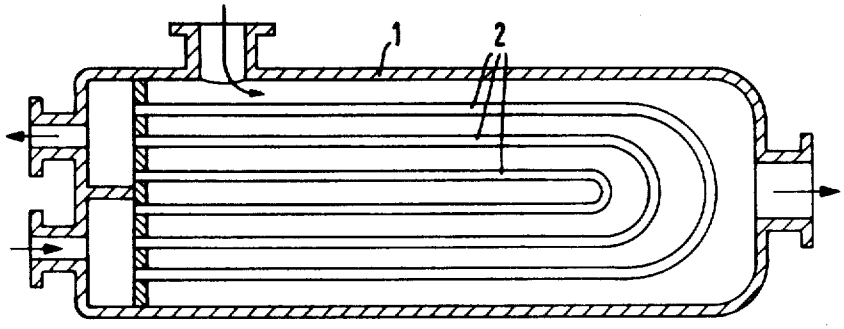
Dec. 5, 1972 F. KELP 3,705,057

METHOD FOR TREATING HEAT EXCHANGERS AND SIMILAR APPARATUS IN THERMAL POWER PLANTS

Filed June 9, 1971



United States Patent Office

3,705,057
Patented Dec. 5, 1972

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METHOD FOR TREATING HEAT EXCHANGERS AND SIMILAR APPARATUS IN THERMAL POWER PLANTS

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Filed June 9, 1971, Ser. No. 151,261
Claims priority, application Germany, June 13, 1970, P 20 29 249.3
Int. Cl. F28f *19/02*
U.S. Cl. 148—6.35 4 Claims

ABSTRACT OF THE DISCLOSURE

A method of treating heat exchangers and like apparatus used in thermal power plants for applying a protective magnetite layer to the surface of iron or steel tubes or other wall portions of the heat exchanger has the steps of subjecting the surface to a flow of steam at a temperature above 220° C. in the absence of air and simultaneously, during the time the protective layer is applied, subjecting the tube to a pressure differential corresponding approximately to the pressure differential to which the tube is subjected in actual use.

My invention relates to a method for treating heat exchangers and similar apparatus used in thermal power plants. It is desirable to produce magnetite protective layers on the surfaces of heat exchanger tubes or other wall portions made of steel, for the purpose of preventing damage due to corrosion. Such protective layers can be applied on iron or steel surfaces with the aid of steam, without admitting air and at temperatures above 220° C., according to the reaction:

$$3Fe+4H_2O \rightarrow Fe_3O_4+4H_2$$

At lower temperatures, this reaction would take place under otherwise the same conditions, only very slowly or not at all.

It has been discovered that, though uniform magnetite layers could be provided in this manner on the surfaces of heat exchanger tubes, the protective effectiveness of these layers may prove unsatisfactory. When a heat exchanger treated in the foregoing manner is operated, as a result of the pressure in the tubes conjointly with thermal influences, expansion phenomena will occur in the tubular wall which could easily be sustained by the heat exchanger material itself within the elastic range but which will cause the relatively brittle although relatively well-adhering, magnetite layer to tear apart. Hence tears or fissures may occur at whose bottom metallic bare iron or metallic bare steel may lie unprotected, so that corrosion will set in there and tend to expand even farther.

Accordingly, it is an object of my invention to provide a method of treating heat exchangers and the like for applying a protective magnetite layer to the surface of iron or steel tubes or other wall portions of the heat exchanger. Subsidiary to this object, it is an object of my invention to provide a method of treating heat exchangers to permit protective magnetite layers to be applied to pertinent surfaces of the heat exchangers which will not develop tears or fissures in normal operational use.

It is another object of my invention to provide a method of applying a layer of protective magnetite to the surface of iron or steel tubes or other wall portions of heat exchangers which will not develop tears or fissures during normal operational use.

Based on this recognition and in accordance with my invention, the wall portions to be treated for production of protective layers are subjected to difference pressures which correspond approximately to the pressure values that occur during operation. When steam is passed through, the steam pressure may be adjusted so that it is close to the operating pressure of the subsequent working medium. For treating feedwater preheaters, the vapor pressure during the production of protective layers may amount inside the tubes, to about 80 to 90% of the pressure difference which occurs during subsequent operation, while the pressure outside the tubes corresponds approximately to atmospheric pressure.

The invention will now be discussed with reference to the drawing which illustrates, in schematic representation, a heat exchanger which can be treated according to the method of the invention.

If such a heat exchanger, for example, a low pressure feedwater preheater is later operated with a feedwater pressure of 25 kp./cm.^{2} in the tubes and a steam pressure of 2 kp./cm.^{2} outside the tubes, then a difference pressure of 23 kp./cm.^{2} prevails during operation. If the protective layer is produced at a vapor pressure inside the tubes **1** of 20 kp./cm.^{2} and at an atmospheric pressure in the region **2** surrounding the tubes, the protective layer will have been formed at conditions which are somewhat below the conditions encountered in later operation with respect to expansions. During subsequent operation this leads to a slight tensile stress and, when the exchanger is shut down there is a compressive stress in the magnetite protective layer. Both stresses may be withstood without fissures developing so that the magnetite layer can maintain its protective function during at all occurring pressures.

The total range to be bridged depends upon how the tubular wall thickness is dimensioned. The invention makes it possible, however to cover pressure ranges which without entailing a danger of damage, are at least three times as high as those of the methods used heretofore.

While the invention has been described by means of a specific example and in a specific embodiment, I do not wish to become limited thereto for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. Method of treating heat exchangers and like apparatus used in thermal power plans for applying a protective magnetite layer to the surface of iron or steel tubes or other wall portions of heat exchangers, said method comprising the steps of subjecting said surface to a flow of steam at a temperature above 220° C. in the absence of air and simultaneously, during the time the protective layer is applied, subjecting said tube to a pressure differential corresponding approximately to the pressure differential to which said tube is subjected in actual use.

2. Method according to claim **1**, wherein the pressure of said steam is adjusted to correspond to the pressure of the medium traversing said tube during actual use.

3. Method according to claim **1**, wherein the tubes of feed-water preheaters are treated for facilitating the ap-

plication of said protective layer, the pressure of said steam within said tube being adjusted during the application of said layer to correspond to within 80 to 90% of the pressure difference occurring during actual use of the preheater while the pressure outside said tube corresponds to atmospheric pressure.

4. Method of applying a layer of protective magnetite to the surface of iron or steel tubes or other wall portions of heat exchangers and like apparatus for use in thermal power plants, said method comprising the steps of applying a protective layer of magnetite to said surface while, simultaneously, subjecting said surface to a flow of steam at a temperature above 220° C. in the absence of air, and simultaneously, subjecting said tube to a pressure differential corresponding approximately to the pressure differential to which said tube is subjected in actual use.

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RALPH S. KENDALL, Primary Examiner

U.S. Cl. X.R.

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