Jan. 6, 1970 D. B. POWELL 3,488,610

CIRCUIT BREAKER WITH IMPROVED THERMAL-MAGNETIC TRIPPING MECHANISM

Filed Sept. 21, 1967 2 Sheets-Sheet 1

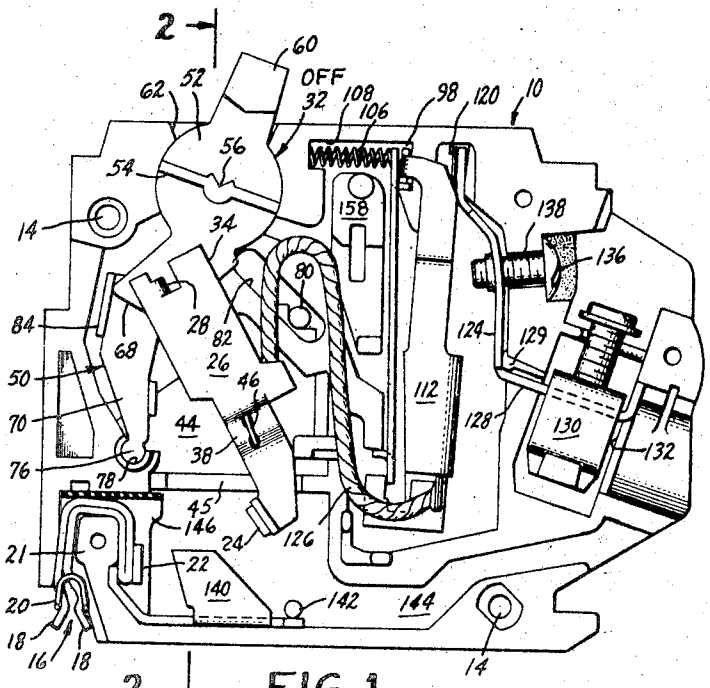


FIG. 1

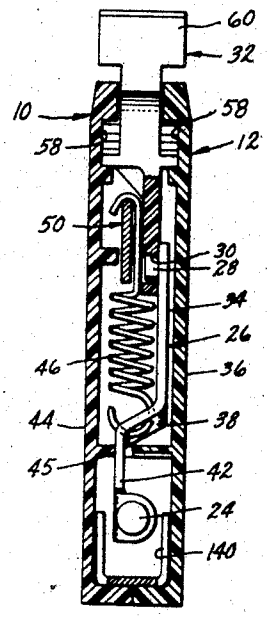


FIG. 2

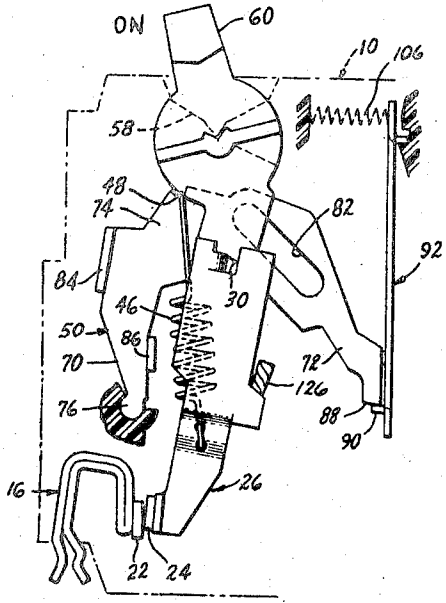


FIG. 3

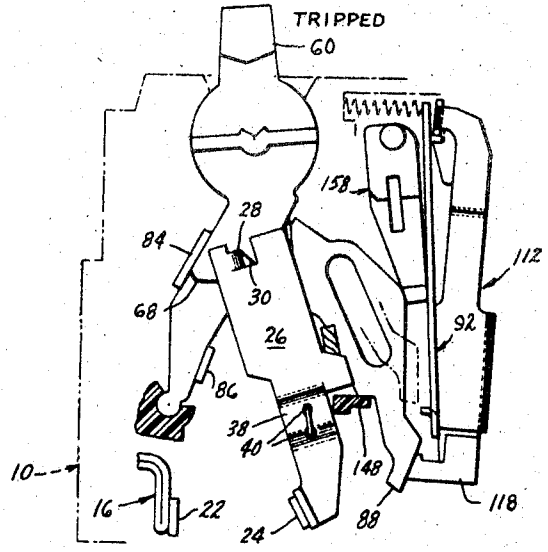


FIG. 4

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CIRCUIT BREAKER WITH IMPROVED THERMAL-MAGNETIC TRIPPING MECHANISM

Filed Sept. 21, 1967 2 Sheets-Sheet 2

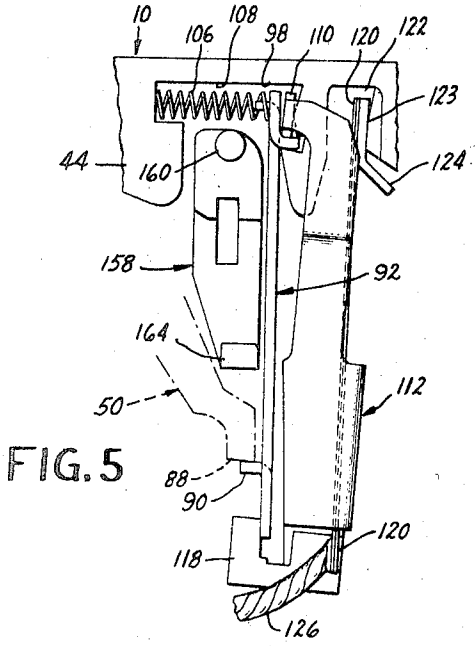


FIG. 5

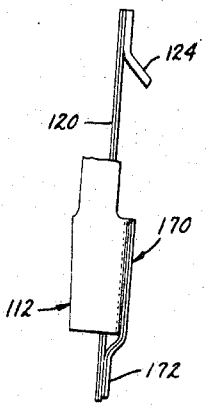


FIG. 7

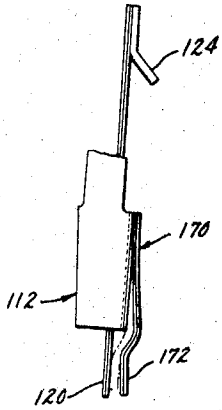


FIG. 8

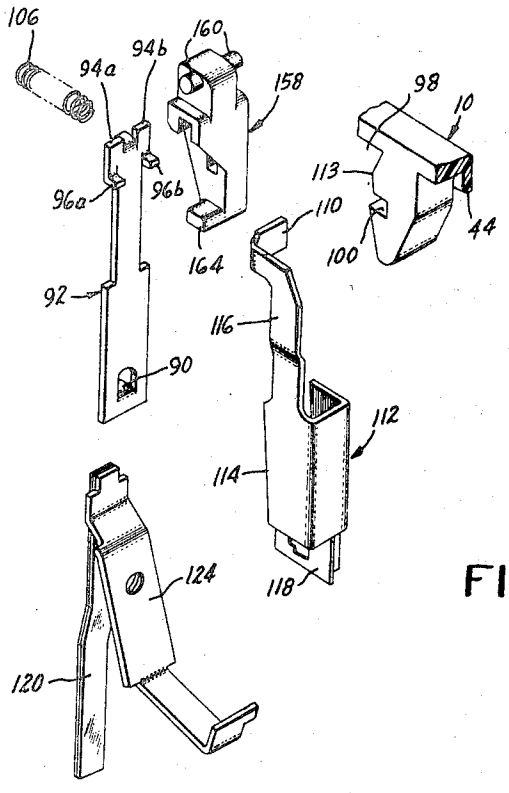


FIG. 6

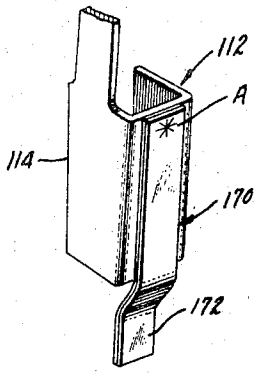


FIG. 9

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3,488,610

# CIRCUIT BREAKER WITH IMPROVED THERMAL-MAGNETIC TRIPPING MECHANISM

David B. Powell, Bristol, Conn., assignor to General Electric Company, a corporation of New York

Filed Sept. 21, 1967, Ser. No. 669,435
Int. Cl. H01h 73/48, 75/12, 77/02
U.S. Cl. 335—23 19 Claims

## ABSTRACT OF THE DISCLOSURE

A circuit breaker is constructed to have a highly effective thermal-magnetic tripping mechanism which is adaptable to devices of small width wherein an elongated latch member has its lower end portion latchingly engaged with one end of the cradle and an elongated magnet member has a generally U-shaped field portion opening toward and spaced from the lower end portion of the latch member. A bimetallic strip pivotally mounted at its upper end extends through the field portion of the magnet member for generation of a magnetic field therein and, upon deflection as a result of a sustained short circuit current, will pivot the latch member away from the cradle to effect release thereof. The upper end portions of the latch and magnet members are pivotally connected for relative movement therebetwen and ar pivotally supported in the casing for pivotal movement relative to the cradle about a common pivot for simultaneous pivoting thereof.

## BACKGROUND OF THE INVENTION

The line terminal and stationary contact construction illustrated and described in the present application are more fully described and claimed in copending application, Ser. No. 631,530, filed Apr.17, 1967, now Patent No. 3,383,486, by the inventor herein and assigned to the same assignee as the present invention.

The operating mechanism for the cradle, contact arm and operating handle illustrated and described herein are more fully disclosed and claimed in the copending application of the same inventor filed concurrently herewith and entitled Compact Circuit Breaker Construction, also assigned to the same assignee as the present invention.

Over the past several years, there has been a growing demand for reduction in the width of circuit breakers so as to facilitate minimization of the panel board assemblies or the utilization of a pair of circuit breakers side-by-side on a single line stab of a panel board which might otherwise seat only a single larger width breaker. In addition, there has been a growing desire to improve the predictability of operation of the thermal-magnetic tripping means and to facilitate the calibration thereof. Further problems have been introduced by the introduction of common trip members for simultaneously tripping coupled breakers.

