Title: AQUEOUS METAL FINISHING SOLUTION, METHODS FOR FINISHING METAL COMPONENTS, SYSTEM FOR CLEANING METAL COMPONENTS AND FINISHED BRASS PRODUCTS

Abstract: An improved method of finishing metal components, such as brass fittings, is provided. The method employs a finishing solution comprised generally of an aqueous solution of organic acid, oxidizing agent and oxidation stabilizer. As such, the finishing of the metal component can be carried out in a single process tank and only requires a single set of rinses. The improved method provides a more efficient and economical process, while also providing a chromium-free finishing solution.
FIELD OF THE INVENTION

[0001] The invention relates to an improved brass bright dip solution and method for finishing brass components, and more specifically to a chromium-free solution and process for finishing brass components.

BACKGROUND OF THE INVENTION

[0002] Brass components, such as, for example, fittings, are typically finished prior to use or installation by contact with a finishing solution. Such a finishing removes oxides that form along the surfaces of the brass components, thereby reducing corrosion and making the component more stable for clean environments. In addition, depending on the desired aesthetic appearance for the finished brass component, copper or zinc can be dissolved in the finishing solution at a greater rate, thereby leaving a copper-enriched surface or a zinc-enriched surface. If it is desirable to have a yellow-gold appearance, the finishing solution should dissolve copper at a higher rate than zinc, thereby leaving a zinc-enriched surface. If it is desirable to have more of an orange tint, the finishing solution should dissolve zinc at a higher rate than copper, thereby leaving a copper-enriched surface.

[0003] Current techniques are cumbersome, relatively expensive and produce large amounts of waste water that must be treated. Current processes employ three different process tanks, a pre-dip acid tank filled with nitric acid, an acid mix tank filled with a solution of nitric acid, sulfuric acid, and hydrochloric acid, and a brightening or finishing tank filled with a solution of sodium dichromate and sulfuric acid. After each of these process tanks a series of rinse tanks is employed. After rinsing the components, the rinse water must be treated prior to recycling. Furthermore, since the process involves hexavalent chromium, which many European regulations prohibit, it is desirable to eliminate chromium compounds from the finishing solution.

SUMMARY OF THE INVENTION

[0004] An improved brass bright dip solution and method for finishing brass components is provided herein. The brass bright dip solution is a finishing solution that leaves components with an oxide-free surface with a yellow-gold luster. The method and solution of the present invention is a chromium free process.
In one embodiment the finishing solution is an aqueous solution of organic acid, an oxidizing agent, and an oxidization stabilizer. In one particular embodiment, the finishing solution is comprised of an aqueous solution of citric acid, hydrogen peroxide, and a hydrogen peroxide stabilizer.

Another aspect of the present invention is an improved method of finishing metal components, such as brass fittings. The improved process employs a single processing tank and only one rinse cycle. As such, the improved method employs less rinse water, only one process fluid to create, monitor and control, and provides an easier treatment of the used rinse water.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention may be more readily understood by reference to the following drawings. While certain embodiments are shown as illustrative examples of the present invention, the scope of this application should not be construed as limited to these illustrative examples.

**DETAILED DESCRIPTION OF THE INVENTION**

The present invention provides a composition for finishing components, specifically brass components, and an improved method for finishing such components. While the description of the invention is generally directed to brass components, such as, for example, a fitting, other types of components can be finished employing the same solution and process. For example, it is contemplated that the composition and process of the present invention can be employed for finishing various copper alloys, such as, for example, bronze and pewter, zinc alloys, tin alloys, nickel alloys and other such alloys. Furthermore, while the invention is generally described herein as a solution, other compositions are possible, such as, for example, dispersions.

The finishing solution is generally comprised of an aqueous solution of an organic acid, an oxidizing agent and an oxidant stabilizer. Preferably, the aqueous solution is formed with deionized water. The organic acid can be any mild organic acid such as, for example, gluconic acid, salicylic acid, citric acid, or mixtures thereof. However citric acid is preferred. It is preferable to use an organic acid with a pH in the working range of about 0.75 to about 1.65. In one embodiment, the oxidizing agent is hydrogen peroxide, however other oxidizing agents can be used. Other oxidizing agents that can be used include inorganic acids, such as, for
example, nitric acid, sulfuric acid and phosphoric acid. The oxidant stabilizer can be 244 PCM Stabilizer, which is a mixture of p- hydroxy benzenesulfonic acid and sulfuric acid and proprietary ingredients and made by M.F. Good Company, acetanilide, or other comparable components.

[0011] In one embodiment, the finishing solution is comprised of about 150 to about 250 grams per liter organic acid, about 5 to about 8 percent by volume oxidizing agent, about 4 percent to about 7 percent by volume oxidant stabilizer, and the balance water.

