

Nov. 7, 1961

R. SCHEIDIG
REED-CONTACT THERMO RELAY
Filed July 29, 1959

3,008,019

Fig.1

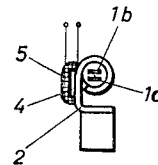
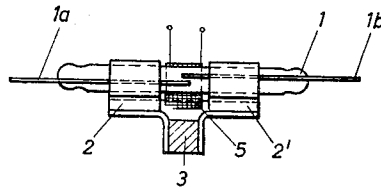


Fig. 1a

Fig.2

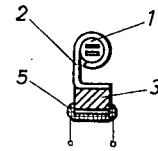
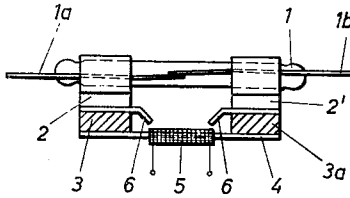


Fig. 2a

Fig.3

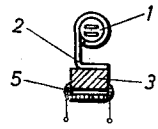
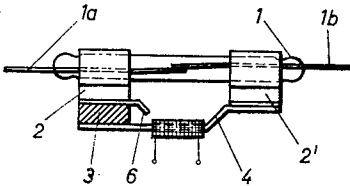


Fig. 3a

Fig.4

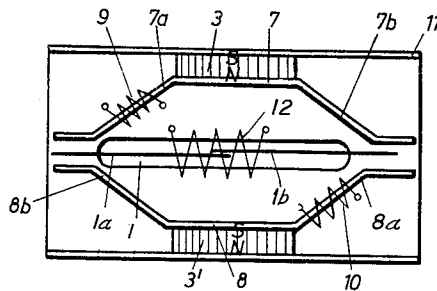
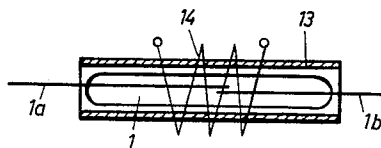


Fig.5



INVENTOR.
R. SCHEIDIG

BY

Paul W. Henningsen

AGENT

1

3,008,019

REED-CONTACT THERMO RELAY

Rudolf Scheidig, Stuttgart-Feuerbach, Germany, assignor to International Standard Electric Corporation, New York, N.Y., a corporation of Delaware

Filed July 29, 1959, Ser. No. 830,257

Claims priority, application Germany Aug. 7, 1958

7 Claims. (Cl. 200—88)

This invention relates to a thermal relay for communications, especially telephone systems, whose contacts are sealed into protective envelopes and penetrated by the controlling magnetic flux generated by a coil or by a permanent magnet.

Thermal relays are predominantly used in circuits where substantial delays are desirable. In a well-known relay of this type, a bimetallic strip is employed which, after being deformed to an expected degree under the effect of ambient temperature or a special heating coil, operates the contact to be controlled.

However, known relays of this type are costly and require special means to be provided for compensation of ambient-temperature variations.

The invention solves in a particularly simple manner the problem of controlling relay contacts by the temperature-dependent variation of the magnetic circuit also in thermal relays of which the armature contacts are sealed in protective envelopes. This is accomplished by the invention inasmuch as the flux of a permanent magnet controlling the armature contacts, is controlled by a variable-permeability member whose permeability decreases with increasing temperature. This member is provided magnetically in series or in parallel to the said permanent magnet or to the armature contacts. In another embodiment of the invention a bridge-type arrangement of the said variable-permeability member of the magnetic circuit is disclosed where one of the bridge diagonals is constituted by the armature contacts or reeds while the permanent magnet is in the other diagonal. In this arrangement, the temperature-dependent variable-permeability members are bracket-shaped, the bracket ends being magnetically connected to, but electrically insulated from, the reeds or armatures. Another very favorable arrangement according to the invention is an assembly of armature contacts or reeds placed into a sleeve of variable-permeability material here replacing the said member, this assembly being surrounded by the heating coil which is also magnetically effective and replaces the permanent magnet.

The invention is explained in detail on the basis of some design examples shown in FIGS. 1 through 5 as designated herein:

FIGS. 1 and 1a show, respectively, front and side elevations of the thermal relay of the invention having normally open contacts;

FIGS. 2 and 2a show, respectively, front and side elevations of a two-magnet thermal relay of the invention having normally closed contacts;

FIGS. 3 and 3a show, respectively, front and side elevations of a single-magnet thermal relay having normally closed contacts;

FIG. 4 shows a partial sectional view of a two-magnet bridge type thermal relay having normally open contacts and having a magnetic biasing winding; and

FIG. 5 shows a partial sectional view of the thermal relay without any permanent magnets associated therewith.

The thermal relay shown in front and side elevations in FIG. 1 consists of a protective envelope 1 sealing the contact reeds 1a and 1b and being held by a particularly designed iron circuit 2. The two yokes 2 and 2' of the

2

iron circuit are connected to the permanent magnet 3 so as to form a magnetic path. A parallel path is provided by the variable-permeability member 4 connected to the same yokes. This member 4 is made of a metal having a good permeability at normal, for instance, room temperature, but losing its permeability at a known increased temperature. In the design shown, the heating of member 4 is accomplished by the heating coil 5. At normal temperature, member 4 presents a magnetic short-circuit to the magnet 3 so the contact of reeds 1a and 1b is open. An increase of the temperature causes member 4 to become less permeable, the magnetic short becomes ineffective, and the flux of the permanent magnet 3 now flows through the reeds 1a and 1b causing the latter to close the contact at the point where the reeds overlap. When the heating coil 5 is switched off, the temperature of member 4 decreases; upon reaching the normal temperature, the magnetic shunt becomes effective again and the contact is opened.

