Patented July 27, 1943

2,325,304

UNITED STATES PATENT OFFICE

2,325,304

INHIBITION OF CORROSION OF MAGNESIUM AND MAGNESIUM BASE ALLOYS

Charles James Bushrod, Prestwich, England, assignor to Magnesium Elektron Limited, London, England, a British company

No Drawing. Application August 27, 1942, Serial No. 456,424. In Great Britain September 16, 1941

6 Claims. (Cl. 148—6)

This invention relates to the inhibition of the corrosion of magnesium and magnesium base alloys by methyl alcohol, and by alcoholic mixtures containing methyl alcohol, especially a mixture consisting of methyl and ethyl alcohols in about equal proportions. For example, magnesium and magnesium base alloys dissolve rapidly in high purity methyl alcohol, and rapid attack results when such alloys come into contact with carburetor de-icing fluids consisting of methyl and ethyl alcohols of high purity. Ethyl alcohol of high purity has no action on magnesium or magnesium base alloys.

The incorporation in the corrosive medium of various substances varies the rapidity with which the corrosion occurs. We have experimented on various substances, including water, sulphur containing organic compounds (such as mercaptans, thiophene, thiodiglycol etc.), nitrogen containing organic compounds (such as pyridine, aniline, quinoline, etc.), compounds having as anions oleate, palmitate, stearate, fluoride, etc., and having as cations sodium, potassium, ammonium and substituted ammonium ions. Finally we have succeeded in obtaining very good results using small proportions of those fatty acids the magnesium salts of which are substantially insoluble in alcohol and water, together with an alkali metal or ammonia base in an amount at least sufficient to neutralize the acid. Saturated and unsaturated fatty acids may be used. The acid is preferably palmitic, stearic or oleic acid. Alternatively such oxy-fatty acids containing two or more carbon atoms, carboxylic acids and the substitution products thereof or phenolates as are capable of reacting with magnesium to form substantially insoluble compounds also may be used. The base is preferably ammonia, which may be used in slight excess but other organic bases may be used provided that insolubility of the resulting magnesium compound is still achieved.

For example, we have carried out tests with 18 gauge magnesium alloy containing only about 2% of manganese as the sole alloying constituent and ascertained the periods for complete dissolution of strips of the metal measuring 7 cm. x 1 cm. in 25 cc. of methyl alcohol. With small quantities of water, ammonium carbonate, potassium fluoride, ammonium fluoride and fatty acids with minor quantities of ammonia, complete dissolution varied between 0.04 and 5 days. With an addition of 2% palmitic acid and 2.4% aqueous solution of ammonia (specific gravity 0.880) there was no detectable corrosion of the metal after 20 days in the part immersed in liquid, and this part retained its original polish; some spots of corrosion product were observable on the metal standing above the surface of the liquid. A similar result was obtained with the following:

1% stearic acid, 2% aqueous ammonia solution.
0.4% oleic acid, 1.5% ammonia solution.
0.4% oleic acid, 2% ammonia solution.
1% oleic acid, 3% ammonia solution.

Using 0.4% oleic acid and 1.5% ammonia solution some corrosion occurred although the attack was not serious after 10 days.

Similar experiments were carried out with methyl and ethyl alcohol mixtures with similar results.

For use with de-icing fluids it is desirable that the residue remaining on evaporation should not exceed 0.4% and this condition can be fulfilled by the use of 1.2% total inhibitor consisting of oleic or palmitic acid with ammonia solution.

Experiments have been carried out with a view to ascertaining the minimum quantity of ammonia and oleic acid which will effectively inhibit the corrosive action of mixtures of ethyl alcohol and methyl alcohol in equal proportions on magnesium alloys and it is found that 0.75% ammonia solution of 0.880 specific gravity with 0.15% oleic acid gives very satisfactory results.

I claim:

1. A method of inhibiting corrosion of magnesium and magnesium base alloys in contact with methyl alcohol and mixtures containing methyl alcohol, which comprises treating the magnesium-containing surface with such alcoholic liquid including an organic acid whose magnesium salt is substantially insoluble in alcohol and water, together with an inorganic alkaline neutralizer.

2. A method of inhibiting corrosion of magnesium and magnesium base alloys in contact with methyl alcohol and mixtures containing methyl alcohol, which comprises treating the magnesium-containing surface with such alcoholic liquid including an acid from the group consisting of palmitic, oleic and stearic acids, together with ammonia at least sufficient to neutralize the acid.

3. A method of inhibiting corrosion of magnesium and magnesium base alloys in contact with methyl alcohol and mixtures containing methyl alcohol, which comprises treating the magnesium-containing surface with such alcoholic liquid including an organic acid whose mag-

nesium salt is substantially insoluble in alcohol and water, together with an inorganic alkaline neutralizer in excess.

4. A method of inhibiting corrosion of magnesium and magnesium base alloys in contact with methyl alcohol and mixtures containing methyl alcohol, which comprises treating the magnesium-containing surface with such alcoholic liquid including an acid from the group consisting of palmitic, oleic and stearic acids, together with ammonia in excess of an amount sufficient to neutralize the acid.

5. A method of inhibiting corrosion of magnesium and magnesium base alloys in contact with methyl alcohol and mixtures containing methyl alcohol, which comprises treating the magnesium-containing surface with such alcoholic liquid including an organic acid whose magnesium salt is substantially insoluble in alcohol and water, together with an inorganic alkaline neutralizer, the total of the acid and neutralizer being less than 1.2 per cent of the quantity of alcoholic liquid.

6. A method of inhibiting corrosion of magnesium and magnesium base alloys in contact with methyl alcohol and mixtures containing methyl alcohol, which comprises treating the magnesium-containing surface with such alcoholic liquid including an acid from the group consisting of palmitic, oleic and stearic acids, together with ammonia, the total of the acid and ammonia being less than 1.2 per cent of the quantity of alcoholic liquid.

CHARLES JAMES BUSHROD.