United States Patent Office 2,823,139 Patented Feb. 11, 1958

2,823,139

METHOD OF INCREASING THE SCALING RESISTANCE OF METALLIC OBJECTS

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No Drawing. Application May 18, 1953
Serial No. 355,869

Claims priority, application Germany May 23, 1952

11 Claims. (Cl. 117—71)

The present invention relates to a process for imparting high scaling resistance to 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 as well as to the influence of corrosive gases, particularly gases which have a strong oxidizing action. The life of such metal objects is consequently relatively short and this necessitates undesirable frequent replacement of the scale encrusted parts, as, 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 other casting apparatus; 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 often exposed to conditions giving rise to scaling.

It has already been proposed to reduce the scaling resistance of objects of structural steel or boiler plates by applying a protective coating of a chromium and nickel containing iron alloy and then spraying on a coating of aluminum containing paint. Investigations, however, have shown that such protective coatings would not hinder extremely intense scaling of the objects when they were subjected to temperatures over 1000° C. after 235 hours.

It was unexpectedly found according to the invention, that excellent scaling resistance can be achieved against the corrosive influence of hot gases at temperatures over 800° C. and up to about 1100° C. if the metal objects are first spray coated with chromium-nickel-iron or chromium-nickel alloys and such coatings are then provided with a coating of chromium oxide (Cr_2O_3), lithium compounds, especially lithium carbonate, lithium oxide and lithium hydroxide, or aluminum oxide.

The latter coating materials can be applied in a number of ways. A simple procedure is to mix such materials in powder form with a lacquer or paint, preferably a bituminous base paint and then applying such lacquer or paint upon the sprayed metal coating.

It is also possible to suspend the lithium compounds, aluminum oxide and magnesium oxide either singly or in admixture in water and applying such suspension to the sprayed metal coating. Preferably, when the above-mentioned materials are mixed the quantity of lithium compound, preferably lithium carbonate, amounts to 5 to 20% and the remainder is aluminum oxide and magnesium oxide.

Mixtures of lithium carbonate with the aluminum oxide and/or magnesium oxide can also be applied in admixture with a lacquer. When suspensions in water are employed, care should be taken in preparing such suspensions so that a good coating can be obtained therewith by painting it with a brush. The preferred ratio of lithium compound, particularly, lithium carbonate, to the aluminum oxide and/or magnesium oxide is between 1:1.

Of the chromium and nickel containing alloys suitable for the first coating applied to the metal objects to be protected, chromium-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; or chromium-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 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 following examples will serve to illustrate the process according to the invention.

Example 1

A coating of an alloy composed of 20% chromium, 30% nickel and the remainder essentially iron was sprayed on the articles to be protected and therafter an admixture of finely ground lithium carbonate powder with bituminous paint, was painted over the sprayed on metal coating. The quantity of lithium carbonate mixed with the bituminous paint was such that the mixture could easily be applied with a brush.

Example 2

A coating of an alloy composed of 20% chromium, 30% nickel and the remainder essentially iron was sprayed on the articles to be protected and thereafter a suspension of 20% lithium carbonate and 80% Al_2O_3 in water was painted over the sprayed on metal coating.

Example 3

The articles to be protected were first spray coated with a metal coating of the alloy indicated in the foregoing examples and the spray coated articles were then coated with a mixture of 40% of finely ground Cr_2O_3 and 60% of a bituminous paint. The latter coating is most easily applied merely by brushing it on.

All of the articles treated in accordance with the foregoing examples were found to possess excellent resistance against scaling.

We 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 said coated metal article a coating consisting essentially of a material selected from the group consisting of chromium oxide, aluminum oxide, lithium oxide, lithium hydroxide and lithium carbonate.

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 according to claim 1 in which said coating on the chromium-and-nickel containing alloy coated article is applied in the form of a bituminous paint.

4. A method according to claim 1 in which said coating applied to chromium-and-nickel containing alloy coated article contains lithium carbonate.

5. 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 said coated metal article a coating in the form of an aqueous suspension of finely divided lithium carbonate.

6. 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 said coated metal article a coating in the form of an aqueous suspension of finely divided aluminum oxide.

7. 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 said coated metal article a coating in the form of an aqueous suspension of finely divided lithium carbonate and aluminum oxide.

8. A process in accordance with claim 7 in which said lithium carbonate and aluminum oxide are present in a proportion of from 1:10 to 1:1.

9. 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 said coated metal article a coating in the form of an aqueous suspension of finely divided lithium carbonate and magnesium oxide.

10. A process in accordance with claim 9 in which said lithium carbonate and magnesium oxide are present in a proportion of from 1:10 to 1:1.

11. 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 said coated metal article a coating in the form of an aqueous suspension of finely divided lithium carbonate, aluminum oxide and magnesium oxide, the quantity of lithium carbonate being 5 to 20% of the mixture of lithium carbonate, aluminum oxide and magnesium oxide.

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