

Nov. 3, 1942.

G. C. ARMSTRONG

2,300,901

THERMAL OVERLOAD RELAY

Filed Jan. 24, 1940

2 Sheets-Sheet 1

Fig. 1.

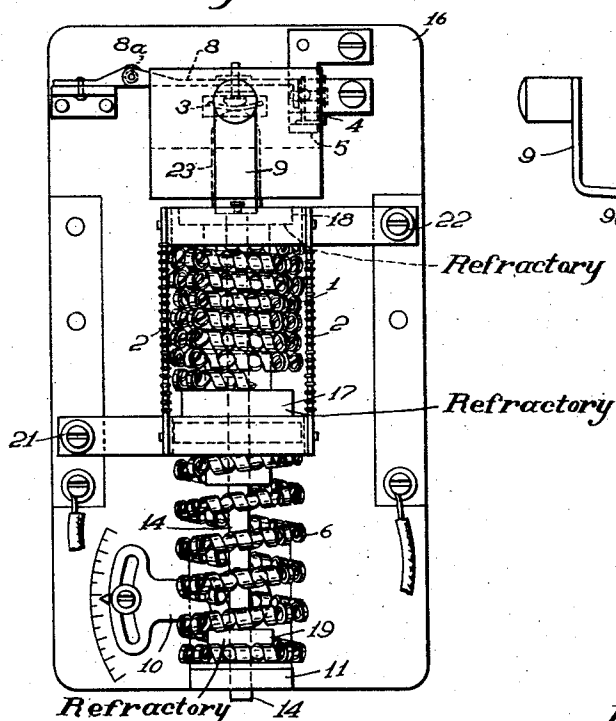


Fig. 2.

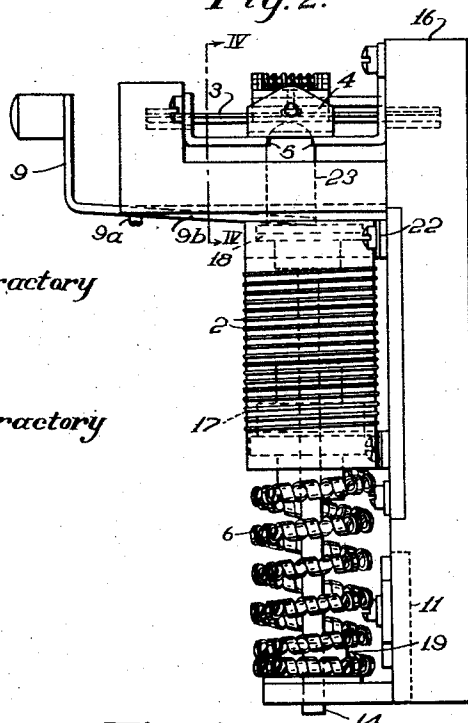


Fig. 4.

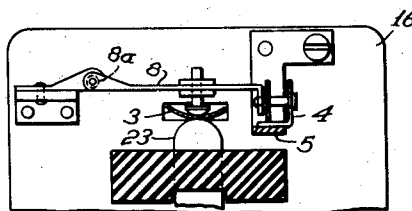


Fig. 3.

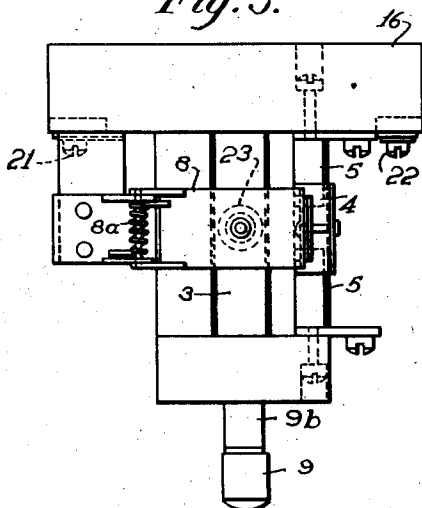
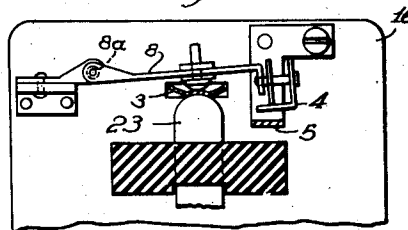


Fig. 5.



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Fig. 6.

