

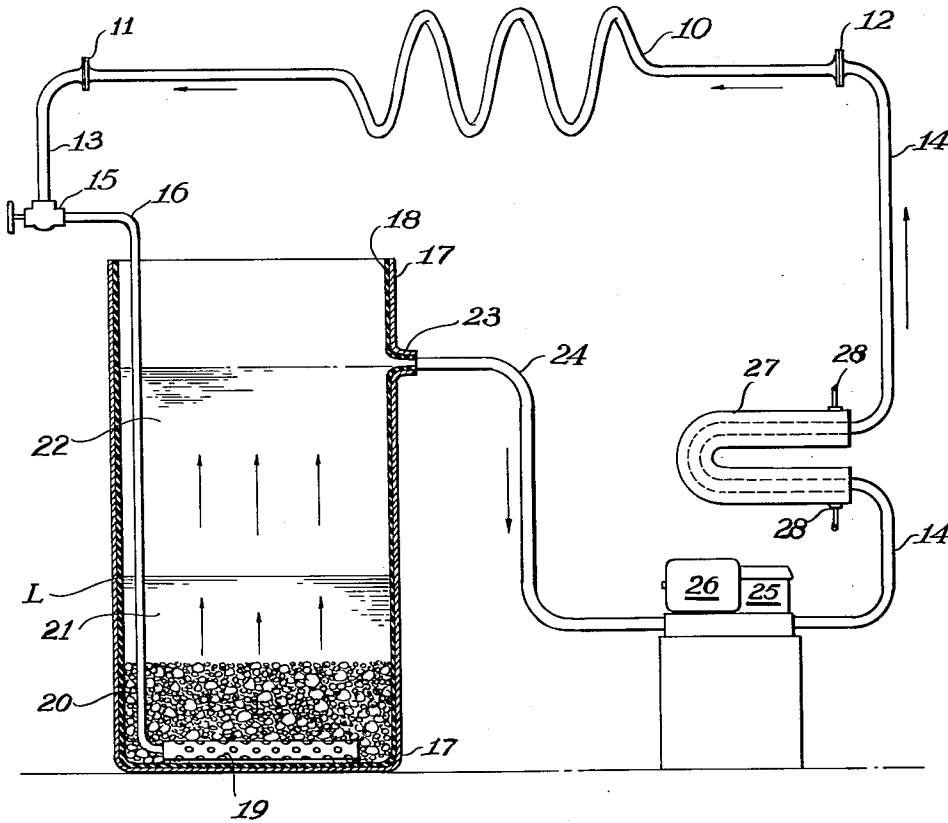
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METHOD OF CLEANING PIPES AND THE LIKE

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METHOD OF CLEANING PIPES AND THE LIKE
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This invention relates to a method of cleaning pipes and the like and more particularly to a method by which pipes may be cleaned so as to remove mill scale and other undesirable materials therefrom while simultaneously coating the pipes with a phosphate to prevent oxidation thereof.

The principal object of the invention is the provision of a method of cleaning pipes and the like and preventing oxidation therein.

A further object of the invention is the provision of a method of cleaning pipes and the like that will degrease the same and simultaneously remove mill scale therefrom.

A still further object of the invention is the provision of a method of cleaning pipes and the like through the use of a phosphoric acid ester in a hydrocarbon to degrease and clean the pipes simultaneously.

A still further object of the invention is the provision of a method of continuously cleaning pipes and the like and incorporating means for removing mill scale and the like from the cleaning solution.

The method for cleaning pipes disclosed herein comprises an improvement in an art which has heretofore deemed it necessary to clean pipes as used with various mill equipment by pumping a degreasing material through the same flushing them and then circulating hydrochloric acid to remove the mill scale. Such cleaning methods frequently resulted in the serious oxidation of pipes which often offset the material removed in the cleaning operation.

The present invention relates to a method by which the pipes are cleaned and protected against oxidation and which method provides for the removal of greasy substances as well as mill scale and the like without recirculating the mill scale in the pipes being cleaned. Apparatus for practicing the invention is disclosed in the accompanying drawing.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the method hereinafter described and claimed, it being the intention to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

The invention is illustrated in the accompanying drawing, wherein:

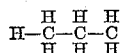
The FIGURE is a schematic diagram of apparatus for handling liquid cleaning material and circulating the same through a pipe to be cleaned.

In the drawing, a pipe 10 to be cleaned has end portions 11 and 12 which are respectively connected with tubes 13 and 14. The tube 13 connects with a valve 15 and a second tube 16 leads from the valve 15 into a container which is lined with an acid resisting substance 18. The second tube 16 connects with a diffuser 19 positioned in the bottom of the container 17. A layer of gravel 20 is positioned in the container 17 above the diffuser 19 and the diffuser 19 and the gravel 20 are covered by a pool of hydrochloric acid 21 the top level of which is indicated by the letter L. A portion of the container 17 above the hydrochloric acid 21 is filled with a cleaning fluid 22, up to an outlet 23.

