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METHOD OF INCREASING THE SCALING RESISTANCE OF METALLIC OBJECTS

Herbert Schulze, Altena, Germany, assignor to Vereinigte Deutsche Metallwerke Aktiengesellschaft, Frankfurt am Main, Germany, a corporation of Germany

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This invention relates to a method for substantially reducing the scaling tendency of metallic objects, especially those of steel of all kinds.

Many metal objects, especially those of iron, steel, copper, or alloys thereof, are frequently exposed to high temperatures and to the influence of corrosive gases, particularly those which have an intense corrosion action. The life of such objects is consequently relatively short, and this necessitates undesirable frequent replacement of the scale-encrusted parts, as can be observed; for example, in the case of grate bars, boiler plates, or other parts of furnaces. Furthermore, other oven parts; and also hardening and smelting crucibles, troughs, and other vessels for salt baths; and in addition casting molds and casting equipment; annealing boxes, carburizing boxes, parts of smelting and roasting furnaces; superheaters, protective tubes; or in general tubes and plates and many other articles used in industrial installations; are exposed to a considerable extent to damage through corrosive attacks.

It has been ascertained in accordance with the invention that substantial protection against the corrosive action of hot gases at temperatures above 800° C., and which may range as high as about 1100° C., can be achieved if metal objects are sprayed to provide a coating of chrome-nickel-iron or chrome-nickel alloys and are then subjected to an after-treatment with calcium-silicon, preferably the compound corresponding to calcium-silicide (CaSi₂), or with calcium-aluminum, preferably the compound corresponding to Al₂Ca. The calcium-silicon or calcium-aluminum can advantageously be used in the form of a finely ground powder, which for the purpose of facilitating application can be applied by the brush when stirred up in a paint; for example, a paint having a bitumen basis. The proportion of calcium-silicon or calcium-aluminum in the paint should be made as high as possible. A mixture proportion of calcium-silicon or calcium-aluminum with the paint of 1:1, or preferably 2:1, should be maintained.

Of the chrome-nickel-containing scaling-resistant materials in question, chrome-nickel-iron alloys containing 18 to 30% of nickel, about 18 to 25% of chromium, up to 3% of silicon, and the remainder iron; or 60 to 65% nickel, 12 to 20% of chromium, up to 3% of silicon, and the remainder iron; and chrome-nickel alloys containing 75 to 80% of nickel, 15 to 20% of chromium, and up to 2% of silicon, have given best results. The alloys

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mentioned can in addition contain up to 10% of tungsten and/or molybdenum. Moreover, their resistance to heat may be improved in known manner by additions of alkaline earths, rare earths, thorium, zirconium, uranium, either singly or several together, while of each of the elements mentioned contents of from 0.02 to 0.5% may be present. The thickness of the sprayed metal coating to be applied is about 0.25 to 0.40 mm.

The hereindescribed method will be explained in greater detail with reference to the following example.

Example

After applying to a salt bath crucible of boiler plating a sprayed layer of a thickness of 0.4 mm. composed of a chrome-nickel-iron alloy of the composition: 20.5% of chromium, 30.2% of nickel, 2.2% of silicon, remainder iron, a mixture consisting of 60 parts by weight of finely ground calcium-silicon powder and 40 parts by weight of a paint having a bitumen basis was painted thereon. After heating for a few hours to 150 to 200° C., the layer applied dried to form a firmly adhering solid coating of uniformly black-gray color. When used as a salt crucible for hardening salt, with direct gas heating, at a temperature of about 1050° C., such a crucible had at least twice as long a life as an untreated crucible of the same parent material under the same conditions. The high resistance to scaling of objects treated by the hereindescribed method is not impaired if the atmosphere contains sulphur.

I claim:

1. A method of improving the scaling resistance at temperatures above 800° C. in the presence of corrosive gases of a metal article coated with a scaling resistant chromium-and-nickel containing alloy which comprises applying to such coated metal article a coating of a bituminous paint containing a material selected from the group consisting of CaSi₂ and Al₂Ca.

2. A method according to claim 1 in which the thickness of the scaling resistant chromium-and-nickel containing alloy on the metal article is 0.25 to 0.40 mm.

3. A method of improving the scaling resistance at temperatures above 800° C. in the presence of corrosive gases of a metal article coated with a scaling resistant chromium-and-nickel containing alloy which comprises applying to such coated metal article a coating of a material selected from the group consisting of CaSi₂ and Al₂Ca suspended in a bituminous paint, the proportion of said material to the paint being between 1:1 and 2:1.

4. A method of improving the scaling resistance at temperatures above 800° C. in the presence of corrosive gases of a metal article coated with a scaling resistant chromium-and-nickel containing alloy which comprises applying to such coated metal article a coating of CaSi₂ suspended in a bituminous paint, the proportion of said CaSi₂ to the paint being between 1:1 and 2:1.

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