

Oct. 19, 1965

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3,213,232

FORCED AIR-COOLED THERMALLY CALIBRATED CIRCUIT BREAKER

Filed May 9, 1963

4 Sheets-Sheet 1

FIG. 1.

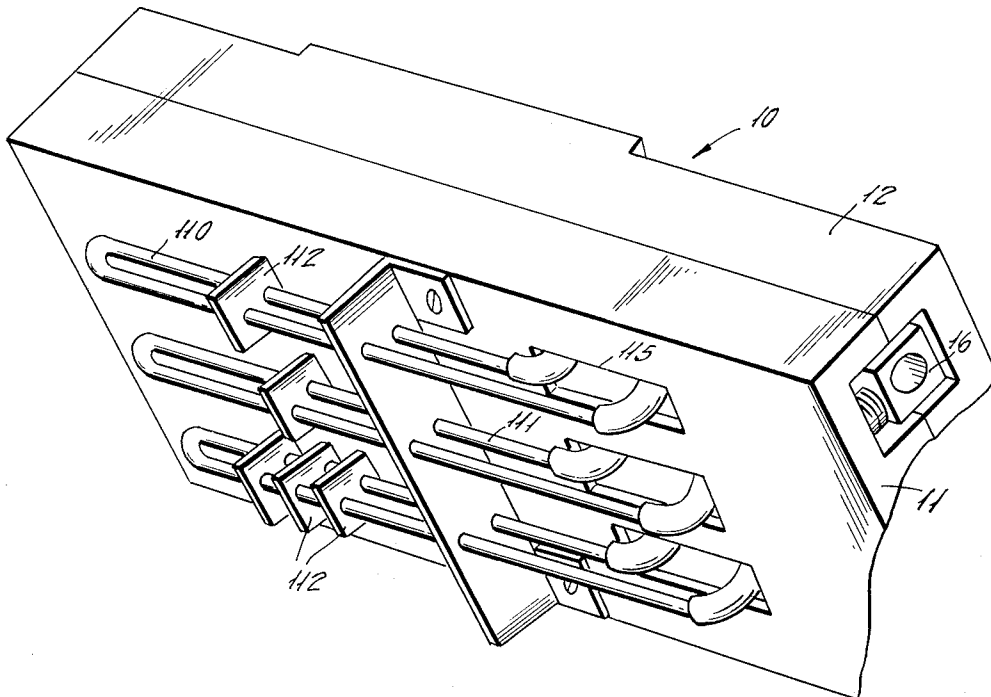
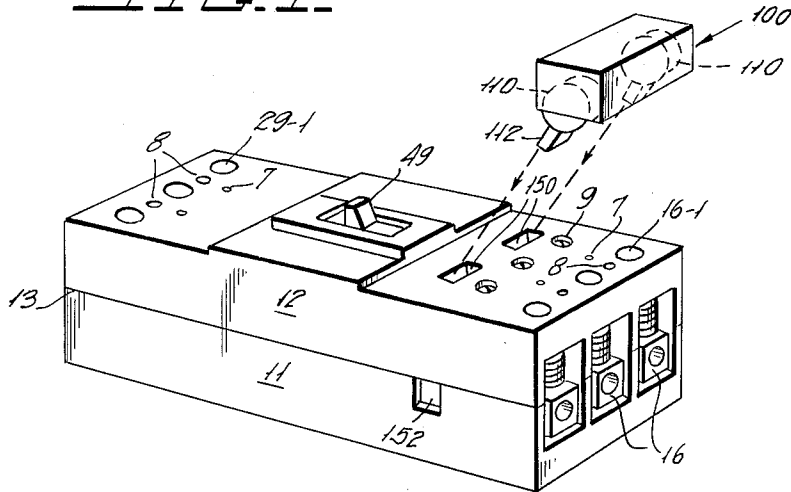


FIG. 4.

