

Aug. 6, 1929.

J. G. DAVIDSON

1,723,923

INHIBITOR

Filed March 14, 1928

Fig. 1.

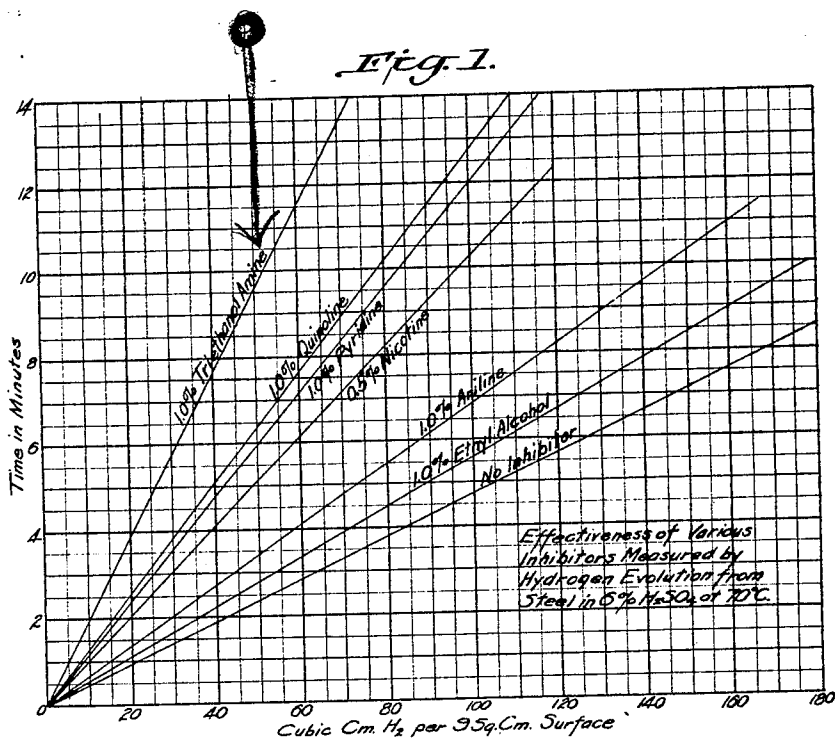
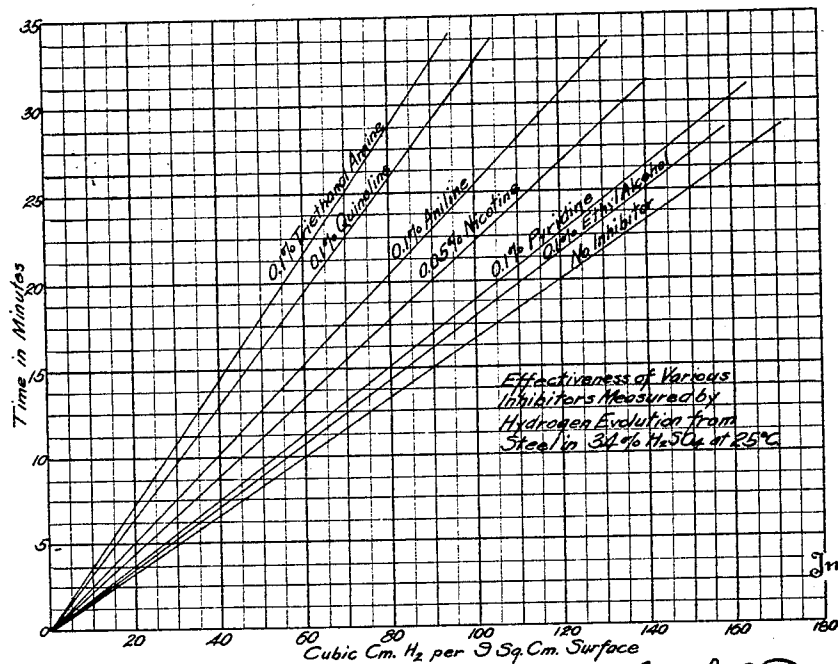


Fig. 2.

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signatures

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Patented Aug. 6, 1929.

1,723,923

UNITED STATES PATENT OFFICE.

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INHIBITOR.

Application filed March 14, 1928. Serial No. 261,676.

