Feb. 26, 1935. P. TROMBETTA ET AL 1,992,588

ELECTRIC HEATER

Filed Nov. 1, 1929

FIG. 1.

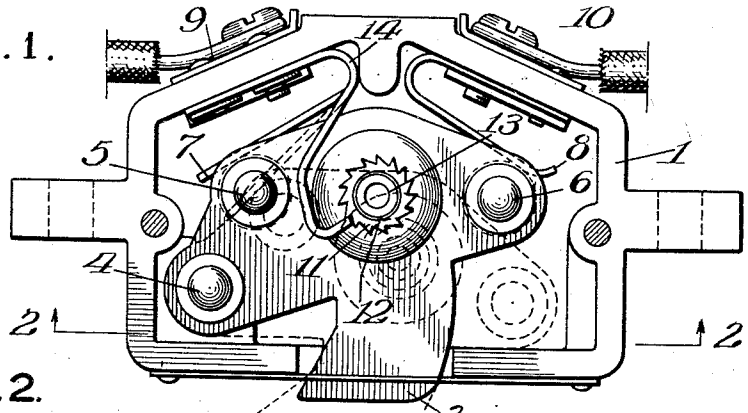


FIG. 2.

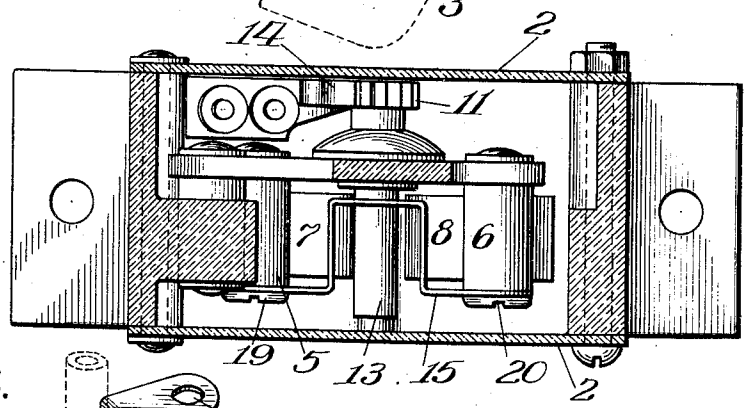


FIG. 3.

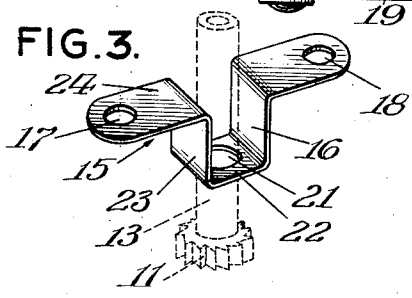


FIG. 4.

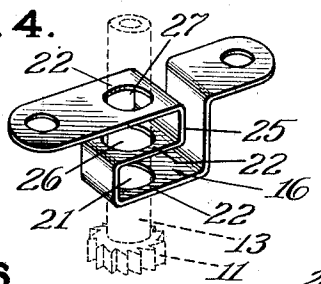


FIG. 5.

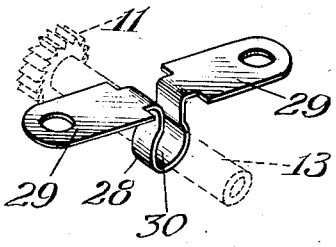
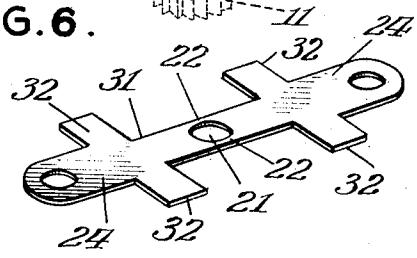


FIG. 6.



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ELECTRIC HEATER

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Application November 1, 1929, Serial No. 403,990

5 Claims. (Cl. 219—19)

This invention relates to electric heaters.

An object of the invention is to provide an electric heater having heat characteristics which are controllable over a wide range.

The electric heater to which the invention applies is particularly adapted for use in thermally operable circuit breakers such as that disclosed in the copending application of Gustav O. Wilms and Panfilo Trombetta filed on even date herewith.

This circuit breaker is ordinarily employed to protect electric motors and has its heater connected in circuit with the motor to generate heat and soften a fusible binder to permit the circuit breaker to open whenever the motor is subjected to an excessive overload or whenever a predetermined overload continues for a predetermined period of time.

An overload which would damage one motor might not damage another as the period during which a motor may be operated safely under an overload varies according to the characteristics of the motor and the amount of overload.

