Patented June 20, 1939 2,163,368

UNITED STATES PATENT OFFICE

2,163,368

LEAD ALLOY

Jesse O. Betterton and Yurii E. Lebedeff, Metuchen, N. J., assignors to American Smelting and Refining Company, New York, N. Y., a corporation of New Jersey

No Drawing. Application March 24, 1936, Serial No. 70,607

1 Claim. (Cl. 75—166)

This invention relates to lead alloys and particularly concerns the improvement of certain lead alloys with respect to their oxidizing characteristics.

In the manufacture of cable sheathing, pipe, sheeting and the like, it has long been the practise to utilize lead containing a small amount of another metal or other metals which impart to the alloy certain desired characteristics, e. g. increased tensile strength, improved resistance to corrosion, greater hardness, etc. Among the elements used either singly or with others for this purpose, which will hereinafter be referred to as "improvement" metals, antimony, arsenic, bismuth, cadmium, calcium, magnesium, tin and zinc are the more important.

While such lead alloys have proven themselves superior to lead with respect to the properties for which they have been employed, nevertheless an undesired characteristic accompanies the addition of these improvement metals to lead namely, their general tendency toward excessive oxidation.

That the susceptibility of alloys of lead and the aforesaid improvement metals to excessive oxidation is a serious disadvantage is very apparent in the extrusion of cable sheathing where the oxidation products become incorporated in the sheath causing weakness and areas favoring the inception of corrosion.

It has now been found that by incorporating phosphorus in amounts not exceeding approximately 0.01% in a lead alloy containing not more than approximately 0.5% of improvement metal or metals, the tendency of the alloy toward excessive oxidation is reduced to a very great extent and this highly desirable result is obtained without materially affecting the tensile strength of the composition.

In determining the oxidation of the various compositions investigated, the following procedure was followed in all cases: a 500 gram sample of the composition was melted in a casserole and the surface stirred for ten minutes at a temperature of 355° C. by means of a rotating paddle operated at 100 R. P. M. The dross was then skimmed and weighed after which the oxide was dissolved in molten zinc chloride. Upon solidification the mass was lixiviated with water and the remaining lead button weighed. The difference between the weight of the dross skimmed and the weight of the lead button was the weight of the oxide formed in the particular test.

The following tabulated results with alloys of antimony and cadmium, two of the most common improvement metals in cable sheathing, will serve to illustrate the invention:

Composition	Grams oxide
Refined Pb	0.350
Refined Pb+0.20% Cd	4.171
Refined Pb+0.20% Cd+0.003% P	2.162
Refined Pb+0.20% Cd+0.007% P	0.460
Refined Pb+0.03% Sb	4.799
Refined Pb+0.03% Sb+0.003% P	1.544
Refined Pb+0.03% Sb+0.007% P	1.022

It will readily be seen from the above examples that whereas the lead containing only the improvement metal has a decided tendency to oxidize as compared to refined lead, the addition of only a small amount of phosphorus very markedly diminishes that characteristic. Further, as hereinbefore stated, this beneficial effect is accomplished without material adverse effect upon the tensile strength. To illustrate:

Composition	Tensile strength (Psi)
Refined Pb	1905
Refined Pb+0.20% As+0.007% P	2825
Refined Pb+0.05% Sb+0.007% P	2920
Refined Pb+0.20% Cd	3120
Refined Pb+0.20% Cd+0.003% P	3120

It will thus be appreciated that the present invention provides lead alloys which are admirably adapted for cable sheathing and the like. As before stated the improvement metal content should not be more than approximately 0.5% and investigations indicate that an improvement metal content of from 0.05% to 0.3% is, generally speaking, to be preferred. The phosphorus content should range between 0.001% and 0.01%. Material departure from these phosphorus and improvement metal or metals ranges should not be indulged in as the amount of phosphorus necessary to counteract the increased oxidation accompanying material increases of improvement metals would adversely affect other desired properties of the particular alloy.

What is claimed is:

An alloy consisting of cadmium in an effective amount but not exceeding 0.5%, phosphorus in an effective amount but not exceeding 0.01% and the balance lead.

JESSE O. BETTERTON.
YURII E. LEBEDEFF.