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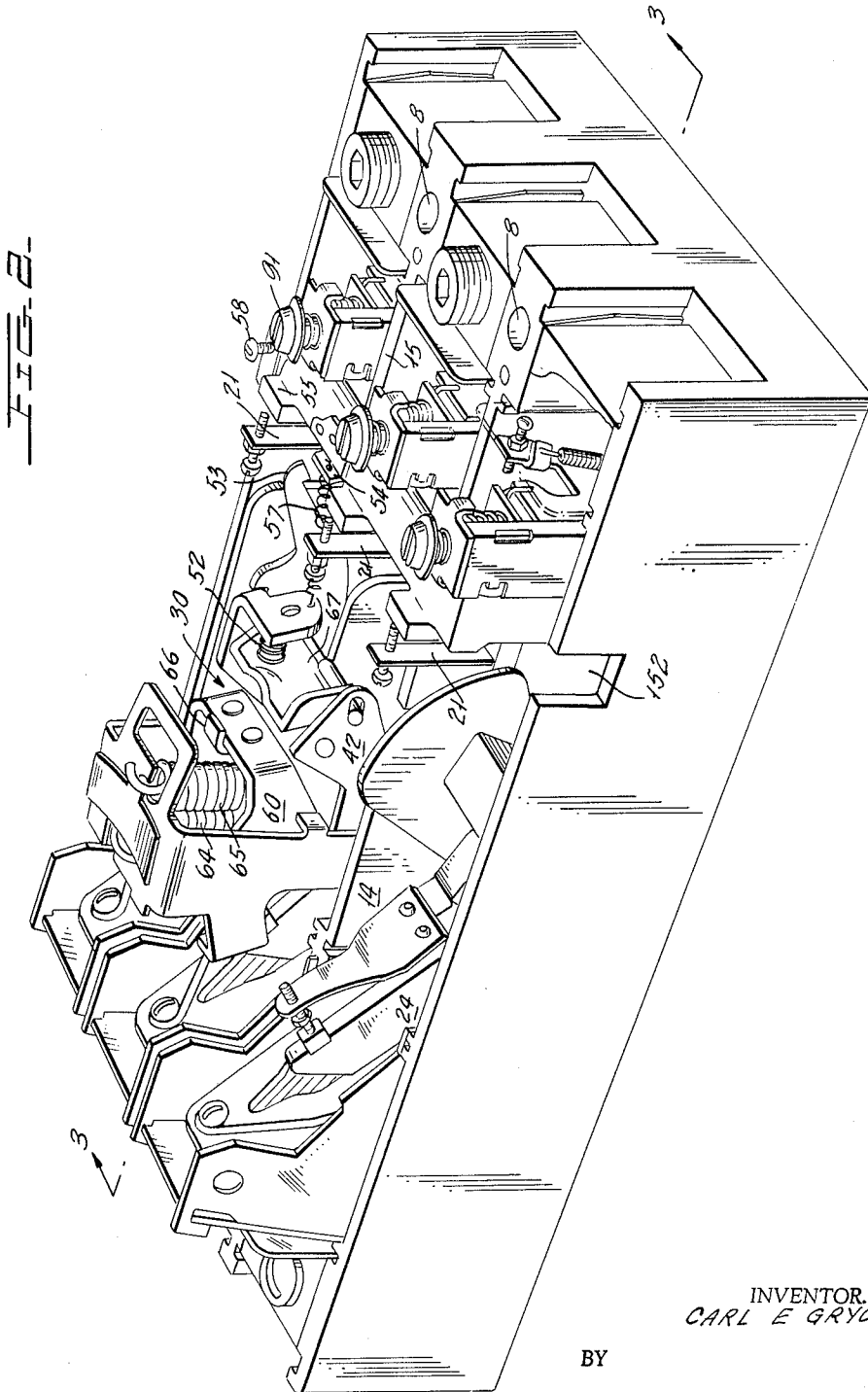
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4 Sheets-Sheet 3

