Sept. 14, 1954 F. WELLS 2,689,288

THERMAL RELAY

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Fig. 2.

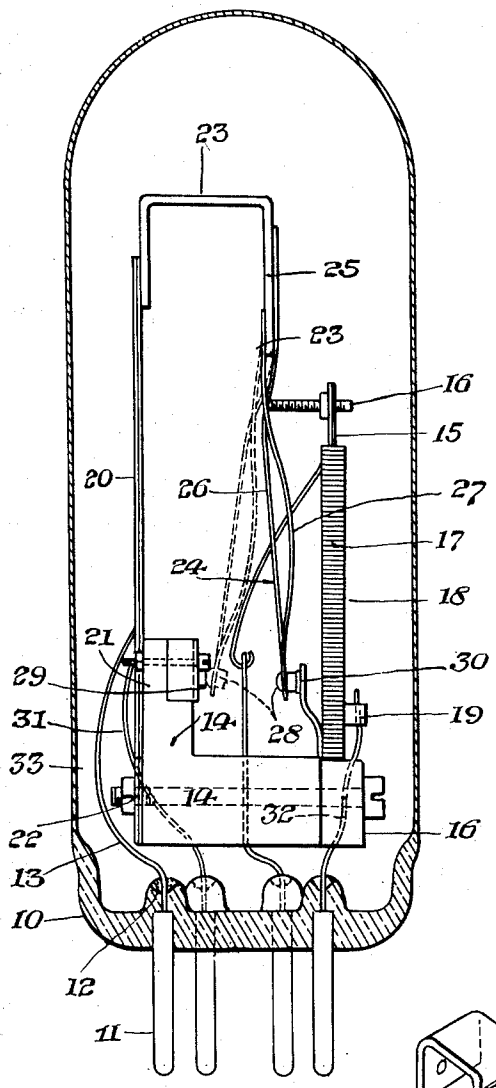


Fig. 1.

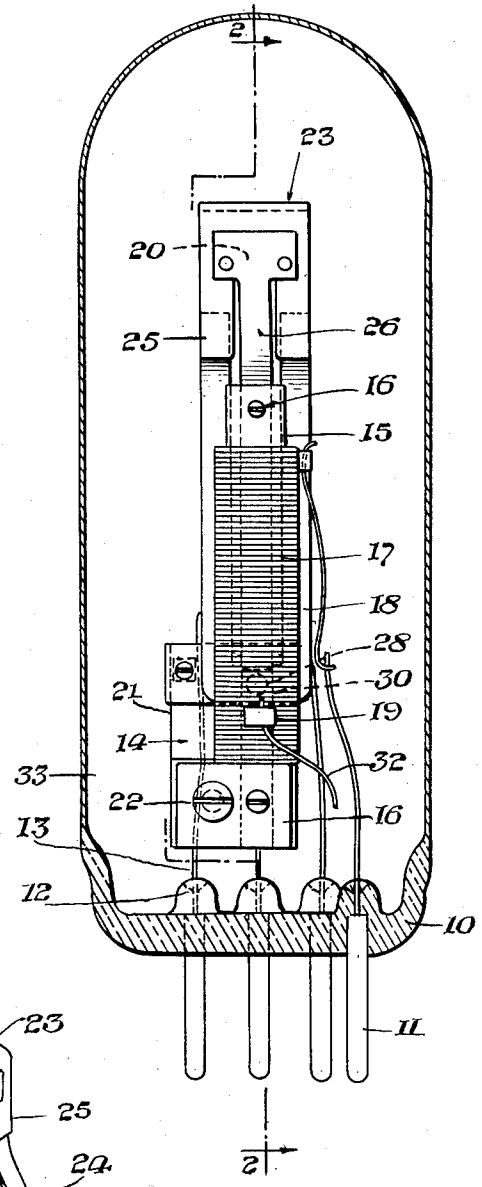
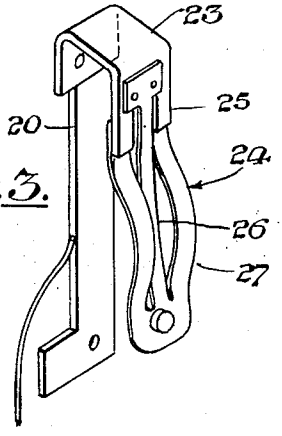


Fig. 3.



