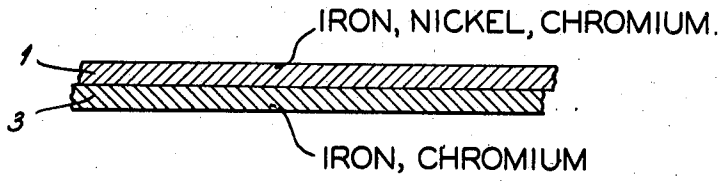
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CORROSION-RESISTING THERMOSTAT METAL

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CORROSION-RESISTING THERMOSTAT METAL

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8 Claims. (Cl. 29—195.5)

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This invention relates to composite metal elements and particularly to bimetallic elements which are corrosion resisting.

This application is a continuation-in-part of my copending application Serial Number 399,398, filed June 23, 1941, now Patent 2,366,178, issued January 2, 1945.

Among the several objects of the present invention are the provision of a composite thermostat metal which is corrosion resisting, which has an improved bond, and which has a long life when operating in corrosive atmospheres and mediums; the provision of composite thermostat metal of the class described which has both good hot-rolling and cold-rolling properties; and the provision of composite thermostat metal of the type indicated which is relatively simple and economical to manufacture. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the ingredients and combinations of ingredients, the proportions thereof, and features of composition, which will be exemplified in the products hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is illustrated one of various possible embodiments of the invention,

The single figure is a representation of a bimetallic element showing a strip of iron chromium alloy fused throughout its length to a similar strip of iron nickel chromium alloy.

Many of the thermostatic elements commonly in use are subject to corrosion when used in the presence of moisture in places such as steam radiators, relief valves, or water mixing valves, or in other installations where corrosion-promoting fluids or atmospheres come in contact with the thermostat metal. As a result, such elements frequently need replacing, and inasmuch as corrosion tends to reduce their activity and life, such corrosion may set up, unknown to the user, dangerous conditions which might result in loss of life or injury. To avoid this corrosion of the composite metal element, it has sometimes been customary in the past to treat the thermostat metal surface to make it less subject to corrosion, as by plating it with a corrosion-resisting material, such as cadmium, tin, zinc, lead, or chromium. This, however, has the disadvantage that the plating increases the cost materially and does not assure satisfactory life for the thermostatic element. Furthermore, such plating is not entirely satisfactory since an electro-voltaic potential may be set up which produces pitting and eating away of the protective metal.

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It has sometimes been the practice in the past to make a composite metallic element from an iron alloy having a high chromium content, and a metal alloy having a higher coefficient of expansion. The metal used for the high coefficient of expansion side has been one of the brasses. The mechanical properties of these brasses have presented manufacturing difficulties, which in many instances have prevented the manufacture of an adequate and satisfactory composite metal. For example, the cold-working properties of brass are so different from those of the chromium iron alloy that it has been difficult to satisfactorily cold-work the metal after it has been put together to form a thermostat bimetal. Moreover, it is highly advantageous in the manufacture of bimetal to hot-roll the material down from its thick ingot size to an intermediate stage. The brasses are not adapted to this, since their hot-rolling temperatures differ too much from that of the chromium iron alloy. The manufacture of the brass-chrome iron bimetals has therefore been a relatively expensive process compared to the manufacture of bimetal in accordance with the present invention. The ingot size of the brass-chrome iron bimetals must be kept small because of the aforementioned difficulties and properties.

Where other constituents have been proposed for corrosion resisting bimetals, it has been found relatively impossible to directly bond the metals together. For this reason, an intermediate solder layer has been used which has led to two serious disadvantages. First, the use of the solder layer decreases the corrosion-resisting property of the thermostat metal due to inferior bonding, and second, the solder layer decreases the strength of the metal at elevated temperatures, since the solder bond is relatively weak. Also, solder-bonded material is difficult to hot-roll satisfactorily.

By the present invention, it is possible to accomplish a direct bond between the metals with or without an interliner of some metal, such as nickel, which is first plated onto the chrome steel alloy hereafter mentioned, to prevent its oxidization during heating, and they may be hot-rolled or cold-rolled in the desired manner. Their manufacture is accordingly economical, and a highly corrosion-resisting thermostat metal is obtained.

According to the present invention a thermostatic element is provided which is corrosion-resisting per se, particularly to air, water and water vapor, thus eliminating the need for surface plating. In addition, the present invention provides a thermostatic element made of composite ther-

mostat metal of the corrosion-resisting type which has a direct bond between the layers thereof.

The thermostat metal of the present invention comprises layers of metal firmly secured together over their entire areas by a direct bond. One of the layers, in the present invention, comprises a corrosion-resisting metal having a low coefficient of expansion. The other layer comprises a second corrosion-resisting metal having a relatively high coefficient of expansion.

