the stationary magnetic member **109**. When the current reaches the second predetermined value, this magnetic flux is strong enough to attract the armature **95** toward the stationary magnetic member **109**, and the spring **91** flexes permitting the armature **95** and bimetal **77** to move as a unit to the magnetically-tripped position seen in FIG. 4 wherein the releasable member **67** is released to trip the breaker in the same manner as was hereinbefore described. Following a magnetic tripping operation, the circuit breaker is reset and relatched in the same manner as was hereinbefore set forth with regard to the time-delay thermal tripping operation. The bimetal **77** and armature **95** are shown in the attracted position in FIG. 4. It can be understood that when the circuit is interrupted the armature **95** will no longer be attracted to the stationary magnetic member **109** and the spring **91** will return the bimetal **77** and armature **95** to the unattracted position.

Another embodiment is shown in FIGS. 6 and 7 where the same reference characters are used with the reference character **105** being primed to indicate the different position of the stop part or fulcrum part **105'** on the releasable member **67**, and with the reference character **107** being primed to indicate the different position of the stop part **107'** on the armature. The releasable member is shaped differently to reposition the fulcrum part **105'**. Otherwise, the parts shown in FIGS. 6 and 7 would be used in a circuit breaker of identical construction to that hereinbefore described with reference to FIGS. 1–5. As can be seen in FIGS. 6 and 7, the shape of the releasable member **67** has been modified to provide a greater distance between the latch surface **103** and the fulcrum part **105'**. This construction provides a longer lever arm to thereby provide increased unlatching movement of the latch surface **101** during thermal tripping operations.

Another embodiment of the invention is shown in FIG. 8 wherein the reference characters and parts are the same as those shown in FIGS. 6 and 7 with the exception that

the reference character **107** is double primed and applied to a bump or projection on the face of the armature **95**. In the same breaker frame sizes, various latch engagements may be necessary for different ratings. The amount of latch engagement between the latch surface **103** of the releasable member **67** and the latch surface **101** of the armature **95** can be controlled by means of the projection **107''** that can be provided as a variable projection manufactured with the armature **95**. Another way of varying the amount of latch engagement would be to keep the manufacture of the armature **95** constant and varying the shape of the releasable member **67** to position the stop part **105'** to thereby control the amount of latch engagement.

If for some foreseen reason breakers should fall out of calibration, and this would be under exceptional circumstances, then correction could be made by slightly adjusting the armature and bimetal. In order to cause the breaker to trip sooner by providing less latch engagement, a tool such as a screwdriver blade could be placed between the bimetal and the upper portion of the armature **95**, and the blade could be rotated to wedge the upper portion of the armature **95** away from the bimetal to thereby reduce the amount of latch engagement between the latch surface **103** of the releasable member **67** and the latch surface **101** of the armature. Reversing the process with a pair of pliers or other type of tool by squeezing the upper end of the armature **95** toward the bimetal **77** would increase the amount of latch engagement between the releasable member **67** and bimetal **77** to cause the breaker to trip with a longer time delay.

