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NONFERROUS METAL BURNISHING COMPOSITION AND BURNISHING PROCESS

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The present invention relates to the surface finishing treatment of non-ferrous metals, such as brass and copper, more commonly known in the art as "burnishing," wherein the metallic articles to whose surface is to be imparted the desired bright finish or luster, are subjected to a tumbling treatment in an aqueous solution, together with other solid particles or burnishing elements such as steel balls, flint chips, wood pegs, wood chips, etc. It is the general objective of such a burnishing treatment to perform two functions: first, the removal of any tarnish on the non-ferrous metal surface, and secondly the lusterizing, brightening or polishing of such surface, without causing the redeposition of a tarnish.

Heretofore such burnishing metal treatments have been carried out in an aqueous solution containing soap and sodium cyanide, or one containing a wetting agent such as ispropyl naphthalene sulfonate. The burnishing treatments accomplished by the use of such aqueous solutions however, have been found to be deficient in that they would not accomplish both of the desired functions of removing tarnish and brightening of the metal surface without tarnish redeposition.

I have discovered that this dual function objective can be attained by performing the burnishing treatment in an aqueous solution containing a synthetic organic wetting agent, preferably one derived from a long chain alkoxy compound, and containing an alkylenepolyamine. Only very small amounts of such wetting agent and alkylenepolyamine need be present in the aqueous solution to achieve the desired result. Thus 0.005–0.05% by weight (all percentages herein given by weight unless otherwise specified) of alkylenepolyamine and 0.05–0.1% of long chain alkoxy-derivative wetting agent, represent suitable and operative range concentrations of these ingredients.

In making up a composition suitable for use in the burnishing operation, i. e., by further dilution with water, a composition consisting of 5–20 parts by weight of wetting agent and ½–2 parts of alkylenepolyamine, represents preferred range proportions. When such composition is to be made in liquid form, as a concentrated stock solution for use by the burnishing operator, then water may be added to the last given range proportions of ingredients in a quantity sufficient to make a total of 100 parts.

The long chain alkoxy-derivative wetting agent ingredient of my composition is commercially available under various trade names, such as

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"Cerfak N–100" and "Cerfak N–101" (a sulfonated condensation product of an alcohol and a higher fatty acid); "Arctic Syntex M" (a sodium salt of a sulfonated glycerol-higher fatty acid monoester corresponding to the chemical formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical); "Alrosol" (an alkanolamine-higher fatty acid condensation product); "Duponol ME," dry and "Duponol G" (the sodium salts of sulfated higher alkanols, principally lauryl alcohol).

As the alkylenepolyamine ingredient of my composition, it has been determined that ethylene diamine, propylene diamine and triethylene tetramine are most suitable and to be preferred.

Monoethanolamine is preferably added to the composition of my invention as a stabilizing and an alkaline pH control agent, and in an amount equal to one-half that of the wetting agent; or in a range proportion of 0.025–0.05% concentration in the final burnishing solution.

In order to determine the operability and efficiency of the compositions of my invention, they have been subjected to a "tarnish removal test" and "luster test," the conditions and specifications of which are as follows:

Tarnish removal test

Specimens of brass plate, measuring 3" x 1½", with ⅜" on each of the 1½" width ends bent over at right angles, are placed in a rubber lined, closed tumbling barrel together with 50 lbs. of ¼" diameter steel balls. This tumbling barrel, mounted on a horizontal axis, is driven at a speed of 30 R. P. M. The specimen brass plates before charging into the barrel, are first degreased with an alkaline detergent, and then given a tarnish by the following procedure:

1. Immersed in a 2% caustic soda solution at 35° C. and subjected to a 2.8 ampere current for 1 minute, with the brass specimen as the anode.
2. Subjected to the same electrolytic treatment in the same caustic soda solution for 1 minute, but at a current of 0.25 ampere.
3. Removed from caustic soda solution, held in the air for 1 minute and rinsed off with water.

