April 5, 1966 A. STROBEL 3,244,837

HEATING MEANS FOR BIMETAL TRIP ELEMENT

Filed Dec. 17, 1962

FIG. 1

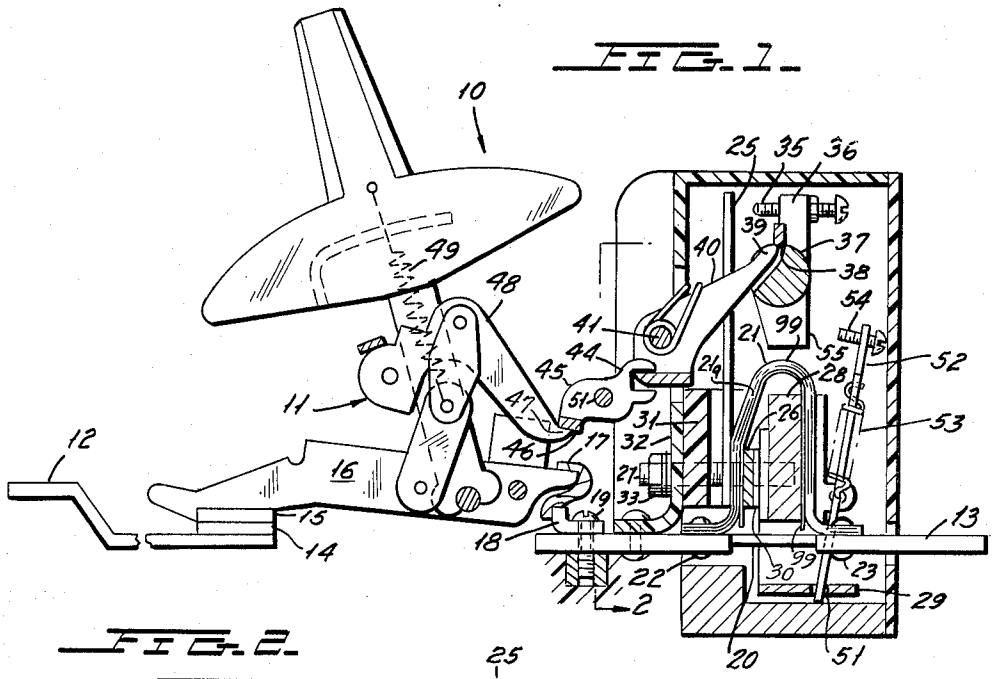


FIG. 2

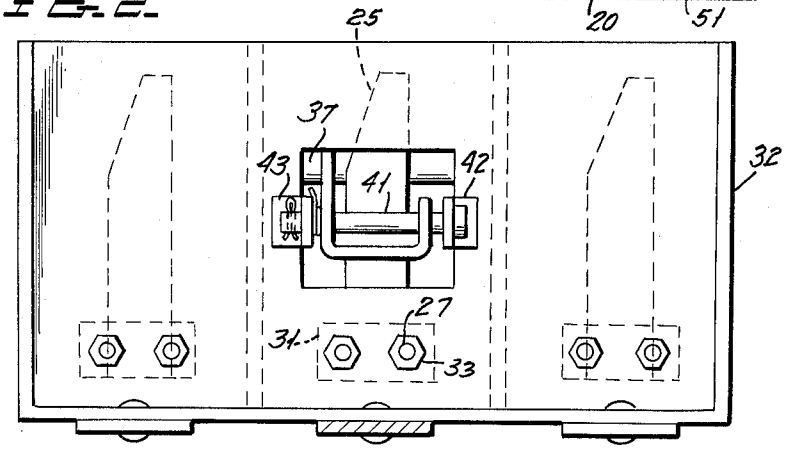
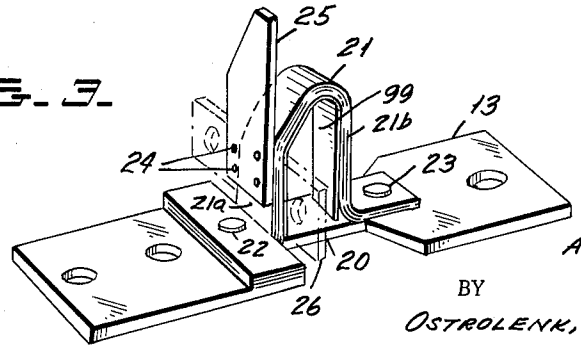


FIG. 3



INVENTOR.
ALBERT STROBEL

BY

OSTROLENK, FABER, GERB & SOFFEN

ATTORNEYS

United States Patent Office 3,244,837 Patented Apr. 5, 1966

3,244,837

HEATING MEANS FOR BIMETAL TRIP ELEMENT

Albert Strobel, Cherry Hill, N.J., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed Dec. 17, 1962, Ser. No. 244,989
5 Claims. (Cl. 200—116)

This invention relates to circuit breakers in general and more particularly to a construction for an automatic trip unit having a novel bimetal heater arrangement.

