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H. S. GANO

1,693,379

THERMAL RELAY

Filed June 23, 1926

Fig. 1.

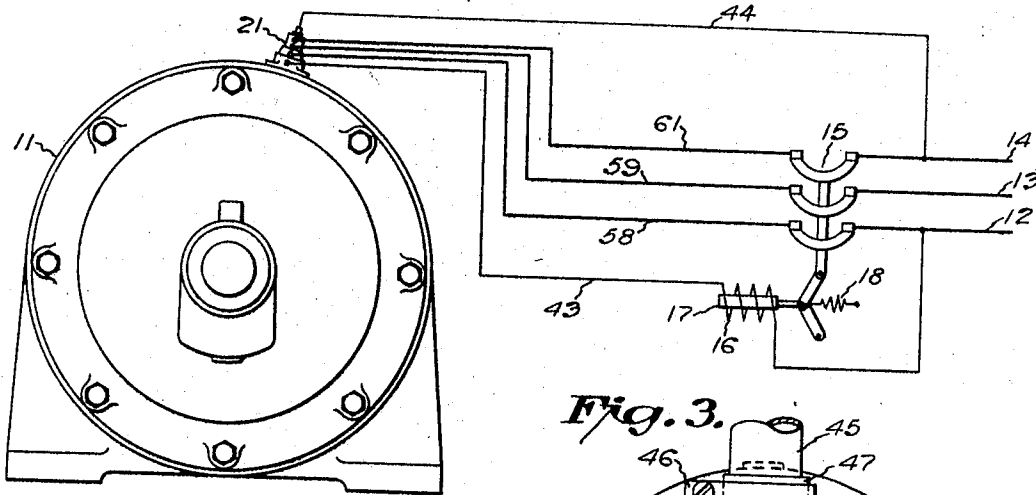


Fig. 2.

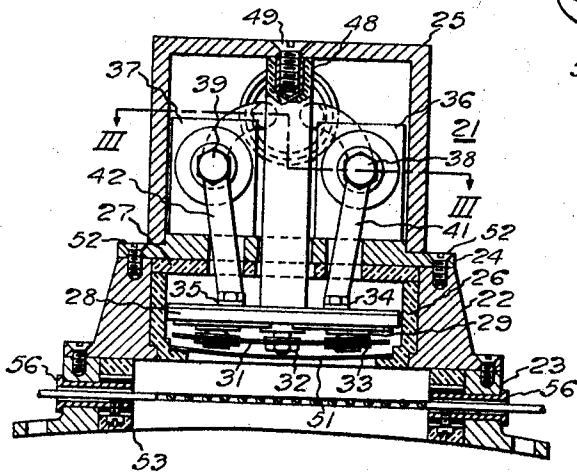


Fig. 3.

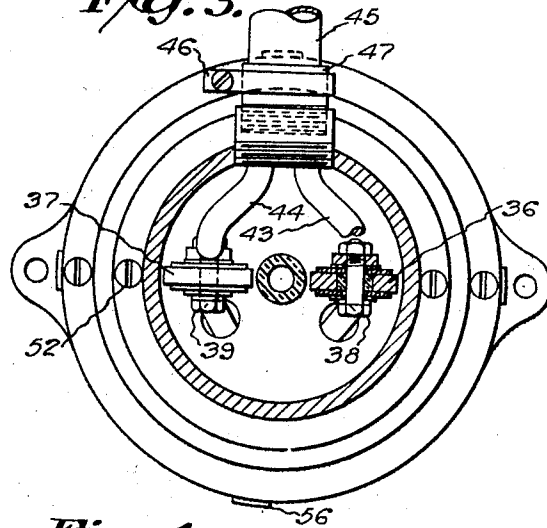
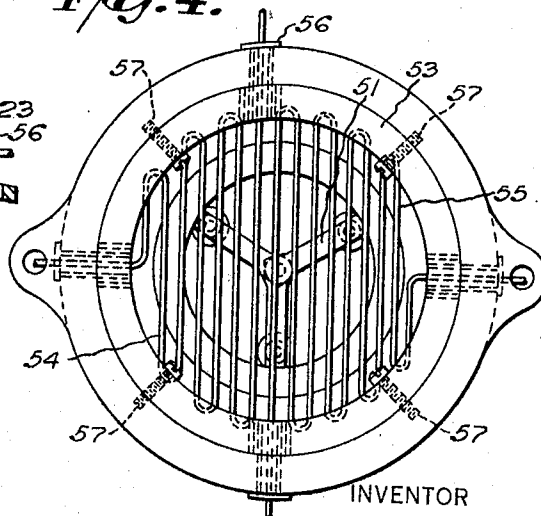