For the metal having a low coefficient of expansion a high chromium content stainless iron is employed. The composition of this alloy may be as follows:

	Per cent
Manganese	0.2–0.6
Carbon	0.01–0.2
Chromium	12–20
Silicon	0–1.5
Copper	0–1.5
Iron	Remainder.

For the high expansion material an alloy of nickel, chromium and iron is employed. The composition of this alloy may be as follows:

	Per cent
Nickel	16–20
Chromium	10–13
Silicon	0.2–1.0
Manganese	0.35–0.8
Carbon	0.05–0.2
Molybdenum	0–0.5
Iron	Remainder.

Referring now to the drawing, a bimetallic element composed of the two alloys described above, is illustrated. Numeral 1 represents the high coefficient of expansion iron, nickel, chromium alloy while 3 is the low expansion iron chromium alloy.

The composite thermostat metal of which bimetal will be described as an illustrative embodiment, may be formed in the ways set forth in my co-pending application Serial Number 399,398, reference to which is hereby made.

The tensile strength and other mechanical properties of the two alloys are sufficiently near to one another so that the two metals work well together and may be easily hot and cold-worked. This facilitates manufacture and as a result of obtaining a direct bond between the metals, a thermostat metal having a higher strength, greater activity, wider usable temperature range, longer life and better corrosion-resisting properties than the corrosion-resisting bimetals hitherto known, is obtained. Former metals allegedly designed to have these desirable properties have instead been relatively weak, corrode relatively easily, are more difficult to manufacture, and in general are not satisfactory.

As specific examples of alloys which may be advantageously employed in the present invention, the following examples are given. They are illustrative only:

Low expansion alloy No. 1

	Per cent
Manganese	0.2–0.6
Carbon	0.01–0.2
Chromium	12–20
Silicon	.2–1.5
Copper	.5–1.5
Iron	Remainder.

Low expansion alloy No. 2

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Silicon	1
Copper	1
Iron	Balance

Low expansion alloy No. 3

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16–20
Iron	Balance

Low expansion alloy No. 4

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Silicon	1
Copper	1
Iron	Balance

High expansion alloy No. 1

	Per cent
Nickel	18.0
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.1
Iron	Remainder.

High expansion alloy No. 2

	Per cent
Nickel	18.0
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.05
Iron	Remainder.

High expansion alloy No. 3

	Per cent
Nickel	18.0
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.1
Molybdenum	0.2–0.5
Iron	Remainder.

High expansion alloy No. 4

	Per cent
Nickel	16
Chromium	10
Silicon	0.2
Manganese	0.35
Carbon	0.05
Iron	Remainder

Attention is directed to my copending applications, Serial Nos. 28,418 and 28,419, both filed May 21, 1948.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above alloys without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A corrosion-resisting thermostat metal com-

posed of an alloy having substantially the following composition:

	Per cent
Manganese	0.2–0.6
Carbon	0.01–0.2
Chromium	12–20
Silicon	0.2–1.5
Copper	0.5–1.5
Iron	Remainder

and an alloy having substantially the following composition:

	Per cent
Nickel	16–20
Chromium	10–13
Silicon	0.2–1.0
Manganese	0.35–0.8
Carbon	0.05–0.2
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

2. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Silicon	1
Copper	1
Iron	Remainder

and an alloy having substantially the following composition:

	Per cent
Nickel	18
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.1
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

3. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Silicon	1
Copper	1
Iron	Balance

and an alloy having substantially the following composition:

	Per cent
Nickel	18
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.1
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

4. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Silicon	1
Copper	1
Iron	Balance

and an alloy having substantially the following composition:

	Per cent
Nickel	18
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.05
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

5. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Silicon	1
Copper	1
Iron	Balance

and an alloy having substantially the following composition:

	Per cent
Nickel	16
Chromium	10
Silicon	0.2
Manganese	0.35
Carbon	0.05
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

6. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Silicon	1
Copper	1
Iron	Balance

and an alloy having substantially the following composition:

	Per cent
Nickel	18
Chromium	11.5
Silicon	0.26
Manganese	0.57
Carbon	0.05
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

7. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Silicon	1
Copper	1
Iron	Balance

and an alloy having substantially the following composition:

	Per cent
Nickel	16
Chromium	10
Silicon	0.2
Manganese	0.35
Carbon	0.05
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

8. A corrosion-resisting thermostat metal composed of an alloy having substantially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Silicon	1
Copper	1
Iron	Balance

and an alloy having substantially the following composition:

	Per cent
Nickel	16–20
Chromium	10–13
Silicon	0.2–1.0
Manganese	0.35–0.8
Carbon	0.05–0.2
Iron	Remainder

the surfaces of said alloys being fused together at the junction.

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