A return tubular member 24 connects with the outlet 23 and with a pump 25 which is adapted to be driven by a motor 26. The pump 25 also communicates with the tube

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14 heretofore described and the tube 14 extends through a heat exchanger 27 which is illustrated as a jacket type exchanger surrounding a portion of the tube 14. Communication ports 28, 28 provide means for introducing a heated medium such as steam into the heat exchanger jacket 27 so that a cleaning solution flowing through the tube 14 will be heated thereby. The cleaning solution 22 is an orthophosphoric ester hydrocarbon solution comprising approximately 90% kerosene and approximately 10% by volume of a phosphate. The phosphate of the solution preferably comprises a phosphoric acid ester such as mono di iso-octyl acid orthophosphate (RH_2PO_4) of 168 molecular weight, where the R is an alkyl group



from 5 to 12 carbon atoms inclusive. The cleaning solution upon being heated to 125° F. is circulated through the pipe 10 where it picks up the grease and dissolves the mill scale and is returned to the container 17 through the diffuser 19 and gravel bed 20 with the mill scale in the form of iron oxide. The hydrochloric acid solution which is approximately 20 to 28% acid then reacts with the mill scale iron oxide in the cleaning solution in the nature of an ion exchanger and thus continually rejuvenates the phosphoric acid ester in the cleaning solution. I believe that the orthophosphoric acid ester reacts with the iron oxide or other metal compound to form a compound or chelate by the replacement of the hydrogen in the acid radical with the metal. The hydrochloric acid reverses this reaction by forming the salt of the hydrochloric acid and restoring the hydrogen in the acid radical of the orthophosphoric acid ester. This is about the same reaction that takes place between ion exchange resins and the metal ions in water to soften it. Instead of a solid and a liquid exchanging ions, the ions are exchanged between two immiscible liquid. The cleaning solution may thus be circulated continuously and will effectively remove greasy deposits from the pipes being cleaned as well as mill scale and oxidation and will not recirculate these products due to the ion exchange action occurring in the container 17 as heretofore described.

It will thus be seen that this method of cleaning pipes and the like relies on the hydrocarbon kerosene as a degreasing agent and on the phosphoric acid ester to remove the mill scale and oxidation from the pipes and effectively phosphatize the surfaces of the pipes being cleaned to prevent oxidation therein subsequent to the cleaning operation. The method also provides for the constant cleaning of the iron oxide from the cleaning solution.

Those skilled in the art will recognize that cleaning mill pipes subject to mill grease and mill scale deposits has heretofore been a lengthy and expensive time consuming operation during which the equipment serviced by the pipes being cleaned was rendered inoperative. Frequently such cleaning operations took as long as 36 hours to complete with the attendant loss of production on the equipment involved.

The present invention discloses a method which can be completed in 6 hours or less with all the advantages attendant thereto and by eliminating the two or three stage degreasing, flushing and acidizing treatments heretofore believed necessary. A better cleaning job results as the pipes cleaned are not subjected to air or water and show no tendency towards further oxidation during the cleaning treatment. The phosphatizing occurring as a result of the cleaning method protects the pipes for an indefinitely long period.

It will accordingly be seen that the method of cleaning pipes and the like disclosed herein meets the several

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objects of the invention and having thus described my invention, what I claim is:

1. The method of cleaning pipes and the like to remove mill scale, rust and greasy deposits therefrom which consists in circulating therethrough and under pressure a solution of a hydrocarbon and a phosphoric acid ester whereby said hydrocarbon emulsifies the greasy deposits and the phosphoric acid ester reacts with the mill scale and rust to form iron oxide and subsequently subjecting said solution to hydrochloric acid whereby said phosphoric acid ester is reconstituted by the hydrochloric acid forming the salt of the hydrochloric acid and restoring the hydrogen in the acid radical of the phosphoric acid ester.

2. The method set forth in claim 1 and wherein the hydrocarbon comprises kerosene and the phosphoric acid ester comprises mono di iso-octyl acid orthophosphate.

3. A method of cycling a cleaning solution through an ion exchanger and a pipe to be cleaned of mill scale, rust and grease and which method comprises circulating a solution of a hydrocarbon and a phosphoric acid ester through said pipe and said ion exchanger whereby said solution

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reacts with said mill scale and rust to form an iron oxide and wherein said ion exchanger includes hydrochloric acid whereby said iron oxide is removed from said cleaning solution by reaction and the phosphoric acid ester content thereof reconstituted thereby.

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Notice of Adverse Decision in Interference

In Interference No. 94,209 involving Patent No. 3,010,853, W. R. Elliott,
METHOD OF CLEANING PIPES AND THE LIKE, final judgment
adverse to the patentee was rendered Dec. 20, 1965, as to claims 1 and 2.
[*Official Gazette May 17, 1966.*]