[0012] In one particular embodiment, the finishing solution is comprised of an aqueous solution of citric acid, hydrogen peroxide, and 244 PCM Stabilizer. The solution can comprise about 50 to about 300 grams per liter of citric acid, or as much as about 600 grams per liter, about 1.5 percent to about 30 percent by volume hydrogen peroxide, about 2 percent to about 7 percent by volume 244 PCM Stabilizer, and the balance deionized water. Optionally, the 244 PCM Stabilizer can be replaced with about 0.02 to about 0.2 grams per liter of acetanilide. Preferably, the finishing solution comprises about 150 to about 200 grams per liter of citric acid, about 5 percent to about 8 percent by volume hydrogen peroxide, about 4 percent to about 7 percent 244 PCM Stabilizer, and the balance deionized water. More preferably, the solution finishing comprises about 200 grams per liter of citric acid, about 6.5 percent by volume hydrogen peroxide, about 5 percent 244 PCM Stabilizer, and the balance deionized water. The preferred finishing solution mentioned in this disclosure is ideal for creating a bright yellow-gold luster for brass components. By varying the components, such as by providing a solution that dissolves zinc at a higher rate than copper, brass components can be created with an orange luster. For example, this can be achieved by lowering the citric acid below 100 grams per liter or by replacing the citric acid with nitric acid. Furthermore, by using this solution or other solutions made by varying the components, other alloys, such as, for example, bronze or pewter, can also be finished.

[0013] The finishing solution may conveniently be made by adding citric acid, in crystalline form, to deionized water at room temperature. The mixture is then stirred until all the citric acid crystals dissolve. The hydrogen peroxide stabilizer is then added to the solution. Finally the hydrogen peroxide is added. The solution is then mixed to form a homogenous solution. Similar solutions can be made in a similar fashion.

[0014] Figure 1 illustrates a convenient way of finishing brass components with the preferred finishing composition described above. In order to finish the brass components, the components are dropped into the process tank 10 filled with the finishing solution. Optionally, grease, oils,
soils, and other contaminants can be removed in an alkaline rinse tank 15 prior to placement of the components into the process tank 10. The finishing solution can be maintained any temperature between its boiling and freezing points, although it is most convenient to operate at room temperature. Preferably the finishing tank operates at a temperature between about 60°F and about 90°F, and it is even more preferable to operate the finishing tank at a temperature between about 70°F and about 80°F. Furthermore, in order to facilitate uniform finishing, one or more tumblers 20 can be placed in the process tank 10. Any type of tumbler can be used provided it tumbles, turns or otherwise agitates the components. The components are submerged in the solution for a time sufficient to remove the oxides, which is typically between about 30 to about 120 seconds, and more typically about 60 seconds, depending on the degree of finishing desired as well as the concentrations of ingredients in the finishing solution.

[0015] After the finishing process is complete, the components are removed from the process tank 10 and rinsed in one or more rinse tanks 30. In one embodiment three counter-flow rinse tanks using deionized water are used, however the number of rinse tanks used can vary depending on the volume, flow, and purity desired. Rinse water from the rinse tanks can directly contact the metal component, thereby avoiding an acid-treatment step. Water from the rise tanks 30 is then transferred to a treatment facility 35 to remove any contaminants prior to recycling of the water. The treatment facility can provide for treatment of the used rinse water in a single step, as opposed to the multiple treatment steps required by the prior art process. The components are then dried, preferably by one or more forced hot air dryers 40.

[0016] If the preferred finishing solution mentioned above is used, the resulting finished product is a brass component with a bright yellow-gold luster. The surface of the brass component is essentially oxide free and is zinc enriched. By employing the method mentioned above, the process of finishing components is greatly simplified. In comparison to conventional methods, the time to finish products is greatly reduced. Furthermore, less chemicals and less processing tanks are required. In addition, only one processing solution needs to be monitored and controlled, whereas in conventional methods three different processing solutions must be monitored and controlled. A further advantage of the present invention is the avoidance of highly corrosive acids, such as nitric acid, sulfuric acid and hydrochloric acid, and carcinogenic chromium compounds. An even further advantage is the reduction in the number of rinse cycles, and thus a reduction in the amount of rinse water used and a reduction in the amount of water that must be treated. Also, since the acid employed is less corrosive and there is an absence of chromium compounds, the rinse water treatment process is greatly simplified.
[0017] The present invention has been described with reference to the preferred embodiments. However, it should be appreciated that alternations and modifications are possible and that describing each of these alternations or modifications is not possible. As such, it should be appreciated that these alternations are within the scope of the present invention to the extent they fall within the scope of the claims included herewith.
CLAIMS

1. An aqueous finishing solution comprising an organic acid, an oxidizing agent, and an oxidant stabilizer.

2. The finishing solution of claim 1, wherein the organic acid is citric acid, gluconic acid, salicylic acid, or combinations thereof.

