Sept. 9, 1941. G. C. ARMSTRONG 2,255,638

OVERLOAD RELAY

Filed Jan. 24, 1940

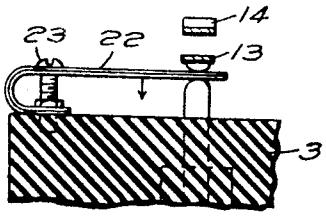


Fig. 2.

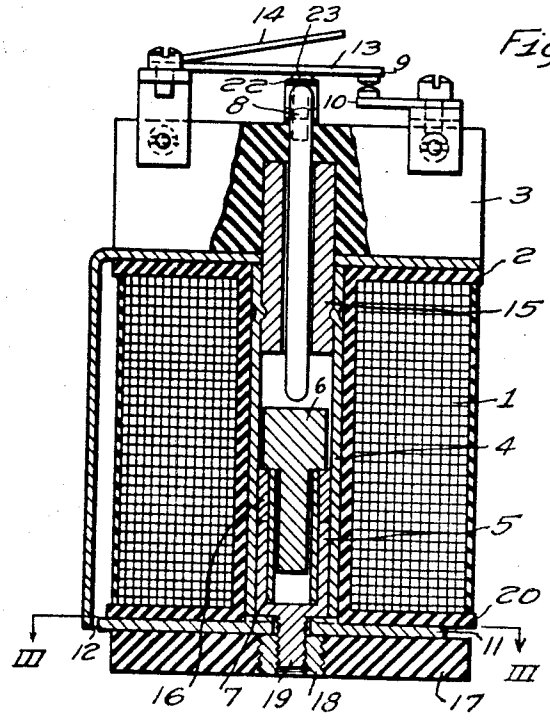


Fig. 1.

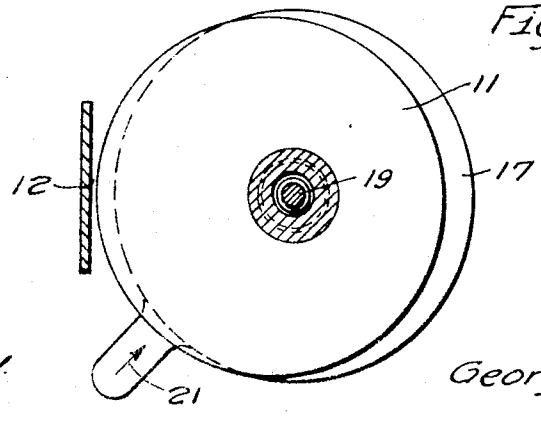


Fig. 3.

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OVERLOAD RELAY

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12 Claims. (Cl. 200—88)

My invention relates to an overload relay, and more specifically to one that is responsive to heat generated in response to an overload current.

An object of my invention is to provide an overload relay for use on alternating current circuits, which may be immersed in air or oil and which will give outstanding performance on extremely high overload currents.

Another object of my invention is to provide an overload relay which is adjustable in rating.

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

Figure 1 is a side view partly in cross section of an overload relay involving the principles of my invention;

Fig. 2 is a modified showing of the movable contact arm; and

Fig. 3 is a sectional view taken along line III—III of Fig. 1.

A coil or winding 1 carrying the current of the circuit which is to be protected, and an insulating spool 2 are mounted upon an insulating base 3 which is arranged to hold the relay upon a panel by means of suitable mounting bolts (not shown). The insulated casing forms a hermetic seal making it possible to operate the relay in an oil bath. The coil is arranged to surround a copper tube 4 in which is placed a stationary pole 5 to which is attached on its upper face, a ring of an alloy steel material 16 (for example, "Invar") having a curie point preferably above 100° C. A nickel-steel alloy having a curie point of about 125° C. is a very suitable example. A movable plunger 6 rests on the magnetic alloy ring 16 and is guided by a brass tube 7.