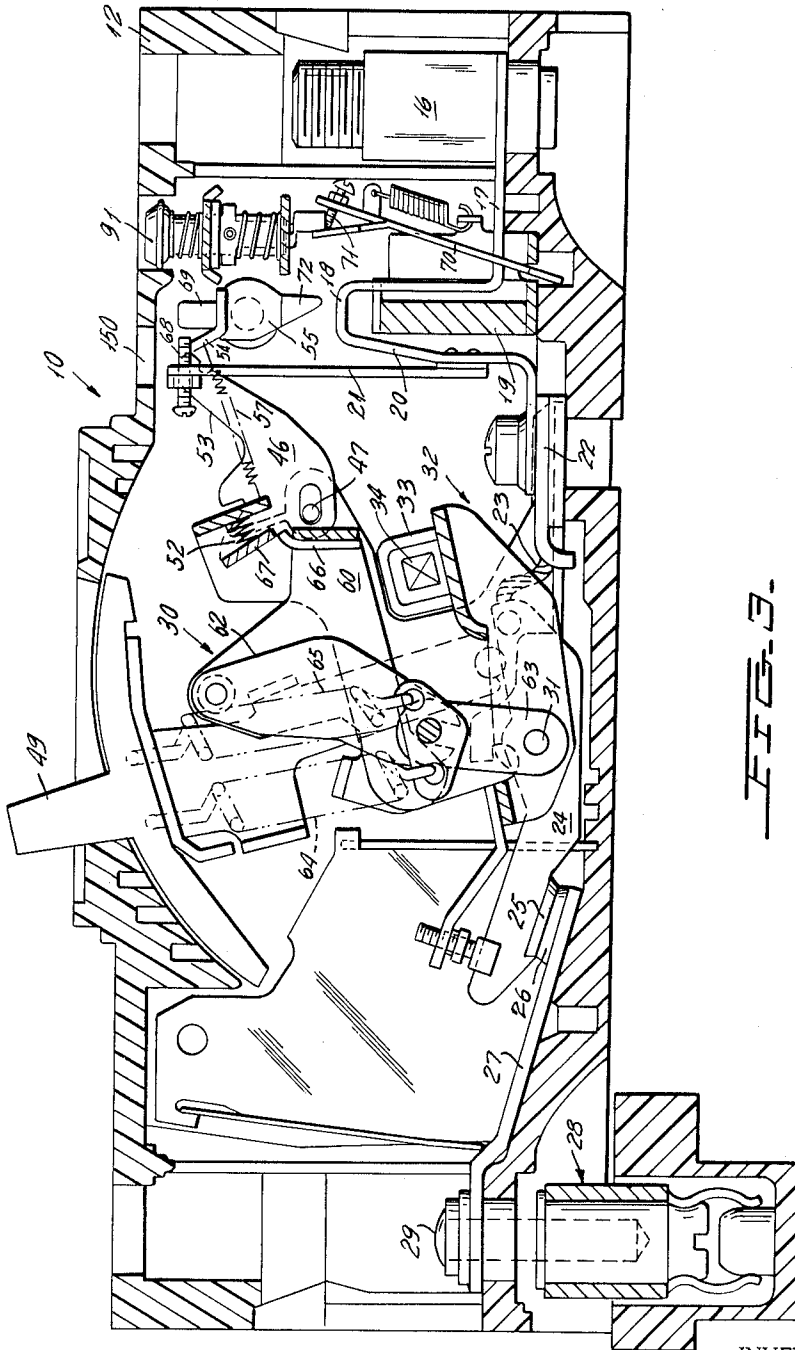


FIG. 3.

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4 Sheets-Sheet 4

FIG. 5.

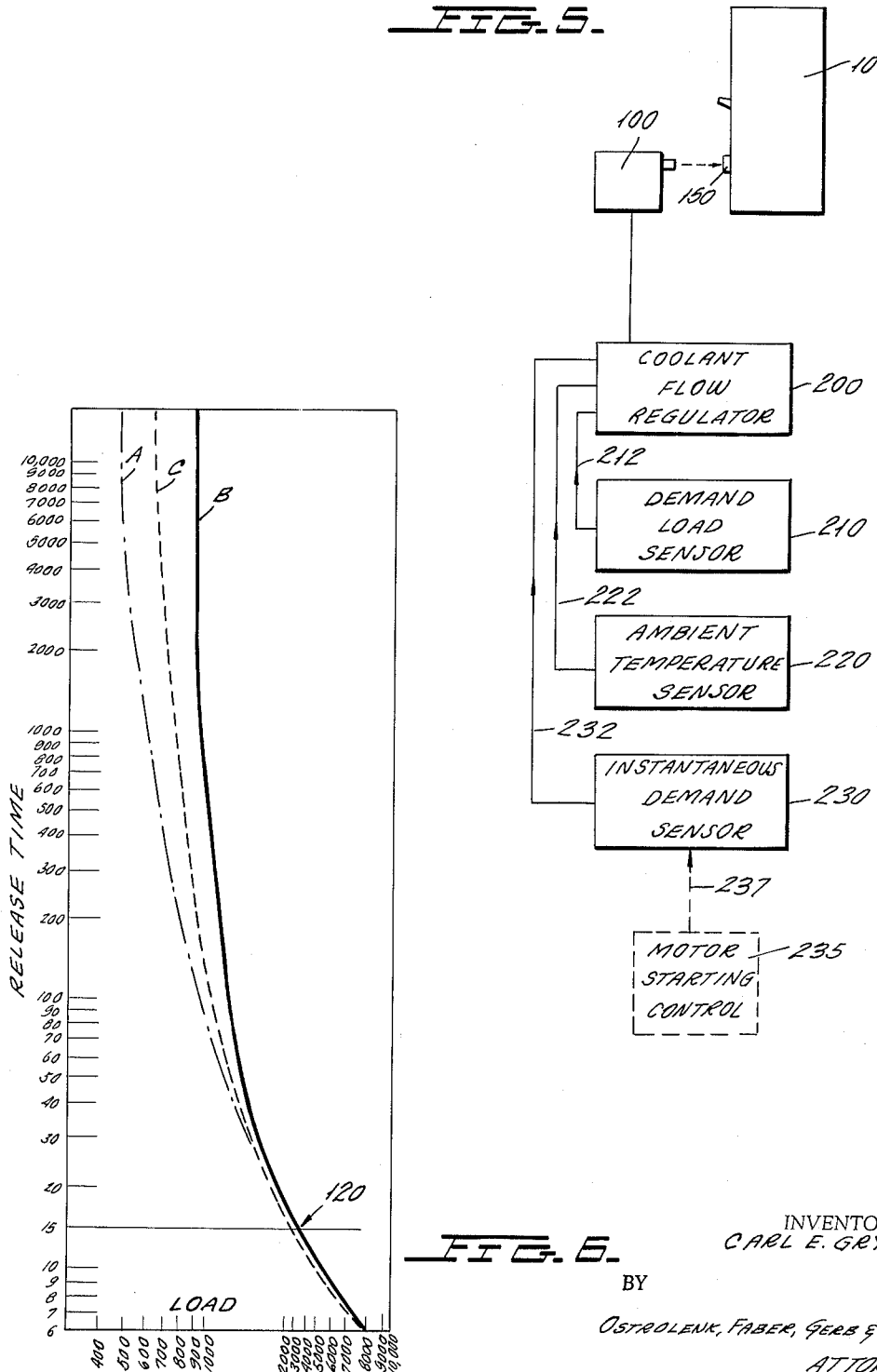


FIG. 6.