Practically all motors may be operated safely under small overloads for long periods of time, operated under large overloads for periods of time which vary according to the amount of overload, but are quickly damaged by an excessive overload.

In order to obtain the maximum output during a given period of time, a motor should continue to operate until subjected to a prohibitive overload or until an overload has continued for such a length of time that further operation would result in damage to the motor.

Motors which are subjected to overloads may be protected by thermally operable circuit breakers.

Another object of this invention is to provide such a circuit breaker with an electric heater having heat characteristics corresponding to the characteristics of any particular motor.

In the past, difficulty has been experienced in providing, in a circuit breaker of the type shown in the present application, a heater made of resistance material having a uniform cross-section, the heat characteristics of which varied only within close limits.

Another object is to provide an electric heater made of resistance material of non-uniform cross-sectional area whereby the heat characteristics thereof may be varied within close limits.

Under a slight overload, the heater of a thermally operable circuit breaker generates heat which will accumulate and soften the fusible binder unless a portion of the heat is dissipated.

Another object is to provide an electric heater having a radiator to dissipate a portion of the heat generated thereby.

Another object is to provide an electric heater in which the path of the current is constricted at the point of effective heat distribution.

Another object is to provide an electric heater made from a flat strip of resistance material and having a constricted part to impede the flow of an excessive current therethrough and a radiator to dissipate a part of the heat generated in the constricted part.

Another object is to provide an electric heater which may be adapted for use in various circuit breakers and to protect various types and sizes of motors.

Another object is to provide an electric heater made from a flat strip of resistance material and shaped to define and partially enclose a heating space.

Another object is to provide an electric heater which may be readily and economically manufactured.

According to the invention, the heater is made from a flat strip of resistance material, provided with terminals for connection into an electric circuit, and constricted intermediate the terminals to impede a current flowing therethrough.

The invention further provides a radiator intermediate the constricted part and a terminal to dissipate a part of the heat generated.

Embodiments of the invention and a circuit breaker in which the same may be employed are shown in the accompanying drawing, in which the views are as follows:

Fig. 1 is a top plan view of the circuit breaker, the top cover plate being omitted.

Fig. 2 is a sectional front view thereof taken on the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of the heater shown in Fig. 1.

Fig. 4 is a perspective view of a modification of the heater shown in Fig. 3.

Figs. 5 and 6 are perspective views of other forms of heaters.

The circuit breaker has its mechanism arranged in and carried by a casing 1 which is preferably made of insulating material and has the top and bottom thereof closed by cover plates 2.

A support 3 is pivoted upon a pin 4 and carries contacts 5 and 6 to engage spring contacts 7 and 8 which are electrically connected to terminals 9 and 10 arranged upon the outside of the casing 1 for connection into an electric circuit.

The contact 5 is in continual engagement with the spring contact 7 which tends to swing the support 3 upon the pin 4 and move the contact 6 out of engagement with contact 8 to open the circuit.

A ratchet wheel 11 is fixed by a fusible binder on a heat conductor 13 which is carried by and heat insulated from the support 3.

The contact 6 is held in engagement with the contact 8 by a catch 14 which is carried by the casing and engages the ratchet wheel 11.

The circuit breaker described above forms no part of the present invention and is described and claimed in the copending application of Gustav O. Wilms and Panfilo Trombetta.

An electric heater 15, which embodies the present invention, is connected between the contacts 5 and 6 and arranged in intimate thermal association with the heat conductor 13 to generate heat upon the passage of an excessive current through the circuit breaker.

The heat is transferred to the heat conductor 13 by radiation and conducted thereby to the binder 12 to soften the same and release the ratchet wheel so that the spring contact 7 may urge the support 3 upwardly and separate contacts 6 and 8 to open the circuit.

The electric heater 15 is formed from a flat strip of resistance material, bent intermediate its ends to form a heating compartment 16, and provided with terminal apertures 17 and 18 to receive the screws 19 and 20 by means of which the heater is connected between the contacts 5 and 6.

An aperture 21, of greater diameter than the conductor 13, is formed in the heater 15 intermediate the ends thereof, and the conductor 13 extends therethrough and into the compartment 16.

The current carried by the heater 15 is forced through the constricted parts 22 at each side of the aperture 21 and any current above a predetermined minimum will cause the same to become high temperature areas which radiate heat to the heat conductor 13.

A part of the heat generated in the high temperature areas 22 is conducted to and radiated by the side walls 23 of the compartment 16 and the terminal arms 24.

The side walls 23 also confine a part of the heat in the compartment 16 to heat that part of the conductor 13 lying therein and prevent excessive radiation therefrom.

The heat generated in the high temperature areas 22 under the influence of a small or harmless overload will be largely dissipated by the radiators 23 and 24 and the amount of heat conducted by the conductor 13 to the fusible binder 12 will be insufficient to fuse the same.