It is an object of the present invention to present a novel circuit breaker construction utilizing a thermal-magnetic tripping means readily adapted to casings of relatively small width and nevertheless able to carry short circuit currents effectively while affording long lived rapid operation.

It is also an object to provide such a circuit breaker construction wherein the thermal-magnetic elements may be fabricated and assembled with relative facility and economy.

Another object is to provide such a circuit breaker construction wherein use of a common trip member is readily accomodated and possible damage thereby to the thermal-magnetic means is precluded.



Still another object is to provide a thermal-magnetic means for a circuit breaker which is readily adapted to facile calibration and in which operation is not highly sensitive to minor deviations in tolerance or calibration.

## SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects can be readily attained in a circuit breaker wherein the casing has a releasable cradle pivotably mounted at one end therein and an elongated latch member having its lower end portion latchingly engaged with the free end of the cradle. An elongated magnet member in the casing has a generally U-shaped field portion adjacent its lower end opening towards and spaced from the lower end portion of the latch member. Means in the casing provide a pivotal connection between the upper end portions of the latch and magnet members for relative movement therebetween and pivotally support the upper end portions of the latch and magnet members for pivotal movement about a common pivot for simultaneous pivoting thereof relative to the free end of the crade. Biasing means pivot the lower end portion of the latch member toward the free end of the cradle so as to encourage latching engagement therebetween, and a bimetallic strip pivotally mounted at one end extends through the field portion of the magnet member to generate a magnetic field therein upon passage of current therethrough.

The bimetallic strip is deflectable by a sustained short circuit current of relatively low magnitude flowing therethrough to pivot the latch member against the pressure of the biasing means away from the free end of the cradle, thereby releasing the cradle and tripping the breaker. Upon passage of a sudden relatively high short circuit current flowing through the bimetallic strip, a magnetic field will be generated in the field portion of the magnet member which is of sufficient magnitude to pivot the latch member about the pivot between the latch and magnet members and towards the field portion, thereby effecting release of the cradle and tripping of the breaker.

In the preferred embodiment of the present invention, the bimetallic strip will normally act upon the magnet member to effect pivoting thereof and the magnet member in turn will act upon the latch member to effect pivoting thereof and reelase of the cradle since the members are pivotable together about a common pivot point. To effect such movement of the latch member, engagement must be provided between the latch and magnet members most conveniently by a hook-shaped element or the like which will engage the lower end of the latch member upon pivoting of the magnet member in a direction away therefrom.

This arrangement permits the latch member to pivot towards the magnet member about the pivot therebetween when a common trip member is employed and thus precludes damage which might result from the use of a stationary magnet member or a structure in which the bimetallic strip carries the field piece and closely coupled to the latch member to effect tripping thereof.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a side elevational view of an electric circuit breaker embodying the present invention with one side of the insulating casing removed to show internal construction;

FIGURE 2 is a sectional view of the circuit breaker of FIGURE 1 generally along the line 2—2 thereof;

FIGURE 3 is a fragmentary, partially diagrammatical view showing the operating mechanism in the "on" condition;

FIGURE 4 is a similar view showing the operating mechanism in the "tripped" condition;

FIGURE 5 is a fragmentary sectional view thereof on a greatly enlarged scale illustrating the tripping mechanism;

FIGURE 6 is an exploded view of the thermal-magnetic tripping mechanism of the circuit breaker of FIGURE 1;

FIGURE 7 is a fragmentary elevational view of an alternate embodiment of thermal-magnetic trip construction;

FIGURE 8 is a view similar to FIGURE 7 drawing in phantom line the displacement of the main bimetallic strip provided by the ambient bimetallic strip; and

FIGURE 9 is a perspective view of the magnet-ambient bimetallic member subassembly of FIGURE 7.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGURES 1–6 of the drawings in detail, an electric circuit breaker embodying the present invention has a molded insulating casing provided by a pair of interfitting sections generally designated by the numerals **10**, **12** which are secured together by fasteners (not shown) seated in the apertures **14** therein. Each of the sections has a complex interior surface configuration providing ribs, shoulders, apertures and recesses as will be described more fully hereinafter in connection with the various parts of the operating mechanism.

At the front end of the casing is a line terminal generally designated by the numeral **16** which has at one end a pair of clamping jaws **18** biased together by a spring clip **20** extending through an aperture in the wall of the sections **10**, **12** for engagement with a stab or contact of a panel board (not shown). The terminal **16** fits over a shoulder or rib **21** formed on the casing sections **10**, **12** and has a stationary contact **22** at its other end.

A movable contact **24** is carried by the lower end of the contact arm generally designated by the numeral **26** for movement into and from electrical engagement with the stationary contact **22**. As best seen in FIGURES 2 and 6, the contact arm **26** is fabricated from sheet metal to minimize thickness of the breaker and has a laterally extending finger **28** at its upper end which is pivotably mounted in the aperture **30** of the operating handle generally designated by the numeral **32**. The upper portion **34** of the contact arm **26** is generally planar and extends adjacent the sidewall **36** of the casing section **12** and to the side of the operating handle **32**. At its center is an offsetting portion **38** with a pair of apertures **40** therein and extending transversely of the casing below the operating handle **32**. The lower portion **42** of the contact arm **26** is generally L-shaped with its vertical portion extending generally planar adjacent the sidewall **44** of the casing section **10** and its horizontal portion carrying the movable contact **24**.

