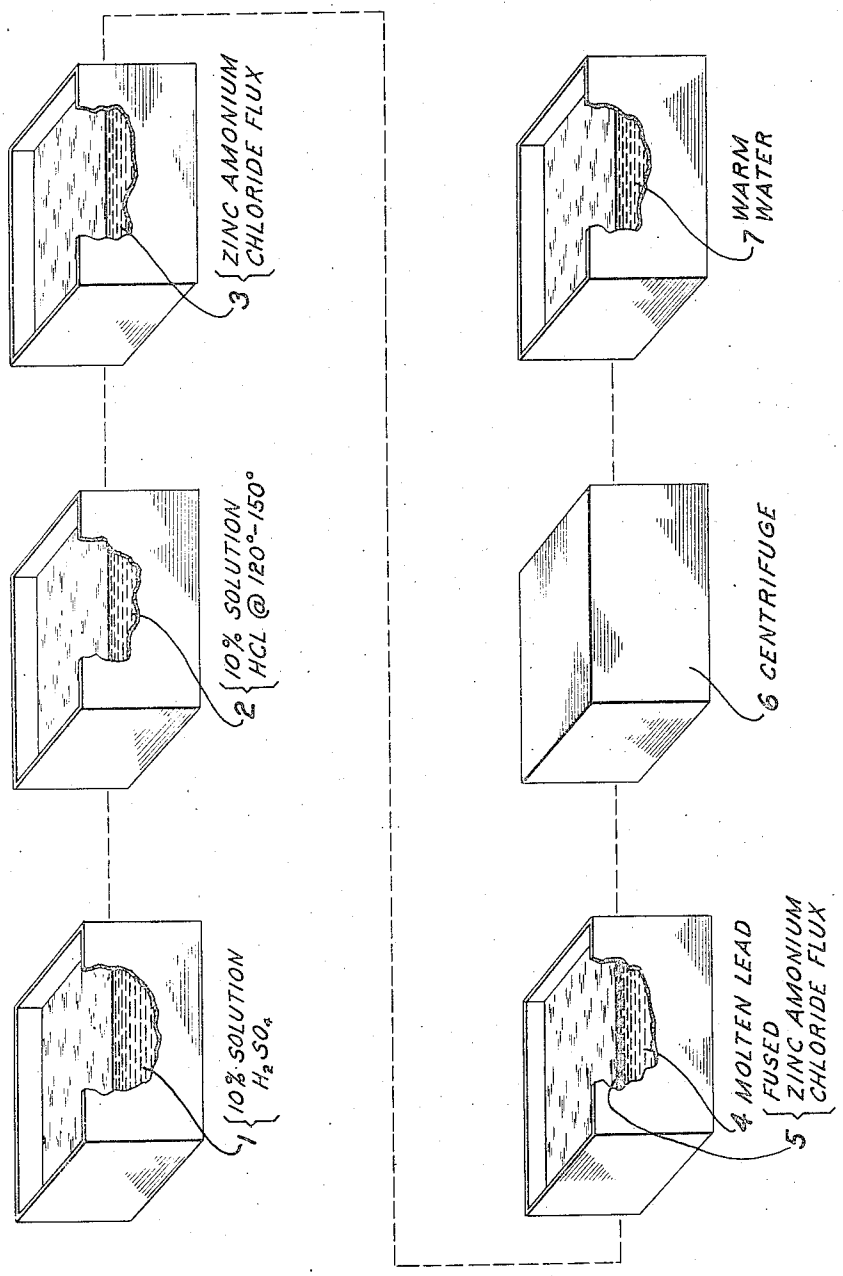
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METHOD OF LEAD COATING FERROUS ARTICLES

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METHOD OF LEAD COATING FERROUS ARTICLES

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This invention relates to protective coating processes and more particularly to a process of coating iron or steel with lead.

In the past, lead has been used as a protective coating for iron and steel articles to make them corrosion resistant only very rarely, due to the difficulty heretofore experienced in making the lead adhere to the ferrous metal. When, in the past, it has been found possible to make a lead coating adhere to ferrous metal articles, considerable difficulty has been experienced in making these coatings bridge pits or seams in the articles and plain lead coatings heretofore have had objectionable pin holes in them.

