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THERMOSTATIC MATERIAL

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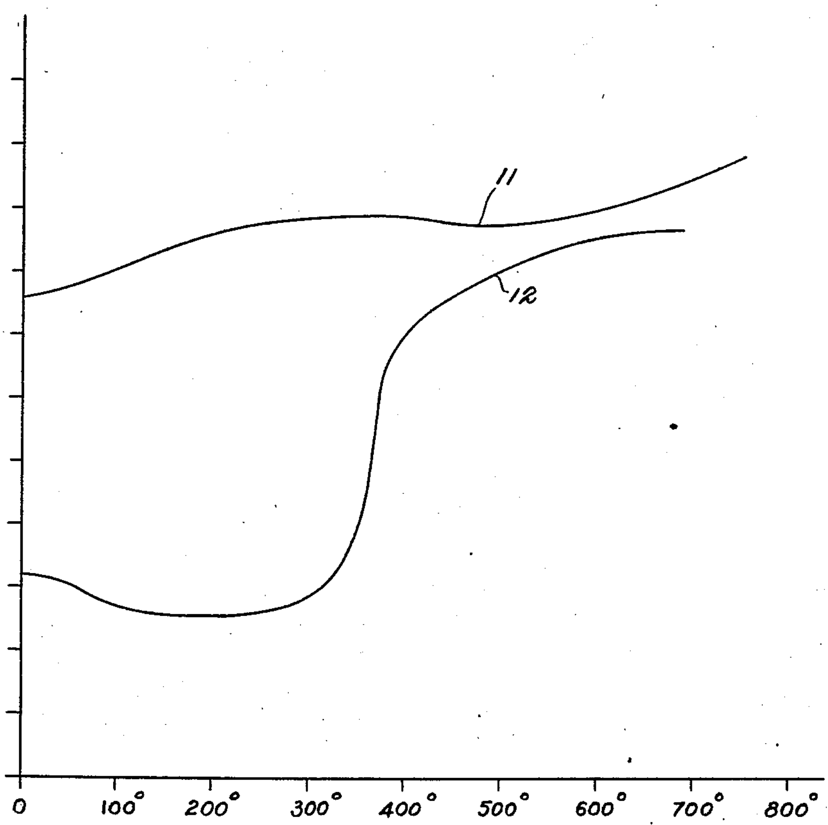

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UNITED STATES PATENT OFFICE.

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THERMOSTATIC MATERIAL.

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My invention relates to temperature controlled devices and particularly to thermostats and thermostatic material.

One object of my invention is to provide a bimetallic thermostat, the elements of which shall have widely different temperature coefficients of expansion, and that shall be composed of material capable of being subjected to relatively high temperatures.

Another object of my invention is to provide an element for a bimetallic thermostat that shall have a relatively high modulus of elasticity, which shall remain substantially constant even at high temperatures and when the element is subjected to wide variations of temperature.

In practicing my invention, I provide a thermostatic element comprising a plurality of metals, one of which is an alloy comprising cobalt and iron.

The single figure of the drawing illustrates two curves showing the temperature coefficients of expansion or the temperature expansivities thereof at varying temperatures, of two metallic elements which I prefer to employ in my thermostat.

A number of metals that may be employed in thermostatic elements for use in relatively low temperature are well-known, such as iron and brass. However, when such metals are subjected to relatively high temperatures, they soon loose their original operating characteristics and fail to respond to changes of temperature, and the device therefore becomes useless. I have found that an alloy of cobalt and iron, in varying proportions, may be employed as one of the metallic elements in a bimetallic thermostat, and that it will continue to operate properly even when subjected to temperatures of the order of 300° C. or higher for long periods of time.

The relative proportions of cobalt and iron employed in the alloy may vary widely. I may employ as low as 10% of cobalt, or I may employ as high as 80 to 90% of cobalt. Iron will constitute the other main ingredient of the alloy, although chromium, tungsten, or molybdenum may be added in relatively small quantities for increasing the modulus of elasticity of the alloy at high temperatures. The resulting alloy has a lower expansivity but a much higher modulus of elasticity at high temperatures than is possessed by Monel metal, which latter is an alloy now frequently employed in bimetallic thermostats, and its elastic strength is greater than that of Monel metal. The temperature coefficient of elastic modulus of the alloy is also reduced relatively to that of Monel metal.

Other metallic ingredients, such as nickel, may also be present, but the amounts will be so small that they may be considered as being impurities only.

The relative percentages of iron and of cobalt are to be determined more particularly with regard to certain operating characteristics that it is desired that the thermostat elements possess upon its incorporation in a bimetallic member. Thus, when the percentage of iron is much greater than that of cobalt, the alloy may be easily worked, will be cheaper, but will not be so well able to withstand higher temperatures. On the other hand, if the amount of cobalt is much greater than the amount of iron, the alloy will possess a high temperature expansivity and will be better able to withstand higher temperatures but it will be more expensive and somewhat harder to work.

