CLEANING OF LIQUID CIRCULATING EQUIPMENT
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C Lewing of Liquid Circulating Equipment

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2 Claims

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ABSTRACT OF THE DISCLOSURE

On-stream method of removing scale, mud and vegetable matter from water cooling equipment while maintaining normal flow of a stream of cooling water therewith comprises injecting into the stream of flowing cooling water a solution of specified acid and corrosion inhibitor wetting agent to provide particular concentrations of same in the cooling water and at a flow rate of at least 3 feet per second through the water circulating channels of said cooling equipment.

This invention relates to improvements in the cleaning of water circulating equipment in cooling installations, for example, condensers and coolers of industrial plants, such as those employed in refineries.

Water circulating equipment tends to become fouled with deposits of scale, vegetable material and mud, particularly when the cooling water is taken directly from a natural source such as the sea or a dam or river. For example, there is a large number of coolers and condensers in a refinery and, where the refinery is situated near a source of natural water such as the sea, it is convenient to draw the cooling water from the natural water source. The water circulating coolers become fouled with scale, weed and mud and, after a period of time, have to be cleaned. For this purpose it is the usual practice to take them off stream for cleaning. In addition to the cost of dismantling and cleaning there is a loss of throughput on the plant whilst the coolers are out of service due to reduced cooling capacity.

In view of its obvious advantages, attempts have been made to clean coolers, condensers and the like, whilst they remain on stream by the injection of chemical reagents into the cooling water for a brief period. The prior art methods have been able to remove scale and mud but have not effectively removed vegetable matter, such as weed, or have taken a long time to be effective, or else have been expensive, and it has been general practice therefore to dismantle the coolers, and either to clean them manually or to circulate hot alkaline chelating agents through them whilst they are out of service. Another method that has been tried is the so-called "sand shurry"; in this method sand, air and water are passed at high velocity through the cooler in the reverse direction to normal water flow.

Normal off-stream chemical cleaning consists in taking the cooler out of service, arranging a temporary pipework circuit incorporating a pump and mixing tank and circulating acids through the cooling assembly until cleaning is complete. Usual acid strengths are comparatively high, in the range of 5—10% by weight of the acid cleaning solution, the acid solution being circulated slowly at a rate of about 1 foot per second and at a temperature of up to 180° F. for periods of up to 24 hours.

It has now been found that coolers, condensers, and the like may be effectively cleaned whilst remaining on stream with the removal not only of scale and mud but also of vegetable matter such as weed, and in a comparatively inexpensive manner. In accordance with the invention an acid, a corrosion inhibitor and a wetting agent are added to the cooling water; preferably the corrosion inhibitor is one which also functions as a wetting agent, so that the inhibitor and wetting agent are provided by the one reagent. Heretofore foaming inherent in the use of wetting agents has been regarded as objectionable and to be avoided if possible but, in the present invention, foaming is not objectionable. The corrosion inhibitor is, suitably, an amine or mixture of amines which may be primary, secondary, or tertiary, preferably C10, long chain amines, or alkylamines, or diamines or amidoamines, or quaternary ammonium compounds; alternatively derivatives of the foregoing, for instance hydroxy or ethoxy derivatives, may be used; particularly suitable are alkylammonium reaction products produced by the reaction of 1 to 4 moles of alkyl chloride per mole of amine as described in British patent specification No. 912,343. Representative of this class of reagent is that sold commercially by the Armour Chemical Company under the registered trademark "Armohib," e.g. Armohib 25 or Armohib 26; other suitable inhibitors are mercaptans, heterocyclic nitrogen compounds, ureas, and thioureas. The acid, which may be, for example, hydrochloric acid or sulphuric acid, or other acid that will dissolve scale, is suitably present in an amount sufficient to provide from 0.1—2%, preferably a 1% w/w. concentration in the cleaning solution and the inhibitor may, for example, be present in an amount of 1% v/v. based on the total volume of concentrated acid injected where the inhibitor also acts as a wetting agent; where a wetting agent must be added additionally the combined amount of inhibitor and wetting agent is suitably from 0.1—2%, and preferably, about 1%.

In order to achieve effective cleaning of the coolers a high flow rate of cleaning fluid is maintained to achieve a high tube velocity. The flow rate is preferably at least 3 to 4 feet per second and improved cleaning is achieved with increasing flow rate up to about 9 feet/second; if flow rates are increased beyond 9 feet per second corrosion problems are liable to occur. The acid is pumped into the cooling water steadily to provide a substantially uniform concentration, e.g. at least 0.5%, suitably about 1% w/w and suitably for a single period of e.g. 20 minutes. The amounts of acid, corrosion inhibitor and wetting agent, may be varied.

For example, if weed fouling is light, smaller amounts of wetting agent may be used, as little as 0.1% in some cases. On the other hand where scale is excessive, the amount of acid may be increased, e.g. up to 2%, or even 3%. Furthermore the greater the concentration of cleaning reagents, the shorter the treatment time that is required and the treatment time may be as low as 10 minutes, or even less.

Injection of the cleaning solution is suitably accomplished by pumping the cleaning chemicals from a mixing tank to an injection point fitted to the water side of the cooler, or condenser, to be cleaned and delivering the required volume against the pressure of the cooling system. Cooling water flow is maintained to the cooler in normal manner and the cleaning reagents are injected for the required period. Where required the acid effluent emerging from the cooler being cleaned can be neutralised by adding alkaline material to the effluent.

The invention is further illustrated by reference to the accompanying drawing which shows, in diagrammatic longitudinal section, a cooler being subjected to the on-stream cleaning method of the invention.

As shown in the drawing a cooler 1, of conventional design is provided with a normal cooling water inlet 2, cooling water outlet 3, and cooling water circulating channels 4. A solution of acid with corrosion inhibitor and wetting agent 5, provided in a tank 6, is pumped by a
pump 7, through connections 8 and 9, into the stream of cooling water at the inlet 2 and flows with the cooling water through the circulating channels 4 to the outlet 3. The flow of inhibitor acid solution from the tank 6 is controlled by suitable valve means such as 10 and 11.

What is claimed is:

1. An on-stream method of removing scale, mud and vegetable matter from water circulating circuits and water cooling equipment while maintaining normal flow of a stream of cooling water therein, which comprises the steps of preparing a solution comprising an acid selected from the group consisting of hydrochloric and sulfuric acid and a corrosion inhibitor-wetting agent selected from the alkanol-amine reaction product produced by the reaction of 1-4 moles of alkanol with one mole of amine, thereafter injecting into said stream of cooling water normally flowing in the water circulating circuit a sufficient amount of said solution to provide concentration of from about 0.1 to about 3 weight percent of said acid in said water circulating circuit, and a concentration of said corrosion inhibitor-wetting agent of from about 0.1 to about 2 volume percent based on the total volume of said acid, said method further characterized in that a rate of flow of said solution of at least 3 feet per second is maintained through the water circulating channels of said cooling equipment.

2. The method of claim 1 wherein said solution is pumped from a mixing tank to the water inlet of the water circulating circuit while said water cooling equipment is on stream.

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