My invention relates to pickling baths for steel products, and particularly to new inhibitors for decreasing the rate of solution of metal therein.

5 In the iron and steel industries it is frequently desired that the mill scale be removed from various classes of product, preparatory to such operations as galvanizing, wire-drawing, etc. This is commonly accomplished by pickling the material in acid, usually sulphuric acid in water solution, which may be used in a hot dilute form, or a cold concentrated form. Such acid baths tend to dissolve the steel body as well as the scale coating, resulting in a waste of metal, and leaving the surface dirty and rough, instead of clean and smooth as is desired. Many attempts have been made to reduce the rate of solution of the metal by the addition of such substances as arsenic, lead, barium, various cyanides, glue, flour, formaldehyde, quinoline, pyridine, etc., with varying success.

My invention utilizes the ethanol amines and their homologues as inhibitors in pickling baths, thereby obtaining the new and useful result of a substantial reduction in the rate of solution of the iron base without effect upon the speed and completeness of solution of the scale coating, as well as the avoidance of "hydrogen embrittlement", of small objects such as wire, and a reduction of acid fumes and vapor carried into the air by escaping hydrogen.

Other objects of my invention will be apparent from the following description wherein,

Figures 1 and 2 are curves showing the rate of evolution by hydrogen from steel in a pickling bath treated with my new inhibitor in comparison with the various substances of the prior art, in various concentrations of acid, at various temperatures.

A commercially convenient ethanol-amine substance is a mixture of about three parts of triethanol amine, $N\equiv(CH_2-CH_2-OH)_3$, with one part of diethanol amine $NH=(CH_2-CH_2-OH)_2$. This mixture may conveniently be added to the ordinary acid pickling bath in proportions of 0.5% to 5% or more. Alternatively any one of the three ethanol amines or mixtures thereof may be used instead of the above described mixture, and portions thereof may be re-

placed by the homologues such as the propanol amines, the butanol amines, etc. all of these substances being substituted ammonias of the aliphatic series. The pickling bath when so treated shows an equally high rate of solution of the scale coating, and shows a substantial reduction in rate of solution of the metal, as indicated by the rate of evolution of hydrogen shown in the accompanying curves.

This composition of my invention is further highly advantageous because of the high boiling points of the ethanol amines, which cause them to stay in the pickling bath with a very small loss by evaporation.

The ethanol amines are more conveniently available on the commercial market at the present time and I find them suitable substances for use in the production of an embodiment of my invention. However, the other substances in the homologous series, such as propanol amines, etc., above-mentioned, are equally useable, and it is desired that the use of the words "hydroxy alkyl amines," in the appended claims shall be construed to include not only the ethanol amines as above-mentioned but the higher homologues partaking of the same general nature.

The pickling bath of my invention is particularly usable with steel and iron products, but it is also useable in pickling baths for other metals such as copper etc.

It is likewise useable in other ways than as a pickling bath. I find that a solution of acid as above-described with an addition of the hydroxy alkyl amines is conveniently useable for the cleaning out of pipes and other metal conduits, in situ, the acid and amine solution being passed through the pipes, to remove the lining of scale and obstructing matter which tends to form in piping systems with the passage of time.

By the system of my invention I have thus produced a new and useful type of pickling bath having a much higher efficiency, with a much lower rate of solution of the free metal being cleaned.

While I have described several modifications of the composition of my invention, it is capable of still other modifications therefrom without departure from the spirit thereof and it is desired therefore that only such modifications shall be imposed thereon

as are required by the prior art or indicated by the appended claims.

I claim as my invention:

1. A pickling bath comprising an acid and
5 a hydroxy alkyl amine.
2. A pickling bath comprising an acid in water solution and a dissolved hydroxy alkyl amine.
3. A pickling bath comprising an acid in
10 water solution and a dissolved ethanol amine homologue.
4. A pickling bath comprising a water so-

lution of an acid and a plurality of dissolved ethanol amines.

5. A pickling bath comprising water solu- 15
tion of sulphuric acid and an ethanol amine dissolved therein.

6. A solution having a selective dissolving effect upon oxide compounds comprising a water solution of acid and a hydroxy alkyl 20
amine.

In testimony whereof, I affix my signature.

JOSEPH G. DAVIDSON.