In molded case circuit breakers, especially in the higher current rated units, the current carrying and contact operating elements are closely spaced within the housing. Trip units for these breakers are usually provided with bimetals which are indirectly heated by means of laminated conductors. The laminated conductors are arranged to also supply current for energization of the instantaneous magnetic trip structure.

A laminated heater is required since it is necessary to provide for flexibility between the bimetal and the heater terminals. The bimetal must be mounted rigidly to maintain calibration settings for time delayed tripping while the conductor between the heater terminals and the bimetal must be flexible to allow for distortion which often occurs when interchangeable trip units are mounted in different base assemblies.

Industry is constantly striving to reduce the size of circuit interrupters for a given rating and as a result is striving to reduce the size of trip units for these interrupters. A major obstacle to be overcome in reducing the size of such a trip unit is the substantial thickness of the laminated heater required to carry the entire phase current without overheating the entire interrupter. In an attempt to overcome this obstacle the prior art has utilized solid heater constructions, but in so doing has sacrificed calibration accuracy.

In the device of the instant invention the conventional laminated heater is combined with a solid heater with these heaters being connected in electrical parallel. The solid portion is provided with a reduced cross-section between the points where the laminated portion is fastened. The laminated portion and the solid portion of reduced cross-section are so proportioned that a large percent of the total phase current flows through the solid portion creating some heat whereas a relatively smaller portion flows through the laminated portion. The laminated portion is constructed of relatively few layers with a relatively high total resistance and as a result furnishes most of the heat to operate the bimetal. In addition, the current through the laminated portion is sufficient to operate the magnetic structure. It has been found that the solid heater portion may be located in a section of the trip unit where space requirements are not as critical as in most other sections of the trip unit. Further, by reducing the number of laminations required the width of the trip unit may be reduced considerably.

Accordingly, a primary object of this invention is to provide a circuit interrupter having a novel trip unit construction.

Another object is to provide a trip unit having a novel bimetal heater construction.

Still another object is to provide a bimetal heater having a solid portion and a laminated portion in shunt with the solid portion with the laminated portion arranged to carry current for energization of a magnetic trip unit.

A further object is to provide a bimetal heater having parallel solid and laminated portions with the impedances of these portions being proportioned such that most of the heat for bimetal deflection results from the passage of current through the laminated portion.

These as well as other objects of this invention shall become readily apparent after reading the following description of the accompanying drawings in which:

FIGURE 1 is a side elevation showing current carrying and operating elements in the center phase of a three phase circuit breaker which includes a trip unit having a bimetal heater constructed in accordance with the teachings of the instant invention.

FIGURE 2 is an end view of the trip unit looking in the direction of arrows 2—2 of FIGURE 1.

FIGURE 3 is a perspective illustrating the relationship between the bimetal, the laminated heater portion and the solid heater portion.

Now referring to the figures. Circuit interrupter **10** is a three phase molded case unit having a contact operating mechanism **11** of a type described in detail in United States Patent 2,932,706, issued April 12, 1960, to A. Bodenschatz, entitled Hold Open and Anti-Rebound Latches. Since contact operating mechanism **11** forms no part of this invention, mechanism **11** shall not be described herein except in relation to the trip unit.

Each phase of circuit breaker **10** is provided with a current path extending between line terminal **12** and load terminal **13** as follows: line terminal **12** through stationary contact **14** mounted thereon, to movable contact **15** and contact arm **16** carrying contact **15** at one end thereof, through flexible braid **17** mounted to the other end of contact arm **16**, to clip **18** connected to the left end of load terminal **13** by fastening means **19**.

A portion **20** of load terminal **13** intermediate its ends is of reduced cross-section and is shunted by looped laminated member **21**. Fasteners **22**, **23** secure laminated member **21** at the ends thereof to load terminal **13**. Rivets **24** secure the lower end of bimetal **25** to leg **21***a* of laminated member **21** and to plate **26**. Studs **27** extend through magnetic core **28**, frame **29**, spacers **30**, plate **26**, insulating spacer **31** and insulating wall **32** from load side to line side thereof. Disposed on the line side of the wall **32** are nuts **33** in threaded engagement with screws **27**. As is well-known to the art, wall **32** and the elements secured thereto constitute a three phase interchangeable trip unit.