The motor may thus continue to operate under the small and harmless overload.

A certain amount of the heat generated by larger overloads is dissipated by the radiators 23 and 24 but conduction of heat by the conductor 13 exceeds the dissipation by radiation according to the overload, so that the binder 12 is fused after certain periods of time which vary inversely to the amount of overload.

A properly selected heater arranged in the circuit breaker which controls the motor will permit the motor to continue operating until the overload becomes dangerous.

A large and prohibitive overload causes a high degree of heat to be generated and transferred to the fusible binder 12 to fuse the same almost instantly as the radiators 23 and 24 are incapable of instantly dissipating so large an amount of heat.

The heat characteristics of the heater may be varied to correspond to the characteristics of any motor or other appliance by varying either the width or thickness of the resistance material, varying the size of the aperture 21 relatively to the diameter of the heat conductor 13 to vary the distance that heat must be radiated to the heat conductor, varying the diameter of the aperture 21 relatively to the width of the strip to vary the cross-sectional area of the high temperature areas 22, varying the size of the radiators 23 and 24 to vary the area of the radiating surfaces, varying the width of the strip contiguous to the aperture 21, or providing fins to increase the radiating surface as shown in Fig. 5, varying the width of the compartment 16 to vary the distance between the heat conductor 13 and the radiators 23, varying the depth of the compartment 16 to vary the indirect heating areas and the heat dissipating surfaces, or by combining any two or more of such variables.

The heater shown in Fig. 4 is similar to the heater 15 except that one side wall thereof is provided with a reverse bend 25 having apertures 26 and 27 therein in alinement with the aperture 21.

Additional high temperature areas 22 are thus provided which multiply the capacity of the heater.

The heater shown in Fig. 5 is made from a flat strip of resistance material and reduced in width intermediate the ends thereof to form a high temperature area 28 and radiators 29.

The high temperature area 28 may be looped to form a heating compartment 30 to receive a heat conductor 13 or the binder to be fused.

The heater shown in Fig. 6 is similar to the heater shown in Figs. 2 and 3 but has a notch 31 formed at each side of the aperture 21 to reduce the width of the high temperature areas 22 and may also be provided with fins 32 to increase the area of the radiators 24.

The heaters shown in Figs. 5 and 6 may be shaped to conform to the instrument in which the same are employed and the heat characteristics thereof may be varied as above set forth.

The invention disclosed herein is susceptible of various modifications and adaptations without departing from the scope thereof as hereafter claimed.

The invention is hereby claimed as follows:

1. An electric heater for heating a heat conductor, comprising a high resistance metal strip provided with a convoluted part intermediate its ends and apertures in said convoluted part in axial alinement for receiving said heat conductor, and terminals arranged at opposite sides of said convoluted part for connecting said heater in an electric circuit.

2. An electric heater for heating a heat conductor, comprising a high resistance metal strip provided with an aperture formed therein intermediate its edges to receive said heat conductor and restricted parts of high impedance to electric current between said aperture and said edges for generating heat, having the parts of said strip at opposite sides of said aperture bent to parallel relation providing opposed radiating surfaces which define and partially enclose a heating space for said conductor, and having terminal parts extending from said radiating parts for connecting said heater into an electric circuit.

3. An electric heater for a thermally operable circuit breaker having a heat conductor extending therefrom, comprising a high resistance flat metal strip provided with an aperture formed therein intermediate the edges thereof to receive said extending heat conductor and to provide restricted parts between said aperture and the edges of said strip for impeding the flow of electric current therethrough to generate heat and having parts of said strip at opposite sides of said aperture arranged to define a heating space for said heat conductor and other parts of said strip bent outward from said latter parts to provide terminal connections for connecting said heater into an electric circuit and for supporting said heater on said circuit breaker.

4. A circuit breaker including a heat conductor and a latch connected to said heat conductor by a fusible binder, a heating unit comprising a metallic strip having an aperture therein surrounding said heat conductor at the end thereof adjacent said latch, radiating fins formed integrally on said strip on either side of said aperture and extending substantially parallel to said conductor to define and partially enclose a heating space, and terminal members on said strip to connect the heating unit in a circuit.

5. In a circuit breaker including a heat conductor and a latch connected to said heat conductor by a fusible binder, a heating unit comprising a metallic strip having an aperture therein surrounding said heat conductor at the end thereof adjacent said latch, radiating fins formed integrally on said strip on either side of said aperture and extending substantially parallel to said conductor to define and partially enclose a heating space, and terminal members on said strip extending outwardly from the fins to connect the heater in a circuit.

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