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TIN ALLOY

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This invention relates to tin alloys and methods of producing the same.

It is known that the metal tin, although ductile, is very weak and numerous metals have been alloyed with tin with the object of increasing its strength without seriously impairing its ductility. Thus, lead, bismuth, and antimony are commonly used for this purpose and ductile alloys of tin with these and other metals such as cadmium are largely used in making pewter and for the manufacture of tin foil, sheet, and strip used for a variety of purposes such as the wrapping of goods, the making of collapsible metal containers, the construction of chemically resistant plants and vessels, and the like. Such tin alloys, however, have suffered from the disadvantage that their strength could not be permanently improved by cold working or heat treatment since any advantage resulting from these processes was temporary in character and disappeared in the course of a few days or weeks at ordinary atmospheric temperatures.

The object of the present invention is to produce improved tin alloys having all the advantages of the known alloys but without the disadvantage noted above and the invention consists in a method of producing a tin alloy which consists in adding to the tin an amount of cadmium in excess of 1 per cent. and not exceeding 15 per cent. and heating the alloy to a temperature exceeding 130° C. but less than the temperature at which the alloy begins to melt, and cooling rapidly, as by quenching or cooling in air.

The invention also consists in a method according to the two preceding paragraphs in which the first heat treatment is followed by a further heat treatment consisting in heating the alloy to a temperature not greater than 130° C. as, for example, by immersion in boiling water.

The invention also consists in tin alloys whenever produced by the herein described methods.

In carrying our invention into effect in one convenient manner we produce our improved tin alloy by adding to the tin an amount of cadmium in excess of 1 per cent., the best results being obtained when the amount of cadmium in the alloy is about 4 to 6 per cent. of the whole although amounts up to 15 per cent. may be present without serious detriment.

The alloy thus produced is subjected to a heat treatment which consists in heating the alloy to a temperature exceeding 130° C. but less than the temperature at which the alloy begins to melt and then cooling rapidly (as by quenching) or cooling in air. The best results are obtained if the alloy is maintained at the temperature to which it is heated for a period sufficiently long to enable equilibrium to be attained at that temperature, a period of half an hour to three hours being usually sufficient. The necessary time can, however, be determined by miscroscopical examination of the structure.

The above treatment is preferably followed by a further heat treatment consisting in heating the alloy to a temperature not greater than 130° C. as, for example, by immersion in boiling water, and it is found that this second heat treatment although not essential confers greater stability on the heat-treated alloy.

The period of second heat treatment varies with the previous history of the metal, for example the size of casting, temperature of casting and whether the metal has been worked by rolling, etc.

Cadmium tin alloys produced by this invention show a considerable improvement in strength as compared with the tin itself or with cadmium tin alloys that have not been heat-treated without losing their ductility and this improvement in strength is retained either permanently or for a very long period of time at atmospheric temperatures.

Moreover, the alloys also possess the property of being strengthened by the application, after heat treatment, of a moderate degree of cold working such as is involved in bending, pressing, forming, spinning and similar manufacturing processes, the improvement in strength thus acquired being wholly or partially retained either permanently or for very long periods of time.

The alloys so produced are capable of being used as an improved form of pewter and for making into sheet, strip, foil or other worked forms, or into articles made from such worked forms, and the percentage of cadmium employed, the temperature to which the alloy is heated and the period of time for which such heating is maintained, as also the rapidity of the cooling operation may be varied depending upon the purpose for which the alloy is to be used or any practical requirements that may have to be fulfilled.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. A method of producing a tin alloy which consists in adding to the tin an amount of cadmium in excess of 1 per cent. and not exceeding 15 per cent. and heating the alloy to a temperature exceeding 130° C. but less than the temperature at which the alloy begins to melt, and cooling rapidly, as by quenching or cooling in air.

2. A method according to claim 1 in which the first heat treatment is followed by a further heat treatment consisting in heating the alloy to a temperature not greater than 130° C. as, for example, by immersion in boiling water.

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