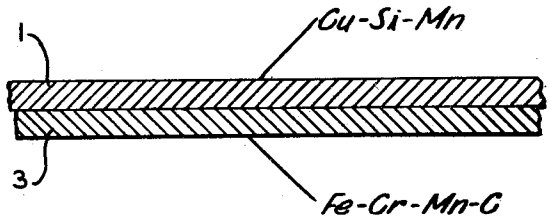
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CORROSION-RESISTING COMPOSITE METAL

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CORROSION-RESISTING COMPOSITE METAL

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13 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 division of my co-pending application, Serial No. 399,398, filed June 23, 1941, Patent 2,366,178.

Among the several objects of the present invention are the provision of a composite thermostatic metal which is corrosion-resisting, which has an improved bond, and which has a long life when operating in corrosion-promoting atmospheres and mediums; the provision of composite thermostatic metal of the class described which has both good hot-rolling and good cold-rolling properties; and the provision of composite thermostatice 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 copper silicon 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, or water mixing valves, or in other installations where corrosion-promoting fluids or atmospheres come in contact with the thermostatic metal. As a result, such elements frequently need replacing, and inasmuch as corrosion tends to reduce their activity in 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 thermostatic 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 thermostatic 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 led to two serious disadvantages. First, the use of the solder layer decreases the corrosion-resisting property of the thermostatic 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, and they may be hot-rolled or cold-rolled in the desired manner. Their manufacture is accordingly economical, and a highly corrosion-resisting thermostatic 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 thermostatic metal of the corrosion-resisting type which has a direct bond between the layers thereof.

The thermostatic 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 coefficent 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 copper and silicon is employed. The composition of this alloy may be as follows:

	Per cent
Copper	96–99
Silicon	0.5–4
Manganese	0–1
Tin	0–2.5

The composite thermostatic metal of which bimetal will be described as an illustrative embodiment may be formed in any of the customary manners. It is preferably formed in one of the ways described in my co-pending application, Serial No. 399,398, filed June 23, 1941, Patent 2,366,178, reference to which is hereby made.

Referring now to the drawing, the single figure illustrates a bimetallic element composed of the two alloys discussed above. Numeral 1 represents the copper silicon alloy while 3 is the iron chromium alloy.

The tensile strength and other mechanical properties of the copper silicon alloys described are sufficiently near to the same properties of the chrome-iron alloys that the two metals work well together and may be easily cold-worked. This makes the manufacture thereof more economical. As a result of obtaining a direct bond between the metals comprising the present invention, a thermostatic 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:

Chrome-iron alloy

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

Copper-silicon Alloy No. 1

	Per cent
Copper	97–99
Silicon	0.75–1.75
Manganese	0.2–1.0

Copper-silicon alloy No. 2

	Per cent
Copper	97–98.5
Silicon	1–2.5
Manganese	.15–.35

Copper-silicon Alloy No. 3

	Per cent
Copper	98
Silicon	1.25
Manganese	0.75

Attention is directed to my copending applications, Serial Nos. 563,013, 563,014 and 563,015, all filed November 11, 1944.

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 thermostatic metal composed of an iron alloy containing: manganese approximately 0.2–0.6%, carbon approximately 0.01–0.2%, chromium approximately 12–20%, and the balance iron; and a copper alloy containing: silicon approximately 0.5–4%, manganese approximately 0.15–1%, and the balance copper; the surfaces of said alloys being fused together at the junction.

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

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	97–99
Silicon	0.75–1.75
Manganese	0.2–1.0

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

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

	Per cent
Manganese	0.2–0.6
Carbon	0.01–0.2
Chromium	12–20
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	97–99
Silicon	0.75–1.75
Manganese	0.2–1.0

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

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

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	97–99
Silicon	0.75–1.75
Manganese	0.2–1.0

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

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

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	98
Silicon	1.25
Manganese	0.75

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

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

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	98
Silicon	1.25
Manganese	0.75

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

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

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	12–16
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	97–98
Silicon	1–2.5
Manganese	0.15–0.35

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

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

	Per cent
Manganese	0.2–0.6
Carbon	0.01–0.2
Chromium	12–20
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	97–98.5
Silicon	1–2.5
Manganese	0.15–0.35

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

9. A corrosion-resisting thermostatic metal composed of an alloy having essentially the following composition:

	Per cent
Manganese	0.2–0.6
Carbon	0.01–0.2
Chromium	12–20
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	98
Silicon	1.25
Manganese	0.75

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

10. A corrosion-resisting thermostatic metal composed of an alloy having essentially the following composition:

	Per cent
Manganese	0.4
Carbon	0.05
Chromium	16
Iron	Remainder

and an alloy having essentially the following composition:

	Per cent
Copper	97–98.5
Silicon	1–2.5
Manganese	0.15–0.35

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

11. A corrosion-resisting thermostatic metal composed of an alloy having essentially the following composition:

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

and an alloy having essentially the following composition:

	Per cent
Copper	97–99
Silicon	0.75–1.75
Manganese	0.2–1.0

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

12. A corrosion-resisting thermostatic metal composed of an alloy having essentially the following composition:

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

and an alloy having essentially the following composition:

	Per cent
Copper	97–98.5
Silicon	1–2.5
Manganese	0.15–0.35

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

13. A corrosion-resisting thermostatic metal composed of an alloy having essentially the following composition:

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

and an alloy having essentially the following composition:

	Per cent
Copper	98
Silicon	1.25
Manganese	0.75

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

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