Engaged at one end in the apertures **40** of the contact arm **26** is a tension spring **46** which has its other end engaged in a notch or recess **48** in the upper edge of the cradle generally designated by the numeral **50**. In this manner, the spring **46** applies biasing pressure on the contact arm **26** toward the handle **32** and cradle **50** which ensures rapid snap action into open or closed contact position as it pivots about the handle **32**. As best seen in FIGURE 2, by having the upper edge of the finger **28** cut at a slight angle to the horizontal (about 8 to 15 degrees) and a cooperating taper in the aperture **30** of the handle **32**, the upper portion **34** of the contact arm **26** is drawn toward the side surface of the handle **32** for sliding movement thereon to avoid friction on the casing sidewall **12** and also facilitate retention of the elements during assembly. The lower portion **42** slides along the surface of the rib **45** on the sidewall **44** of the casing section **10**.

The operating handle **32** has a hub portion **52** with diametrically extending ribs **54** on either side having a notch **56** in the upper edge thereof and which pivotably seat in cooperatively configured and dimensioned generally butterfly-shaped recesses **58** in the sidewalls **36**, **44** of the casing sections **10**, **12** so as to be pivotably supported thereby. A grip portion **60** extends outwardly of the casing through an aperture **62** in the top wall **64** of the casing section **10** for manual engagement. A depending portion or extension **68** extends forwardly of the casing and has the aperture **30** therein pivotably supporting the contact arm **26**.



The cradle **50** is a relatively thin member disposed between the operating handle **32** and the sidewall **44** of the casing **10**. It has a generally inverted U-shaped configuration with a pair of legs **70**, **72** and a center portion **74** having the notch **48** in its upper edge into which the spring **46** is hooked. The forward leg **70** has a generally circular end portion **76** which is pivotably retained in cooperatively configured recesses **78** formed in the sidewalls **36**, **44** of the casing sections **10**, **12** so that the cradle **50** may pivot thereabout. To prevent binding of the cradle **50** between the casing sections **10**, **12** due to deflecting pressure on the sidewalls, a spacing boss **80** is provided on the sidewall **44** of casing section **10** which extends through an elongated slot **82** in the cradle rear leg **72**. As the cradle **50** pivots about the end portion **76**, the boss **80** will slide freely within the slot **82** thereof.

At its upper end, the cradle front leg **70** has a laterally inwardly extending tab **84** at its front edge which is adapted to be engaged by the depending portion **68** of the operating handle **32** when it is moved to the "off" position shown in FIGURE 1 so as to produce pivoting of the cradle **50** from the "tripped" condition shown in FIGURE 4. The further pivoting of the handle **32** in the clockwise direction past the "off" position lifts the cradle **50** into the latched condition. When the cradle **50** is released from the latch **90**, it rotates clockwise as viewed in FIGURE 1, carrying the upper end of the spring **46** across the line of centers of the spring anchor point **26***a* on contact member **26** and pivot **28** on handle **32**. This causes the spring **26** to rotate the contact arm **26** toward open condition. As the contact arm **26** moves to open condition, the toggle system comprising handle pivot **32***a*, contact arm pivot **28**, and spring anchor point **26***a* collapses by movement of the mid-point **28** to the left as viewed, rotating the handle clockwise. The clockwise rotation of the handle **32** is limited by its engagement with tab **84** of the cradle **50**. A second laterally inwardly extending tab **86** is provided on the rear edge of the front leg **70** at a point spaced downwardly from the tab **84** so that it will strike the contact arm **26** upon tripping of the breaker in the event that the stationary contact **22** and movable contact **24** are fused together by a short circuit current and thus break them apart.

The rear leg **72** of the cradle **50** has a latch portion **88** at its lower end providing a shoulder or edge which is latched or engaged with a tab **90** adjacent the lower end of the latch member generally designated by the numeral **92** in the normal operating or untripped condition of the breaker. The upper end portion of the latch member **92** has laterally extending shoulder portions **94***a*, **94***b* with rearwardly extending arms **96***a*, **96***b* at the lower end thereof, and the shoulder portion **94***a* seats in the recess **98** in the sidewall **44** of the casing section **10**. The arms **96***a*, **96***b* slidably seat on a downwardly sloping shoulder **100** of the recess **98** in the sidewall **44** of the casing section **10**.

Mounted on the arms **96***a*, **96***b* of the latch member **92** is the laterally extending finger **110** of the magnet member generally designated by the numeral **112**. The finger portion **110** extends transversely with its transverse plane tapering rearwardly from the arms **96***a*, **96***b* so as to provide a diverging spacing between the opposed surfaces of the finger portion **110** and latch member **92**. The latch member **92** is biased about the pivot provided by the bottom edge of the finger **110** of the magnet mem-

ber **112** in a clockwise direction and into latching condition by a compression spring **106**. A recess **108** in the sidewall **44** of the casing section **10** provides a seat for one end of the spring **106** and the other end fits over a forwardly extending tang **109** upon the upper end of the latch member **92** spaced above the point of its pivot with the magnet member **112**.

