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TIME DELAY RELAY

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Fig. 1.

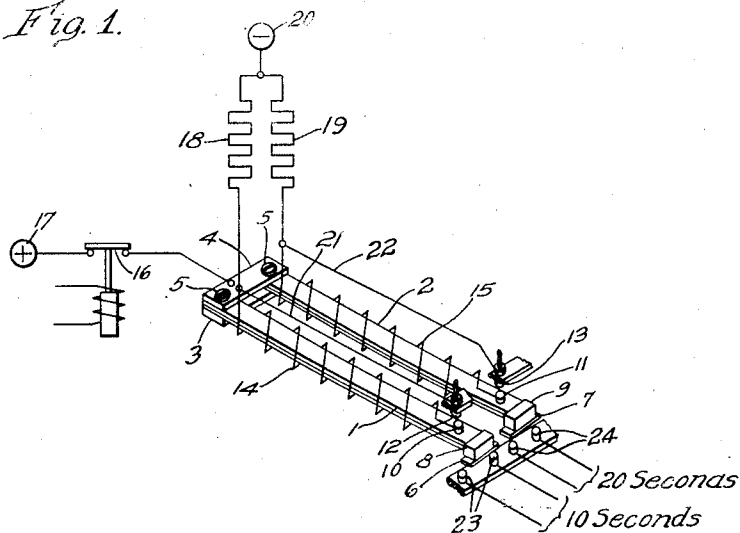
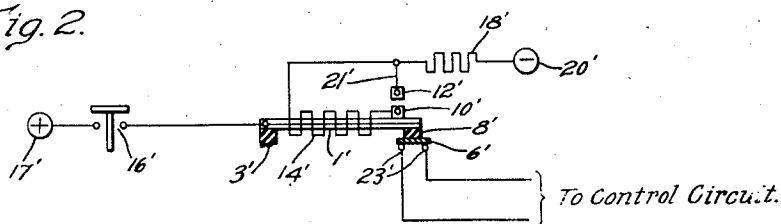


Fig. 2.



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TIME DELAY RELAY

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7 Claims. (Cl. 175—320)

My invention relates to a time delay relay and more particularly to a time delay relay of the type employing a temperature responsive member, as, for example, a bimetallic element.

It is an object of my invention to provide a novel relay which utilizes the cooling period of a thermostat to make possible improved accuracy in selecting the period of time delay.

It is another object of my invention to provide such a time delay relay which is novel and economical and may be readily reset after an operation.

Another object of my invention is to provide a novel relay which will supply a plurality of different time delays.

According to one form of my invention, a resistance coil is disposed in heating relationship to a bimetal fixed at one end. The other end of the bimetal is arranged to move as it is heated until a contact carried thereby and connected to an end of the heating coil engages a stationary contact connected to the other end of the heating coil to shunt it. While the heater is shunted, the bimetal cools to a point at which the shunt circuit is disengaged, whereupon the heater again functions. Thus the bimetal is retained at a substantially constant temperature, and upon the energy source being disconnected from the heating coil, it cools and, in a predetermined time, carries a contact bridging member disposed on its movable end to a position closing an operating circuit. A plurality of these units, each adjusted to have a different cooling period, may be employed to operate each of a plurality of circuits after different time delays.

Other objects of my invention will become evident from the following detailed description, taken in conjunction with the accompanying drawing, in which:

Figure 1 shows a preferred form of my invention partly in perspective; and

Fig. 2 is a schematic showing of another form of my invention.

Referring to Fig. 1, a pair of bimetal elements 1 and 2 are each secured at one end to a support 3 by means of a conducting plate 4 attached thereto as by bolts 5. On the other or movable ends of the bimetals 1 and 2 are disposed bridging conductors 6 and 7, respectively, which are insulated from the bimetals by blocks 8 and 9 of non-conductive material. Contacts 10 and 11 are disposed on the upper portions of the bimetals 1 and 2, respectively. Arranged to be engaged by these contacts when the respective bimetals are in predetermined heated conditions

are stationary contacts 12 and 13, which may be made adjustable in any suitable manner, as by the screw and nut arrangement shown.