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FORCED AIR-COOLED THERMALLY CALIBRATED CIRCUIT BREAKER

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Filed May 9, 1963, Ser. No. 279,091

19 Claims. (Cl. 200—88)

This invention relates to circuit breakers in general and more particularly to a novel arrangement for selectively varying the overload-release time characteristic of a conventional type of circuit breaker unit.

It is well known in circuit breaker operation to provide a trip unit for disengaging the cooperating contacts upon the occurrence of both moderate and high overload conditions. The former is usually provided by a bimetallic element which is deflected responsive to the existence of such an overload condition. The extent of such deflection is related to both the overload magnitude and the time duration for which such overload condition exists. Accordingly, such a moderate overload trip means may be designed to provide a predetermined overload-release time characteristic, in accordance with system requirements.

The high overload release is most often provided by an electro-magnetic armature device, the coil of which is positioned in the current path of the circuit breaker. The unit is appropriately calibrated such that the flux generated by the magnetic coil corresponding to a predetermined high overload condition will be of a sufficient magnitude to instantaneously attract the tripping armature, thereby disengaging the circuit breaker contacts.

It is oftentimes desirable to selectively vary the characteristics of the moderate overload trip, while still maintaining the instantaneous protection afforded by the high overload magnetizable trip and the rapid release time of the bimetallic trip responsive to such high overloads. Heretofore, this has been obtained by the provision of various mechanical means interconnected to the tripping mechanism, such as screw adjustable biasing means. Accordingly, the variations permitted by such adjustments are normally of a relatively permanent nature, as for example the initial calibration of the circuit breaker prior to installation by the customer.

Circuit breakers have also been constructed having a removable and replaceable trip unit within an individual housing. Such replaceable trip units are electrically and mechanically connected to the circuit breaker, as by screws. This arrangement involves costly and cumbersome constructions, and has been found to be less than desirable when it is required to frequently vary the trip characteristic of the circuit breaker.

My invention advantageously permits such selective variation in the overload-release time characteristic in a simplified and efficient manner with minimum modification of the existing circuit breaker construction. In accordance with the basic objectives of my invention, the circuit breaker is adapted to permit the introduction of a cooling medium about the bimetallic element. The thermal relationship of the cooling medium and bimetallic element is regulated to selectively vary the overload-release time characteristic responsive to moderate overload in a predetermined manner. Accordingly, the rate of deflection of the bimetallic element may be controllably varied by adjusting the heat transfer therefrom to the cooling medium. That is, by increasing the flow of coolant about the tripping unit, it is possible to obtain a higher continuous current carrying capacity without changing the construction of the bimetallic trip unit. The air circulation will have a negligible effect upon the release time of the bimetallic trip responsive to high overload, or the operation of the high overload magnetic trip. Thus, the

instantaneous protection afforded thereby is still maintained should a severe overload occur.

In accordance with one embodiment of my invention, a fan unit external to the circuit breaker provides a forced air coolant source. Aperture passageways are cut within the circuit breaker housing to permit the entry of the air and its uniform circulation about the bimetallic element. As an alternate embodiment of my invention, fluid-cooling means, such as circulating water, oil or other compositions having the requisite thermal and electrical insulating properties, may be used. Conduit means are provided about the circuit breaker housing to circulate the cooling medium in proper thermal relationship with the bimetallic element for controllably varying the heat-transfer therewith.

As a particularly advantageous aspect of my invention, the rate of coolant flow may be appropriately correlated to the distribution system requirements to continuously vary the tripping characteristic of the circuit breaker in conformity therewith. As, for example, the instant invention would find particular utility in an electrical distribution system, wherein the steady-state load requirement varies by a predetermined amount over its normal cycle of usage; as for example during specific times of the day. The coolant flow is correlated to such predetermined system variations, as by increasing the flow rate during the peak overload conditions and decreasing such flow during the periods of lighter load conditions. In this manner the tripping characteristic curve of the bimetallic element responsive to moderate overload will be varied to permit such anticipated cyclic variation without tripping the circuit breaker, while still maintaining the protection afforded by the bimetallic and magnetizable trip, if a severe overload condition occurs.

As another application of my invention, the coolant flow may be regulated responsive to ambient temperature variations. During high ambient conditions, increased coolant circulation would be provided, thereby maintaining the overload characteristic of the bimetallic element, appropriately compensated for ambient variation.

As another system application of my invention, it is well known that high instantaneous currents are experienced in the starting of large inductance devices, such as motors. Since such conditions last for only a relatively short interval of time, it is desired that the line circuit breaker maintain current continuity. Accordingly, the coolant flow regulator of my invention may be appropriately interconnected to the starting circuitry of such devices to increase coolant flow, and accordingly permit the circuit breaker to tolerate such high inrush currents without tripping.

