

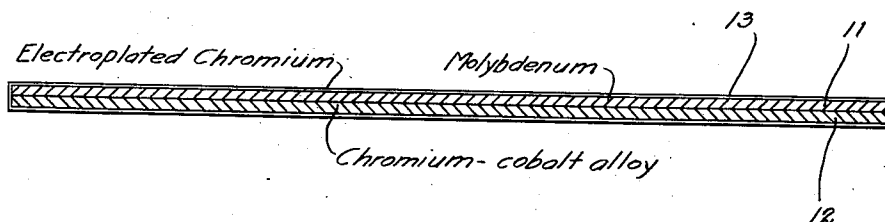
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THERMOSTATIC MATERIAL

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WITNESSES:

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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 thermostatic material.

The object of my invention is to provide
5 a metallic thermostat that shall operate properly over a relatively large temperature range, that shall resist oxidation at high temperatures, and that shall retain its operating characteristics even after a long continued use.

In practicing my invention, I provide a thermostat comprising metallic elements one of which is molybdenum and the other of which is an alloy of chromium and cobalt
15 and which may also contain iron. An oxidation-resistant coating of electrolytic chromium is also provided over the outer entire surface of the thermostatic member.

In the single figure of the accompanying drawing, I have illustrated, in longitudinal section, the device embodying my invention.

The use of two metals, intimately united over their entire adjacent and abutting surfaces, for obtaining a movement of one part
25 thereof relatively to the other part under temperature changes is well known, particularly for relatively low temperatures.

When the problem is presented of providing such a metallic thermostat for relatively
30 high temperatures and for relatively large temperature changes, it is one that is not easily solved, particularly by the use of the metals heretofore employed, as these metals lose their original characteristics and also
35 oxidize at the relatively high temperatures. These temperatures may be as high as 600° C. or even up to 800° C. I have found that molybdenum has a relatively high elastic limit, even when heated to the hereinbefore
40 mentioned high temperatures, and I have also found that certain alloys of chromium and cobalt have relatively high strength at the high temperatures hereinbefore mentioned, together with a relatively great resistance to
45 oxidation.

Molybdenum has a mean or average temperature expansivity of approximately 6×10^{-6} between the limits of 0° C. and 800° C., while an alloy of chromium and cobalt containing approximately 80% of cobalt and approximately 20% of chromium has a mean or average temperature expansivity of approximately 17×10^{-6} between 0° C. and 800° C. and is a ductile alloy.

I have found that an alloy containing

approximately 22% cobalt, 22% of chromium and 56% of iron has a slightly higher temperature expansivity and could also be employed as one of the metallic elements in a metallic thermostat.

Molybdenum oxidizes when heated in the open air to temperatures above 500° C. and must, therefore, be protected against such oxidizing action when it is desired to employ the device at temperatures above this
60 limit.

A deposit of electrolytic chromium or of a chromium-nickel alloy over the finished thermostatic element will accomplish this.

In the drawing, numeral 11 designates a
70 strip of molybdenum that has been suitably united with a substantially similar strip 12 of a chromium-cobalt alloy in a manner well known in the art to constitute the so-called bimetallic thermostat. The numeral 13 in-
75 dicates a coating of chromium or of a chromium-nickel alloy that has been electroplated thereon over substantially the entire surface to provide an oxidation-resistant covering or coating.

I have found that a number of alloys of cobalt and chromium, having different proportions of the two metals therein, may be employed, and I have found that the percentage of cobalt in a cobalt chromium alloy
85 may range from 70% to 90%, with the percentage of chromium varying from approximately 30% to approximately 10%. While I do not specifically claim relatively small admixtures of other metals, such metals are
90 usually present in very small quantities and may include manganese, silicon, tungsten, carbon, etc. These relatively small quantities of other metals that may be termed impurities, are important from a metallurgical standpoint, as they ensure sound and
95 forgeable ingots.

I have hereinbefore mentioned the possibility of the use of a cobalt-chromium-iron alloy, and such alloys may contain from
100 10% to 30% of cobalt, 30% to 10% of chromium, the balance being mostly iron, and small quantities of the other materials, mentioned above in connection with the cobalt chromium alloys, as ensuring sound and
105 forgeable ingots.

A device embodying these metals, when properly rolled and heat treated, will function properly over the relatively large temperature range of substantially 0° C. to 110

800° C. will retain its operating characteristics even when subjected to long continued use under the relatively large temperature variations and the relatively high maximum temperatures and will be substantially oxidation-resistant because of the electro-deposited coating of oxidation resistant metal or alloy thereon.

Since various modifications and changes may be made without departing from the spirit and scope of the invention, I desire that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:

- 15 1. A heat-responsive device comprising a plurality of metallic elements, one of said elements being a ductile chromium-cobalt alloy and the other element being molybdenum.
- 20 2. A heat-responsive device comprising a plurality of metallic elements, one of said elements being a ductile chromium-cobalt alloy, the other element being molybdenum, and an oxidation-resistant coating of chromium on both said elements.
- 25 3. A heat responsive device comprising a plurality of metallic elements, one of said elements being a ductile chromium-cobalt alloy having an appreciable admixture of iron, and the other element being molybdenum.
- 30 4. A heat responsive device comprising a plurality of metallic elements, one of said elements being a ductile chromium-cobalt-

alloy having an appreciable admixture of iron, the other element being molybdenum, and an oxidation resistant coating of electrolytic chromium.

5. A heat-responsive device comprising a plurality of metallic elements, one of said elements being a ductile chromium-cobalt alloy comprising 30% to 10% of chromium, 10% to 30% of cobalt, substantially all of the remainder being iron, and the other element being molybdenum.

6. A heat-responsive device comprising a plurality of metallic elements, one of said elements being a ductile chromium-cobalt alloy comprising 30% to 10% of chromium, 10% to 30% of cobalt, substantially all of the remainder being iron, the other element being molybdenum, and an oxidation resistant coating of chromium on the two elements.

7. A heat responsive device comprising a plurality of metallic elements, one of said elements being molybdenum and the other element being a ductile oxidation resistant alloy containing chromium, the latter element cobalt and having a mean temperature expansivity greater than 16×10^{-6} for a temperature range of from 0° C. to substantially 600° C.

In testimony whereof, I have hereunto subscribed my name this 9th day of March, 1925.

PORTER H. BRACE.