Fig. 4.



WITNESSES:

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THERMAL RELAY.

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My invention relates to temperature-controlling devices and particularly to thermal relays.

An object of my invention is to provide a relatively simple, compact, and efficient thermal relay for controlling the energization of an energy-translating device.

In practicing my invention, I provide a casing which is directly mounted on an energy-translating device, a thermally actuable switch to be directly energized by the energy-translating device and a plurality of heating elements in the casing energized in accordance with the current traversing one or a plurality of phase windings of the energy-translating device.

In the single sheet of drawings:

Figure 1 is a view of an energy-translating device shown in side elevation, with which is associated a device and system embodying my invention,

Fig. 2 is a sectional view of a device embodying my invention,

Fig. 3 is a lateral sectional view of the device taken along the line III—III of Fig. 2, and,

Fig. 4 is a bottom plan view of the thermal relay embodying my invention.

Referring more particularly to Fig. 1 of the drawings, I have there illustrated a motor 11 which is intended broadly to represent any energy-translating device, such as a motor, a generator or a transformer.

A three-phase supply circuit comprises conductors 12, 13 and 14 available to energize the device 11, and a circuit-interrupting means 15, of any desired type usually employed in the art, is connected in the supply-circuit conductors to permit of suitably controlling the energy-translating device 11.

The circuit breaker 15 is held in its normally closed position by a holding coil 16 and a core member 17 which is operatively connected to the mechanism of the breaker 15. When the holding coil 16 is de-energized, a spring 18, also connected to the breaker, effects the opening of the breaker to thereby de-energize the translating device 11.

A thermal relay 21 is secured against an outer surface of the energy-translating device 11 and, preferably, against the iron portion thereof.

The device 21 comprises an intermediate tubular casing portion 22, a bottom annular portion 23, a terminal supporting portion 24

and a cover member 25. The portion 22 is of metal and of a suitable thickness to provide sufficient strength for the purpose desired. The member 22 is provided with an annular lining 26 of a suitable electric-insulating and heat-insulating material consisting either of asbestos lumber or of a fibrous bakelite material. An annular member 27 of electric-insulating and heat-insulating characteristics is provided at the upper or outer edge portion of the member 26 to substantially close the upper end of the member 22.

A thermally-actuable switch is located in the member 22 within the lining 26, the switch comprising a base portion 28 having a plurality of fixed contact members 29 insulatedly mounted thereon. A disc 31, of bimetallic material, is operatively secured to the base 28 by a central stud 32 and is provided with a plurality of co-operating contact-bridging members 33 insulatedly mounted thereon in such position as to engage adjacent ends of the fixed contact members 29 when the temperature of the disc is of one value and to be disengaged therefrom when the disc is of another value, whereby an electric circuit may be either closed or interrupted between terminal members 34 and 35 mounted on the base member 28. The thermally actuable switch comprising the base and the bimetallic disc 31 is preferably of the type disclosed and claimed in Patent No. 1,448,240 issued to J. A. Spencer.

