

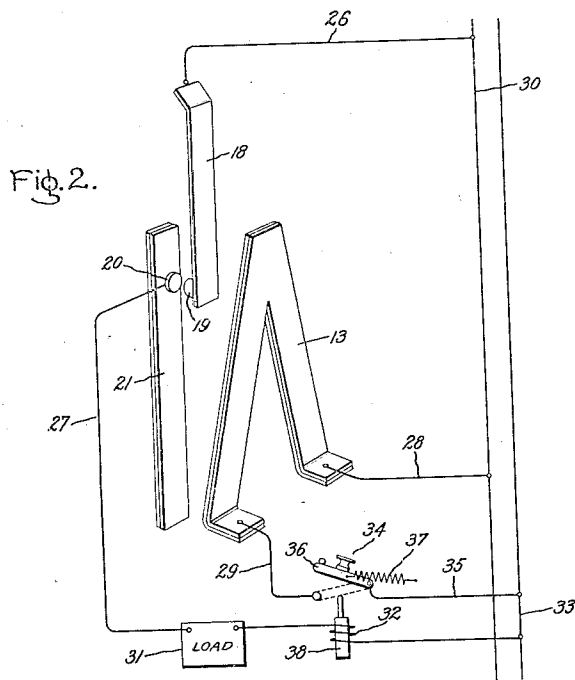
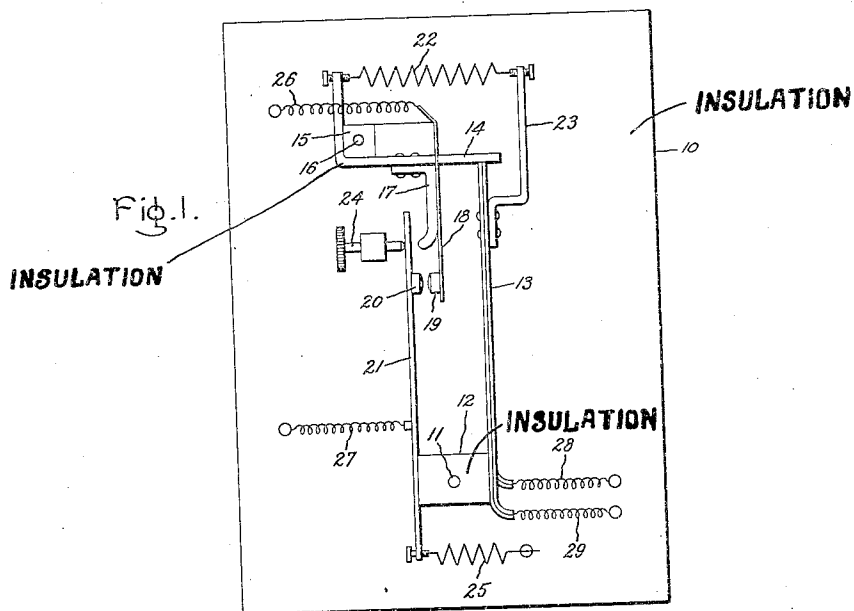
Feb. 7, 1939.

O. WELLE

2,146,608

TIME RELAY

Filed Nov. 10, 1936



Inventor:
Otto Welle,
by *Harry E. Dunkham*
His Attorney.

UNITED STATES PATENT OFFICE

2,146,608

TIME RELAY

Otto Welle, Berlin-Lichtenberg, Germany, assignor to General Electric Company, a corporation of New York

Application November 10, 1936, Serial No. 110,179
In Germany December 16, 1935

12 Claims. (Cl. 200—116)

My invention relates to time relays, more particularly to thermal time relays in which the contact operation is controlled by a heat responsive thermal element and has for an object the provision of a simple and reliable device of this type.

Thermal time relays have heretofore been proposed in which the contact operation is controlled by a thermal element such as a bimetallic strip, the heating circuit of which is energized to initiate a timing interval at the expiration of which the heating circuit is interrupted. During energization of the heating circuit, the thermal element flexes so as to effect closure of the circuit controlling contacts and upon de-energization of the heating circuit, the thermal element cools and returns to its normal position to open the contacts. In such devices, however, the contacts open slowly due to the gradual cooling of the thermal element and accordingly sparking and burning of the contacts occur. Accordingly, it is a further object of my invention to provide a thermal time relay in which the closing and opening movement of the contacts takes place abruptly at the expiration of predetermined times.

