UNITED STATES PATENT OFFICE.

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METHOD OF AND COMPOSITION FOR CLEANING METALS.

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To all whom it may concern:

Be it known that I, JAMES H. GRAVELL, a citizen of the United States, residing at Elkins Park, in the county of Montgomery and State of Pennsylvania, have invented a certain new and useful Method of and Composition for Cleaning Metals, of which the following is a specification.

This invention relates generally to cleaning metals and particularly to cleaning iron and steel, preparatory to painting.

The principal objects of the invention are, first, to provide a method and an admixture or composition for cleaning steel which will be effective even when the metal is both oily and rusty; and second, to hasten the cleaning action of an acid in cases where the rust on the surface of the metal is excessive or where the surface is unduly oily.

In order to accomplish this I combine or admix with the acid fusel oil which is a solvent of mineral oil and is peculiarly adapted for the production of commercially practical and improved industrial results. In such an admixture, however, the fusel oil tends to separate from the acid (or vice versa) and although the admixture works satisfactorily in the hands of an expert workman, it cannot be used to advantage where care is not exercised, and in order to overcome this difficulty, I add to the admixture an agent in which it is miscible, such, for instance, as alcohol or acetone, making a homogeneous fluid.

Such an admixture will not act rapidly on a rusty surface, owing to the fact that little or no water is present to dissolve the salts produced by the acid, but this is corrected by the addition of water and I have discovered that water may be added to the above admixture without causing the ingredients to separate.

My admixture, therefore, primarily consists of an acid and fusel oil, and to this may be added, to improve it, a liquid capable of dissolving the two, and the admixture may be still improved in its rapidity of action by the addition of water.

According to my invention the admixture may be applied to the metal by brushing or spraying or the metal may be immersed in the admixture.

After the admixture has remained on the surface of the metal a sufficient time to attack the surface, which may be both oily and rusty, the metal is washed with water and allowed to dry in which case it is ready for further commercial operations such as fabricating with dies or painting.

Sulfuric, nitric and hydrochloric acids clean steel and their application to that use is helped by the addition of fusel oil. However, such acids cause the steel to subsequently rust, but I find that if a phosphoric or any other acid whose iron salts are permanent in the air is used, the steel is not only freed from this tendency to rust but is put in practically a non-rusting condition, so that when phosphoric acid is used in my admixture, the admixture is highly valuable for preparing metal for painting because metal treated according to my process then will not rust under the paint, even though it had a strong tendency to rust due to acid runs, hand-marks, soldering solutions, etc., on the surface prior to the application of my admixture.

I have found by experiment that the following formula produces a highly satisfactory cleaning agent. The proportions given are by volume:

Phosphoric acid (85% solution)	1 part
Alcohol	1 part
Water	1.5 parts
Fusel oil	.17 parts

The proportions given in the above formula need not be exactly followed to produce satisfactory results as any proportions corresponding with the theory of my invention may be used, and as this invention is of a chemical nature it is evident to those skilled in the art that chemical equivalents may be substituted without departing from the spirit of the invention.

By the described invention the surface tension of the cleaning mixture is low, because the addition of fusel oil to the water produces that result and the presence of alcohol permits of the use of fusel oil in increased quantity. Fusel oil contains amyl alcohol and butyl alcohol and other alcohols such as propyl alcohol. Butyl, amyl and such alcohols are frequently designated monohydric alcohols of a higher boiling point than ethyl alcohol and they will be

so designated herein and they singly or collectively are important factors in the attainment of the described results. In such case the proportions by volume might well be:

Phosphoric acid (85% solution)	1 part
Propyl alcohol	0.4 parts
Water	2. parts
Butyl alcohol	0.25 parts

I claim:

1. The method of cleaning metal consisting in subjecting it to the solvent action of an etching acid in the presence of fusel oil.

2. The method of cleaning metal consisting in submitting it to the action of an admixture of an etching acid, fusel oil and a liquid in which the aforesaid ingredients are miscible.

3. The method of cleaning metal consisting in subjecting it to the action of an admixture consisting of phosphoric acid and fusel oil.

4. The method of cleaning steel, consisting in subjecting it to the solvent action of phosphoric acid, fusel oil, water and a fluid in which said ingredients are miscible.

5. A cleaning agent for metals consisting of an admixture of an etching acid and fusel oil.

6. A cleaning agent for iron and steel, consisting of an etching acid, fusel oil, and a fluid in which said ingredients are miscible to produce a homogeneous fluid.

7. A cleaning agent for metals, consisting of an etching acid, fusel oil, water, and a fluid in which said ingredients are miscible to produce a homogeneous liquid.

8. A cleaning agent for iron and steel, consisting of an admixture of phosphoric acid, alcohol, fusel oil and water.

9. The method of cleaning metal consisting in subjecting it to the solvent action of a metal etching acid in the presence of a monohydric alcohol of a higher boiling point than ethyl alcohol.

10. A cleaning agent for metals consisting of an admixture of a metal etching acid and a monohydric alcohol of a higher boiling point than ethyl alcohol.

JAMES H. GRAVELL.