The magnet member **112** pivots about a point on the rearwardly angled shoulder **113** of the recess **98** in the sidewall **44** which is spaced slightly above the pivot point between the magnet member **112** and latch member **92** (see FIG. 6). As a result, the spring pressure on the latch member **92** above its pivot with the magnet member **112** produces a scissors-type action with the result that the latch member **92** tends to rotate in a clockwise direction and the magnet member **92** tends to pivot in a counterclockwise direction. The pivot point for both members to act in unison is the pivot point of the magnet member **112** on the shoulder **113** of the recess **98**.

The magnet member **112** is fabricated from a magnetically susceptible metal and has a field portion **114** of generally U-shaped cross section opening toward the latch member **92** adjacent the lower end thereof and an arm portion **116** extending upwardly from one leg of the field portion **114** along the sidewall **36** of the casing section **10** with the finger **110** at the upper end thereof. A generally U-shaped hook element **118** of non-magnetic metal extends forwardly from the other leg of the field portion **114** and engages the lower end of the latch member **92** in the normal operating condition.

An elongated bimetallic strip **120** extends through the field portion **114** of the magnet member **112** from a recess **122** in the casing sidewall **44** spaced rearwardly of the recess **98** and having a rearwardly tapering rear wall **123** and wherein its upper end is joined to the terminal strap **124** by brazing, welding or the like. A flexible conductor **126** extends between its lower end below the field portion **114** and the center portion **38** of the contact arm **26** to provide the electrical path through the breaker from the terminal strap **124**. The terminal strap **124** extends through a slot **128** in the casing section **10** after passing about an inwardly projecting boss **129** on the casing section **10** so that it and the wall **123** provide a two point support for the strap **124** outwardly from the wall surface of the casing section **10** therebetween. The outer end of the conductor strap **124** has a load conductor lug **130** thereon disposed in cooperatively configured recesses **132** in the casing section sidewalls **36, 44** to secure a conductor (not shown) from a load thereto. The terminal strap **124** is secured in the casing by the retaining screw **136** which is threadably engaged therein and extends through a slot **138** in the casing section **10**. By turning the screw **136**, the center portion of the strap **124** between the wall **123** and boss **129** can be drawn toward the wall surface adjacent the screw **136** to produce deflection. The upper end of the terminal strap **124** and the bimetallic strip **120** are displaced forwardly within the recess **122** by the deflection, thus altering the pivot point for the bimetallic strip **120** and thereby permitting calibration to a desired temperature rise before it will act upon the magnet member **112** to effect tripping of the breaker.

To assist in heat dissipation and extinguishing of an arc drawn between the contacts **22, 24** upon opening thereof, a metal arc chute **140** is provided and secured in position by the line terminal **16** and the bosses **142** on the sidewalls **36, 44** of the casing sections **12, 10**. Hot gases are vented through the channel **144** provided in the sidewalls **36, 44** of the casing sections **12, 10**. An insulating element **146** is fitted over the line terminal **16** and tends to isolate the line terminal **16** from the surrounding structure and provide a better dielectric path.

In operation of this embodiment, current flows from the line terminal **16** to the contact arm **26** through the closed contacts **22, 24** and thence to the bimetallic strip **120** through the flexible conductor **126**. As the current flows upwardly through the bimetallic strip **120** to the terminal strap **124**, a magnetic field is generated in the field portion **114** of the magnet member **112** which attracts the latch member **92** toward it but the biasing pressure of the compression spring **106** is sufficient to offset the magnetic attraction thus generated during normal operation of the breaker. The normal spacing or magnetic gap of the two members is determined by the hook element **118** which engages the two and prevents them from pivoting apart to a greater distance. However, upon generation of a sudden high overload current of predeterminable magnitude, the magnetic field will be increased sufficiently to overcome the pressure of the spring **106** and pivot the latch member **92** and magnet member **112** relative to each other. Initially, the magnet member **112** will tend to pivot toward the latch member **92** until further movement is blocked by the bimetallic strip **120**. Thereafter, pivoting of the latch member **92** toward the magnet member **112** will take place until the latch portion **88** of the cradle **50** slides from the tab **90** on the latch members **92**.

Upon release of the latch portion **88** of the cradle **50**, the spring **46** pivots the cradle **50** downwardly or clockwise as seen in FIGURES 3 and 4 about the pivoted circular end portion **76**. As it pivots, the front tab **84** thereon strikes the depending portion **68** of the operating handle **32** producing counterclockwise pivoting thereof. As the cradle **50** pivots, the line of action of the spring **46** passes the pivot point for the contact arm **26** in the operating handle **32** with the result that the toggle action snaps the contact arm **26** about its pivot in a counterclockwise direction to open the contacts **22, 24** and produce the magnetically tripped condition indicated in FIGURE 4. Pivoting of the contact arm **26** is limited by the stop boss **148** on the casing sidewall **44**.