From the foregoing, it can be understood that there is provided by this invention a circuit breaker with improved trip means. The latch surface **103** and fulcrum part **105** of the releasable member **67** are positive die cuts which will remain constant during the life of the die that is used in the manufacture of the releasable member **67**. The latch surface **101** and stop portion **107** on the armature **95** are positively determined by the manufacture of the armature **95**. With the surfaces **103**, **105** on the releasable member **67** and the surfaces **101**, **107** on the armature **95** predetermined and fixed, it can be understood that so long as the armature **95** is biased against the releasable member **67** at a predetermined angular position, the amount of latch engagement between the releasable member **67** an armature **95** will be predetermined and constant. Thus, the circuit breakers can be manufactured in quantity with a predetermined amount of latch engagement. With the spring **91** biasing the bimetal **77** to maintain the bias of the armature **95** (at **107**) against the fulcrum part **105** of the releasable member **67**, as the bimetal **77** flexes the lower end of the bimetal will carry the lower end of the armature to the right (FIG. 5) and the deflection of the bimetal will cause the armature **95** to angle against the fulcrum part **105** of the releasable member **67** with a levering action to release the releasable member **67**. It can be understood that by providing a predetermined angular position of the bimetal **77** and armature **95** relative to each other and relative to the releasable member **67**, the tripping characteristics of the circuit breaker can be predetermined by maintaining the bias of the armature **95** against the fulcrum part **105** of the releasable member **67** and by selecting the bimetal **77** with predetermined flexing characteristics. Thus, by the proper selection, construction and arrangement of the parts **67**, **95**, **77**, **91**, predetermined tripping characteristics can be built into the breaker during the manufacture of the breaker, and self-calibrated breakers can be manufactured in quantity without requiring calibration after assembly, and without requiring additional parts such as the calibrating screws that have been used in some prior art breakers. The supporting spring **91** should be strong enough to maintain the bias of the armature **95** against the releasable member **67** during tripping operations yet not so strong as to cause a physical deflection of the bimetal **77** in the cold position of the bimetal which physical deflection could affect the thermal tripping characteristics. The improved trip device also comprises the magnetic trip which operates to move the armature and bimetal as a unit toward the stationary magnetic member during which movement the supporting spring **91** flexes so that the more rigid bimetal need not be flexed by the pull of the armature during magnetic tripping operations.

We claim as our invention:

1. A circuit breaker comprising a pair of contacts, a releasable member comprising a first latch surface, a latch member comprising a support part and a stop part and a second latch surface, a bimetal member for moving said latch member in response to current flow, said latch member at said support part being mounted on said bimetal member, resilient biasing means biasing said bimetal member to effect a bias of said latch member into latching engagement with said releasable member in which latching engagement said second latch surface latches against said first latch surface, said releasable member said latch member said bimetal member and said resilient biasing means being constructed and arranged such that upon flexing of said bimetal member said bimetal member carries said support part of said latch member away from said releasable member while said resilient biasing means effects a bias of said stop part of said latch member against said releasable member until said second latch surface disengages from said first latch surface whereby a predetermined unlatching movement of said second latch surface is provided relative to said first latch surface upon the occurrence of a predetermined flexing of said bimetal member in response to current flow, upon the occurrence of a sustained lesser overload current above a predetermined value said bimetal member flexing to move said latch member to thereby move said second latch surface relative to said first latch surface to an unlatching position to thereby release said releasable member, and means operating upon release of said releasable member to effect opening of said contacts.

2. A circuit breaker according to claim **14**, said first latch member being an armature latch member of magnetic material, a separate magnetic member separate from said armature magnetic member, means supporting said armature latch member and said separate latch member such that said armature latch member is magnetically attracted to said separate magnetic member upon the occurrence of overload current conditions above a second predetermined value, and upon the occurrence of overload current conditions above said second predetermined value said armature latch member being attracted toward said separate magnetic member to release said releasable member.

3. A circuit breaker according to claim **2**, said bimetal member being an elongated bimetal member, said resilient biasing means comprising resilient support means supporting said elongated bimetal member in proximity to one end of said elongated bimetal member, said armature latch member comprising an elongated rigid armature latch member fixedly supported at one end thereof in proximity to the other end of said elongated bimetal member and extending along side said elongated bimetal member on the high expansion side of said elongated bimetal member, said resilient support means biasing said bimetal to bias said armature latch member against said releasable member to provide a predetermined amount of latch engagement between said first and second latch surfaces, upon the occurrence of said lesser overload current above said first predetermined value said elongated bimetal member flexing to carry said one end of said armature latch member away from said releasable member and to angle said armature latch member against said releasable member at said stop part under the bias of said resilient support means to thereby move said second latch surface relative to said first latch surface to an unlatching position to release said releasable member, and

upon the occurrence of said overload current above said second predetermined value said armature latch member being attracted to said separate magnetic member to move said armature latch member and elongated bimetal member as a unit to an unlatching position to release said releasable member which unitary movement is permitted by the flexing of said resilient support means.