Accordingly, it is seen that the basic concept of my invention resides in operating a conventional type of circuit breaker in conjunction with a controlled coolant source to selectively vary the overload-release time characteristic of the bimetallic element in accordance with the system requirements.

Accordingly, a primary object of this invention is to provide a novel trip unit calibration arrangement for a circuit breaker.

Another object is to provide a circuit breaker including coolant flow passageways for directing a coolant about the bimetallic trip, thereby permitting selective variation of the calibration curve thereof.

An additional object of this invention is to provide a means for controllably varying the flow of a coolant about the trip unit of a circuit breaker for correlating the operation thereof to the distribution system requirements.

Still another object is to provide a circuit breaker construction including coolant flow means operatively positioned to direct a coolant about the moderate overload trip sensing means, thereby permitting selective calibra-

tion thereof while still maintaining the instantaneous tripping characteristic of the high overload trip sensing means.

Still another object of the instant invention is to controllably circulate a cooling medium about the bimetallic trip element of a conventional circuit breaker to selectively vary the calibration characteristic afforded by such a bimetallic trip.

Still an additional object of this invention is to provide such variation of the calibration characteristic of a circuit breaker wherein the coolant flow is regulated by sensing means responsive to circuit condition.

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

FIGURE 1 is a perspective view of a typical circuit breaker operating in conjunction with an air flow coolant source, in accordance with the teachings of my invention.

FIGURE 2 is a perspective view of the circuit breaker shown in FIGURE 1, with the cover removed to reveal the internal mechanism thereof.

FIGURE 3 is a cross-section taken through the center-phase of the circuit breaker through line 3—3 of FIGURE 2 and looking in the direction of arrow 3—3.

FIGURE 4 is a simplified perspective view showing a circuit breaker modified in accordance with the teachings of my invention to include a liquid coolant circulating system.

FIGURE 5 is a block schematic diagram showing the manner in which the coolant flow may be regulated and correlated to system conditions.

FIGURE 6 graphically illustrates the manner in which the tripping time characteristic of the bimetallic element may be varied by variation of the coolant flow thereabout.

Now referring to the figures, and particularly FIGURE 1, circuit breaker 10 is of a conventional construction and is typically shown of the type illustrated and further described in U.S. patent application Serial No. 108,812, filed May 9, 1961 entitled "U-Shaped Cradle for Circuit Breaker" invented by Ernest Wortmann and assigned to the assignee of the instant invention, now U.S. Patent No. 3,155,802. It is to be naturally understood that this particular circuit breaker is shown for illustrative purposes only, with the inventive concepts of my invention being equally adaptable to various other circuit breaker constructions well known in the art.

Circuit breaker 10 is provided with a molded insulating housing comprising base 11 and removable cover 12 joined along line 13. Circuit breaker 10 is a three-phase unit, exhibiting substantially identical operation for each phase, with the individual phases being cooperatively tied together in the well known manner. Load terminals 16, externally connectable to the circuit being protected, are provided along one end of the circuit breaker, with a similar arrangement of line terminals 29 (best shown in FIGURE 3) being provided along the opposite end of the circuit breaker. Openings 16-1 and 29-1 are provided along the removable cover 12 and in registry with each of the terminals 16, 29 to provide access thereto. Cover apertures 7 are provided in registry engagement with threaded apertures in the base unit (not shown) to provide fastening of the cover 12 to base unit 11. Apertures 8 extending through the cover 12 and base 11 are preferably provided for fastening the circuit breaker unit 10 to a support panel (not shown). Cover apertures 9 are provided to permit access to the magnetic trip adjustment screw 9-1 (best shown in FIGURES 2 and 3). The construction described up to this point is conventional and is of the type set forth in aforementioned U.S. patent application Serial No. 108,812.

In accordance with the teachings of the instant invention, I provide a coolant flow source 100, shown in FIGURE 1 as a blower assembly of individual fan units 110.

The outputs 112 of the fan units are operatively positioned with respect to aperture passageways 150, provided in the cover 12 of the enclosed circuit breaker housing for entry of the air coolant and circulation about the bimetallic tripping means 21 contained therein (as best shown in FIGURE 3). Side openings 152 are provided in base 11 for the air discharge.

To facilitate an understanding of the manner in which the coolant flow arrangement of my invention operates in conjunction with the conventional circuit breaker mechanism reference is now made to FIGURES 2 and 3. Base 11 is divided into three parallel compartments by partitions 14, 15, each of the parallel compartments housing the current carrying members for the respective phases.

Since each phase is comprised of identical current carrying members, only the current carrying parts of the center-phase will be described. These current carrying parts comprise load terminal connector 16, load terminal 17, the looped extension 18 thereof extending through instantaneous trip magnet 19, through a portion 20 of terminal 17 having a reduced cross-section so as to serve as an indirect heater for the bimetal time delay tripping element 21. The current path continues through conductor 22, flexible braid 23, movable contact arm 24, and movable contact 25 to stationary contact 26, which is mounted upon line terminal strap 27, having tulip type line terminal connector 28 mounted thereto by screw means 29.