Resetting of the breaker mechanism is effected by pivoting the operating handle **32** from the tripped position shown in FIGURE 4 in the clockwise direction to the full extent permitted which produces pivoting of the cradle **50** by reason of the abutment of the depending portion **68** against the front tab **84**. This elevates the rear leg **72** until the latch portion **88** clears the tab **90** on the latch member **92** which is biased by the spring **106** toward the cradle **50** to produce latching thereof and the condition illustrated in FIGURE 1.

Tripping of the breaker can also be effected by a sustained current of low magnitude which will produce bending of the bimetallic strip **120** in the direction of the transverse web of the field portion **114** of the magnet member **112**. As the bending continues, the bimetallic strip **120** will bear against the field portion **114** and pivot the magnet member **112** in a counterclockwise direction which, in turn, will draw or pivot the latch member **92** in the same direction by reason of the engagement of the hook element **118** therewith. As pivoting continues, the tab **90** disengages from the latch portion **88** of the cradle **50** and tripping occurs.

In the illustrated embodiment, there is also shown means for effecting common tripping action with another breaker in a multi-pole arrangement. A common tripping member, generally designated by the numeral **158**, is of elongated nature and has ears **160** adjacent the upper end thereof which pivotally seat in recesses **162** in the sidewalls **36, 44** of the casing sections **12, 10**. At its lower end it has a transversely extending bar **164** adapted to bear against the latch member **92** upon pivoting thereof in the counterclockwise direction so as to effect release of the cradle **50** in the event of pivoting thereof by action of another breaker through a trip interlock (not shown) seated in the slot **166** therein.

Upon tripping of the breaker through action of either the thermal or the magnetic tripping means, the cradle **50** will cam against the lower portion of the common tripping member **158** to produce pivoting thereof in the counterclockwise direction which is thereby translated in-

to equivalent movement of a common tripping member in another breaker coupled therewith.

Manual operation of the breaker between "on" and "off" positions is readily effected through pivoting of the operating handle **32** between the positions shown in FIGURE 1 and FIGURE 3. As the depending portion **68** pivots the upper end of the contact arm **26** through the line of action of the spring **46**, the resultant toggle action opens or closes the contacts **22, 24**.

Turning now to the embodiment of FIGURES 7 through 9, there is provided means for compensating the effect of ambient temperatured variations upon the bimetallic strip **120**. A relatively short ambient bimetallic strip generally designated by the numeral **170** is secured at its upper end to the field portion **114** of the magnet member **112** at the point A by welding or the like to provide a point about which it may pivot. The lower end portion **172** is offset towards the bimetallic strip **120** and will normally bear thereagainst and will flex away therefrom as a result of temperature changes.

In operation of this embodiment, the bimetallic strip **120** will not normally engage the magnet member **112** directly to effect pivoting thereof in response to short circuit current flow but will effect the pivoting thereof through the ambient bimetallic strip **170**. However, increase in ambient temperature producing flexure of the bimetallic strip **120** in the unlatching direction as contrasted with a temperature increase produced by a short circuit current will simultaneously produce flexure of the ambient bimetallic strip **170** in the same direction so that pivoting of the magnet member **112** is not effected. The degree of the normal offset in the lower end portion **172** determines the ambient temperature gradient compensatable before the bimetallic strip **120** bears against the field portion **114** of the magnet member **112** to effect pivotal movement thereof and tripping.

In the illustrated embodiment, the latch and magnet members **92, 112** are shown as having a common pivot provided by the slope of the shoulder **113** defining a wall of the recess **98** in which their upper end portions are received, and the face of the pivot finger **110** of the magnet member **112** slopes away from the opposed surface of the latch member **92**. Although this particular arrangement has proven highly beneficial because of the scissors-type pivoting action generating a controlled spacing therebetween and the optimum operation afforded thereby, the magnet member **112** and the latch member **92** may also pivot about a common pivot provided by the support surface for the latch member **92**. Alternatively, the magnet member **112** may provide arms upon which shoulders on the latch member **92** are pivotally supported and these arms in turn would be pivotably supported on a support shoulder of the casing.

Where the common pivot is below the pivot point between the two members, they will tend to pivot in the same direction in response to the biasing action of the spring so that means for providing the desired spacing therebetween must be provided, such as the bimetallic strip or a shoulder on the casing limiting the pivotal movement of the magnet member towards the latch, or a spring acting therebetween. Instead of using angular shoulders on the casing to provide the support and pivot surfaces, pivot pins and other suitable mounting means can be employed albeit with an increase in number of parts and problems of assembly.

In the illustrated embodiment, the hook element **118** on the magnet member **112** establishes the magnetic gap accurately and it remains constant whether the circuit breaker is cold or hot. If so desired, the latch portion **88** of the latch member **92** may have a projection thereon extending towards the cradle **50** and limiting the amount of surface contact between the tab **90** and the latched end of the releasable cradle **50** so as to minimize the amount of pivoting of the latch member required to effect tripping of the breaker. Such an arrangement is particularly desirable with breakers of low current rating when they are cold to increase their sensitivity.