A resistance-type heater 14 is coiled around the bimetal and connected at one end to the contact 10, while a similar heating coil 15 is connected at one end to the contact 11 and arranged to heat the bimetal 2. The stationary ends of both bimetals are connected through a switch 16 to one terminal 17 of an electrical energy source, which may supply either direct or alternating current. The ends of the heating coils 14 and 15 not connected to their corresponding bimetals are connected through limiting resistances 18 and 19, respectively, to the other terminal 20 of the energy source. Shunt circuits 21 and 22 are each connected between a resistance and the corresponding heating coil and to one of the stationary contacts 12 and 13, respectively.

A pair of contacts 23 are arranged to be closed by the bridging conductor 6, and another pair of contacts 24 are adapted to be interconnected by the bridging member 7 when the respective bimetals are at a temperature slightly above ambient.

It will be evident that with the switch 16 closed the heating coil 14 will be energized through the following circuit: terminal 17, switch 16, conducting plate 4, bimetal 1, contact 10, heating coil 14, resistance 18, and terminal 20. Upon the bimetal being heated to a predetermined temperature, it will be flexed to the position where the contact 10 engages stationary contact 12, thus shorting the heater 14 and permitting the bimetal to cool. After cooling a small amount, the bimetal 1 disengages the contacts 10 and 12 and again places the heater 14 in operation. This cycle continues, thus retaining the bimetal 1 at a substantially constant temperature and deformation. The bimetal 2 is retained in a similar condition by means of its heating circuit.

Upon the switch 16 being opened, both bimetals are permitted to cool and after a predetermined time the bimetal 1 places its bridging conductor 6 in position, interconnecting the contacts 23. The bimetal 2, having a longer cooling period than the bimetal 1, either because of the selection of elements having different inherent temperature characteristics, as a result of different adjustments of the stationary contacts 12 and 13 or both, acts to interconnect contacts 23 after a longer period of time. Thus, as has been found useful in electric elevator signalling systems, contacts 23 may be closed after approxi-

mately ten seconds delay, and contacts 24 after approximately twenty seconds. Preferably, the bridging members close their corresponding contacts before the bimetals return to normal cooled position so as to create a contact pressure.

The purpose of the external or limiting resistances 18 and 19 is to prevent a short on the energy supply when either, or both, of the heating coils 14 and 15 is in shunted condition.

In Fig. 2, which shows schematically a relay in accordance with my invention employing a single bimetal, primed numerals are utilized to designate elements corresponding to those in the circuit of the bimetal 1 in Fig. 1.

In this arrangement of Fig. 2, a bimetal 1' is supported by one end at 3', while the other end has disposed on its upper side a contact 10' and on its lower side a bridging conductor 6'. This bridging conductor is insulated from the bimetal 1' by a block 8' of non-conductive material and is arranged to bridge contacts 23' when the bimetal is in cooled or substantially straight position.

One end of a heating coil 14' is connected to the contact 10', which in turn is electrically connected to the terminal 17' of an electrical energy source through the bimetal 1' and switch 16'. The other end of the heating coil is connected to the other energy supply terminal 20' through a limiting resistance 18'. A shunt circuit 21' connects the heater coil 14' at a point between the heater 14' and the resistance 18' to a stationary contact 12'.

It will be obvious that this relay, which Fig. 2 shows in energized or circuit closing position, operates to give a single delay in the same manner as the apparatus of Fig. 1 furnishes two delay periods.

From the above description of my invention, many of its advantages will become evident. Because of the shunting arrangement, the heating element may be energized to an extent which would ordinarily heat the thermal element far above the desired maximum temperature, making available extremely rapid resetting characteristics. Using the cooling cycle for the time control also renders the ambient temperature over the normal ranges met in practice of small importance in affecting the time.

I do not wish to be restricted to the specific structural details, arrangement of parts, or circuit connections herein set forth, as various other modifications thereof may be effected without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. A time delay relay comprising a thermostatic element carrying circuit operating means arranged to close a controlled circuit when said element is in a cool position, a separate electric circuit including a heater unit in heat conducting relationship to said thermostatic element to retain it in deformed condition with its circuit operating means in open circuit position, said heating circuit including means for shunting said heater unit when said thermostatic element is in a predetermined position of maximum deformation to maintain it at a substantially constant temperature, and means for interrupting said heater circuit to return said thermostatic element to said cool position in a predetermined time to bring said circuit operating means to circuit closing position.