The movable contacts 25 of all three phases are operated simultaneously into and out of engagement with their respective stationary contacts 26 by means of a single operating mechanism 30, which is positioned in the center compartment. Each of the movable contact arms 24 is pivotally mounted at 31 between the arms of its individual U-shaped holder 32. Each holder 32 is provided with a portion 33 which defines a rectangular opening having an insulating tie rod 34 disposed therein. Tie rod 34 extends through all three housing compartments, thereby interconnecting the contact arm holders 32 of all three phases to bring about the simultaneous movement of all three contact arms 24 responsive to tripping of one phase in the well known manner.

An externally accessible handle 49 is provided for manual operation of mechanism 30, as fully described in aforementioned U.S. Patent 3,155,802. The automatic tripping of the circuit breaker contacts 25-26 responsive to predetermined fault conditions is provided by intermediate latch member 46, pivotally mounted on shaft 47 whose ends are guided by elongated slots 48 of the mechanism frame 42. Spring 52 interposed between frame 42 and latch member 46 biases latch member 46 counter-clockwise about pivot 47 towards its latched position. Latch extension 53 of member 46 extends towards the breaker load end, and is engageable with latch plate 54 carried by common tripper bar 55. Tension spring 57 biases tripper bar 55 counter-clockwise to the latch position, which is established through its engagement with adjusting screw 58.

Operating mechanism 30 also includes cradle member 60, a toggle linkage comprises links 62, 63, and operating spring means 64, 65. Cradle 60 is biased to its released or tripped position by spring means 64, 65.

The rotation of common tripper bar 55 in a clockwise direction upon the occurrence of a predetermined fault condition releases the cooperative engagement of members 53, 54 and 66, 67 to effect disengagement of the circuit breaker contacts 25, 26. Tripper bar 55 operates responsive to either the thermally induced deflection of current carrying bimetal 21 upon the occurrence of a moderate fault for an extended time duration; or attraction of armature 70 by instantaneous trip magnet 19 responsive to a severe overload condition. That is, bimetal 21 is suitably calibrated such that the existence of a moderate overload for a predetermined time interval (as shown by curve

A of FIGURE 6) deflects the upper end of bimetal 21 to the right. Adjusting screw 68 secured thereto engages upper tripper bar extension 69, thereby effecting the above-described release of the latched engagement of members 53, 54 and 66, 67. Should a severe overload condition occur, the attraction of armature 70 by magnet 19, and the accompanying movement of adjusting screw 71 to the left, engages lower tripper bar extension 72 to similarly effect release of the circuit breaker contacts from their latched position.

In accordance with the advantageous objectives of the instant invention, aperture 150 is provided in the circuit breaker cover 12 to permit the controlled entry and circulation of a coolant means about bimetallic element 21. The flow of such a coolant means about element 21 will provide heat transfer therefrom, and accordingly modify the amount of deflection it undergoes responsive to the occurrence of a particular overload condition. That is, by increasing the coolant flow, and accordingly the heat transfer from bimetallic element 21, the deflection of element 21 is controllably varied responsive to the overcurrent induced heating thereof. The calibration effect of such variation may be seen by referring to FIGURE 6, wherein curve A (shown dash-dotted) denotes the tripping time calibration curve of a typical 400 amp. trip unit, operating in the conventional manner without any auxiliary coolant flow. Such a bimetallic element is shown to have an exponential relationship of release time versus load, with the calibration curve being advantageously plotted on log-log coordinates. Curve B (shown solid) illustrates the manner in which the calibration curve of bimetallic trip element 21 is modified by the maximum coolant flow obtained from unit 100. This flow may typically be a 100 cubic foot per minute forced air flow provided by the fan assembly 100 of FIGURE 1, and has been found to modify the trip unit to permit 700 ampere continuous current operation. Curve C (shown dotted) depicts an intermediate calibration position provided by adjusting coolant source fan 100 to less than maximum capacity. It is advantageously seen that the release time for high overload conditions, as shown by region 120, is substantially unchanged. As, for example, the tripping time of the bimetallic element 21 is approximately 15 seconds should a 2,000 ampere condition occur. This results from the rapid generation of heat in bimetallic element 21 responsive to such a high overload, which is not dissipated in a sufficiently rapid manner by the coolant flow to appreciably alter the time rate of bimetal deflection. Accordingly, the protection afforded by the metallic element 21 responsive to high overload conditions will be maintained, despite the appreciable variation in its moderate trip characteristic.

It is naturally understood that suitable regulated control of fan unit 100 may selectively vary the calibration response curve of the trip unit 21 to within the limits defined by curves A and B. Such regulated control is preferably system-coordinated, as discussed below in conjunction with FIGURE 5.

