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NONCORROSIVE ALLOY

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3 Claims. (Cl. 75—166)

The object of the invention is to provide an improved non-corrosive alloy, and more specifically an alloy in which lead is the dominant constituent.

Such alloy it has long been recognized should theoretically attain wide usage, as for instance in the grids, terminals and cable connectors of storage batteries in which an electrolyte of sulphuric acid is employed, also in and about the seashore, on shipboard for certain metal fittings and in similar localities, where objects are constantly subjected to the corrosion resulting from the presence of chlorine in the air, and the deposits of salt from ocean spray which greatly accelerate oxidation as well. Other uses might be enumerated, such as objects used in the presence of alkalis, but the foregoing examples will be sufficient for the purpose of this application.

Quite generally, alloys in which lead occupies the dominant part are notably brittle, crystalline, low in tensile strength, soft and therefore incapable of retaining well defined shapes and edges, as for instance bolt and nut angularities, screw threads and the like. As a result, battery plates are subject to buckling, terminals and cable connectors break under the strain of a suddenly applied force or when too tightly screwed, screw threads strip and the angles of both bolt and nut heads easily become rounded.

A further object consists in the provision of an alloy principally of lead, which is characterized by a high degree of conductivity, and conversely a low degree of electrical resistance and resultingly minimum tendency to heat under relatively heavy currents; to provide an alloy principally of lead, which is similarly characterized by a negligible degree of contractability and expansibility; to provide such an alloy having high thermal conductivity; to provide a lead alloy which can be readily cast, rolled, or otherwise formed around electrical conductors and other objects (as when used in ship fittings), and which during such casting will flow into the smallest interstices as between the strands of a cable or the like, thereby creating a most intimate union between the assembled metals, through which union there is also an exceedingly high degree of electrical conductivity.

More specifically, the object is to provide an alloy possessing the above listed characteristics, comprising lead, tin, antimony, copper and arsenic. In this combination of elemental metals, the lead provides a non-corrosive base or body; the antimony imparts to the alloy the desired degree of hardness; the tin co-acts with the lead and antimony to impart to the alloy a high degree of toughness, flexibility and resiliency, while at the same time effecting a more intimate union between the relatively small percentage of copper and the high percentage of lead; copper imparts conductivity, ductility and flexibility to the alloy; and the arsenic makes the alloy flow and solidify with a finer grain.

While this improved alloy may be employed in automatic die casting machines, it has been found that it is particularly adapted to the so-called gravity pour, in which case the cast article is substantially less brittle and more resilient than when produced in an automatic pressure molding machine. It is believed that no previous alloy of this nature has ever satisfactorily combined such a low proportion of copper with such a high proportion of lead, as until the advent of this alloy it has been considered impossible to satisfactorily unite copper and lead in proportions having anywhere near as wide variation as those present in the instant case. In fact, to produce the new alloy, it is necessary to add substantially equal parts of copper and lead, after having first melted the copper at its characteristic temperature of 1981.5° F., and having added the lead in molten state thereto and thoroughly mixed the same together. Having accomplished this union between the copper and the lead, additional lead is added until the desired final relationship is attained between these two metals. The temperature of the copper-lead combination then being lowered and the antimony added in the desired proportion, following which either the tin or arsenic may be united to the molten mass and finally the other of said last two mentioned metals added to produce an alloy within the limits of the proportions herein set forth.

For those purposes to which the new alloy has been applied to date, the preferred proportions range approximately as follows:

	Per cent
Tin	4.75 to 6.00
Antimony	4.50 to 5.75
Copper	0.25 to 1.75
Arsenic	0.05 to 0.25
Lead	90.45 to 86.25

For the casting of storage battery grids and similar objects, which are characterized by relatively slender parts, subjected constantly to the action of sulphuric acid or equally corrosive chemicals, the following formula is preferred with relatively slight variations:

	Per cent
Tin	5.50
Antimony	5.30
Copper	1.60
Arsenic	0.10
Lead	87.50

For the casting of battery and cable terminals, where more tensile strength, elasticity and resiliency are required, while subjected indirectly to the normally corrosive action of copper sul-

phate and the like, the following formula is preferred with relatively slight variations:

