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FREE CUTTING ALLOYS

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1 Claim. (Cl. 75—146)

This invention relates to aluminium base alloys and particularly to alloys of this kind containing magnesium as a major alloying component and is a divisional application from our copending application Serial No. S. N. 176,625 entitled Free cuttings alloys and filed November 26, 1937.

Aluminium base alloys containing from about 3–16% of magnesium are being widely used in various forms because of their favourable mechanical strength properties, their high resistance to corrosion by sea-water and alkaline agents, and also because of the fact that they are readily machined by boring, drilling, shaping, planing or the like. When it is attempted however to utilize these favourable machining properties of the aforesaid alloys on high speed lathes in the mass production of articles, it has been observed that the turnings formed in the operation attain an enormous length, winding round the revolving parts of the lathes and the workpiece itself, and thus obstructing further proper working.

It is accordingly one of the objects of our invention to make aluminium magnesium alloys amenable to machining operations with high speed lathes without encountering the disadvantage hereinbefore referred to. Specifically, it is an object of the invention to provide alloys of the aforesaid type which, on being machined with high speed lathes, produce turnings which will readily break up into smaller parts, these being easily removed from the range of operation, while at the same time accomplishing the foregoing ends without disadvantageously affecting the physical and other useful properties of the alloys.

It has been observed that, when in aluminium alloys containing between 3 and 16% of magnesium certain alloying components capable of forming aluminides with the basic aluminium, particularly manganese, vanadium, chromium, titanium, iron, nickel and cobalt, are present, either singly or in combination and in quantities not substantially exceeding about 5%, the turnings produced in the working of such improved alloys by high speed lathes readily break up into smaller fragments. Investigation has shown that this phenomenon is caused by the presence of primary crystals of the aforesaid aluminides in the crystalline texture which, being hard and brittle, are responsible for the ready breaking up of the turnings. On the other hand, however, it has been observed that the surface of alloys of the aforesaid compositions, after being machined, regularly show a kind of pitting. Closer investigation has shown that this pitting is due to the hard aluminides being present in the texture of the alloys in the form of comparatively large crystals, which, on working the alloys, are torn out of the machined surface by the cutting tool, thus yielding a surface which is not as even and smooth as desired.

The present invention is based upon the discovery that by introducing also zinc into the aforesaid alloys, the aluminides, on solidification of the alloy, do no longer form comparatively large crystals but are disintegrated into very finely divided particles which, on further working the alloys by extruding, forging, etc. prior to the machining operation, easily become disseminated throughout the crystalline texture, being more or less uniformly distributed therein.

The invention thus contemplates alloys of aluminium containing magnesium in quantities ranging between 3 and 16% and further an addition of at least one aluminide-forming metal conjointly with zinc, both the latter additions being present in the alloy in quantities not exceeding about 5%. Preferably, the quantity of zinc incorporated in the alloy should amount to at least 0.2% and should not exceed about 4%.

It has further been found that a similar effect may be obtained when employing aluminium magnesium alloys containing, instead of or in addition to, the aluminide-forming component, a certain quantity of silicon exceeding about 0.3%, which, as is known, forms a hard silicide together with magnesium. Also in this case, an addition of zinc will cause a subdivision of the hard magnesium silicide particles with consequential improvement in the machining properties of the alloy.

The mechanical strength and other favourable properties of the alloys hereindescribed are not materially affected by the addition of the components improving their machining properties according to the present invention, as long as the total of such components does not exceed about 5% of the total weight of the alloy. However, in order to obtain the best results in this respect, it is advisable not to increase the pro-

portion of the aforesaid additions to beyond about 3%.

As examples of alloys which have been found particularly useful for the aforesaid purposes, the following may be mentioned:

(1)	Per cent
Mg	9.0
Zn	1.3
Fe	1.3
Mn	0.5
Al	Rest

(2)	Per cent
Mg	8.0
Zn	1.75
Fe	0.8
Si	1.0
Al	Rest

(3)	Per cent
Mg	11.0
Zn	2.0
Mn	0.8
Si	0.75
Cr	0.4
Al	Rest

(4)	Per cent
Mg	10.0
Zn	1.0
Fe	0.9
Si	0.4
Ti	0.3
Al	Rest

The term "aluminium" used herein and in the appended claim embraces the usual impurities found in aluminium ingot of commercial grade, or picked up in the course of the usual handling operation incident to ordinary melting practice.

The alloys herein disclosed may be subjected to the usual thermal treatments familiar to those skilled in the art for the purpose of improving or altering their physical characteristics.

We claim:

An aluminium base alloy containing from about 3 to 16% of magnesium, from about 0.2 to about 4% of zinc and at least one metal capable of forming an aluminide, the total of the intentional alloying ingredients, apart from aluminium and magnesium, not exceeding about 5% of the total weight of the alloy.

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