The upper end of bimetal **25** is free to deflect to the right with respect to FIGURE 1 when heated. Upon being deflected to the right the free end of bimetal **25** engages adjusting screw **35** extending through extension **36** of common trip bar **37** causing trip bar **37** to pivot in a clockwise direction with respect to FIGURE 1. As trip bar **37** pivots clockwise latching surface **38** carried thereby moves away from tip **39** of member **40**. Latch **40** is pivotally mounted at a point intermediate its ends to shaft **41** which is maintained in a horizontal position by brackets **42**, **43** secured to wall **32** on the line side thereof. Latch surface **44** at the other end of member **40** supports one end of intermediate latch member **45** whose other end provides a surface **46** for engaging the latching tip **41** of operating mechanism cradled **48**.

Operating mechanism spring **49** biases latch tip **47** upward and in so doing exerts a force on intermediate latch member **45** urging it clockwise about its pivot **51**. This in turn urges latch member **40** in a counterclockwise direction about its pivot **41**. Thus, when latch surface **38** releases latch tip **39** latch member **40** is permitted to rotate counterclockwise and intermediate latch member

45 is permitted to rotate clockwise thereby releasing cradle 48 and tripping contact operating mechanism 11.

Magnet 28 is a U-shaped member with leg 21*b* of laminated member 21 passing between the arms of magnet 28 to provide the energizing turn therefor. Sheet mica 99 is disposed between laminated member 21 and plate 26 as well as between member 21 and magnet 28. Frame 29 is provided with apertures 51 which receive downward extensions of armature 52 and constitute a pivot point for armature 52. Tension spring 53, connected at its lower end to frame 29 and at its upper end to armature 52, biases armature 52 to the position shown in FIGURE 1.

When the magnitude of current passing through laminated member 21 exceeds a predetermined level, sufficient flux is generated by magnet 28 to attract armature 52. This causes adjusting screw 54, mounted at the upper end of armature 52, to move to the left with respect to FIGURE 1 into engagement with downward extension 55 of common trip bar 37. The engagement between screw 54 and extension 55 brings about a clockwise rotation of common trip bar 37 causing circuit breaker 10 to trip open in the manner previously explained.

The cross-sectional areas of solid necked-down portion 20 and laminated member 21 are so proportioned that sufficient heat is generated for controlled deflection of bimetal 25. Typically, the impedances of laminated member 21 and necked-down portion 20 are such that a large percentage of the total current flows through necked-down portion 20 creating some heat whereas a relatively small portion of the current flows through laminated portion 21. Laminated portion 21 is constructed of relatively few laminations so as to have a relatively high total resistance with the result being that the current flowing through laminated member 21 generates most of the heat causing deflection of bimetal 25. It is noted that the current magnitude through laminated member 21 upon the occurrence of an overload condition is sufficient to operate the magnetic trip means.

Thus, this invention provides a trip unit in which the bimetal trip element is heated substantially entirely by indirect means. That is, the bimetal is arranged externally of the current path through the breaker. The bimetal heater includes a laminated heater shunted by a solid necked-down portion of the line terminal member. This construction results in a compact unit which maintains calibration accuracy.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. A multiphase circuit breaker including cooperating contact means for each phase; a mechanism connected to said contact means for operating the same into and out of engagement; a heat responsive non-current carrying automatic trip element for each phase arranged to cause said mechanism to operate said cooperating contact means of all phases out of engagement upon the occurrence of predetermined circuit conditions; a substantially flat conducting strip for each of said phases connected in electrical series with the cooperating contact means thereof; a substantially U-shaped heater individual to each of said trip elements with the opposite ends of said heaters being electrically connected to its associated conductive strip to shunt a portion of the conducting strip of its respective phase; said portion of the conducting strip having a cross sectional area substantially less than the remaining cross-sectional area of said conducting strip; said heater being formed to provide a high resistance both for adequate heating of the bimetal and minimum shunting of current from said conducting strip.

2. The device of claim 1 wherein said heaters are mounted directly upon the conducting strips associated therewith.

3. The device of claim 1 wherein each of said portions of the conducting strips and the heaters associated therewith have their electrical resistances proportioned so that more current flows through said portions of said strips than flows through said heaters.

4. The device of claim 1 wherein each of said U-shaped heaters are comprised of a plurality of conductive laminations.

5. The device of claim 4 wherein the U-shaped member is comprised of a plurality of conductive laminations with the number of laminations being selected to provide a relatively high total resistance so that the current flowing therethrough generates most of the heat causing deflection of the heat responsive non-current carrying automatic trip element.

References Cited by the Examiner

UNITED STATES PATENTS

2,047,739	7/1936	Lingal	200—122
2,050,284	8/1936	Dorfman	200—122
2,074,584	3/1937	Graves	200—122
2,439,069	4/1948	Anderson	200—116
2,629,796	2/1953	Kern	200—116
2,795,670	6/1957	Cellerini et al.	200—88
3,097,277	7/1963	Wingard	200—88
3,139,497	6/1964	Geissner	200—116

BERNARD A. GILHEANY, *Primary Examiner.*