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THERMAL RELAY

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3 Claims. (Cl. 200—122)

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This invention relates to thermal relays, and more specifically those of the snap action time delay type.

Presently known thermal relays are subject to an objectionable chattering upon making and breaking contact. This chattering is due to the gradual motion of the thermal actuating arm, which is usually in the form of a bi-metallic strip surrounded or adjacent to a heating element. Other objections to presently known relays are that they do not produce a positive acting contact on opening and closing the circuit. Presently known relays are large and subject to injury from vibration and shock.

Accordingly, it is an object of the present invention to provide a thermal relay having a snap acting contact on opening and closing, whereby a positive action will be provided.

Another object of the present invention is to provide a relay which will be free of chatter upon making and breaking of the contact.

A further object of the present invention is to make a thermal relay having sufficiently small size so as to render it free from damage from vibration and shock.

A feature of the present invention is its sealed construction, whereby all of the elements are contained within a glass envelope.

Another feature of the present invention is the provision of a known quantity of resistance wires, and the control of the amount of an inert gas within the envelope to provide accuracy.

Another feature of the present invention is the snap-acting flat spring, employed as a switching device.

A further feature of the present invention is the use of a compensating bi-metal which prevents ambient temperatures from affecting the timing device.

The invention consists of the construction, combination and arrangement of parts, as herein illustrated, described and claimed.

In the accompanying drawings, forming a part hereof, is illustrated one form of embodiment of the invention, in which drawings similar reference characters designate corresponding parts, and in which:

Figure 1 is a view in side elevation, showing a complete embodiment of the present invention.

Figure 2 is a vertical section, taken on line 2—2 in Figure 1, looking in the direction of the arrows.

Figure 3 is a view in perspective, showing the construction of the flat spring and yoke assembly, in accordance with the present invention.

Referring to the drawings, 10 indicates a base of glass, dielectric material, or the like, bearing

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therein contact plugs 11, to the inner edge of which are soldered, as indicated at 12, suitable leads 31, 32. The leads 31, 32 are sufficiently strong to support thereon an L-shaped dielectric block 14. The horizontal arm of the L-shaped block 14 supports thereon a bi-metallic strip 15, hereinafter referred to as the "acting bi-metal." The acting bi-metal 15 is of conventional construction, but supports at the free end thereof a time-adjusting screw member 16. The screw member 16 is threaded through the strip 15, so that it may be located as desired during the timing of the device.

A heater coil 17 surrounds the acting bi-metal 15, and is electrically insulated therefrom by mica strips 18. The heater coil 17 is connected to two of the leads 11, as indicated at 19, for the purpose of supplying to said heater coil 17 the energizing electrical potential. A second bi-metallic strip 20 is secured to the vertical arm 21 of the dielectric block 14. The second bi-metallic strip 20, which is secured at one end 22, supports on its free end a yoke 23. The yoke 23 is substantially U-shaped, and curves back upon itself in the direction of the dielectric L-shaped block 14. A flat spring member 24 is secured at the end of the yoke 23, which extends in the direction of the base 10. The flat spring member 24 is constructed so as to provide a snap action when pressure is applied to the central member 26 thereof. The central member 26 is substantially straight and is flanked on either side by bowed members 27.

The pressure to the central member 26 is applied by the screw 16 carried by the bi-metallic strip 15. The adjustment of the position of the screw member 16, with respect to the spring member 24, comprises one of the factors in adjusting the time required for the closing or opening of the relay.

The free end of the spring member 24 is provided with a contact 28. Open and closed contacts 29, 30, are provided on the end of leads 31, 32, respectively, which in turn are secured to suitable contact plugs carried by the base. It will be seen by the dotted lines in Fig. 2 that when the snap acting flat spring member 24 is depressed, it will jump from the closed contact 30 to the open contact 29, with an almost instantaneous action. When pressure is relieved from the spring 24, as by the cooling of the bi-metallic strip 15, the contact 28 carried by the end of said spring will snap back to its original position against the closed contact 30, which is shown in full lines in Figure 2.

From the foregoing, it will be seen that the application of electrical potential to the heater

coil 17 will in turn warm the bi-metallic strip 15, so as to cause it to bend. The bending action of the bi-metallic strip 15 will force the screw member 16 against the central portion 26 of the spring 24. The spring 24 will thus be activated with the desired snap action. When the electrical potential is removed from the heating coil 17, the bi-metallic strip will regain its original position, and release the flat spring 24.