The burnishing composition is made up at a concentration of 1 liquid ounce per gallon in tap water of medium hardness (approximately 7 grain hardness) in an amount to make two liters of solution which is then added to the tumbling barrel whereupon the tarnished brass specimens,

together with the steel balls, are tumbled for a one-half hour period. The light reflectance, measured by means of a reflectometer, of the tarnished brass specimens is measured prior to their charging into the tumbling barrel and then after the one-half hour burnishing treatment. An average of initial and of final reflectances is thus made and the increase in average reflectances obtained.

Luster test

The brass plate specimens of the same dimensions as under the tarnish removal test specifications given above are degreased with an alkaline metal cleaner and then dipped for 30 seconds in a 10% sulfuric acid solution at room temperature, in order to remove any tarnish. The so-treated brass specimens are then subjected to a one hour burnishing treatment in the rubber-lined tumbling barrel described above. Average initial and final reflectance readings are similarly obtained upon these so-treated samples. The increase in reflectance constitutes a measure of the efficiency of the burnishing action, and the presence or absence of a tarnish on the burnished specimen is visually observed in order to determine whether there has been a redeposition of tarnish from the burnishing treatment.

Several different alkyl amines in the amount of 2% were added to a 10% stock solution of wetting agent consisting of a sulfonated condensation product of an alcohol and higher fatty acid ("Cerfak N–101"). This stock solution was then made up into a burnishing solution at a concentration of one liquid ounce of stock solution per gallon of tap water. Results of tarnish removal and luster tests upon such compositions were as follows:

Table I

2% Alkylamine Addition to 10% Wetting Agent Solution	Tarnish Removal Test			Luster Test			Appearance
	Initial Reflectance	Final Reflectance	Reflectance Increase	Initial Reflectance	Final Reflectance	Reflectance Increase	
None	21.0	40.0	19.0				
Monoethylamine	18.5	38.5	20.0	49.0	75.5	26.5	Slight Tarnish.
Triethylamine	17.0	38.0	21.0	42.5	73.0	30.5	Do.
Monoamylamine	21.5	40.5	19.0	42.0	75.0	33.0	Do.
Ethylene Diamine [1]	19.5	67.0	47.5	43.5	76.5	32.5	Bright.

[1] 67% solution of ethylene diamine.

From the foregoing it will be seen that the alkyl monoamines were unsatisfactory in that they did not produce a sufficient reflectance increase to remove tarnish in the first instance, and that in the luster tests, even though a substantial increase in reflectance was obtained, tarnish redeposition occurred. On the other hand, in the case of the alkylenepolyamine, namely ethylene diamine, not only was there over twice the increase in reflectance in the tarnish removal test, but there was a substantial reflectance increase in the luster test, with no redeposition of tarnish.

A stock solution was made up consisting of 10% of the same wetting agent as employed in the results shown in Table I, plus 5% monoethanolamine, and varying percentage proportions of different alkylenepolyamines. These solutions were then similarly tested and with the following results:

Table II

Amine Addition to 10% Wetting Agent—5% Monoethanolamine Solution	Tarnish Removal Test			Luster Test			Appearance
	Initial Reflectance	Final Reflectance	Reflectance Increase	Initial Reflectance	Final Reflectance	Reflectance Increase	
None	20.0	39.5	19.5	44 0	61.0	17.0	Tarnished.
Ethylene Diamine * ¼%				44.5	75.0	30.5	Bright.
Ethylene Diamine * ½%				42.5	71.5	29.0	Do.
Ethylene Diamine * ¾%	22.5	59.5	37.0	43.0	74.5	31.5	Do.
Ethylene Diamine * 1%				48.0	80.5	32.5	Do.
Ethylene Diamine * 2%				45.0	81.0	36.0	Do.
Propylene Diamine ½%	17.5	66.0	48.5	42.0	75.5	32.5	Do.
Triethylene Tetramine 2%							

* 67% solution of ethylene diamine.

From the foregoing it will be seen that the addition of the alkylenepolyamine noted, in the amount ranging from ½–2% (viz. ⅛%×67% equals ½% ethylene diamine on the anhydrous basis), satisfies both the tarnish removal and the luster tests.

