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ALLOY

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2 Claims. (Cl. 75—178)

This application relates to zinc base alloys and provides new alloys containing zinc, manganese, aluminum and iron and having superior mechanical properties. The alloys of our invention have an appearance similar to that of white metal alloys.

This application is a division of our co-pending application Serial No. 402,994, filed July 18, 1941, which in turn is a division of our co-pending application Serial No. 314,086, filed January 16, 1940.

We have discovered new zinc alloys containing certain proportions of manganese and aluminum and including a small proportion of iron which, as cast, have an impact strength of about one foot-pound per one-quarter square inch cross-section or more, a tensile strength of about 60,000 pounds per square inch or higher, and high creep resistance. They may be formed into intricate shapes of accurate configuration by die-casting, and are also amenable to casting by other methods.

All percentages and parts given hereinafter are by weight, and on this basis the alloys of our invention contain about 0.02 part to about 5 parts aluminum, about 33.3 parts to about 48.5 parts manganese, about 66.7 parts to about 51.5 parts zinc, and iron in effective proportions up to about 6 parts.

If the foregoing alloy is so constituted that it consists of about 0.02 part to about 5 parts aluminum, about 38 parts to about 48.5 parts manganese, about 62 to about 51.5 parts zinc, with a small proportion of iron, say less than 6 parts, it will have as cast a tensile strength of at least 60,000 pounds per square inch and an impact strength of at least two foot-pounds per one-quarter inch square section. If the alloy consists of about 0.02 part to about 2 parts aluminum, about 43 parts to 48.5 parts manganese, and about 57 to about 51.5 parts zinc, with iron up to 6 parts, it will have as cast an impact strength of at least four foot-pounds per one-quarter inch square section.

In the manufacture of the alloys of our invention, it is not essential in all cases to employ high grade manganese, for the impurities that may occur in the ordinary commercial grades of manganese may be included in our alloys in some cases without too serious effect upon the properties thereof. Manganese suitable for use in the practice of our invention may contain minor proportions of silicon, phosphorus, carbon, nitrogen, and other impurities. We prefer, however, to use manganese of high purity because impurities in the manganese may degrade the mechanical properties of the alloy, and, in particular, cause the presence of hard particles that may interfere with machining and buffing.

The alloys of our invention are relatively hard, having a Brinell hardness in the neighborhood of 160 to 165.

Alloys of our invention are not subject to the temperature embrittlement encountered in many zinc alloys at very low temperatures and have high creep resistance, considerably better than heretofore customary zinc base die-casting alloys. The modulus of elasticity of the alloys of our invention is also greater than that of heretofore customary zinc base die-casting alloys and is in the neighborhood of 14,000,000 pounds per square inch.

The alloys of our invention possess apparent rigidity or stiffness to a degree greater than that of any other zinc alloys of reasonable ductility known to us, and all of the alloys of our invention are machinable. Further, these alloys manifest good resistance to atmospheric corrosion and in water immersion tests showed a corrosion resistance roughly comparable to that of the zinc base die-casting alloys Nos. XXI, XXIII, and XXV of A. S. T. M. tentative specifications B86–38T, 1938.

As indicated hereinbefore, aluminum is an essential ingredient in the alloys of our invention. The aluminum not only improves the casting characteristics of the alloys, but also tends to suppress oxidation of the surfaces of the hot casting so that the alloys of our invention may be cooled in air without serious discoloration. Moreover, the presence of the aluminum in the alloy within the range specified, i. e., 0.02% to about 5%, reduces dross formation on the molten alloy during casting operations and tends to impart an attractive silvery appearance to the casting. When aluminum is not present, a tenacious brown film tends to form on the molten alloy, interfering with pouring and making difficult the production of a casting having a smooth surface. The resulting casting is also unsuitable in that it acquires a brownish discoloration on the surface. However, an aluminum content of more than 5% cannot be tolerated because of the deleterious effect thereof upon the mechanical properties of the alloys. In case the aluminum content exceeds 2%, the tolerance for impurities is limited.

The inclusion of up to 6% iron in the alloys of our invention is desirable. The tolerance for iron of the particular alloy depends upon its

manganese and impurity contents and is greater for some compositions.

The alloys of our invention can be prepared with the ingredients charged into the crucible in the form of unalloyed metals or alloys of these with each other. We prefer to melt the alloys in a crucible substantially non-reactive to the alloys. Clay-silicon carbide and cast iron crucibles have been satisfactory. It is helpful in many cases to protect the surface of the molten alloy with a non-reactive gas, e. g., hydrogen.

As indicated hereinbefore, the alloys of our invention can be die-cast and because of their greater strength and hardness offer certain advantages over heretofore customary zinc die-casting alloys. Certain alloys of our invention have been gravity cast in permanent metal moulds and also gravity cast in sand moulds. Although some differences in properties of the alloys of our invention are induced by the method of casting, the alloys of our invention in general exhibit superior properties as compared to heretofore customary zinc alloys, irrespective of the particular method of casting.

We claim:

1. An alloy consisting of about 0.02 part to about 5 parts aluminum, iron in effective amount up to 6 parts, about 33.3 parts to about 48.5 parts of manganese, and about 66.7 to about 51.5 parts zinc.

2. An alloy consisting of about 0.02 part to about 2 parts aluminum, about 43 parts to about 48.5 parts manganese, and about 57 to about 51.5 parts zinc with iron in effective amount up to 6 parts.

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