Referring to FIGS. 2 and 3, series mounting of the magnet 3 and the variable-permeability member 4 results in a normally closed contact as the member 4 does not present a reluctance to the magnetic flux at normal temperature. When member 4 is heated by coil 5, however, the flux set up by the permanent magnet 3 is interrupted and the contact is opened by the resilience of the reeds at a predetermined temperature. When member 4 has cooled down again, it becomes permeable to the permanent-magnet flux and the armature contact 1a, 1b is closed. The temperature-dependent material for member 4 may be any one of the known nickel-iron alloys having its Curie point in the temperature range between 80° C. and 120° C. approximately. Suitable are also magnetically soft ferrites produced with Curie points in this desired switching-temperature range. The latter material has a permeability that breaks down in a very narrow temperature range substantially above room temperature and no special cooling apparatus is required under normal conditions.

Means to adjust the flux of the permanent magnet may be provided, for instance, in the form of tabs 6 which can be bent towards magnet 3 for shunting. Instead of one magnet as in FIGS. 1 and 3, two magnets (3 and 3a in FIGS. 2) may be used.

FIG. 4 shows an arrangement in which the reeds 1a and 1b sealed in the protective envelope 1 are magnetically connected to, but electrically insulated from, two brackets (7 and 8) made of variable-permeability material which make up a bridge having, in its diagonals, the envelope 1 and the magnets 3, 3'. The two opposed heating coils 9 and 10 are provided on the bridge branches 7a and 8a. The operation of this arrangement is as follows:

The flux set up between the north pole N of magnet 3 and the south pole S of magnet 3' takes the two high-permeability paths through the bridge branches 7a, 8b and 7b, 8a. The iron circuit is closed by the magnetic shield 11. At normal temperature, there is thus no flux through the reeds 1a, 1b. This state is changed when the heating coils 9 and 10 are switched on (they are magnetically ineffective due to bifilar winding): As soon as a predetermined temperature is reached, the permanent-magnet flux is interrupted in the bridge branches 7a and 8a carrying the heating coils. As a result, the flux takes the path from the north pole N of magnet 3 through bridge branch 7b, reed 1b, reed 1a, branch 8b, south pole S of magnet 3', to the return circuit through shield 11. This causes the reeds 1a, 1b to be attracted to each other and to establish a contact. When the temperature-dependent members of the bridge, 7a and 8a, have cooled down, the magnetic shunt to the reeds is reestablished and the contact opens.

An advantage of this arrangement is that the ambient

3

temperature may exceed the Curie point without the relay operating. In FIG. 1, for example, if the relay shown therein was subjected to an ambient temperature above the Curie point of element 4, the magnetic shunt would be destroyed and magnet 3 would cause the relay to operate in the same manner as if element 4 were heated by coil 5. In FIG. 4, since elements 7a—7b and 8a—8b are of the same material their heating to a temperature above their Curie point from ambient temperature would not permit the relay to operate since the magnetic flux at each end of the relay would remain equal. Thus, the relay shown in FIG. 4 will operate only when a temperature unbalance exists between elements 7a and 7b and elements 8a and 8b.

In this arrangement, the sensitivity of the thermal relay can be substantially increased by an auxiliary coil 12 attached to the reeds 1a, 1b and operated simultaneously with the heating coils 9, 10 and switched off together with these. The auxiliary coil 12 is so dimensioned that the magnetic field set up by the coil, presets the reeds 1a, 1b without, however, closing the contact. The auxiliary coil 12 can be replaced by a permanent magnet having a flux independent of the two magnets 3 and 3' and not affecting the opening of the contact.

A particularly advantageous arrangement is shown in FIG. 5 where the permanent magnet 3 can be saved altogether. The reed envelope 1 is surrounded by a sleeve 13 made of temperature-dependent, variable-permeability material. A magnetically effective heating coil 14 is mounted onto the sleeve. When this coil is switched on, the magnetic field set up by the coil has no effect upon the reeds 1a, 1b as long as the field is screened by sleeve 13 in its high-permeability state effectively shielding the contact reeds. As soon as a predetermined temperature is reached, however, sleeve 13 loses its permeability, the shield is effectively eliminated and the contact is operated.

While I have above described the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. A thermal relay comprising magnetically responsive

4

contacts, a magnetic flux generating source in flux-linking relationship with said contacts, a temperature-dependent magnetic member associated with said source for canceling the said flux-linkage relationship between the said contacts and said source by diverting the generated flux through the magnetic member, and means for varying the temperature of said magnetic member to cancel the said diversion of a flux therethrough.

2. A thermal relay according to claim 1 wherein said magnetic source comprises a permanent magnet and wherein said magnetic member diverts said generated flux by shunting said magnet.

3. A thermal relay according to claim 1 wherein said magnetic flux generating source comprises an electromagnetic coil and wherein said magnetic member diverts said generated flux by shielding said contacts from said coil.

4. A thermal relay comprising magnetically responsive contacts, a heat and flux generating winding associated with said contacts, and a temperature-dependent magnetic member for shielding said contacts from the said generated flux until the said generated heat raises the temperature of the said member to a predetermined value.

5. A thermal relay according to claim 4 wherein the said winding encircles the said contacts and wherein the said magnetic member is positioned between said contacts and said winding.

6. A thermal relay according to claim 4 wherein said magnetic member comprises a nickel alloy having a permeability which decreases towards the Curie point at the said predetermined temperature value.

7. A thermal relay according to claim 4 wherein said magnetic member comprises a magnetically soft ferrite having its Curie point at the said predetermined temperature value.

References Cited in the file of this patent

UNITED STATES PATENTS

2,232,501	Wittmann	Feb. 18, 1941
2,296,969	Wittman	Sept. 29, 1942
2,437,488	Ulanet	Mar. 9, 1948