It is an object of the present invention to provide a simple process for applying to ferrous metal articles an inexpensive protective metallic sheath or coating having a low porosity.

In accordance with one embodiment of the invention, articles to be coated are cleaned in successive acid baths, dipped in a zinc ammonium chloride fluxing bath and then, without allowing them to dry, they are dipped in a lead bath containing 1% to 6% antimony and having on its surface a flux of zinc ammonium chloride. The lead bath is maintained at a temperature of from 650° F. to 720° F. and is preferably aged for several days before being used.

A better understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawing, wherein the single figure shows, diagrammatically, the various steps of a process constituting one embodiment of the invention.

In the preferred form of the present invention, the iron or steel parts to be coated are first treated in any suitable manner to remove oil or grease from them, if necessary, and are then dipped in a bath 1 comprising a solution of sulphuric acid containing an inhibitor. The bath 1 of sulphuric acid is maintained at a temperature of approximately 160° F. and comprises 6% to 12% solution. It is desirable to maintain this bath at the temperature just mentioned and to prevent the iron content from increasing beyond 5% of the bath.

After treating parts in the bath 1, they are further prepared by immersing them in a bath 2 comprising a 5% to 10% solution of hydrochloric acid containing an inhibitor for a period of from 10 to 15 minutes at a temperature of 120° F. to 150° F. No rinsing of the parts transferred from bath 1 to bath 2 is necessary. Like the

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bath 1, this bath should not be allowed to have an iron content of more than 5%.

Upon removal of the parts from the bath 2, they are immersed in a bath 3 comprising a water solution of zinc ammonium chloride flux at room temperature until the parts are completely wetted. The solution in the bath 3 may be made by dissolving five parts of zinc chloride and one part of ammonium chloride by weight in six parts of water. In order to maintain an effective solution in this bath, the concentration of iron therein should not be allowed to increase beyond 8% and the iron sludge should not be allowed to accumulate at the bottom of the bath.

While parts from the bath 3 are still wet with the solution thereon, they may be transferred to a bath 4 composed of lead-antimony maintained at a temperature between 650° F. and 720° F., preferably between 670° F. and 690° F., wherein the antimony content is from 1% to 6%, preferably 3%. The molten bath 4 is covered with a layer 5 of fused zinc ammonium chloride flux.

The layer 5 of flux on the bath 4 may be prepared by covering the bath with zinc ammonium chloride crystals and letting them melt and fuse thoroughly before dipping parts in the bath. The fused layer 5 should be prepared and permitted to remain on the top of the bath for approximately two hours before the parts are dipped in the bath. While optimum results are obtained by the application to the lead-antimony bath of a fluxing compound comprising 80% zinc chloride and 20% ammonium chloride, it has been found that the volatile ammonium chloride will evaporate from the bath until the compound contains approximately 85% zinc chloride and 15% ammonium chloride. It has also been found that if sufficient care is exercised to make sure that the coating is complete and the articles covered with a pinhole-free coating, the ammonium chloride may be omitted from the compound. When no ammonium chloride is used in the compound on the lead bath, careful inspection of the articles after each dipping in the lead bath is required since it is necessary to determine visually whether the coating is imperforate. This practice is slower than when ammonium chloride is used and it is preferred to use both zinc chloride and ammonium chloride in the hereinbefore described proportions. The layer 5 of flux is in its most effective condition when it comprises a thoroughly fused dark liquid layer having a minimum thickness of ⅛". This layer will give off very little fumes when the temperature of the lead antimony bath below it is maintained