The terminal supporting member 24 comprises a bottom flange portion and two upwardly extending spaced portions 36 and 37. Terminal members comprising short machine screws or bolts 38 and 39 are insulatedly mounted on the portions 36 and 37 adjacent to the upper ends of these portions. The terminal members 34 and 35 of the switch are connected to the terminal members 38 and 39 by conductors 41 and 42, respectively, openings being provided in the annular member 27 and the flange of the member 24 to permit of the conductors 41 and 42 extending therethrough.

The terminal members 38 and 39 are connected to one terminal of the holding coil 16 and to the supply-circuit conductor 14 by conductors 43 and 44, respectively, as shown more particularly in Figs. 1 and 3 of the drawings. The conductors 43 and 44 may be located in a metallic conduit 45 the end portion of which is such that it may extend into an opening in the housing 25, a clamping

means 46 being provided to hold the conduit 45 in a nipple 47.

The switch base 28 is held in its proper operative position by means of a rod member 5 48 which has screw thread engagement with the upper end of the stud 32, the rod 48 being of such length that its upper end may be secured against the housing 25 by a screw 49 and, when so supported, the thermally actu- 10 able disc 31 and the base will be in substantially the positions shown in Fig. 2 of the drawings.

A protecting member 51, embodying three radially extending arms, as shown more particularly in Fig. 4 of the drawings, inter-fits 15 with the lining 26 to protect the disc 31 against possible mechanical injury.

The flange of the member 24 is secured against the outer face of the annular member 20 32 by a plurality of small machine screws 52.

The annular base portion 23 is of metal and is provided with an annular member 53 of electric-insulating material, such as asbestos 25 lumber.

A plurality of separate heating units 54 and 55 are supported by the annular lining 53 in any suitable or desired manner, the main consideration being that the respective heating units or elements shall be distributed uni- 30 formly over the available space. To this effect, the heating unit comprises a plurality of straight and parallel-extending return-bent convolutions, as shown in Fig. 4 of the drawings. A plurality of electric-insulating bush- 35 ings 56 are provided, extending through the members 23 and 53, and the end portions of the heating elements 54 and 55 extend outwardly through these bushings. The annular member 53 is held in its proper operative 40 position by a plurality of machine screws 57, as shown more particularly in Fig. 4 of the drawings.

The heating units 54 and 55 are respectively connected in series-circuit relation to two 45 phase windings of the energy-translating device 11, as by conductors 58 and 59 between the circuit breaker 15 and through the device 21 to the energy-translating device 11.

A third conductor 61 is, of course, provided, 50 in the case of a three-phase energy-translating device, and this conductor may extend through the thermal relay 21, as shown in Fig. 1, or it may extend to the terminal board of the device, in the usual manner. While I 55 have shown the conductors 58 and 59 as connected to the relay 21 and from there to the proper phase windings, it is, of course, possible to employ other conductors to permit of the use of a standard terminal board or device usually supplied with an energy-translat- 60 ing device.

An energy-translating device of the kind illustrated in the drawings is constructed 65 mainly of three materials, namely, iron, either in the form of a casting or a forging or in

the form of laminated sheet steel, copper, and electric-insulating material separating the iron and the copper. In case of relatively long continued small overloads, it has been found that the iron portion of the translating 70 device is heated more than is the copper portion. However, when the sustained overload exceeds a predetermined value, the copper portion of the translating device is heated to a higher temperature than is the iron portion. 75

Hence, it is desirable that a thermally actuable device operatively associated with an energy-translating device, shall have means permitting it to respond to the temperature of either the iron portion or the copper portion, 80 in accordance with which temperature is the higher. The device embodying my invention meets this requirement in a very simple manner, by mounting a thermally actuable element, namely, the bimetallic disc 31, in close 85 operative relation to the energy-translating device and more particularly against the iron portion thereof, so that the thermal element is directly subjected to the temperature of the iron portion of the translating device. 90

If the translating device is subjected to an excessively high overload, the heating elements 54 and 55, which are energized either by the same current traversing the phase windings of a translating device or by a cur- 95 rent directly in accordance with the current traversing the phase windings, will constitute a source of heat which will also directly affect or energize the thermal element 31. Therefore, when the condition of an excessive over- 100 load occurs heat is generated in the heating units 54 and 55 and is radiated directly against the thermal element 31, whereby the same is quickly actuated to interrupt the circuit through the holding coil 16 of the breaker 15 105 which is thereupon opened by the action of the spring 18, resulting in the de-energization of the energy-translating device 11.

