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METHOD AND MEANS OF PROTECTING LIGHT-METAL SURFACES

Percy Frederick George, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich., a corporation of Michigan.

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This invention relates to a method and means for protecting surfaces of light-metals, especially magnesium and magnesium-base alloys and aluminum and aluminum-base alloys, against corrosive attack by water and water-containing media.

As is known, surfaces of magnesium and magnesium-base alloys, and to a lesser extent also of aluminum and aluminum-base alloys, are corroded by contact with aqueous media, such as acidic or saline solutions. This corrosion is particularly evident in containers, the inner surfaces of which are formed of magnesium- or aluminum-base alloys, which are used in storing liquid hydrocarbons, such as motor fuels and lubricants. In such use there is normally present on the bottom of the container an aqueous phase, consisting principally of moisture condensed from the atmosphere and precipitated from the hydrocarbon by temperature change. This aqueous condensate tends to dissolve any corrosive substances occurring in the hydrocarbon, and, over extended periods of time, attacks the inner surfaces of the container to a marked degree. Corrosion is especially serious when the motor fuel contains anti-knock fluid, e. g. tetra-ethyl lead and ethylene dibromide.

In view of these facts, it is an object of the present invention to provide a simple method and means for substantially preventing corrosion of the character described.

The invention is based upon the discovery that the corrosion of magnesium and magnesium-base alloys and of aluminum and aluminum-base alloys by an aqueous fluid in contact therewith can be substantially prevented by adding to the fluid a salt of zirconium in which the zirconium is present in the negative ion.

While any zirconium salt of the character stated may be used in the invention, the alkali metal and ammonium zirconates are preferred because of their relatively greater effectiveness. Alkali metal fluozirconates may also be employed. Because of the limited solubility of most zirconium compounds, the zirconate or other zirconium salt is usually added to the aqueous medium in a proportion sufficient to form a saturated solution, although lesser quantities are sometimes effective in substantially retarding corrosion, as can be determined by simple test.

In practice, in preventing the corrosive attack on magnesium- and aluminum-alloy tanks containing hydrocarbon fuel in contact with the aqueous condensate normally present in such tanks, a body of the zirconate or other zirconium compound is merely inserted into the tank in such position as to be in contact with the aqueous phase. Enough of the zirconate dissolves in the water to form a saturated solution, and thus substantially to inhibit corrosion of the metal. Because of its limited solubility, one charge of zirconate will suffice to prevent corrosion for a long period of time even though the aqueous phase be periodically drained from the tank. Even after draining, each time water condensate again forms, there is still sufficient solid zirconate to saturate the water and thus to inhibit corrosion.

For convenience, the zirconium-containing salt is usually added to the fuel tank as a preformed body, made either by pressing crystals of the material together to form a solid mass, or by mixing them with a small proportion of a binder such as a synthetic resin and molding the mixture. Alternatively, the zirconium compound may be introduced into a small fabric bag, or, less conveniently, into a perforated metal container, and the resulting article placed in the fuel tank.

While the principle of the invention has been described primarily with respect to preventing the corrosion of containers in which hydrocarbon liquids are stored in contact with water, and is particularly useful in this regard, it will be understood that the invention is broadly applicable to preventing the corrosion of magnesium and magnesium-base alloys by water and water-containing media. For instance, the corrosion of fuel tanks in contact with water-containing alcohol-blended motor fuel may be retarded by dissolving a zirconate in the fuel. Likewise, the zirconium compound may be introduced into the cooling systems of internal combustion engines having magnesium- or aluminum-alloy parts in such systems when employing water or an aqueous alcohol or glycol as the cooling medium, thereby preventing corrosive attack. Other specific applications of the invention will doubtless occur to those skilled in the art.

The following example will serve to illustrate the invention:

Example

Into a miniature gasoline tank formed of Dowmetal E (a magnesium-base alloy containing 6.0 per cent aluminum and 0.2 per cent zinc, the balance being magnesium), there was introduced 200 c. c. of an aviation gasoline containing 6 c. c. per gallon of ethyl fluid, and 10 c. c. of water. After two days standing at room temperature the tank was found to be badly corroded.

In an otherwise identical test in which 1 gram of sodium zirconate was introduced into the tank, there was no observable corrosion after 228 days.

Similar results were obtained in tests carried out on tanks formed of Dowmetal M (an alloy of 98.5 per cent magnesium and 1.5 per cent manganese).

I claim:

1. A method of protecting a container the inner surfaces of which are formed of a metal selected from the class consisting of magnesium and magnesium-base alloys and aluminum and aluminum-base alloys against corrosive attack by a system stored therein consisting essentially of a liquid hydrocarbon in contact with an aqueous phase which comprises inserting into the container in such position as to be in contact with the aqueous phase a body of a salt selected from the class consisting of the alkali metal and ammonium zirconates.

2. A method of protecting a fuel tank formed of a magnesium-base alloy against corrosive attack by a liquid system stored therein consisting of hydrocarbon fuel containing tetra-ethyl lead anti-knock fluid in contact with the aqueous condensate normally present in the tank which comprises inserting into the tank in contact with the aqueous phase a body of a salt selected from the class consisting of the alkali metal and ammonium zirconates.

3. A method of protecting a container the inner surfaces of which are formed of a metal selected from the class consisting of magnesium and magnesium-base alloys and aluminum and aluminum-base alloys against corrosive attack by a water-containing alcohol-blended hydrocarbon motor fuel stored therein which comprises inserting into the container in contact with the fuel a body of a salt selected from the class consisting of the alkali metal and ammonium zirconates.

PERCY FREDERICK GEORGE.