When the pole piece 16 is magnetized, the magnetomotive force of the coil 1 holds the plunger 6 down tightly against its upper surface. When the current in the coil 1, due to an overload, exceeds a particular value, eddy currents built up in the copper tube 4 cause the temperature of the alloy pole piece element 16 to exceed the curie point, and there is thus a resultant loss in magnetic attraction between the alloy pole piece 16 and the plunger 6. This results in the plunger being attracted to the upper stationary pole 15 driving the operating rod 8 upwards and causing the separation of the contact members 9 and 10. The movable contact member 9 is normally urged downwardly by a phosphor bronze or steel spring 13 backed up by a guard 14.

In contact with the lower pole piece 5 is an eccentric steel disc 11 which when turned about the center stud 19 may be caused to vary the air gap 12 (see Fig. 3), thereby changing the magnetic flux which circulates through the center of the coil, and consequently varying the eddy currents set up in the copper tube 4 and the resultant heating. The circumferential edge of the lower ring 20 of the spool may be suitably calibrated and cooperate with the arrow 21 or other index on disc 11. An insulating cap 17 of "Moldarta" or other suitable insulating material has a tapped insert 18 for adjustably clamping the eccentric disc 11 in position.

The relay as shown rests automatically whenever the coil is deenergized. Hand reset may be provided by arranging a latch (not shown) to catch the movable contact carrying member 13 in its open position, holding it there until manually released. The proportions of the magnetic circuit may be so arranged as to provide instantaneous trip at high currents as a result of saturation in the parts of the lower pole.

Fig. 2 is a partial cross sectional view taken at right angles to the view in Fig. 1 and showing a bimetallic element 22 which is adjustable by screw 23 and which bimetallic element compensates for changes in ambient temperature. The bimetal moves in the direction of the arrow when the ambient increases. The temperature required for tripping may be varied by adjusting screw 23. The relay may be inverted to keep the coil heat from heating the bimetal.

This adjustable relay may be used either for air operation or for oil immersion. For oil immersion, slotting (not shown) in the plunger should be provided to by-pass any oil which may leak into the interior of the relay.

The temperature at which the relay operates may be different from 125° C. depending on the materials used, the construction of the coil, the application (i. e., whether or not it is to be sensitive to the ambient, etc.).

Although the reversibly magnetic element has been described as being of a nickel-iron alloy or of "Invar," it will be apparent that any other magnetic material which loses or substantially loses its magnetic property as a result of heat, may be substituted therefor. For example, a nickel copper alloy, often referred to as Monel metal may be substituted. Likewise, an alloy of iron and nickel, with minor percentages of silicon or chromium, and which become non-magnetic when heated to a temperature dependent upon the percentages, may likewise be substituted.

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 drawing and the descriptive disclosure hereinbefore 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. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element disposed in the vicinity of one of said pole pieces and which loses its magnetism to an appreciable extent as the result of excessive current flow through said coil thereby allowing the armature to move under the influence of the other magnetic pole piece, and an electrical switch which is operable by said armature.

2. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, heating means responsive to current flow through said coil, a reversibly magnetic element disposed in the vicinity of one of said pole pieces and which loses its magnetism to an appreciable extent as the result of a predetermined value of heat developed by said heating means thereby allowing the armature to move under the influence of the other magnetic pole piece, and an electrical switch which is operable by said armature.

3. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a metallic member having the property of developing a relatively high temperature as the result of eddy currents induced therein by current flow through said coil, a reversibly magnetic element disposed in the vicinity of one of said pole pieces and which loses its magnetism to an appreciable extent as the result of a predetermined value of heat developed by said metallic member and transferred to said reversibly magnetic element, thereby allowing the armature to move under the influence of the other magnetic pole piece, and an electrical switch which is operable by said armature.

4. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of pole pieces coaxially disposed with respect to said coil, a reciprocable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said poles, a reversibly magnetic tubular element disposed in the vicinity of one of said poles, a thin tubular element which is coaxially disposed with respect to said magnetic tubular element and to said coil axis and which is heated as the result of eddy currents induced therein by current flow through said coil, said reversibly magnetic, tubular element having the property of substantially losing its magnetic property upon being heated a predetermined amount thereby allowing said armature to become attracted by the other of said poles, and an electrical switch which is operated by said reciprocable armature.

5. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of pole pieces coaxially disposed with respect to said coil, a reciprocable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said poles, a reversibly magnetic tubular element disposed in the vicinity of one of said poles, a thin tubular copper element which is coaxially disposed with respect to said magnetic tubular element and to said coil axis and which is heated as the result of eddy currents induced therein by current flow through said coil, said reversibly magnetic, tubular element having the property of substantially losing its magnetic property upon being heated above 100° C. thereby allowing said armature to become attracted by the other of said poles, and an electrical switch which is operated by said reciprocable armature.

6. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of pole pieces coaxially disposed with respect to said coil, a reciprocable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said poles, a reversibly magnetic tubular element disposed in the vicinity of one of said poles, a thin tubular element which is coaxially disposed with respect to said magnetic tubular element and to said coil axis and which is heated as the result of eddy currents induced therein by current flow through said coil, said reversibly magnetic, tubular element having the property of substantially losing its magnetic property upon being heated to approximately 125° C., thereby allowing said armature to become attracted by the other of said poles, and an electrical switch which is operated by said reciprocable armature.

7. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element in the vicinity of one of said pole pieces, a thin metallic cylindrical member coaxially disposed with respect to said coil and adjacent to said magnetic element and which is heated by eddy currents induced as the result of current flow through said coil, said reversibly magnetic element having a "curie point" of about 125° C. or above thereby allowing the armature to move under the influence of the other pole piece upon the attainment of such temperatures by said reversibly magnetic element, and an electrical switch which is operable by said armature.

8. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element of "Invar" in the vicinity of one of said pole pieces, a thin metallic member adjacent to said magnetic element and which is heated by eddy currents induced as the result of current flow through said coil, said reversibly magnetic element having a "curie point" of about

125° C., thereby allowing the armature to move under the influence of the other pole piece upon the attainment of such temperatures by said reversibly magnetic element, and an electrical switch which is operable by said armature.

9. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element disposed in the vicinity of one of said pole pieces and which loses its magnetism to an appreciable extent as the result of excessive current flow through said coil, thereby allowing the armature to move under the influence of the other magnetic pole piece, and an electrical switch which is operable by said armature, said electromagnetic device having a core which has an air gap independent of said armature, means for selectively adjusting the width of said air gap.

10. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element disposed in the vicinity of one of said pole pieces and which loses its magnetism to an appreciable extent as the result of excessive current flow through said coil thereby allowing the armature to move under the influence of the other magnetic pole piece, and an electrical switch which is operable by said armature, said electromagnetic device having a core which has an air gap independent of said armature, an eccentrically mounted magnetic member which is adjustable to provide various widths of said air gap.

11. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element disposed in the vicinity of one of said pole pieces and which loses its magnetism to an appreciable extent as the result of excessive current flow through said coil thereby allowing the armature to move under the influence of the other magnetic pole piece, and an electrical switch which is operable by said armature, said magnetic pole pieces and reversibly magnetic elements being hermetically sealed by a casing thereby adapting the device for immersion in a liquid insulating medium.

12. An overload relay comprising, in combination, an electromagnetic device having a coil and a pair of magnetic pole pieces coaxially disposed with respect to said coil, a slidable, plunger type armature movable within and along the axis of said coil and which is selectively attracted to either of said pole pieces, a reversibly magnetic element in the vicinity of one of said pole pieces, a thin metallic member adjacent to said magnetic element and which is heated by eddy currents induced as the result of current flow through said coil, said reversibly magnetic element having a "curie point" of about 125° C. or above thereby allowing the armature to move under the influence of the other pole piece upon the attainment of such temperatures by said reversibly magnetic element, and an electrical switch which is operable by said armature, said poles, reversibly magnetic elements and thin metallic elements all being hermetically sealed by a casing, thereby adapting the device for immersion in a liquid insulating medium.

GEORGE C. ARMSTRONG.