

UNITED STATES PATENT OFFICE

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LOW EXPANDING ALLOY

No Drawing.

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to him of any royalty thereon.

This invention relates to a new composition of matter, and more particularly to low expanding alloys.

It is an object of the invention to provide an alloy which has a very low, and even abnormally low, coefficient of expansion. Alloys made in accordance with this invention are applicable for purposes where a low coefficient of expansion is required, for example, in (a) length measures, such as length standards; (b) thermostats or thermostatic devices; (c) the construction of instruments or machines requiring fixed distances between points to be independent of temperature, such as the bar between microscopes of a comparator; (d) in the construction of clocks and watches, the alloys herein described will produce apparatus having greater accuracy for measuring time. These alloys with a negligible expansion will make possible a compensated clock pendulum without mercury or nickel steel and thereby induce greater accuracy. Furthermore, the alloys herein described are useful in balance wheels of chronometers to provide good compensation over a range of temperatures.

In carrying out this invention the ingredients are selected and proportioned so that the resulting alloy contains a predominating amount of chromium, say approximately 95% to 99%; a substantial amount of iron, say 0.1% to 3%; a substantial amount of silicon, say 0.1% to 2%; and carbon from a trace to a substantial amount, say 1%. Any alloy of these elements within these approximate limits possesses the characteristic property of low thermal expansion for some particular temperature range. The temperature range over which the alloy has a low coefficient of expansion varies with the percentage of the ingredients of the alloy.

There may be added to the alloy, according to the present invention, small quantities of other elements as accessories, say up to about 1%, in order to improve one or more of the

physical or chemical properties of the alloy without increasing the low coefficient of expansion. Such additional elements may comprise, for example, manganese, nitrogen and oxygen.

An example of an alloy having a low coefficient of expansion is the following: chromium 98½%; iron ¾%; silicon ¼%; carbon ⅙%; accessories comprising manganese, nitrogen, oxygen ⅔%. This alloy has been found by experiment to have a coefficient of linear expansion less than 1×10^{-6} per degree centigrade between -15° and $+30^{\circ}$ centigrade (between 5° and 86° Fahrenheit).

For the temperature range from -100° to -50° centigrade (from -148° to -58° Fahrenheit), the alloy containing approximately 97% chromium, 1% iron, ½% carbon, 1% silicon and ½% accessories comprising manganese, nitrogen, oxygen was found to give excellent results. The coefficient of linear expansion of this alloy is approximately 1×10^{-6} per degree centigrade between -100° and -50° centigrade (between -148° and -58° Fahrenheit).

Having thus described my invention, what I claim is:

1. A low expanding alloy consisting chiefly of chromium, iron, silicon and carbon and containing approximately 98½% chromium, approximately ¾% iron, approximately ¼% silicon and approximately ⅙% carbon.

2. An alloy suitable for use as a low expanding metal, containing chromium from 95 to 99%, iron from 0.1 to 3%, silicon from 0.1 to 2%, and a substantial amount of carbon up to 1%.

3. An alloy suitable for use as a low expanding metal wherein the coefficient of linear expansion is not more than approximately 1×10^{-6} per degree C., between -15° and $+30^{\circ}$ C., said alloy containing chromium approximately 98½%, iron approximately ¾%, silicon approximately ¼%, and carbon approximately ⅙%, said alloy containing not more than ⅔% of manganese, nitrogen and oxygen.

4. An alloy suitable for use as a low expanding metal wherein the coefficient of linear expansion is not more than approxi-

mately 1×10^{-6} per degree C., between -100° and -50° C., said alloy containing chromium approximately 97%, iron approximately 1%, silicon approximately 1%, and carbon approximately $\frac{1}{2}\%$.

5 An alloy suitable for use as a low expanding metal wherein the coefficient of linear expansion is not more than approximately 1×10^{-6} per degree C., between -100° and
10 -50° C., said alloy containing chromium approximately 97%, iron approximately 1% silicon approximately 1%, and carbon approximately $\frac{1}{2}\%$, said alloy containing not
15 more than $\frac{1}{2}\%$ manganese, nitrogen and oxygen.

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