between 650° to 720° F. A large number of parts may be dipped in the bath before it is necessary to add to the flux layer 5. The only time that it is necessary to add to the flux bath is when flux is carried out of the bath by the work and needs to be replaced to provide a complete blanket or covering of the flux on top of the lead antimony and prevent areas of exposed metal on the surface of the bath. When it is necessary to add to the flux bath, the addition of zinc ammonium chloride crystals should be made in small quantities and in such a way that none of the unfused flux crystals come in contact with parts being dipped. Particular care should be exercised to prevent unfused crystals of zinc ammonium chloride from depositing on the parts as they are removed from the bath. It is preferred to add large quantities of the flux forming crystals during the periods when parts are not being dipped in the bath so that two hours or more may elapse before the dipping of parts in the bath 4 is resumed, thus permitting the complete formation of the flux layer 5. As pointed out hereinbefore, it has been found that the most uniform coatings are deposited on the steel or iron parts if the lead antimony bath 4 is permitted to age for several days at the temperature mentioned hereinbefore before dipping operations are started with a newly prepared bath.

In performing the method, the parts are completely submerged in the molten bath 4, passing them through the fused flux layer 5 as the parts are dipped into and removed from the bath and a container holding the parts may be passed into and out of the bath 4 through the flux layer 5 several times to insure the contact of all portions of the parts being coated with the flux. After this repeated dipping to insure the coating of the parts with the flux layer 5, the parts are submerged in the bath and allowed to float therein until heated to the temperature of the bath.

Parts which have been allowed to remain immersed in the bath 4 are passed several times through the molten flux just before withdrawing them permanently from the bath 4 to again coat the parts with flux. After this operation has been performed, the parts which have been removed from the bath 4 are transferred to a centrifuge 6 or other suitable mechanism for shaking or centrifuging the parts, if the parts are of a size to lend themselves readily to such an operation. This removal of the excess metal is followed immediately by quenching in hot water in a bath 7 and after the parts have been quenched in the warm water bath 7, they may be suitably treated, for example, by tumbling them in sawdust. Parts treated in this manner will have an imperforate coating of lead antimony on them which will protect them from corrosion.

Any parts which are found to be not completely coated after following the steps outlined hereinbefore, may be reprocessed without removing the coating already on the parts by beginning the operation in the bath 2 of hydrochloric acid.

If it is desired, a small amount of copper may be added to the bath 2 in the amount of 0.1 to 0.2 ounce of copper sulphate crystals per gallon hydrochloric acid solution in the bath 2. In preparing the bath with copper sulphate crystals, the crystals should be dissolved in a very small amount of water before adding them to the acid bath and when parts are dipped in this solution, a slight copper deposit will form on the surface of the iron or steel parts before they enter the flux solution in bath 3 and the molten lead antimony mixture in the bath 4. It should be noted that there is no rinsing of the parts after dipping them in the first three baths and that water rinsing is not necessary unless the operation of removing oil and grease from the parts involved the use of alkali cleaners. If alkali cleaners were used, rinsing is necessary only before the first dipping of the parts in the bath 1.

While it has been found that a superior coating which is freer from pin holes is produced by using the aforementioned percentages of antimony in the bath 4, an acceptable coating for some purposes may be obtained with antimony-free lead in the bath 4.

What is claimed is:

1. The process of applying a protective coating to ferrous metal articles which comprises cleaning the articles in a hydrochloric acid solution, dipping the articles in a zinc ammonium chloride fluxing bath, dipping the articles without drying them into a lead bath containing from 1% to 6% of antimony, maintaining on the surface of said lead bath a flux comprising a layer of zinc ammonium chloride at least one-eighth inch thick, maintaining said lead bath at a temperature of between 670° and 690° F., and aging said lead bath for approximately forty-eight hours before using it.

2. The process of applying a protective coating to ferrous metal articles which comprises cleaning the articles in a hydrochloric acid solution, dipping the articles in a zinc ammonium chloride fluxing bath, dipping the articles without drying them into a lead bath containing from one to six per cent of antimony, maintaining on the surface of said lead bath a flux comprising a layer of zinc ammonium chloride at least one-eighth inch thick, maintaining said lead bath at a temperature of between 670° and 690° F., aging said lead bath for approximately forty-eight hours before using it, and maintaining the articles wet with the zinc ammonium chloride during their transference to the lead bath.

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