2. A time delay relay comprising a thermal element fixed to supporting means at one end and free to move at the other end in response to temperature changes, an electric circuit including a heater unit operatively associated with said thermal element, said heater circuit including a low resistance circuit arranged to shunt at least a portion of said electric heater when said thermal element is heated to a predetermined maximum temperature to maintain it within a predetermined small range of temperatures just below said maximum, means controlled by said thermal element to place a controlled circuit in a first condition when said thermal element is at a temperature exceeding a second predetermined temperature below said temperature range and in a second condition when said thermal element is at a temperature not exceeding said second predetermined temperature, and means to deenergize said electric heater to permit said thermal element to cool to said second predetermined temperature to change said controlled circuit from said first condition to said second condition after a predetermined time delay.

3. A time delay relay comprising a thermal element fixed to supporting means at one end and free to move at the other end in response to temperature changes, an electric heater operatively associated with said thermal element and arranged to be connected across an electrical energy source, one end of said heater being connected to the movable end of said thermal element, a stationary contact, a low resistance circuit connecting said stationary contact to the end of said heater not connected to said thermal element, said stationary contact being arranged to engage the movable end of said thermal element when in a predetermined position of maximum deformation to shunt said heater with said low resistance circuit to maintain said thermal element at a substantially constant predetermined temperature, means controlled by said thermal element to place a controlled circuit in a first condition when said thermal element exceeds a predetermined lower temperature and in a second condition when said thermal element does not exceed said predetermined lower temperature, and means to disconnect said heater from said energy source to permit said thermal element to cool to said predetermined temperature to change said controlled circuit from said first condition to said second condition after a predetermined time delay.

4. In combination, a circuit to be controlled, a device movable in response to temperature changes, means operable to change said controlled circuit from a first condition to a second condition upon said device cooling to a predetermined critical temperature, a heating circuit for normally maintaining said device at a substantially constant predetermined temperature in excess of said critical temperature, and means operable to reduce the effect of said heating circuit to permit said temperature responsive device to cool to said critical temperature.

5. In combination, a circuit to be controlled, a device movable in response to temperature changes, means operable to change said controlled circuit from a first condition to a second condition upon said device cooling to a predetermined critical temperature, an electric heater disposed in heat conducting relationship to said device, a circuit for energizing said heater to deform said device, said last named circuit including a portion operable to reduce the heating effect

of said heater while said device is in a predetermined position of maximum deformation to permit cooling thereof and normally maintain said device at a substantially constant temperature in excess of said critical temperature, and means operable to interrupt the heater energizing circuit to permit said temperature responsive device to cool to said critical temperature.

6. In combination, a circuit to be controlled, a thermostatic member movable in response to temperature changes, means operable to change said controlled circuit from a first condition to a second condition upon said member cooling to a predetermined critical temperature, an electric heater disposed in heat conducting relationship to said thermostatic member, a circuit for energizing said heater to deform said member, means in said energizing circuit for shunting at least a portion of said heater when said thermostatic member is in a predetermined position of maximum deformation to normally maintain it at a predetermined temperature in excess of said critical temperature, and means operable to reduce the heating effect of said heater to permit said

thermostatic member to cool from said predetermined heated temperature to said critical temperature in a predetermined time.

7. In combination, a circuit to be controlled, a thermostatic member movable in response to temperature changes, means operable to change said controlled circuit from a first condition to a second condition upon said member cooling to a predetermined critical temperature, an electric heater operatively associated with said thermostatic member, a circuit for energizing said heater to deform said member, means connected to said energizing circuit for shunting at least a portion of said heater when said thermostatic member is in a predetermined deformed position to limit its maximum deformation and normally maintain it in a predetermined deformed condition corresponding to a predetermined temperature in excess of said critical temperature, and means operable to interrupt said heating circuit to permit said thermostatic member to cool to said critical temperature.

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