Upon the release of pressure, the flat spring 24 will jump back to assume its original position, wherein the contact 28 bears against the closed contact 30 adjacent the heater coil 17.

The compensating second bimetal 20, upon which the flat spring 24 is carried, is essential to the accurate operation of the relay. This second bimetal removes inaccuracies which result in presently known relays, and which are brought about by ambient temperatures, which may be the result of adjacent electronic apparatus or room temperature. It will be seen that the bimetal 20 will move forward or away from the bimetal 15, depending upon the changes in ambient temperatures.

The entire actuating portion of the relay described above, is enclosed in a glass envelope 33, which is sealed to the base 10, and thereafter evacuated. Following the evacuation of the envelope 33, a suitable amount of inert gas is introduced within said envelope, which inert gas forms another of the factors whereby the time delay can be controlled. Other factors having a bearing upon the time delay interval in the present construction are the amount of resistance wire used to heat the bimetal; the spacing between the adjusting screw 16 and the spring member 24; and the construction of the spring itself.

It has been found that to insure the successful operation and long life of the present device, the spring member 24 must be constructed of a material that will withstand the high temperatures attained by sealing the relay within the envelope. Metals such as covenium have been found to be satisfactory for this purpose.

It will be seen from the foregoing that a time delay relay mechanism, having the advantage of snap action, has been provided. The snap acting relay, furthermore, is capable of being constructed with a minimum amount of size, and with a maximum amount of durability.

It is further possible to very accurately adjust the timing interval in this device, and to maintain said interval, despite various conditions under which the relay may be used.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States, is:

1. A contact switch comprising, a dielectric block, opposed, fixed electrical contacts supported by said block, an elongated bi-metal strip secured to the block and extending therefrom, a heating element adjacent the said bi-metal strip, a support bracket secured to the block in spaced relationship to the bi-metallic member and parallel thereto, a substantially U shaped yoke secured at one leg to the free end of the support bracket having its opposite end extending in the direction of the block, a unitary snap spring member formed of flat spring material and having a substantially straight central leaf and a bowed leaf member laterally disposed on each side of the central leaf, said leaves being secured at their free ends to the yoke so as to depend therefrom and lie between the support bracket and the bi-metal member, a movable electrical contact member secured to the free end of the snap spring and positioned so as to alternately connect with one of the opposed fixed contacts in response to the movement of the snap spring, and a spring actuating arm carried by the free end of the bi-metal in contact with the central spring leaf at all times to transmit the motion of the bi-metal to the spring leaves.

2. A control switch comprising, a dielectric block, opposed fixed electrical contacts supported by said block, a first elongated bi-metal strip secured to the block and extending therefrom, a heating element adjacent the said first bi-metal strip, a support bracket consisting of a second bi-metal secured to the block in spaced relationship to the bi-metallic member and parallel thereto, a substantially U shaped yoke secured at one leg to the free end of the second bi-metal support bracket having its opposite end extending in the direction of the block, a unitary snap spring member formed of flat spring material and having a substantially straight central leaf and a bowed leaf member laterally disposed on each side of the central leaf, said leaves being secured at free ends to the yoke so as to depend therefrom and lie between the support bracket and the first bi-metal member, a movable electrical contact member secured to the free end of the snap spring and positioned so as to alternately connect with one of the opposed fixed contacts in response to the movement of the snap spring, and a spring actuating arm carried by the free end of the bi-metal in contact with the central spring leaf at all times to transmit the motion of the bi-metal to the spring leaves.

3. A contact switch comprising, a dielectric block, opposed fixed electrical contacts supported by said block, an elongated bi-metal strip secured to the block and extending therefrom, a heating element adjacent the said bi-metal strip, a support bracket secured to the block in spaced relationship to the bi-metallic member and parallel thereto, a substantially U shaped yoke secured at one leg to the free end of the support bracket having its opposite end extending in the direction of the block, a unitary snap spring member formed of flat spring material and having a substantially straight central leaf and a bowed leaf member laterally disposed on each side of the central leaf, said leaves being secured at their free ends to the yoke so as to depend therefrom and lie between the support bracket and the bi-metal member, a movable electrical contact member secured to the free end of the snap spring and positioned so as to alternately connect with one of the opposed fixed contacts in response to the movement of the snap spring and an axially adjustable spring actuating arm carried by the free end of the bi-metal in contact with the central spring leaf at all times to adjustably transmit the motion of the bi-metal to the spring leaves.

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