It is, of course, obvious that, if a relatively small overload is permitted to continue, the 110 iron portion of the energy-translating device is gradually heated over a relatively long period of time to the maximum permissible temperature. When this temperature is reached, actuation of the thermal element 31 115 is effected in response thereto. It is, however, to be noted that, even in this case, some heat is generated in the heating units 54 and 55 which also affects the thermal element 31 and aids in causing its actuation. 120

While I have illustrated and described a plurality of heating elements, it is obvious that the device embodying my invention is not limited thereto, as a plurality of such aux- 125 iliary heating units is necessary only in case of a polyphase translating device. Thus, if the device, embodying my invention, is associated with a single-phase energy-translating device of any kind, a single heating element only will be necessary, corresponding 130

changes being made in the circuit breaker and in the diagram of connections employed.

The construction using a base member 23 which may be disassociated from the rest of the thermal relay permits of designing a number of such base members equipped with heating units designed for different normal current values, and of easily and quickly assembling a suitable base member 23 with the other portions of the thermal relay to thereby adapt the assembled thermal relay to any desired normal current value of an energy-translating device.

The device embodying my invention thus provides a relatively simple, compact and easily assembled and disassembled thermal relay that may be operatively associated with an energy-translating device to protect the same against the results of either small and long continued overloads or of large short time overloads.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

I claim as my invention:

1. A thermal relay for an energy-translating device, comprising a thermally-actuable member, means for mounting it on an energy-translating device and for subjecting it to the temperature thereof, and means in said relay for thermally influencing said thermally-actuable member in accordance with the current continuously traversing an energy-translating device with which it is operatively associated.

2. A thermal relay comprising a casing to be mounted on an energy-translating device, a thermostatic switch in said casing subjected to the temperature of the device, and a heating unit in said casing energized in accordance with the current continuously traversing the energy-translating device.

3. A thermal relay for direct mounting on an energy-translating device, comprising a thermally-actuable switch energized in accordance with the temperature of the device, and a heating element in said relay energized

in accordance with the current continuously traversing the device for modifying the effect of the temperature of the device on the thermally actuable switch.

4. A thermal relay for direct mounting on an energy translating device, comprising a thermally-actuable switch energized in accordance with the temperature of the device, and a heating element in the relay located between the device and the thermally-actuable switch and energized in accordance with the current continuously traversing the energy translating device.

5. A thermal relay comprising a casing, a thermally actuable member therein, a heating element in the casing energized in accordance with the current continuously traversing an energy-translating device with which the relay is operatively associated, said thermally-actuable member being energized and actuated in accordance with the co-operating influence of the temperature of an energy-translating device and the temperature of the heating element.

6. A thermal relay for direct mounting on a polyphase energy-translating device, comprising a thermally-actuable member subjected to the heat from an energy-translating device on which it is mounted, and a plurality of heating elements each energized in accordance with a continuously flowing phase current of the energy-translating device for directly modifying the effect of the heat of the translating device on the thermally-actuable member.

7. A thermal relay for direct mounting on an energy translating device, comprising a thermally-actuable switch member, a supporting casing for the switch member, a heating unit energized in accordance with current continuously traversing the energy-translating device, a member for operatively supporting the heating unit, and means for securing the casing and the heating unit supporting member together and against an energy-translating device.

In testimony whereof, I have hereunto subscribed my name this 9 day of June, 1926.

HARLAN S. GANO.