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ALUMINUM-MAGNESIUM ALLOYS

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6 Claims. (Cl. 75—147)

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This invention relates to alloy compositions of matter and more particularly to alloys containing aluminum and magnesium. Heretofore in the art, aluminum alloys containing from 3% to 8% magnesium have been known and recognized as casting alloys not subject to any improvement in their physical properties by heat treatment methods now known in the art. The physical properties of these alloys, however, vary widely and inconsistently and the main object of the invention is to stabilize the physical properties of this type of alloy.

Another object is to provide cast articles comprised of an aluminum-magnesium alloy containing 3% to 8% magnesium, balance aluminum, having consistent physical properties.

Other objects will be apparent as the invention is more fully hereinafter disclosed.

In accordance with these objects, I have discovered that one of the major causes for inconsistent physical properties in this type of aluminum-magnesium alloy is the presence of gases and non-metallic inclusions in the solidified cast metal and that by thoroughly degasifying and scouring the molten metal prior to casting a considerable step forward towards stabilization of the physical properties in the solidified cast alloy is obtained.

However, I have found that even by using the best degasifying and scouring technique available in the art the best stabilized values for tensile strength and elongation obtainable in this type of alloy are between 25,000 and 30,000 p. s. i. and about 14%, respectively. It is highly desirable to increase the tensile strength of this type of alloy to a value well above 30,000 p. s. i. and my researches have indicated that this result may be obtained by incorporating in the alloy, while in its molten state, the metals manganese and titanium each in approximately equal amounts within the range .10% to .35%. The precise reason or explanation for the effect obtained in these said alloys by the addition of manganese and titanium within the range specified is not at this time apparent. These metals acting in combination appear to function as a precipitating phase dispersion agent during solidification of the alloy from the molten phase and coact to produce a substantially uniform dispersion of the precipitating phases throughout the aluminum matrix. Such a uniform dispersion of the precipitated phases produces consistently uniform and higher physical properties in the cast metal.

As one specific embodiment of the present invention, but not as a limitation thereof, a 4%

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magnesium alloy (balance aluminum) thoroughly degasified and scoured free of non-metallic inclusions prior to casting and cast under the best casting practice available, provides cast articles which on test seldom show a tensile strength as high as 30,000 p. s. i. and more frequently tensile strengths under 25,000 p. s. i. The percentage of rejects in such cast articles for tensile strength values below 25,000 p. s. i. usually runs high and on the average in the neighborhood of 10% to 25%.

The same alloy, to which has been added about .20% each of manganese and titanium, preferably immediately following degasification and scouring and just prior to casting, consistently and uniformly tests 33,000 to 35,000 p. s. i. tensile strength with a percentage of rejects for tensile strength values below 30,000 p. s. i. averaging in the neighborhood of 5%. The average value of the elongation of such alloys is 15% to 16%.

In the 6% magnesium alloy (balance aluminum) the best average value for tensile strength obtainable by best prior art degasification and scouring practices approximates 28,000 p. s. i. with an elongation of about 10%. The percentage of rejects for tensile strength values below 25,000 p. s. i. averages 25%. The addition of .20% each of manganese and titanium to this alloy while in the molten state and preferably following degasification and scouring and prior to casting, raises the average tensile strength to about 40,000 p. s. i. with an elongation of about 13% to 14%, and the percentage of rejects for tensile strength values below about 35,000 p. s. i. is about 1%.

The addition of .20% each of maganese and and titanium to aluminum-magnesium alloys containing over about 6% magnesium improves the tensile strength of the alloy in the same way and order as in the 4% to 6% magnesium alloys. These alloys, however, are not of as great commercial importance as the 4% to 6% magnesium alloys of the specific embodiments.

In the practice of the present invention, under .10% of each of the metals manganese and titanium do not appear to produce any marked improvement in the tensile strength of the alloy. Over .35% of each of these metals appear to harden the alloy and lower the elongation. My researches have indicated that for best and most consistently uniform results these two metals should be present in approximately equal amounts and that .20% of each of these metals produce the best results.

The addition of the maganese and titanium to

the alloy is best effected by first forming an aluminum-base master alloy containing approximately equal percentages of maganese and titanium, which alloy is thoroughly degasified and scoured prior to solidification. The addition of this master alloy to the 4% to 6% magnesium alloy (balance aluminum) following degasification and scouring, results in a rapid solution and dispersion of the manganese and titanium content thereof throughout the aluminum-magnesium allow.

It is believed apparent that the invention may be widely varied without essential departure therefrom and all such modifications and departures therefrom are contemplated as may fall within the scope of the following claims:

What I claim is:

1. A casting alloy consisting of magnesium 4% to 6%, manganese and titanium each .10% to .35%, balance aluminum.

2. A casting alloy consisting of magnesium 4%, manganese and titanium each approximating .20%, balance aluminum.

3. A casting alloy consisting of magnesium 6%, manganese and titanium each approximating .20%, balance aluminum.

4. Cast articles comprised of the alloy of claim 1, said alloy prior to casting being thoroughly degasified and scoured of non-metallic inclusions, said cast articles being characterized by having a consistently uniform dispersion of the precipitated phases throughout the cast body and by a tensile strength consistently higher than obtainable in the same alloy without the manganese and titanium additions thereto.

5. Cast articles comprised of the alloy composition of claim 2, and characterized by having in the degasified and scoured state a uniform dispersion of the precipitated phase throughout the cast body and by a tensile strength consistently approximating 35,000 p. s. i. and above 30,000 p. s. i.

6. Cast articles comprised of the alloy composition of claim 3, and characterized by having in the degasified and scoured state a uniform dispersion of the precipitated phase throughout the cast body and by a tensile strength consistently approximating 40,000 p. s. i. and above 35,000 p. s. i.

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