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3,306,738

ALUMINIUM ALLOYS

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4 Claims. (Cl. 75—143)

The present invention relates to aluminium alloy castings which are subject to abrasion during use and to aluminium alloys for use in the production of such castings. Examples of components which might be formed from aluminium castings having wear-resistant properties compatible with the abrading surface are brake drums and internal combustion engine cylinder blocks. Known aluminium having adequate abrasion resistance for these purposes are usually too brittle to permit them to withstand the substantial loadings which are, in service, applied to brake drums, for example. They are, in addition, often difficult to cast.

Heretofore when aluminium has been utilised for the production of components of this type, it has usually been the practice to provide a wearing surface in the form of a liner of another metal so that one of the known casting alloys having adequate mechanical strength properties can be employed for the body of the casting. This expedient is costly and the heat dissipation by transfer from the liner to the aluminium body is usually relatively poor. It has therefore been for some time desirable to be able to produce aluminium castings which combine a wear-resistant surface with adequate mechanical strength and toughness and to have available a readily castable aluminium alloy from which such castings can be produced. The present invention relates to a new aluminium alloy from which castings, which combine good wearing characteristics with adequate mechanical properties, machinability and freedom from brittleness, may be produced.

It is well-known to utilise aluminium alloys containing about 17 to 23% of silicon for the production of components such as pistons, and such pistons have adequate wear-resistance properties. However, these alloys are too brittle to permit the production therefrom of components, such as engine blocks and brake drums, which are subjected to substantial mechanical loadings in service. If the silicon content is reduced to about 15%, the brittleness of the alloy is reduced, but at the same time the wearing resistance characteristics are sacrificed and the alloys would not be as suitable for the production of brake drums and cylinder blocks, having integral cylinder walls. We have now discovered that the addition of cobalt to alloys containing less than 17% Si, for example, alloys containing about 10–17% Si, increases the wear-resistance of such alloys to an extent to make them the equal to or an improvement on, in this respect, the alloys containing 17–23% Si; this is accomplished not only without sacrifice in toughness as might be expected, but with further improvement of toughness characteristics and with improvement in machinability. Other commonly employed alloying elements may be added with effects already well known in the art to improve such properties as hot strength, wear resistance, etc. We find that very good results can be obtained in the production of cast products with aluminium alloys containing silicon, about 10 to 17%, cobalt, about .01 to 5% and copper up to about 5%. Other alloying elements some or all of which may be added are manganese, up to about 1%, chromium, up to 1%, magnesium, up to about 2%, and nickel up to 10%.

We have found that the wear resistance of castings

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produced from alloys made in accordance with the invention is superior where the casting has a very fine structure, that is where the primary silicon particles are below 50 microns and preferably below 25 microns. In addition the constituent particles in the eutectic should be of such a small size that under microscopic examination they are not resolved as discrete particles at 25× magnification and preferably not at 400× magnification. Commonly known grain refiners may be added to the alloy. For example, titanium in an amount of about 0.2% or a combination of titanium and boron in an amount of about 0.05% titanium and 0.01% boron.

In order to produce the desired fine grain structure the castings are poured in a permanent mould and chilled as rapidly as possible, for example, by the application of coolant sprays to the external surface of the mould.

The preferred composition of alloy is silicon, about 15%, copper, about 1%, and cobalt, about 2%, the balance being aluminium of commercial purity. The preferred ranges of copper and cobalt are respectively about 0.5 to 2.5% and about 0.1 to 5%, and of silicon, about 14 to 17%.

It has been found that using the specific alloy of preferred composition above referred to, vehicle wheel hub and brake drum castings may be produced having adequate wear resistance and machinability, whereas the same components would have been much too brittle for normal service, if cast in the normally used hypereutectic aluminium-silicon alloys containing 17 to 23% silicon. Brake drum castings made in the alloy of the present invention have been found to have excellent machining characteristics for this type of alloy and the drums successfully withstood wear tests and did not require the use of special brake linings.

We claim:

1. An aluminium alloy consisting essentially of:

- (a) silicon, about 10–17%;
- (b) cobalt, about 0.01–5%;
- (c) copper, about 0.5–5%;
- (d) manganese, up to 1%;
- (e) chromium, up to 1%;
- (f) magnesium, up to 2%;
- (g) nickel, up to 10%;

(h) aluminium and incidental impurities, the balance;

(i) said alloy being characterized by the primary silicon particles being below 50 microns in size.

2. The alloy of claim 1 wherein said primary particles are below 25 microns in size.

3. The alloy of claim 1 including a grain refiner in conventional amount.

4. An aluminium alloy consisting essentially of:

- (a) silicon, about 14–17%;
- (b) cobalt, about 0.1–5%;
- (c) copper, about 0.5–2.5%;
- (d) manganese, up to 1%;
- (e) chromium, up to 1%;
- (f) magnesium, up to 2%;
- (g) nickel, up to 10%;

(h) aluminium and incidental impurities, the balance;

(i) said alloy being characterized by the primary silicon particles being below 25 microns in size.

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