3. The finishing solution of claim 1, wherein the oxidizing agent is hydrogen peroxide.

4. The finishing solution of claim 1, wherein the oxidant stabilizer is 244 PCM Stabilizer, acetanilide, or combinations thereof.

5. The finishing solution of claim 1, wherein the solution is comprised of about 150 to about 250 grams per liter organic acid, about 5 to about 8 percent by volume oxidizing agent, about 2 percent to about 7 percent by volume oxidation stabilizer, and the balance water.

6. The finishing solution of claim 5, wherein the organic acid is citric acid, the oxidizing agent is hydrogen peroxide, and the oxidant stabilizer is 244 PCM Stabilizer.

7. The finishing solution of claim 1, wherein the finishing solution is chromium-free.

8. A method of finishing a metal component, comprising the steps of:

   contacting the metal component with an aqueous finishing solution comprising an organic acid, an oxidizing agent, and an oxidant stabilizer.

9. The method of claim 8 further comprising the step rinsing the components with rinse water.

10. The method of claim 8, wherein said solution is chromium-free.

11. The method of claim 8 further comprising the step of drying the components with one or more forced hot air dryers.

12. The method of claim 8 further comprising the step of cleaning the components in an alkaline rinse prior to contacting the components with said finishing solution.
13. The method of claim 8, wherein the component is submerged in the finishing solution, and the method further comprises the step of tumbling the component while submerged in the in the finishing solution.

14. The method of claim 9, wherein the components are rinsed by three counter-flow deionized water rinse tanks.

15. The method of claim 9 further comprising the step of treating the rinse water in a single step.

16. A system for cleaning metal components comprising:

   one process tank containing an aqueous solution comprising an organic acid, an oxidizing agent, and an oxidation stabilizer; and

   one or more rinse tanks proximate to said process tank.

17. The system of claim 16, wherein said one or more rinse tanks are counter-flow deionized water rinse tanks.

18. The system of claim 16, further comprising one or more force hot air dryers.

19. The system of claim 16, further comprising one or more tumblers located within said process tank.

20. A method for removing oxides from the surface of a metal component to thereby produce a finished metal component comprising the steps of:

   (1) contacting the component with an aqueous finishing solution;

   (2) directly contacting the component produced in step (1) with rinse water to thereby produce said finished metal component.

21. The method of claim 20, wherein said aqueous solution is comprises an organic acid, an oxidizing agent, and an oxidation stabilizer.

22. A brass product finished by the process comprising the steps of:

   contacting the metal component with an aqueous finishing solution comprising an organic acid, an oxidizing agent, and an oxidation stabilizer.
23. A method of finishing a metal component comprising the steps of:

contacting the metal component with a finishing solution, wherein said finishing solution
is comprised of an acid with a pH between about 0.75 and about 1.65; and

rising the metal component with rinse water.

24. The method of claim 23 wherein said finishing solution is contained in a single tank.

25. The method of claim 23, wherein the metal component is rinsed by three counter-flow
deionized water rinse tanks.

26. The method of claim 23 further comprising the step of treating the rinse water in a single
step.

27. The method of claim 23 wherein the metal component is brass.

28. A method of finishing a metal component comprising the steps of:

contacting the metal component with a single finishing solution contained in a single
process tank; and

rising the metal component with rinse water.

29. The method of claim 28, wherein the metal component is rinsed by three counter-flow
deionized water rinse tanks.

30. The method of claim 28 further comprising the step of treating the rinse water in a single
step.

31. The method of claim 28 wherein the metal component is brass.
FIG. 1

WATER TREATMENT

FINISHED PRODUCT

AIR DRYER

RINSE TANKS

PROCESS TANK

ALKALINE RINSE
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C23F3/06 C23F3/00 C23G1/10 C23G1/02

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C23F C23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance
  *E* earlier document but published on or after the international filing date
  *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  *O* document referring to an oral disclosure, use, exhibition or other means
  *P* document published prior to the international filing date but later than the priority date claimed

*"T"* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

*"X"* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

*"Y"* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

*"A"* document member of the same patent family

Date of the actual completion of the international search: 6 August 2004

Date of mailing of the international search report: 18/08/2004

Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax (+31-70) 340-3016

Authorized officer: Torfs, F

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Continuation of Box II.2

Claims Nos.: 5,6

In claim 6, the stabilizer is identified by a trade name. Since the trade names cannot be regarded as internationally accepted standard descriptive terms having a precise technical meaning, they are not allowable in a claim. Hence, claim 6 is not allowable for lack of clarity. The term "percent by volume" in claim 5 can only relate to the commercial product since acetanilide is a solid compound. Consequently also claim 5 is not allowable for lack of clarity.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.
INTERNATIONAL SEARCH REPORT

Box II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 5, 6
   because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
   see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest
☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

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<td>13-09-1988</td>
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