In accordance with my invention, a thermal relay is provided having a thermal element arranged to effect an abrupt closing of the circuit establishment of a heating circuit, together with means for interrupting the heating circuit upon closure of the contacts and means influenced by the thermal element for abruptly opening the contacts a predetermined time after the heating circuit is interrupted. More particularly, the circuit controlling contacts are biased for movement from one position to a second position, one of the contacts being restrained in the one position by the thermal element which is mounted on a pivotal support. Upon a predetermined change in temperature, the thermal element flexes to release the one contact for operation in accordance with its bias to engage the second contact, and upon operation of the one contact to this position the free end of the thermal element is restrained against return movement to its normal position. Accordingly, as the thermal element cools, its pivotal support is rotated. The other contact is carried by this pivotal support and therefore rotation of the support moves the engaging contacts so as to return the one contact to its normal position, whereupon the free end of the thermal element is released to latch the one contact in this position, the pivotal support thereupon

abruptly rotating so as to return the other contact to its normal position.

For a more complete understanding of my invention, reference should now be had to the drawing, in which Fig. 1 is a diagrammatic elevational view of a thermal time relay embodying my invention, and Fig. 2 is a circuit diagram illustrating one manner in which my invention may be utilized.

Referring now to Fig. 1, the thermal time relay shown comprises a base 10 from which extends a pin 11 for pivotally mounting a support or block 12 on which is carried a bimetallic thermal element 13. The upper free end of the thermal element 13 is interposed in the path of movement of a latch 14 which extends outwardly from a second support 15 pivotally mounted on a pin 16. As shown, the latch 14 carries an angle piece 17 along which lies a conducting spring 18, the lower end of which supports a movable contact 19. Arranged for co-operation with the contact 19 is a second movable contact 20 which is supported on a conducting arm 21 carried by the support 12. In order to bias the contacts 19 and 20 for movement in a left-hand direction, I provide a spring 22, one end of which is adjustably secured to an upstanding portion of the latch 14 and the other end of which is adjustably secured to an arm 23 carried by the bimetallic element 13. As shown, the movable contact 19 is normally restrained in one position by engagement of the latch 14 with the thermal element 13 and the movable contact 20 is restrained in a second position by engagement of the arm 21 with an adjustable stop 24. An additional spring 25 is provided for assisting the spring 22 in biasing the support 12 for counterclockwise movement about its pivot.

As will be explained more fully in connection with Fig. 2, a pair of conducting leads 26 and 27 are provided for connecting the contacts 19 and 20 in a suitable load circuit to be controlled and a pair of similar conducting leads 28 and 29 are provided for connecting the thermal element 13 in an energizing circuit.

Referring now to Fig. 2, the conducting lead 26 is shown as connected directly to a supply conductor 30 and the conducting lead 27 is connected to a suitable load 31, the other side of which is connected in series with a trip coil 32 to a supply conductor 33. Likewise, the lead-in conductor 28 extends from one leg of the thermal element 13 to the supply conductor 30 and the lead-in conductor 29 is connected to a control switch 34,

one terminal of which is connected by a conductor 35 to the supply conductor 33.

Although any suitable type of control switch may be provided, I have shown for purposes of illustration a switch having a movable contact blade 36 which is manually operable from an open circuit position (shown in heavy lines) to a closed circuit position (shown in dotted lines) and which is provided with a biasing spring 37 which selectively biases the contact blade to either of its positions. It will be understood, of course, that while I have shown the thermal element 13 connected directly in an energizing circuit, a separate heating unit may be provided connected in the energizing circuit and disposed adjacent the thermal element.

Upon closure of the control switch 34 and the consequent heating of the thermal element 13, the upper free end of the thermal element moves in a right-hand direction, as viewed in Fig. 1, until it moves clear of the latch 14 and releases the latch for movement in a clockwise direction about the pivot 16 under the bias of the spring 22 so as to move the contact 19 from the position shown in the drawing into engagement with the contact 20. Closure of the contacts 19 and 20 completes the load circuit and energizes the trip coil 32, whereupon a plunger 38 associated with the trip coil is operated to move the contact blade 36 from its closed position to its open circuit position and thus interrupt the heating circuit of the thermal element 13.

The thermal element 13, of course, begins to cool as soon as its energizing circuit is interrupted, but it will now be observed that the end of the latch 14 is disposed in the path of the thermal element so as to prevent the free end thereof from returning to its normal position. Even though the free end of the thermal element 13 is restrained against movement to its normal position, the thermal element straightens out as it cools and thus effects rotation of the support 12 in a clockwise direction about the pivot 11 and accordingly the contact 20 moves in a right-hand direction so as to return the contact 19 to its original position.

As the contact 19 is moved in a right-hand direction by the contact 20, the latch 14 is raised and as soon as the contact 19 reaches its original position, the free end of the thermal element 13 will be released, whereupon the support 12 will be abruptly rotated in a counterclockwise direction by the spring 22 to return the thermal element 13 to its latching position and to return the contact 20 to its normal position shown, thus abruptly separating the contacts 19 and 20.