4. A circuit breaker according to claim 3, means connecting said elongated bimetal member as a current carrying bimetal member in the circuit of said breaker, and upon the occurrence of said overload current above said second predetermined value the current in said elongated bimetal member generating magnetic flux in a magnetic circuit through said armature latch member and said separate magnetic member to effect attraction of said armature latch member toward said separate magnetic member to effect release of said releasable member.

5. A circuit breaker according to claim 1, said latch member at said support part being fixedly mounted on said bimetal member, said releasable member said latch member said bimetal member and said biasing means being constructed and arranged such that upon flexing of said bimetal member said bimetal member carries said fixedly mounted support part of said latch member away from said releasable member while said biasing means biases said bimetal to effect a bias of said stop part of said latch member against said releasable member until said second latch surface disengages from said first latch surface.

6. A circuit breaker according to claim 5, said first latch member being an armature latch member of magnetic material, a separate magnetic member separate from said armature latch member, means supporting said armature latch member and said separate magnetic member such that said armature latch member is magnetically attracted to said separate magnetic member upon the occurence of overload current conditions above a second predetermined value, and upon the occurrence of overload current conditions above said second predetermined value said armature latch member being attracted toward said separate latch member moving said bimetal member and said armature latch member as a unit to release said releasable member.

7. A circuit breaker according to claim 6, means connecting said bimetal member as a current carrying bimetal member in the circuit of said circuit breaker, and upon the occurrence of said overload current above said second predetermined value the current in said bimetal member generating magnetic flux in a magnetic circuit through said armature latch member and said separate magnetic member to effect attraction of said armature latch member toward said separate magnetic member to effect release of said releasable member.

8. A circuit breaker according to claim 13, said rigid latch member being an armature latch member of magnetic material, a separate magnetic member separate from said armature latch member, said separate magnetic member and said armature latch member being supported such that said armature latch member is magnetically attracted to said separate magnetic member upon the occurrence of overload current conditions above a second predetermined value, and upon the occurrence of overload current conditions above said second predetermined value said armature latch member being attracted toward said separate magnetic member to move said armature latch member and bimetal member as a unit toward said separate magnetic member against the bias of said resilient means to release said releasable member.

9. A circuit breaker according to claim 8, said bimetal member having a high expansion side and a low expansion side, said armature latch member being carried on said bimetal member on the high expansion side of said bimetal member, said separate magnetic member being spaced from said armature latch member and bimetal member on the low expansion side of said bimetal

member, means connecting said bimetal member to carry current in the circuit of said circuit breaker, said armature latch member and said separate magnetic member being supported such that the current in said bimetal member generates magnetic flux to cause attraction of said armature latch member toward said second magnetic member, and upon the occurrence of said overload current conditions above said second predetermined value said armature latch member being attracted to said separate magnetic member and moving as a unit with said bimetal member against the bias of said biasing means toward said separate magnetic member to release said releasable member.

10. A circuit breaker according to claim 9, said resilient biasing means being a spring member supported on a stationary support, said bimetal member being supported and carried on said spring member whereby said bimetal member is resiliently mounted on said stationary support.

11. A circuit breaker according to claim 10, said spring member being a leaf spring member supported on said stationary support with said bimetal member being supported on said leaf spring member spaced from said stationary support whereby said bimetal member is resiliently mounted on said stationary support.

12. A circuit breaker comprising a pair of contacts, a releasable member movable when released from an initial position to a tripped position to effect opening of said contacts, a stationary support, a leaf spring member comprising a first support part secured to said stationary support, said leaf spring member comprising a second support part, an elongated bimetal member fixed to said second support part of said leaf spring member, a latch member carried on said bimetal member and being in a latching position latching said releasable member in said initial position, said leaf spring member biasing said bimetal member to thereby bias said latch member to said latching position, and upon the occurrence of certain overload current conditions said leaf spring member and said bimetal member operating to move said latch member against said releasable member with an angular levering movement to thereby move said latch member from said latching position to an unlatching position to release said releasable member.