It will be readily appreciated that the illustrated embodiment affords significant advantages from the standpoints of ease of fabrication of the several elements and ease of assembly of the elements. In assembling the thermal-magnetic tripping mechanism, the assembly of the terminal strap **124** and bimetallic strip **120** is dropped into its slot **128** of the casing with the joined upper ends thereof disposed in the recess **122** of the casing section **10**. The retaining screw **126** is then inserted in the slot **138** of the casing and engaged with the terminal strap **124**. The magnet member **112** and latch member **92** are then seated in the recess **98** of the sidewall **44** with the magnet member **92** being rotated into position about the bimetallic strip **120**. Insertion of the compression spring **106** over the tang **109** on the latch member **92** and into the recess **108** of the sidewall **44** then applies the biasing pressure to these two elements. Upon completion of the assembly, the retaining screw **136** is tightened to ensure the desired calibration of the bimetallic strip **120**.

By reason of the relatively long length of the bimetallic strip and its arrangement within the assembly, it can be seen that a highly effective low level magnetic trip is provided while at the same time minimizing its sensitivity from the standpoint of calibration. Similarly the magnetic trip is rendered highly responsive to short circuit currents at levels which may be relatively low dependent upon the desired point of operation of the tripping mechanism.

Although the operating mechanism of the illustrated embodiment is optimum from the standpoint of competence, and ease of construction and assembly, it will be appreciated that the thermal-magnetic tripping mechanism of the present invention may be utilized with other more conventional types of operating mechanism. It will also be appreciated that other more conventional means for effecting calibration of the bimetallic strip can be employed such as a screw acting directly upon the upper end portion of the terminal strap and bimetallic strip to shift the pivot point thereof.

Thus it can be seen from the foregoing detailed specification and the accompanying drawings that the circuit breaker of the present invention provides a thermal-magnetic tripping mechanism readily adapted to relatively small widths while still affording highly effective means for handling substantial circuit currents. The interrelation of the parts permits a minimization of parts and the size of the assembly while affording optimum coaction therebetween. The several parts can be readily fabricated and easily assembled rapidly and with minimum likelihood of improper assembly.

While the invention has been illustrated and described with respect to specific embodiments, it will readily be apparent that many modifications thereof may be made and it is intended by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

**1.** In a circuit breaker, the combination comprising:

(a) a casing;

(b) a releasable cradle having one end portion pivotally mounted in said casing;

(c) an elongated latch member having its lower end portion latchingly engaged with the other end portion of said cradle;

(d) an elongated magnet member having a generally U-shaped field portion adjacent its lower end opening towards and spaced from said lower end portion of said latch member;

(e) means in said casing pivotally supporting said latch and magnet members for pivotal movement as a unit about a common pivot for simultaneous pivoting thereof relative to said casing and relative to said

cradle other end portion, said latch member and said magnet member also being pivotally movable with respect to each other;

(f) biasing means pivoting said lower end portion of said latch member towards said cradle other end portion; and

(g) a bimetallic strip fixedly mounted at one end and extending through said field portion to generate a magnetic field therein upon passage of current therethrough, said bimetallic strip being deflectable by a sustained short circuit current of relatively low magnitude flowing therethrough to pivot said latch member and said magnet member about said common pivot in a direction so as to move said lower portions of said latch member and said magnet member away from said cradle against the pressure of the biasing means and thereby to release said cradle, said bimetallic strip upon passage of a sudden relatively high short circuit current flowing therethrough generating a magnetic field in said field portion of said magnet member of sufficient magnitude to pivot said latch member relative to said magnet member in a direction towards said field portion and thereby to release said cradle.

**2.** The circiut breaker in accordance with claim **1** wherein said bimetallic strip deflects into contact with said lower end of said magnet member upon passage of a sustained overload current therethrough to effect pivoting thereof and wherein said magnet member is engageable with said latch member to effect pivoting thereof upon said pivotal movement thereof by said bimetallic strip so as to release said cradle from said latch member.

**3.** The circiut breaker in accordance with claim **1** wherein said bimetallic strip limits movement of said magnet member towards said latch member.

**4.** The circuit breaker in accordance with claim **1** wherein said circuit breaker includes means pivotally inter-connecting said latch member and said magnet member, and wherein the common pivot for said magnet and latch members relative to said casing is spaced toward the upper ends thereof from said inter-connection so as to provide a scissors-type action therebetween by said biasing means tending to move the lower ends of said magnet and latch members apart.

**5.** The circuit breaker in accordance with claim **4** wherein the upper end portions of said magnet and latch members above said pivot therebetween are angularly offset with respect to each other to permit pivoting of the one upper end portion relative to the other upper end portion for enhanced scissors-type pivotal action.

**6.** The circuit breaker in accordance with claim **1** wherein said pivotal supporting means in said casing includes a laterally extending arm portion at the upper end portion of one of said members and a cooperating shoulder portion on the upper end portion of the other member pivotably supported thereon.

**7.** The circuit breaker in accordance with claim **6** wherein said casing provides a shoulder supporting the lower surface of said arm portion.

**8.** The circuit breaker of claim **1** wherein said pivotal supporting means includes a shoulder on the casing providing a pivot point and bearing surface for one of the members and a second shoulder on the casing providing sliding support for the other member to provide pivotal movement about a common pivot provided by said pivot point.

**9.** The circuit breaker in accordance with claim **1** wherein there is provided a common trip member pivotally mounted in said casing and pivotable against said latch member to effect release of said cradle, said latch member being pivotable towards said magnet member about said pivotal supporting means.