FIGURE 4 illustrates an alternative embodiment of my invention, wherein a closed circulating liquid coolant system is provided for varying the overload-release time characteristic of bimetallic element 21 in the same manner as above-described in conjunction with the air flow coolant arrangement. The circulatory system includes conduits 111 which enter the circuit breaker through passageways 115, located to internally position the conduits in proper thermal relationship with respect to bimetallic element 21 for the requisite heat transfer therefrom. Conduits 111 are suitably interconnected with a conventional type of circulating cooling system (not shown). If desired, radiating fins 112 may be provided along externally positioned conduit means 111 with circulation to the radiating fins being accomplished by convection.

Reference is now made to FIGURE 5, which schematically shows the manner in which the regulation of

the coolant flow rate may be suitably correlated to system requirements. Coolant flow regulator 200 may be any suitable device for selectively varying the coolant flow rate; as, for example, when coolant source 100 is a forced air blower, regulator 200 may provide fan speed control or adjustment of the air flow valve. One such form of system coordination may be provided by a demand load sensor 210 responsive to the steady-state distribution system demands. Should the demand vary in a predetermined manner over specific periods of the day, demand load sensor may include an appropriate timing device to provide an output signal 212 to coolant flow regulator 200, related to the anticipated heavy load and light load periods. Accordingly, the trip unit of circuit breaker 10 will be selectively calibrated between the limits of curves 6A and 6B, in coordination with the load requirements.

Additional system coordination may be provided by ambient temperature sensor 220, which typically includes a thermostatic device having an output signal 222 related to ambient temperature. That is, as the ambient temperature increases, the signal 222, presented to coolant flow regulator 200, provides increased air flow from blower unit 100, thereby maintaining the overload-release time characteristic of bimetallic element 21 over such extremes in ambient temperature.

Further system correlation may be provided by an instantaneous demand sensor 230, responsive to extreme overloads for short periods of time. As, for example, in starting a large motor where high starting currents are to be anticipated, the motor starter control 235 may be operatively interconnected with instantaneous demand sensor 230. Signal 232 responsive to such motor starting serves to increase the coolant flow during these periods, and thereby avoids bimetallic tripping of the circuit breaker.

As a further aspect of my invention, it is to be understood that the various output signals of sensors 210, 220 and 230 may be collectively presented to coolant flow regulator 200, thereby coordinating the tripping of circuit breaker 10 to a collective consideration of a plurality of system parameters. It is to be understood that the maximum capacity of coolant source 100 is adjusted so as to still provide a sufficient tripping characteristic (curve 6B) to avoid system or circuit breaker damage. It is likewise understood that the instantaneous trip of magnet 19 will be unchanged by the calibration variation provided by the coolant flow system of my invention. Hence, the instant invention maintains appropriate circuit protection against severe short conditions, while selectively varying the overload trip.

Thus, it is seen that this invention provides a simplified and efficient arrangement for controllably varying the calibration characteristic of the overload trip responsive to variations in system requirements. Accordingly, although I have here described specific preferred embodiments of my novel invention, many such variations and modifications will now be apparent to those skilled in the art; as for example the objectives of my invention may likewise be practiced in conjunction with numerous other coolant flow arrangements and circuit breaker constructions. Accordingly, I therefore prefer to be limited not by the specific disclosure herein, but only by the appended claims.

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

1. In a circuit breaker, a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position;

coolant flow means operatively positioned to direct a cooling medium about said overload sensing means, for selectively varying the overload-release time characteristic of said trip unit.

2. In a circuit breaker, a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said overload sensing means including a bimetallic element, means coupling said bimetallic element to said trip means for movement of the latter as the bimetal is deflected; coolant flow means operatively positioned to direct a cooling medium about said bimetal, for selectively varying the overload-release time characteristic of said trip unit.

3. In a circuit breaker, a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; coolant flow means positioned to direct a cooling medium about said overload sensing means, for selectively varying the overload-release time characteristic of said trip unit; said circuit breaker being contained in an enclosed housing; said coolant flow means including passage means externally communicable with a coolant source and positioned with respect to said overload sensing means to circulate a cooling medium thereabout.

4. In a circuit breaker, a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said overload sensing means including a bimetallic element, means coupling said bimetallic element to said trip means for movement of the latter as the bimetal is deflected; coolant flow means operatively positioned to direct a cooling medium about said bimetal, for selectively varying the overload-release time characteristic of said trip unit; said circuit breaker being contained in an enclosed housing; said coolant flow means including passage means externally communicable with a coolant source and operatively positioned with respect to said bimetal to circulate a cooling medium thereabout.

5. The circuit breaker of claim 4, wherein said passage means is adapted to cooperate with an air flow source, external to said enclosed housing; said passage means including aperture means extending through said housing about the location of said trip means.

6. The circuit breaker of claim 4, wherein said passage means is adapted to cooperate with a liquid coolant circulatory system, external to said enclosed housing; said passage means containing conduit means of said circulatory system operatively positioned in predetermined thermal transfer relationship with respect to said bimetal.