13. A circuit breaker comprising a pair of contacts, a releasable member movable when released from an initial position to a tripped position to effect opening of said contacts, latch means in a latching position latching said releasable member in said initial position, resilient means biasing said latch member against said releasable member, and upon the occurrence of certain overload current conditions means operating to move said latch means against said releasable member with an angular levering movement to thereby move said latch means from said latching position to an unlatching position to release said releasable member, said latch means comprising a rigid latch member, a bimetal member carrying said rigid latch member, said resilient means biasing said bimetal member to thereby bias said rigid latch member against said releasable member, and upon the occurrence of sustained lesser overload current conditions above a first predetermined value said bimetal member flexing to a tripped position during which flexing movement said biasing means biases said bimetal member to thereby maintain the bias of said rigid latch member against said releasable member to move said rigid latch member against said releasable member with said angular movement to provide a levering action of said rigid latch member against said releasable member to effect release of said releasable member.

14. A circuit breaker according to claim 13, and means operating upon the occurrence of an overload above a second predetermined value higher than said first predetermined value to move said rigid latch member rapidly to release said releasable member.

15. A circuit breaker comprising a stationary contact, a movable contact, a movable contact arm carrying said movable contact, a releasable member, trip means comprising a bimetal member and a lever latch member, said lever latch member comprising a support part, said lever latch member being fixedly secured to said bimetal member at said support part, said lever latch member being in a latching position latching said releasable member in an initial position, operating spring means, manually operable means operable when said releasable member is in said initial position to operate said operating spring means and move said movable contact arm to open and close said contacts, upon the occurrence of certain overload current conditions above a first predetermined value said bimetal member flexing to angle said lever latch member against said releasable member with a levering action to thereby release said releasable member, and upon release of said releasable member said operating spring means operating to move said releasable member and said movable contact arm to a tripped position to open said contacts.

16. A circuit breaker according to claim 15, and electromagnetic trip means operating automatically upon the occurrence of overload current conditions above a second predetermined value higher than said first predetermined value to move said lever latch member to release said releasable member.

17. A circuit breaker according to claim 15, said breaker comprising a front and a back, said manually operable means being positioned at the front of said breaker, an elongated bimetal member, spring support means supporting said elongated bimetal member at the front of said elongated bimetal member, said lever latch member comprising an elongated member, means fixedly securing said lever latch member in proximity to the back of said latch member to said bimetal member in proximity to the back of said bimetal member on the high-expansion side of said bimetal member with said lever latch member extending frontward along side the high-expansion side of said bimetal member, said releasable member comprising a first latch surface and a fulcrum part which part is positioned frontward of said first latch surface, said lever latch member comprising a second latch surface and a stop part which stop part is disposed frontward of said second latch surface, said spring support means biasing said bimetal member toward said releasable member to a latching position wherein said stop part on said lever latch member engages said fulcrum part on said releasable member and wherein said second latch surface engages said first latch surface to latch said releasable member, upon the occurrence of a sustained lesser overload current above a first predetermined value said bimetal member being heated and flexing to move the back end thereof away from said releasable member and to angle said lever latch member against said fulcrum part of said releasable member with a levering action during which movement said spring support means biases said lever latch member against said fulcrum part of said releasable member and during which movement said second latch surface moves away from said first latch surface to release said releasable member; and upon release of said releasable member said operating spring means operating to move said releasable member to a tripped position to effect movement of said movable contact arm to open said contacts.

18. A circuit breaker according to claim 12, said lever latch member being an armature lever latch member of magnetic material, a separate magnetic member, means supporting said separate magnetic member spaced from said armature lever latch member and spaced from said bimetal member on the low expansion side of said bimetal member, and upon the occurrence of an overload current above a second predetermined value higher than said first predetermined value said armature lever latch member being attracted to said separate magnetic member and moving with said bimetal member toward said separate magnetic member to release said releasable member.

19. A circuit breaker according to claim 10, means connecting said bimetal member to carry current in the circuit of said circuit breaker, and upon the occurrence of an overload above said second predetermined value the current in said bimetal member generating magnetic flux to cause said attraction of said armature lever latch member toward said separate magnetic member.

20. A circuit breaker according to claim 19, said spring support means comprising a flat leaf spring supported at one end thereof on a stationary support and being connected at the other end thereof to said bimetal member to support said bimetal member and to provide said bias of said bimetal member and said armature lever latch member toward said releasable member.

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