It will be apparent that the closing and opening time of the thermal relay may be varied simply by adjusting the member 24 so as to vary the gap between the contacts 19 and 20 and to vary the initial position of the thermal element 13. In some cases it is desired to compensate for variations in the ambient temperature conditions and this may be accomplished by forming the arm 21 of bimetallic material, as shown in Fig. 2. When this arm 21 is formed of bimetallic material, the conducting lead 27 should, of course, be connected either directly to the contact 20 or to the arm 21 closely adjacent the contact 20 so that the load current flowing through the contacts will not heat the arm 21.

When this arm 21 is formed of bimetallic material, it will be apparent that a change in ambient temperature tending to move the free end of the thermal element 13 in a right-hand direction so

as to decrease the degree of latching between the element 13 and the latch 14 will also effect right-hand movement of the free end of the arm 21. Since the springs 22 and 25 are arranged to maintain the free end of the arm 21 in engagement with the adjustable stop 24, the support 12 will be rotated about its pivot 11 to maintain the proper degree of latching between the thermal element 13 and the latch 14. Similarly, if the ambient temperature conditions tend to effect movement of the free end of the thermal element 13 in a left-hand direction, the corresponding flexure of the arm 21 will effect clockwise rotation of the support 12 to maintain the free end of the thermal element 13 in its proper latching position.

Although I have shown a thermal relay in which the contacts are closed a predetermined time after the thermal element 13 is heated, it will, of course, be understood that the relay may be so arranged as to close the contacts when the thermal element is cooled and to open the contacts again when the thermal element is heated. Thus, a temperature change of one sense effects closing of the contacts while a temperature change of an opposite sense effects opening of the contacts.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto, since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A thermal time relay comprising a pair of relatively movable contacts, a thermal element, means for establishing a heating circuit for said thermal element, means influenced by said thermal element for moving one of said contacts with a snap action to abruptly close said contacts a predetermined time after said heating circuit is established, means responsive to closure of said contacts for interrupting said heating circuit, and means influenced by said thermal element for moving one of said contacts with a snap action to abruptly open said contacts a predetermined time after said heating circuit is interrupted.
2. A thermal time relay comprising a pair of contacts, means biasing said contacts for movement from one position to a second position, a thermal element, means for establishing a heating circuit for said thermal element, means including said thermal element for normally latching one of said contacts in said one position and for releasing said one contact for movement to said second position abruptly to engage the other of said contacts a predetermined time after said heating circuit is established, means responsive to closure of said contacts for interrupting said heating circuit, and means including said thermal element for moving said pair of contacts to said one position as said thermal element cools, whereupon said one contact is latched in said one position and said other contact is released for abrupt movement to said second position thereby to open said contacts a predetermined time after closure thereof.
3. A thermal time relay comprising a pair of contacts, means biasing said contacts for movement from one position to a second position, a thermal element, means for establishing a heating circuit for said thermal element, means including said thermal element for normally latching one of said contacts in said one position and

for releasing said one contact for movement to said second position abruptly to engage the other of said contacts a predetermined time after said heating circuit is established, means responsive to closure of said contacts for interrupting said heating circuit, means including said thermal element for moving said pair of contacts to said one position as said thermal element cools, whereupon said one contact is latched in said one position and said other contact is released for abrupt movement to said second position thereby to open said contacts a predetermined time after closure thereof, and adjustable means for simultaneously varying the time delay with which said contacts are closed and opened.

4. A thermal time relay comprising a pair of contacts, means biasing said contacts for movement from one position to a second position, a thermal element, means for establishing a heating circuit for said thermal element, means including said thermal element for normally latching one of said contacts in said one position and for releasing said one contact for movement to said second position abruptly to engage the other of said contacts a predetermined time after said heating circuit is established, means responsive to closure of said contacts for interrupting said heating circuit, means including said thermal element for moving said pair of contacts to said one position as said thermal element cools, whereupon said one contact is latched in said one position and said other contact is released for abrupt movement to said second position thereby to open said contacts a predetermined time after closure thereof, adjustable means for varying said determined times of opening and closing said contacts, and means for compensating for changes in ambient temperature to maintain constant the time setting provided by said adjustable means.

5. A thermal relay comprising a pair of contacts, means biasing said contacts for movement from one position to a second position, means including a thermal element for normally latching one of said contacts in said one position whereby said contacts are maintained in open circuit relation, said thermal element being operable in response to a temperature change of a predetermined sense to release said one contact for movement to said second position to engage the other of said contacts, and means including said thermal element for simultaneously moving said pair of contacts from said second position to said one position in response to a temperature change, of an opposite sense, said thermal element and said biasing means being effective when said contacts attain said one position to latch said one contact in said one position and to return said other contact quickly to said second position.