**10.** The circuit breaker in accordance with claim **1** wherein an ambient bimetallic strip is mounted at one end on said field portion of said magnet member and said first mentioned bimetallic strip bears thereagainst, said ambient bimetallic strip and said first mentioned bimetallic strip deflecting in the same direction in response to changes in ambient temperature to prevent undesired tripping of the breaker.

**11.** The circuit breaker in accordance with claim **4** wherein said bimetallic strip deflects into contact with said lower end of said magnet member upon passage of a sustained overload current passing therethrough to effect pivoting thereof and connecting means are provided between said latch and magnet members to engage said latch member upon pivoting of said magnet member by said bimetallic strip and thereby effect pivoting of said latch member to release said cradle, and wherein said biasing means acts upon said latch member above the pivotal connection between said latch and magnet members and said common pivot is spaced toward the upper ends of said members from the pivot therebetween to provide a scissors-like pivoting action pivoting the lower end portions of said members apart, said connecting means providing a controlled spacing therebetween but permitting pivoting of the members toward each other.

**12.** The circuit breaker in accordance with claim **11** wherein the upper end portions of said magnet and latch members above said pivot therebetween are angularly offset with respect to each other to permit pivoting of the one upper end portion relative to the other upper end portion for enhanced scissors-type pivotal action.

**13.** The circuit breaker in accordance with claim **1** wherein said pivotal supporting means includes a laterally extending arm portion at the upper end portion of said magnet member and a shoulder on the latch member pivotably seated thereon, said casing providing a first angularly disposed shoulder supporting said arm portion thereon and a second angularly disposed shoulder spaced above said first shoulder and against which said upper end portion of said magnet member bears in response to the pressure of said biasing means to provide said common pivot therefor.

**14.** In a circuit breaker, the combination comprising:

(a) a casing;

(b) a releasable cradle having one end portion pivotally mounted in said casing;

(c) an elongated latch member having its lower end portion latchingly engaged with the other end portion of said cradle;

(d) an elongated magnet member having a generally U-shaped field portion adjacent its lower end opening toward and spaced from the lower end portion of said latch member, one of said latch and magnet members having a laterally extending arm at the upper end portion thereof pivotally supporting a shoulder on the upper end portion of the other of said members to provide a pivot point for relative movement therebetween;

(e) means in said casing supporting said upper end portion of said other member for pivotal movement and providing a common pivot for simultaneous pivoting of said members about said cradle other end portion, said common pivot being spaced toward the upper ends of said members from the pivot point therebetween;

(f) biasing means acting against said upper end portion of said latch member above said pivot point therebetween to pivot said lower end portion of said latch member toward said cradle other end portion to effect latching engagement therebetween and to pivot the lower end portion of said magnet member away from said cradle other end portion;

(g) connecting means between said latch and magnet members adjacent the lower ends thereof for engaging said latch member upon pivoting of said magnet member away from said cradle; and

(h) a bimetallic strip pivotably mounted at one end and extending through said field portion to generate

a magnetic field therein upon passage of current therethrough, said bimetallic strip being deflectable against said magnet member by a sustained short circuit current of relatively low magnitude flowing therethrough to pivot said magnet member and thereby said latch member away from said cradle against the pressure of the biasing means and thereby to release said cradle, said bimetallic strip upon passage of a sudden relatively high short circuit current flowing therethrough generating a magnetic field in said field portion of said magnet member of sufficient magnitude to pivot said latch member about the pivot between said latch and magnet members toward said field portion and thereby to release said cradle.

**15.** The circuit breaker in accordance with claim **14** wherein the upper end portions of said magnet and latch members above said pivot therebetween are angularly offset with respect to each other to permit pivoting of the one upper end portion relative to the other upper end portion for enhanced scissors-type pivotal action.

**16.** The circuit breaker in accordance with claim **14** wherein said support means is provided by a first angularly disposed shoulder on said casing providing a support for said arm of said one member and a second angularly disposed shoulder on said casing against which said upper end portion of said magnet member bears in response to the pressure of said bearing means to provide said common pivot therefor.

**17.** The circuit breaker in accordance with claim **14** wherein there is provided a common trip member pivotally mounted in said casing and pivotable against said latch member to effect release of said cradle, said latch member being pivotable towards said magnet member about the pivot therebetween.

**18.** The circuit braker in accordance with claim **14** wherein an ambient bimetallic strip is mounted at one end on said field portion of said magnet member and said first mentioned bimetallic strip bears thereagainst, said ambient bimetallic strip and said first mentioned bimetallic strip deflecting in the same direction in response to changes in ambient temperature to prevent undesired tripping of the breaker.

**19.** The circuit breaker in accordance with claim **14** wherein said bimetallic strip is pivotally mounted at said one end upon a conductor strap secured in said casing by a threaded member threadably seated therein and wherein said casing has a recess portion adjacent said threaded member to provide a pair of shoulders to opposite sides of said threaded member, said one end of said bimetallic strip being displaceable by rotation of said threaded member to draw said conductor strap towards the wall of said casing in said recess portion and produce deflection of the conductor strap.

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