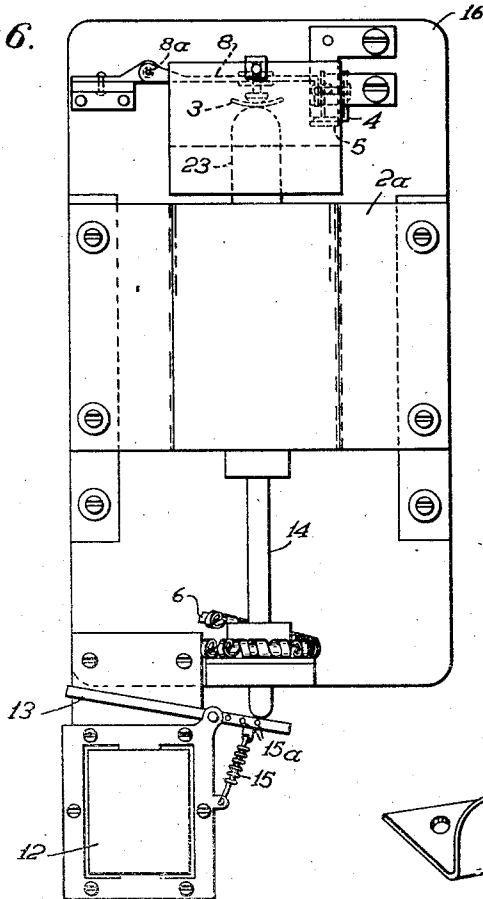


Fig. 8.



Fig. 9.

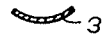


Fig. 10.

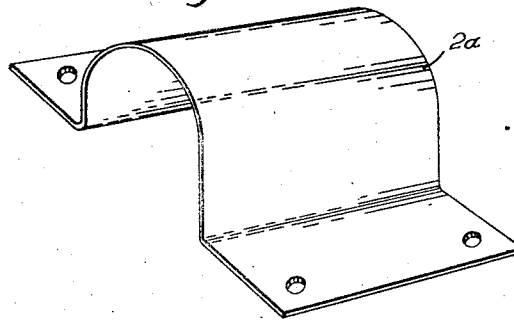
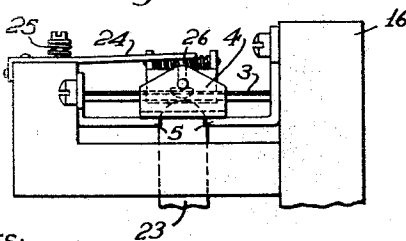


Fig. 7.



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THERMAL OVERLOAD RELAY

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Application January 24, 1940, Serial No. 315,385

3 Claims. (Cl. 200—122)

My invention relates to an overload relay which is responsive either to a heating current of predetermined duration or to a suddenly applied overload current of substantial value.

An object of my invention is to provide a thermal relay which includes a bimetallic element having the form of a coiled coil, more specifically, a coil wound in the form of a helix about a small diameter, which helix is wound in the form of a helix (or a double helix) about a larger diameter, thus being, in reality, a coiled, helical coil.

Another object of my invention is to provide a thermal relay which is self-compensating for changes in ambient temperatures.

A still further object of my invention is to provide a thermal relay having a bimetallic element in the form of a coiled coil and an actuating mechanism which includes a spring-like member of arcuate cross section which imparts a snap action to the operation of the relay contact members.

Still another object of my invention is to provide a thermal relay with a saturable reactor connected in parallel with its heating element so that the relay will be responsive to sudden onrushes of high overload currents.

A still further object of my invention is to provide a thermal relay which may be either automatically resettable or manually resettable, as desired.

Other objects and advantages will become more apparent from a study of the following specification when considered in conjunction with the accompanying drawings, in which:

Figure 1 is a front view of a thermal relay embodying the principles of my invention;

Fig. 2 is a side view of a relay shown in Fig. 1;

Fig. 3 is a top view of the relay shown in Fig. 1;

Fig. 4 is a sectional view taken along the line IV—IV of Fig. 2 showing the contact members in the closed position;

Fig. 5 is a view similar to Fig. 4 except that the contact members are shown in the open position instead of the closed position;

Fig. 6 is a modification of my invention embodying a saturable reactor which effects tripping in response to high overload currents and embodying automatic resetting;

Fig. 7 is a side view of a portion of the relay shown in Fig. 6;

Figs. 8 and 9 are top and sectional views of the spring in Figs. 1 to 5 for effecting snap action; and

Fig. 10 is a perspective view of a preferred

shape of heater (shown enlarged) to be used with my relay.

A relay, in accordance with my invention, makes use of double helical bimetallic elements. A narrow strip of bimetal is first wound in a small diameter helix, and this coiled strip then wound in a second larger diameter helix. This second helix lengthens or shortens when heated, depending upon whether the bimetal is wound with the high-expansion metal inward or outward in the small helix.

Referring more particularly to Figs. 1 to 5, inclusive, numeral 16 denotes a stationary support or base of suitable insulating material upon which are mounted various elements of a thermal relay. A pair of bimetallic elements 1 and 6, each being in the form of a coiled helical coil are mounted in coaxial relationship, being supported at their ends by spacer members 17, 18 and 19, preferably of refractory material. Spacer member 17 is slidable on guide rod 14, and actuating member 23 and spacer member 18 are rigidly secured to guide rod 14. A heater element 2 has its terminals 21 and 22 also rigidly secured to the stationary base 16.

The upper bimetal 1 expands under action of the heater 2 which carries the motor current or other load current. If the current is of sufficient value, the force exerted by the bimetal 1 exceeds the reactive force of a snap acting spring 3 of arcuate cross section (whose ends fit in slots formed in base 16), the spring suddenly flattens out and weakens in reaction (as shown in Fig. 5), the bimetal springs upwardly, lifting the upper spacer member 18 and actuating member 23 suddenly, separating the movable contact member from the stationary contact members 5, thus interrupting an auxiliary circuit (not shown).