	Per cent
Tin	5.65
Antimony	5.35
Copper	1.65
Arsenic	0.15
Lead	87.20

The new alloy is not subject to corrosion, even when exposed to the effects of sulphuric acid, and also possesses substantially negligible coefficients of contraction and expansion. The alloy, when cast around the end of a stranded copper cable, has the property of flowing into the interstices between and about the individual strands, and resultingly cooperates therewith to form a complete and intimate union with the cable in a manner similar to that of a weld. This intimate union between the cable and a terminal or other element formed of said alloy accordingly serves to very substantially improve the electrical conductivity between the parts. The new alloy, furthermore, may be used to directly constitute the cable, either solid or stranded, and which may be cast, rolled or drawn, and in turn united integrally with a terminal or other element formed of the same alloy, thereby effecting a high degree of electrical conductivity for both the cable and the added element. Such a structure eliminates mechanical losses, minimizes electrical resistance and resulting heat, and at the same time avoids all possibility of corrosion under the attack of air-borne and other acids. In the same manner, the said alloy can be employed as a sheathing for either one or a group of cables formed of the same or different metal. Additionally it has been found by actual test that an immersion of a terminal (for example) formed of the new alloy in sulphuric acid, having a specific gravity of 1.285 at room temperature over a period of twelve days, resulted in a loss in weight of only 0.057 gram, as compared with a loss of 0.272 gram of a bronze terminal of the same size, other conditions being identical, while a like test upon a lead covered terminal having a steel insert or core lost 1.057 grams of its weight.

With regard to electrical conductivity of the new alloy, a terminal formed from the same united in accordance with accepted practise to the end of a copper cable, showed the following results, when compared with identically the same type of union between a copper terminal and the said copper cable, the cable comprising a 19-inch length of 127 strands of 22 gauge copper wire:

	Copper terminal connected with copper cable	Terminal formed from new alloy in connection with copper cable
Resistance ohms	.000117	.000114
Conductance mhos	8550	8770

In addition to the foregoing, it should be noted that devices requiring a substantial degree of resiliency such, for instance, as cable terminals, which are designed to surround and securely grip the terminal posts of a storage battery when formed of the new alloy, possess all of the resiliency and flexibility that can be desired, thereby resulting in a uniform connection between the battery posts and cables connected thereto, and at the same time resisting all tendency to become loosened therefrom, due to vibration, as when the several elements are mounted in an automobile or other vehicle, which is repeatedly subjected to high rates of vibration.

While fairly specific limits have been hereinbefore set for the several ingredients of which the new alloy is formed, it is to be understood that somewhat wider variations may be made therein for accommodating the alloy to various other uses, in addition to those in which it has already been tested, wherefore such variations are anticipated within the scope of the present invention and the appended claims, so long as the resulting alloy conforms to the general advantages herein set forth.

Also, it should be noted that after the new alloy has once been compounded, it should be melted for pouring and casting only at temperatures ranging substantially between 900° F. and 950° F., in order that the entire portion of each constituent metal will become molten and thereby insure nonseparation and permanent homogeneity. Within this temperature range, even the copper appears to melt in association with the other metals present. By contrast, other known alloys, having a preponderance of lead as the basic metal, melt and satisfactorily cast at 450° F. to 500° F. Therefore, a melting point between 900° F. and 950° F. is considered an essential characteristic of the improved alloy, and the appended claims should be so interpreted with relation to the prior art.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent of the United States is:

1. A non-corrosive alloy of lead, comprising substantially 4.75%–6.00% of tin, substantially 4.50%–5.75% antimony, substantially 0.25%–1.75% copper, substantially 0.05%–0.25% arsenic, and the remainder lead.

2. A non-corrosive alloy of lead for cast battery terminals and similar objects, comprising substantially 5.65% tin, substantially 5.35% antimony, substantially 1.65% copper, substantially 0.15% arsenic, and substantially 87.20% lead.

3. A non-corrosive alloy of lead for cast storage battery grids, posts and similar objects, comprising substantially 5.50% tin, substantially 5.30% antimony, substantially 1.60% copper, substantially 0.10% arsenic, and substantially 87.50% lead.

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