

UNITED STATES PATENT OFFICE

2,428,804

COPPER CLEANING COMPOSITION

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Philadelphia, Pa.No Drawing. Application September 7, 1945,
Serial No. 615,067

1 Claim. (Cl. 252-100)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

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This invention relates in general to the cleaning of copper and copper containing materials, and in particular to a composition of matter for use therein.

It is another object to provide a new copper cleaning composition.

Further objects and advantages of this invention as well as its use and operation will be apparent from the following description and claim.

According to this invention copper or a copper containing article is cleaned by treating it under conditions hereinafter to be described with a substantially homogeneous cleaning agent comprising an acid, an oxidizing agent and a brightening agent, with or without the addition of a diluent.

A wide variety of acids may be used in the cleaning agent, including for example, acids as widely different in characteristics as sulfuric acid, phosphoric acid, formic acid and the like. There may be used both organic and inorganic acids either alone or in combinations; likewise there may be used oxidizing and non-oxidizing acids.

The purpose of the acid in the cleaning agent is to dissolve the readily acid-soluble constituents of the corrosion from the surface of the copper containing article. As an additional advantage, the acid serves to stabilize the cleaning agent, in which capacity it is effective when the cleaning agent contains an oxidizing agent which is unstable under neutral or alkaline conditions.

It will be understood that there is wide freedom of choice in the selection of a suitable acid, and that there is no limitation to specific acids set forth in the specification.

For the oxidizing agent there is used a moderately strong oxidizing agent, either organic or inorganic. The purpose of the oxidizing agent is twofold: first, it oxidizes the relatively insoluble cuprous compounds to the relatively more soluble and more readily attacked cupric compounds; and second, it very slowly oxidizes copper itself from the surface of the copper containing article, thus encouraging a "flaking off" action. The flaking off action removes from the surface of the article various insoluble and inert foreign matter which frequently is entrapped by the naturally forming tarnish or corrosion, and presents a new, and accordingly a bright, clean surface. An oxidizing agent which has been found admirably suited to these purposes is hydrogen peroxide, and in the presently preferred embodiment of the invention hydrogen peroxide is now being used; however, it will be understood that the selection of the oxidizing agent is not limited thereto.

The third operative constituent of the cleaning agent is a brightening agent comprising substances such as, for example acetic acid, cream of tartar (potassium acid tartrate) citric acid,

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glycollic acid and the like. In general it may be said that the brightening agent is a weakly acidic compound such as an organic acid or an organic acid salt; however, it is obvious that other non-organic or non-acidic substances may be used for this purpose and that their selection is within the skill of one trained in the art.

It will be seen from an examination of the constituents described herein that numerous of the brightening agents may also be used as the acidifying agent, and accordingly it is within the scope of this invention that there may be provided a cleaning composition comprising an oxidizing agent and an acidifying-brightening agent; however it is usually the case that more advantages may be obtained when two different compounds are used for these two different purposes and the combined effects of the two compounds are realized.

When the cleaning composition is dissolved in water or an aqueous solution to provide a cleaning solution in which the article may be cleaned by simple immersion there may optionally be added a detergent or wetting agent to increase the effectiveness of the cleaning agent in removing tarnish or corrosion from cracks and crevices. Alternatively, the cleaning composition may be carried in a conventional paste or cream emulsion, and in this form is particularly adapted for local application where the article contains elements which might be harmed by immersion in a low viscosity solution. Various other vehicles and diluents will be obvious and will have obvious advantages for particular desired results.

The following specific example is given to illustrate the invention as adapted to provide a cleaning solution for the removing of tarnish and corrosion by immersion. It will be understood, however, that this example is given solely for the purposes of illustration, and that the scope of the invention is not to be limited to or by the scope of this example.

A liquid cleaning solution is prepared by dissolving 5 parts by weight of sulfuric acid, $4\frac{1}{2}$ parts of hydrogen peroxide (30% H_2O_2) and 3 parts acetic acid (glacial) in $87\frac{1}{2}$ parts of water. The resulting solution is relatively stable, to the extent that even upon being maintained at about 35° to 40° C. for sixteen 8-hour periods on successive days this solution will lose only about 3.3% of its original strength as determined by available hydrogen peroxide. After intermittent use for several months during which time the solution may accumulate various types of impurities including corrosion products of copper and its alloys, paint, oil, grease, dirt, and the like, there will be no noticeable decrease in efficiency.

100 grams of this cleaning solution is sufficient to clean successively a number of copper surfaces totalling approximately 200 square inches in

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about 7 to 15 minutes for each article cleaned, at a temperature of about 23 to 30° C. At the end of this time or after subsequent periods of use, the solution may be replenished, if necessary, by the addition of hydrogen peroxide or acid as required.

Wood, varnish and similar materials are not visibly affected by immersion in this solution for one hour at room temperature, and an article containing these materials may, in general, be cleaned most satisfactorily by complete immersion in the cleaning solution. Lead, aluminum, tin, iron, and similar metals are attacked by the solution.

The solution has only slight effect on the surface of the copper containing article, and immersion of copper in the solution for 10 minutes at 20° C. causes a loss of about 9 mg. of copper per square inch.

The method of using this cleaning solution will vary, depending on the nature of the article to be cleaned, the type of soil or corrosion products, and the degree and character of cleaning desired. Where the cleaning solution is used on extremely difficult cases of corrosion or the like, or where a more rapid cleaning is desired, the cleaning bath may advantageously be heated. By protracting the immersion time, if desired, a variety of surface finishes may be obtained. For average conditions the following procedure will work satisfactorily.

An article to be cleaned is completely immersed in a bath of the cleaning solution for about 10 minutes at about 25° C. When the tarnish is substantially dissolved or loosened, the article is removed from the bath and rinsed in a suitable manner either in a water bath or in running water. If a crust remains on portions of the surface it may usually be removed by brushing during the rinsing period. If necessary, a second immersion in the cleaning bath will remove final traces of tarnish, corrosion or other dirt.

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By the use of this invention it is now possible to remove tarnish and the products of atmospheric corrosion as well as dirt and impurities of widely varying nature from articles and parts composed of copper and copper alloys. The invention permits the cleaning of articles without their disassembly when the copper is used in conjunction with wood, porcelain and other non-metallic materials, and as well with numerous corrosion resisting metals. The articles may be cleaned rapidly, effectively and safely with a minimum of effort and disturbance and a maximum thoroughness.

It is to be understood that various modifications and changes may be made in this invention without departing from the spirit and scope thereof as set forth in the appended claim.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

A copper cleaning composition comprising approximately 5 parts by weight of sulphuric acid, 4½ parts of 30% hydrogen peroxide, 3 parts of acetic acid, and 87½ parts of water.

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