The bimetal 6 is so wound that it contracts in length when heated thus differing from bimetal 1 which expands in length when heated. The bimetal 6 being mounted below and beyond the heating range of the heater 2, is responsive practically only to the ambient temperature. Its contraction compensates for the expansion of the operating bimetal 1 due to increase in ambient temperature, thereby compensating for changes in ambient temperature and making the relay responsive to overload current only, regardless of the value of the ambient temperature.

When the bimetal 1 cools, the relay may be reset by moving reset lever 9 clockwise about its pivot 9a. Its arm 9b will then abut the upper surface of spacer member 18 thus pushing it and actuating member 23 downwardly. The movable

contact member 4 is returned to its initial contact engaging position by action of the arm 8 biased downwardly by spring 8a. After the actuating member 23 has been lowered, spring 3 will move from the position shown in Fig. 5 to the position shown in Fig. 4.

A lever 10 is rotatably mounted on the base 16, and is used to adjust the position of a slidable bracket 11 by the action of an eccentrically positioned pin (not shown) which engages a slot in the slide. Such adjustment means is well known in the art and forms no part of my invention.

Fig. 6 shows an attachment to provide instantaneous trip at high over currents comprising a saturating reactor 12 which is connected in parallel with a modified form of heater 2a. Obviously a wire type of heater such as 2 in Fig. 1 could be substituted for heater 2a. When the current is very high, the reactor 12 saturates magnetically, and the leakage flux attracts the armature 13 which, acting through the rod 14 trips the relay contact members 4, 5. An alternative connection would be to connect the reactor in series with the heater. The tripping current is dependent upon the number of turns in the reactor coil and the strength of the spring 15 which is adjustable by shifting its attachment to differently located holes 15a in the armature.

In order to make the heaters capable of withstanding high short circuit currents of short duration, the heater 2a (see Fig. 10) is semi-cylindrically designed to make the flow from terminal to terminal take a substantially straight path. If desired, slots (such as shown in dotted lines) in the direction of current flow may be cut out of 2a. High currents tend to melt conductors at point of high current density. Such points occur at slot corners where direction of current flow reverses such as in irregularly shaped heaters, that is heaters having staggered slots at right angles to the lead-in current path which force the current to zigzag back and forth and reverse its direction a number of times. Of course a wire form of heater such as 2 in Fig. 1 is of uniform cross section and does not possess this fault.

Fig. 7 shows an arm 24 biased downwardly by an adjustable spring 25 for pushing a resetting pin 26 downwardly for effecting automatic reset of the relay (instead of manual reset) after the bimetallic helix 1 has cooled.

All moving parts of my relay move at a right angle to the direction of the throw of any suitable control panel carrying base 16 shocked by blows from front or rear. The parts are light, and restrained by springs of high strength relative to the inertia forces. The relay is, therefore, well adapted for maritime applications where sudden lateral movements of a ship occur frequently.

I am, of course, aware that others, particularly after having had the benefit of the teachings of my invention may devise other devices embodying my invention, and I, therefore, do not wish to be limited to the specific showings made in the drawings and the descriptive disclosure hereinafter made, but wish to be limited only by the scope of the appended claims and such prior art that may be pertinent.

I claim as my invention:

1. A thermal relay comprising, in combination, a bimetallic element in the form of a coiled coil, means for heating the same, actuating means, switching means operated by said actuating means in response to movement of said coiled switching coil under the action of said heating means, and a second bimetallic element in the form of a coiled coil coaxially disposed with respect to said first coiled coil and subject almost exclusively to ambient temperature, said second coiled coil having its bimetallic elements reversed as distinguished from said first coiled coil therefore moving in an opposite direction longitudinally under the influence of increase in surrounding temperature.

2. A thermal relay comprising, in combination, a bimetallic element in the form of a coiled helical coil, means for heating the same, actuating means, switching means operated by said actuating means in response to movement of said coiled helical switching coil under the action of said heating means, and a second bimetallic element in the form of a coiled helical coil coaxially disposed with respect to said first coiled helical coil and subject almost exclusively to ambient temperature, said second coiled helical coil having its bimetallic elements reversed as distinguished from said first coiled helical coil therefore moving in an opposite direction longitudinally under the influence of increase in surrounding temperature.

3. A thermal relay comprising, in combination, a bimetallic element in the form of a coiled coil, electrical means for heating said coiled coil, actuating means actuated by the longitudinal movement of said coiled coil under the influence of heat, a switch actuated by said actuating means and means interposed between said actuating means and said switch for affording snap action in the actuation of said switch, and a second bimetallic element in the form of a coiled coil coaxially disposed with respect to said first coiled coil and subject almost exclusively to ambient temperature, said second coiled coil having its bimetallic elements reversed as distinguished from said first coiled coil therefore moving in an opposite direction longitudinally under the influence of increase in surrounding temperature.

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