Aug. 10, 1926. 1,595,749

N. K. ANDERSEN

THERMAL RELAY

Filed May 11, 1921

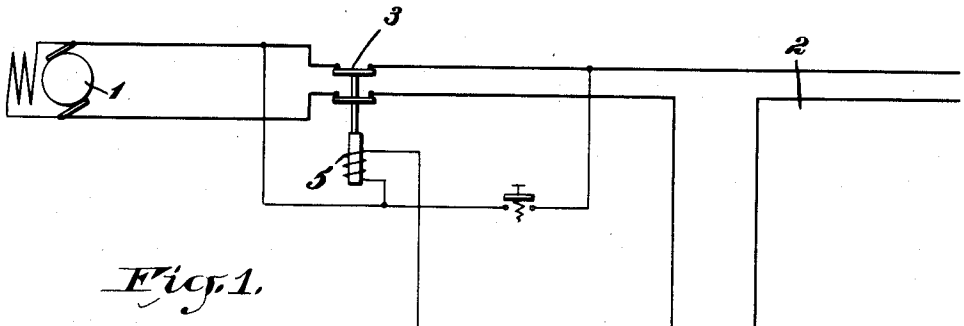


Fig. 1.

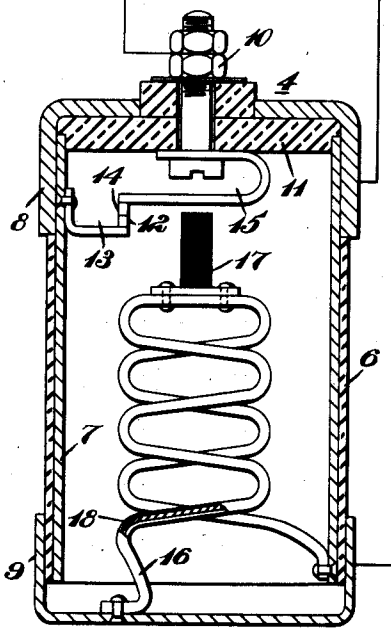
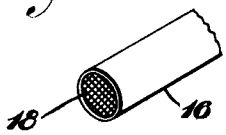


Fig. 2.



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UNITED STATES PATENT OFFICE.

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THERMAL RELAY.

Application filed May 11, 1921. Serial No. 468,718.

My invention relates to thermal relays and particularly to thermal relays that are actuated with a quick or snap action.

One object of my invention is to provide a thermal relay embodying thermal responsive means that are operated with a relatively quick movement at a predetermined temperature.

Another object of my invention is to provide a relay, of the above-indicated character, in which the thermal responsive means shall embody a relatively large heat-storage capacity.

A further object of my invention is to provide a thermal relay embodying thermal responsive means that change in form at a predetermined temperature to effect a sudden increase in the volume thereof.

A further object of my invention is to provide a relay, of the above-indicated character, that shall embody a time element of such character or value as to effect the protection of an electrical apparatus from overheating.

In practicing my invention, I employ a cylindrical tube provided with end ferrules, whereby the same may be inserted into standard fuse clips. A metallic tube consisting of copper or copper-nickel alloy and containing a metal, such as sodium, is connected between the two ferrules. The sodium is adapted to melt at a temperature of approximately 96° centigrade and thereupon to increase suddenly in volume. The tube is so disposed, in serpentine form, as to constitute substantially a bellows member that is expanded upon the melting, and the consequent expansion, of the sodium at the predetermined temperature. The sudden longitudinal movement of the tube, caused by the bellows action thereof, effects the disengagement of a plurality of contact members with a relatively quick movement.

The circuit of the holding coil of a circuit interrupter is thereupon opened to permit the interrupter to disconnect the apparatus to be protected from the circuit that supplies energy thereto.

Figure 1 is a diagrammatic view of an electrical circuit and a relay connected thereto that embodies my invention.

Fig. 2 is a cross-sectional view of the tubular member illustrating the disposition of the metallic sodium therein.

Referring to Fig. 1, an electrical apparatus, such as a motor 1, receives energy from a circuit 2 through an interrupter 3 that is controlled by a thermal relay 4 to protect the motor 1 from overheating. The interrupter 3 is provided with a holding coil 5 whereby the relay controls the interrupter 3.

The relay 4 comprises a cylindrical member 6 of insulating material within which is disposed a similar tubular member 7 of conducting material. Two ferrule members 8 and 9 are disposed on the respective ends of the tubular members. The ferrule 8 is disposed on the conducting member 7, and the ferrule 9 is disposed on the insulating member 6. A terminal member 10 is supported on a bushing 11 of insulating material that is disposed between the ferrule 8 and the tubular member 7 to render the same relatively stationary. A stationary contact member 12 is disposed upon, and secured to, a conducting bracket member 13 that is secured to the tubular member 7 of conducting material. The contact member 12 is adapted normally to be engaged by a contact member 14 that is secured to, and supported by, a flexible conducting member 15 which is secured to the terminal member 10.

A tubular conducting member 16, that is provided with a core of metallic sodium, is arranged in serpentine form and has the respective ends thereof connected to the ferrule 9 and to the tubular member 7 of conducting material, respectively. The end loop of the tubular member 16 has a rod 17 of insulating material secured thereto that is adapted to engage the flexible member 15 to effect the disengagement of the contact members 12 and 14 when the tubular member 16 expands to a predetermined degree.

The core 18 of metallic sodium embodies a relatively large heat-storage capacity and, since it is uniformly heated, will increase in temperature until the melting point of the sodium is attained. Since substantially all of the sodium will melt simultaneously, the expansion of the tube that will be effected will result, with substantially a snap-action, to quickly disconnect the contact members 12 and 14.

The relay tends to follow the actual operating temperature curve of the apparatus 1 that is to be protected because of the

thermal characteristics of the tubular member and the core of sodium. Effective thermal protection is therefore obtained.

My device is not limited to the particular structure that is illustrated, since various modifications may be made therein within the spirit and scope of the invention, as set forth in the appended claim.

I claim as my invention:

A thermal relay comprising a cylindrical casing, two end ferrules therefor and a conducting member connected therebetween containing a substance having a high temperature coefficient of expansion and disposed in serpentine form to occupy a relatively small space and means controlled thereby by reason of expansion effected therein by increase of temperature.

In testimony whereof, I have hereunto subscribed my name this 25th day of April, 1921.

NIELS K. ANDERSEN.