Preferred formulations of the burnishing composition embodying the principle of my invention and satisfactory for commercial use as concentrated or stock solutions for subsequent dilutions by the burnishing operator are given as follows:

Example 1

	Per cent
Wetting agent, sulfonated condensation product of an alcohol and a higher fatty acid ("Cerfak N–100" or "Cerfak N–101")	10
Monoethanolamine	5
Ethylene diamine (67% solution)	2
Water	Balance

Example 2

	Per cent
Wetting agent, sodium salt of sulfonated glycerol-higher fatty acid monoester ("Arctic Syntex M")	20
Ethylene diamine (67% solution)	2
Water	Balance

Example 3

	Per cent
Wetting agent, sodium salt of sulfonated glycerol-higher fatty acid monoester ("Arctic Syntex M")	20
Monoethanolamine	5
Ethylene diamine (67% solution)	½
Water	Balance

Example 4

	Per cent
Wetting agent, alkanolamine-higher fatty acid condensation product ("Alrosol")	10
Monoethanolamine	5
Ethylene diamine (67% solution)	½

Example 5

	Per cent
Wetting agent, sulfonated condensation product of an alcohol and a higher fatty acid ("Cerfak N–101")	10
Monoethanolamine	5
Propylene diamine	½

Example 6

	Per cent
Wetting agent, sulfonated condensation product of an alcohol and a higher fatty acid ("Cerfak N–100" or "Cerfak N–101")	10
Monoethanolamine	5
Triethylene tetramine	2
Water	Balance

The compositions of all the foregoing Examples 1 to 6, when employed at a concentration of approximately one liquid ounce per gallon of aqueous solution, in addition to satisfactorily meeting the tarnish removal and luster tests hereinabove described, have also enjoyed excellent tarnish removal and brightening results in commercial burnishing operations.

Equivalent modes of practicing my invention may be followed provided that they are within the scope and purview of the appended claims.

I, therefore, distinctly claim and particularly point out as my invention:

1. The method of removing tarnish and polishing brass articles, which comprises ball-burnishing said articles in an aqueous solution containing 0.05%–0.1% by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; and 0.005%–0.05% of ethylene diamine.

2. The method of removing tarnish and polishing brass articles, which comprises ball-burnishing said articles in an aqueous solution containing 0.05%–0.1% by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; 0.005%–0.05% of ethylene diamine, and 0.025%–0.05% of monoethanolamine.

3. The method of removing tarnish and polishing brass articles, which comprises ball-burnishing said articles in an aqueous solution having a concentration of approximately one liquid ounce per gallon of a composition consisting of 10 parts by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; 5 parts of monoethanolamine, 1½–2 parts of ethylene diamine and a quantity sufficient of water to make 100 parts.

4. The method of removing tarnish and polishing brass articles, which comprises ball-burnishing said articles in an aqueous solution containing 0.05%–0.1% by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; and 0.005%–0.05% of an alkylene-polyamine selected from the group consisting of ethylene diamine, propylene diamine and triethylene tetramine.

5. A metal burnishing composition in liquid form consisting of 5–20 parts by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; and ½–2 parts of an alkylene-polyamine selected from the group consisting of ethylene diamine, propylene diamine and triethylene tetramine; and the balance consisting essentially of water.

6. A metal burnishing composition in liquid form consisting of 5–20 parts by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; 1½–2 parts of an alkyleneployamine selected from the group consisting of ethylene diamine, propylene diamine and triethylene tetramine; and a quantity sufficient of water to make 100 parts.

7. A metal burnishing composition in liquid form consisting of 5–20 parts by weight of a wetting agent selected from the group consisting of the sodium salt of sulfonated glycerol-higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical and the sodium salt of sulfated lauryl alcohol; and 1½–2 parts of ethylene diamine, the balance consisting essentially of water.

8. A metal burnishing composition in liquid form consisting of 20% by weight of the sodium salt of sulfonated-glycerol higher fatty acid mono-ester corresponding to the formula:

$$RCOOCH_2CHOHCH_2OSO_3Na$$

where RCOO represents a mixed coconut oil-fatty acid radical; 5% of monoethanolamine, ½% of ethylene diamine solution of 67% strength, and the balance water.

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