7. In combination, a circuit breaker and coolant source; said circuit breaker comprising a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in

release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said circuit breaker being contained in an enclosed housing; said coolant source being external to said circuit breaker housing; passage means in said housing externally communicable at one end with said coolant source, and internally communicable at its opposite end with said overload sensing means to circulate a cooling medium thereabout, whereby the overload-release time characteristic of said trip unit is selectively varied.

8. In combination, a circuit breaker and coolant source; said circuit breaker comprising a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable trip means operatively connected to said movable contact arm carrying one of said cooperating contacts; arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said overload sensing means including a bimetallic element, means coupling said bimetallic element to said trip means for movement of the latter as the bimetal is deflected; said circuit breaker being contained in an enclosed housing; said coolant source being external to said circuit breaker housing; passage means in said housing externally communicable at one end with said coolant source, and internally communicable at its opposite end with said bimetal to circulate a cooling medium thereabout, whereby the overload-release time characteristic of said trip unit is selectively varied.

9. The combination as set forth in claim 8, wherein said coolant source comprises an air flow source; said passage means includes aperture means extending through said housing, and positioned adjacent the location of said trip means to selectively circulate the air flow about the inner volume of said circuit breaker housing containing said bimetal.

10. The combination as set forth in claim 8, wherein said coolant source comprises a liquid coolant circulatory system, and said passage means contains conduit means of said circulatory system operatively positioned in predetermined thermal transfer relationship with respect to said bimetal.

11. In combination, a circuit breaker and coolant source; said circuit breaker comprising a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said circuit breaker being contained in an enclosed housing; said coolant source being external to said circuit breaker housing; passage means in said housing externally communicable with said coolant source, and operatively positioned with respect to said overload sensing means to circulate a cooling medium thereabout, whereby the overload-release time characteristic of said trip unit is selectively varied; coolant flow regulator means for adjusting the rate of coolant medium flow from said coolant source to said circuit breaker; said regulator means system coordinated to predetermined circuit conditions for selectively varying the overload-release time characteristic of said trip unit responsive thereto.

12. The combination as set forth in claim 11, further including demand load sensing means for adjusting said predetermined coolant flow regulator responsive to steady-state load requirements, whereby the overload-release time characteristic of said trip unit is coordinated therewith.

13. The combination as set forth in claim 11, further including instantaneous demand sensing means, for adjusting said coolant flow regulator responsive to predetermined

instantaneous demands, whereby the overload-release time characteristic of said trip unit is coordinated therewith.

14. The combination as set forth in claim 11, further including ambient temperature sensing means for adjusting said coolant flow regulator responsive thereto, whereby the overload-release time characteristic of said trip unit is maintained over ambient temperature extremes.

15. The combination as set forth in claim 11, further including demand load sensing means for adjusting said predetermined coolant flow regulator responsive to steady-rate load requirements; and ambient temperature sensing means for adjusting said coolant flow regulator responsive thereto; said demand load sensing means and ambient temperature sensing means collectively coordinating the overload-release time characteristic of said trip unit to system load requirements over ambient temperature extremes.

16. In a circuit breaker, a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said overload sensing means including a bimetallic element, means coupling said bimetallic element to said trip means for movement of the latter as the bimetal is deflected, to release said trip unit responsive to moderate overload, and a magnetizable means to release said trip means responsive to high overload; coolant flow means, means communicating between said coolant flow means and said bimetal to direct a cooling medium about said bimetal for selectively varying the overload-release time characteristic of said trip unit moderate overload sensing means, while maintaining the characteristic of said high overload sensing means.

17. In combination, a circuit breaker and coolant source; said circuit breaker comprising a pair of cooperating contacts and a mechanism for operating said contacts into and out of engagement; said mechanism comprising a movable contact arm carrying one of said cooperating contacts; trip means operatively connected to said movable

contact arm in a manner such that said contacts cannot be operated into engagement when said trip means is in release position; overload sensing means responsive to circuit condition for moving said trip means to release position; said overload sensing means including a bimetallic element, means coupling said bimetallic element to said trip means for movement of the latter as the bimetal is deflected, to release said trip unit responsive to moderate overload, and a magnetizable means to release said trip means responsive to high overload; said circuit breaker being contained in an enclosed housing; said coolant source being external to said circuit breaker housing; passage means in said housing externally communicable at one end with said coolant source, and internally communicable at its opposite end with said bimetal to circulate a cooling medium thereabout, whereby the moderate overload-release time characteristic of said trip unit is selectively varied while maintaining the high overload-release time characteristic.

18. The combination as set forth in claim 17, further including demand load sensing means for adjusting said predetermined coolant flow regulator responsive to steady-state load requirements, whereby the overload-release time characteristic of said trip unit is coordinated therewith.

19. The combination as set forth in claim 17, further including demand load sensing means for adjusting said predetermined coolant flow regulator responsive to steady-rate load requirements; and ambient temperature sensing means for adjusting said coolant flow regulator responsive thereto; said demand load sensing means and ambient temperature sensing means collectively coordinating the overload-release time characteristic of said trip unit to system load requirements over ambient temperature extremes.

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