A curve designated by 11 in the drawing illustrates the temperature coefficient of expansion of a cobalt iron alloy between the temperatures of zero and approximately 600° C.

A curve 12 illustrates the temperature coefficient of expansion of a nickel-steel alloy containing approximately 42% of nickel. The nickel-steel alloy has a very much lower temperature coefficient of expansion at temperatures from substantially zero to 300° C. than the cobalt iron alloy, but its temperature coefficient of expansion increases at temperatures above 350° C. and becomes but slightly less than that of the cobalt iron alloy. Where a temperature range of from substantially zero to 300° C. is to be controlled, it will be possible to obtain relatively large deflections of a thermostatic element which comprises a cobalt-iron alloy and at 42% nickel steel alloy as the two elements of a bimetallic member.

A cobalt alloy of the kind hereinbefore described has a modulus of elasticity that is relatively high as compared to that of other metals or alloys heretofore employed in bimetallic thermostats, such as Monel metal, which is maintained substantially unchanged at the higher operating temperatures to which such a thermostatic member will be subjected. It will, therefore, have a greater rigidity, particularly at the higher operating temperatures, and this will compensate for the somewhat smaller coefficient of expansion that such an alloy possesses relatively to some of the other metals or alloys used for this kind of work. As the modulus of elasticity is greater than, say that of Monel metal, a predetermined difference in expansivity will result in larger stresses and produce a greater deflection of the thermostat than when some other metal or an alloy such as Monel metal, is used as one of the elements in a temperature responsive device.

The elastic strength of the alloy is increased and the temperture coefficient of elastic modulus is decreased, making it possible to operate the temperature responsive device employing such an element at relatively high temperature.

Any desired method of manufacturing a bimetallic member comprising the two hereinbefore mentioned alloys may be employed, and as such methods of manufacture or the method of construction of thermostatic members constitutes no part of my present invention, no detailed description thereof is here given.

While I have shown a curve of expansion coefficients having nickel steel alloy as the low expansion member of a thermostatic element, I do not desire to be limited to the nickel-steel alloy, as my invention relates more particularly to the use of a cobalt-iron alloy, with relatively small quantities of a metal of the chromium group as addition elements for increasing the strength and modulus of elasticity thereof, and it is evident that it may be employed with any other suitable alloy or metal having a different coefficient of expansion, and with which it can be properly united and to which it can be properly secured, to provide the usual bimetallic member.

Various modifications and changes 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.

I claim as my invention:

1. A heat responsive device comprising metallic elements, one of said elements being an alloy comprising cobalt and iron, and the other element being nickel steel.

2. A heat responsive device comprising metallic elements, one of said elements being an alloy comprising cobalt and iron, and the other element being a reversible nickel steel.

3. A heat responsive device comprising metallic elements having different temperature expansivities, the high expansion element being an alloy comprising cobalt and iron, the percentage of cobalt being less than the percentage of iron, and the low expansion element being an alloy of nickel and iron.

4. A heat responsive device comprising metallic elements having different coefficients of expansion, one of said elements being an alloy of cobalt, iron and a metal of the chromium group and the other of said elements being a nickel-iron alloy.

5. A heat responsive device comprising metallic elements having different temperature coefficients of expansion, one of said elements being an alloy of cobalt, iron and a metal of the chromium group, the percentage of the cobalt and iron being greater than the percentage of the metal of the chromium group and the other of said elements being an alloy of nickel and iron.

6. A heat responsive device comprising metallic elements having different coefficients of expansion, one of said elements being an alloy of cobalt and iron and of a small percentage of a metal for increasing the elastic strength thereof at a relatively high temperature and the other of said elements being an alloy of nickel and iron.

7. A heat responsive device comprising metallic elements having different coefficients of expansion, one of said elements being an alloy of cobalt and iron and of a small percentage of a metal for reducing the temperature coefficient of elastic modulus and the other of said elements being a reversible nickel steel.

8. A heat responsive device comprising metallic elements having different coefficients of expansion, one of said elements being an alloy having a higher modulus of elasticity than Monel metal and the other of said elements being a reversible nickel steel.

9. A heat responsive device comprising metallic elements having different coefficients of expansion, one of said elements being an iron alloy having a higher modulus of elasticity than Monel metal and the other of said elements being a nickel-iron alloy.

10. A temperature responsive device comprising metallic elements having different coefficients of expansion, one of said elements being an alloy having substantially the same temperature expansivity as, and a higher modulus of elasticity than, Monel metal and the other of said elements being a nickel-iron alloy.

In testimony whereof, I have hereunto subscribed my name this 29th day of August, 1925.

VICTOR G. VAUGHAN.