Patented Aug. 17, 1926. 1,596,761

UNITED STATES PATENT OFFICE.

WILLIS M. PEIRCE AND EDMUND A. ANDERSON, OF PALMERTON, PENNSYLVANIA, ASSIGNORS TO THE NEW JERSEY ZINC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

DIE-CASTING METAL.

No Drawing. Application filed May 11, 1925. Serial No. 29,560.

This invention relates to casting alloys, and particularly to die-casting alloys having zinc as the principal constituent and containing aluminum with or without copper or other elements to give the metal the desirable and necessary characteristics.

Die-casting metals of this kind are well known and in common use and possess comparatively high tensile strength, high impact strength and fair ductility. These alloys are also notably free from hot shortness and are reasonably satisfactory, therefore, as die-casting materials. The known alloys are, however, subject to intercrystalline oxidation in the presence of warmth and moisture and are liable to swelling, warping and loss of strength when subjected to such adverse conditions. Moreover, changes occur in these alloys upon simple aging at ordinary temperatures unaccompanied by serious intercrystalline oxidation, which may result in serious detriment to the physical properties such as tensile and impact strength.

It is the object of the present invention to improve alloys such as those cast in permanent and sand molds, and particularly die-casting alloys by reducing the tendency to intercrystalline oxidation and changes upon aging while preserving or improving the other properties of the metal which make it suitable for die-casting purposes.

Other objects and advantages of the invention will be apparent as it is better understood by reference to the following specification in which the preferred embodiments of the invention are described.

The invention depends upon the addition of magnesium in relatively small amounts to zinc alloys and upon the effect thereof in reducing deterioration by oxidation, and furthermore in preventing undesirable changes in physical properties due to structural or equilibrium changes which tend to proceed slowly in these alloys. It has been discovered that the addition of as little as one tenth of one per cent of magnesium to an alloy of zinc and aluminum containing preferably at least eighty-five per cent of zinc results in a very marked improvement of the metal. On the other hand, the addition of magnesium must not exceed substantially three tenths of one per cent because any material addition to this amount will result in serious impairment of the ductility and casting properties of the metal. Magnesium has the same beneficial effect when added in substantially the same proportions to zinc alloys containing both copper and aluminum in amounts totalling not more substantially than fifteen per cent.

As an example of the invention, an alloy of zinc base with aluminum in variable proportions between one and fifteen per cent can be materially improved by the addition of one tenth of one per cent of magnesium thereto. Such an alloy has a high tensile strength and is affected much less seriously by oxidizing conditions than the same alloy without the addition of magnesium. Furthermore, aging when unaccompanied by serious oxidation, does not result in detrimental changes in physical properties, such as loss of tensile or impact strength, to such a degree as occurs in the same alloy without magnesium. It has about the same degree of ductility and better casting qualities due to higher fluidity and lower shrinkage.

In the preferred embodiment of the invention aluminum and copper are added to the zinc in the proportions of four per cent of aluminum and three per cent of copper. This alloy is improved by the addition of one tenth of one per cent of magnesium and the relative properties of the two metals are indicated by the following table indicating tests conducted with the two alloys:

Alloy No. 1 was a zinc base alloy containing 4% Al and 3% Cu, and alloy No. 2 was a zinc base alloy containing 4% Al, 3% Cu, and 0.1% Mg.

	Alloy No. 1.	Alloy No. 2.
Tensile strength as cast, pounds per square inch	41,500	41,200
Impact strength as cast, foot pounds per square inch	76	90
Impact strength after 6 months aging in an ordinary atmosphere	25	92
Tensile strength after 10 days in a saturated atmosphere at 95° C., pounds per square inch	5,700	17,400
Tensile strength after 50 days in a saturated atmosphere at 70° C	4,400	14,200
Tensile strength after 30 days in a saturated atmosphere at 40° C	30,900	42,100
Tensile strength after 1 day anneal at 100° C	30,500	41,300
Tensile strength after 6 months aging in an ordinary atmosphere	42,000	46,800
Increase in width of a 1 inch bar after 60 days in a saturated atmosphere at 70° C. inch	.032	.006
Depth of penetration of oxidation after 10 days in a saturated atmosphere at 95° C. inch	.020	.008

The alloy containing magnesium has high fluidity and lower shrinkage and is a better casting metal. Its ductility is unimpaired.

The same improvement by the addition of magnesium in relatively small amounts has been noted, also in connection with other alloys containing relatively large proportions of zinc and aluminum with other metals similar to copper. The reason for the improvement noted cannot be fully explained. The effect apparently is to reduce the tendency to intercrystalline oxidation with the result that the alloy is stabilized and prevented from deteriorating in the manner common with many zinc base die-casting alloys containing aluminum.

It is to be understood that in preparing the alloys described the zinc used should be substantially pure and substantially free at least from impurities such as lead and cadmium which are known to cause the deterioration of zinc base die-casting alloys containing aluminum. A high grade zinc, such as the well-known "Horsehead" brand, should be used, therefore, and the other metals employed should likewise be free from impurities which are likely to have a deteriorating influence upon the alloy.

The invention comprehends the addition of relatively small amounts of magnesium, for example one tenth to three tenths of one per cent, to zinc alloys containing eighty-five per cent or more of the zinc and one or more metals, such as aluminum, copper, etc., to produce die-casting metals having high tensile strength, good ductility and high resistance to deterioration when aged in the presence of warmth and moisture and when aged in ordinary atmospheres. Various changes may be made, therefore, in the constituents and proportions thereof as used in the alloys without departing from the invention or sacrificing any of the advantages thereof.

We claim:

1. A zinc base alloy containing not less than 85% zinc and 0.01 to 0.3% magnesium.

2. A zinc-base alloy including 1.0 to 15% aluminum and 0.01 to 0.3% magnesium.

3. A zinc-base alloy including 1.0 to 15% aluminum and copper, and 0.01 to 0.3% magnesium.

4. A zinc-base alloy including approximately 4% aluminum, 3% copper, and 0.01 to 0.3% magnesium.

In testimony whereof we affix our signatures.

W. M. PEIRCE.
EDMUND A. ANDERSON.

DISCLAIMER.

1,596,761.—*Willis M. Peirce* and *Edmund A. Anderson*, Palmerton, Pa. DIE-CASTING METAL. Patent dated August 17, 1926. Disclaimer filed May 20, 1927, by the assignee, *The New Jersey Zinc Company*.

Hereby disclaim from the scope of claims 1, 2 and 3 all zinc-base alloys except those containing aluminum and copper, or their equivalents, in such proportions that the alloys have such tensile strength, impact strength, ductility, fluidity, low shrinkage and freedom from hot-shortness as make them suitable for die-casting purposes; in which alloys magnesium in the percentages specified reduces intercrystalline oxidation and undesirable changes in physical properties upon aging.

[*Official Gazette June 7, 1927.*]