6. A thermal relay comprising a pair of contacts, means biasing said contacts for movement from one position to a second position, means including a thermal element for normally latching one of said contacts in said one position whereby said contacts are maintained in open circuit relation, said thermal element being operable in response to a temperature change of a predetermined sense to release said one contact for movement to said second position to engage the other of said contacts, means including said thermal element for simultaneously moving said pair of contacts from said second position to said one position in response to a temperature change of opposite sense, said thermal element and said biasing means being effective when said contacts attain said one position to latch said one contact

in said one position and to return said other contact quickly to said second position, and means for adjusting said contacts and said thermal element to vary the degree of temperature change to which said relay is responsive.

7. A thermal relay comprising a pair of contacts, means biasing said contacts for movement from one position to a second position, a thermal element arranged to flex when heated, means including said thermal element for normally latching one of said contacts in said one position and for releasing said one contact for movement to said second position to engage the other of said contacts upon a predetermined flexure of said thermal element, means including said thermal element for simultaneously moving said pair of contacts from said second position to said one position as said thermal element cools, whereupon said one contact is latched in said one position by said thermal element and said other contact is quickly returned to said second position by said biasing means.

8. A thermal time relay comprising a pair of pivoted supports, a pair of contacts respectively carried by said supports, means biasing said supports for individual movement to operate said contacts from one position to a second position, a latch secured to one of said supports, a thermal element mounted on the second of said supports with its free end disposed in the path of movement of said latch for normally restraining said one support and its contact in said one position, means for heating said thermal element to cause movement of said free end out of the path of said latch to release said support and its contact for movement to said second position thereby to engage the other contact, said latch thereupon moving into the path of the free end of said thermal element to prevent said free end from returning to its normal position whereby said thermal element during cooling effects pivotal movement of said second support to operate said pair of contacts from said second position toward said one position and thus move said one support so as to withdraw said latch from the path of said thermal element whereupon said thermal element and its support are released for movement abruptly to return said other contact to said second position and to latch said one contact in said one position.

9. A thermal time relay comprising a pair of contacts each mounted for movement with respect to the other, a thermal element, means for establishing a heating circuit for said thermal element, means operated by said thermal element for moving one of said contacts into engagement with the other with a snap action a predetermined time after said heating circuit is established, means responsive to engagement of said contacts for interrupting said heating circuit, and means operated by said thermal element for moving the other of said contacts with a snap action to disengage said first contact a predetermined time after said heating circuit is interrupted.

10. A thermal time relay comprising a pair of contacts each mounted for movement with respect to the other, a thermal element, means for establishing a heating circuit for said thermal element, means operated by said thermal element for moving one of said contacts into engagement with the other a predetermined time after said heating circuit is established, means responsive to engagement of said contacts for interrupting said heating circuit, and means operated by said

thermal element for moving the other of said contacts to disengage said first contact a predetermined time after said heating circuit is interrupted.

- 5 11. A thermal time relay comprising a pair of pivotally mounted supports, a thermostatic strip secured at one end to a first of said supports, a first contact mounted on said first support, a second cooperating contact mounted on the second of said supports, means biasing each of said supports for movement of each of said contacts from a first position in engagement with the other of said contacts to a second position in engagement with the other of said contacts, a latching projection on said second support normally engaged by the end of said thermostatic strip to hold said second contact in its first position, means for heating said strip to cause it to flex and thereby disengage said projection for movement of said second contact to said second position into engagement with said first contact, said projection moving into the path of said strip, whereby when said strip cools it flexes to move said contacts to said first positions whereby said projection is moved out of the path of said strip to release said first contact for movement back to its second position to separate said contacts, said strip then engaging said projection to hold said second contact in said first position.
- 30 12. A thermal time relay comprising a pair of pivotally mounted supports, a pair of bimetallic thermostats each secured at one end to a first

of said supports, a first contact mounted on the end of a first of said thermostats, a second cooperating contact mounted on the second of said supports, means biasing each of said supports for movement of each of said contacts from a first position in engagement with the other of said contacts to a second position in engagement with the other of said contacts, a latching projection on said second support normally engaged by the end of the second of said thermostats to hold said second contact in its first position against its bias, said first contact being then in its second position, means for heating said second thermostat to cause it to flex and thereby disengage said projection and release said second support for movement of said second contact to said second position into engagement with said first contact, said projection moving into the path of said second thermostat, means responsive to engagement of said contacts for interrupting said heating means whereupon said second thermostat cools and flexes to move said first support said contacts and said second support together to said first positions whereby said projection is moved out of the path of said second thermostat to release said first support which then moves in accordance with its bias to move said first contact back to its second position to separate said contacts, said second thermostat then engaging said projection to hold said second contact in its first position.

OTTO WELLE.