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[54] **ALLOY ON ALUMINUM-ZINC-BASIS**

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[51] **Int. Cl.** **C22c 21/00**

[58] **Field of Search**... 75/146, 141, 178 A, 178 AC, 75/178 AM; 148/32, 32.5

[56] **References Cited**

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[57] **ABSTRACT**

The invention relates to an alloy on aluminum-zinc-basis consisting of 38 to 75 % aluminum, nickel, and, if desired, magnesium and copper, remainder zinc, wherein the improvement resides in that the nickel content amounts to at least 0.05 % and maximally corresponds to the course of the eutectic groove in the aluminum-zine-nickel system, this maximum content of nickel amounting to 0.6 % when 38 % aluminum are present, to 1.1 % when 50 % aluminum are present, to 1.7 % when 60 % aluminum are present, to 2.4 % when 70 % aluminum are present, to 2.8 % when 75 % aluminum are present, and progresses continuously between the given values. This alloy is an excellent bearing metal by which the running characteristics are essentially improved.

3 Claims, No Drawings

ALLOY ON ALUMINUM-ZINC-BASIS

The invention relates to an alloy on aluminum-zinc-basis consisting of 38 to 75 %, preferably of 50 to 65 % aluminum, nickel and, if desired, magnesium and copper, remainder zinc, and to a process for the production of such alloy and process for the production of shaped bodies from such alloy.

Such alloys are used primarily as bearing material for bearing bushings or the like, which parts are produced by casting or by appropriate shaping from rolled plates and sheets. In any case at first a casting is made whose structure is responsible to a great degree for the properties of the bearing.

On account of their great solidification interval the alloys on aluminum-zinc-basis defined in the introduction tend towards inverse ingot segregation as a result of which intercrystalline porosity occurs. Contrary to previous belief, such pores are not advantageous for the running behaviour of the bearing. Porous bearings which are soaked with oil are selflubricating only when pores of particular dimensions are distributed regularly over the bearing running surface. If this is not the case, the porous parts of a sliding area deprive the dense parts of the oil film which may lead to abrasion of the bearings.

It has been known that castings made of aluminum-zinc-alloys and having simple shapes are imparted with excellent mechanical properties by rapid cooling after casting. However, it has not been possible so far to make use of the advantages gained by rapid cooling of the casting, since with increasing solidification speed also the reverse ingot segregation is enhanced so that to an increasing degree pores will occur in the castings. It is true that the tendency towards the formation of pores may be reduced by technological measures, such as increased use of risers and on-casts and by keeping the metal therein liquid. However, the metal which solidifies in the risers and on-casts must be separated from the cast product proper, for example by means of flame cutting, and is cast to the scrap. Seeing that the amount of metal solidifying in the risers and gates makes up a considerable percentage of the total amount of metal which is to be cast in the production of a cast product, the disadvantages and additional costs caused by the great amount of scrap in casting are great. Apart from such economic considerations, the mentioned technological aids for casting do not with sufficient reliability lead to the desired success.

The invention is aimed at avoiding these disadvantages and, in an alloy of the kind defined in the introductory part, resides in that the nickel content amounts to at least 0.05 % and maximally corresponds to the course of the eutectic groove in the aluminum-zinc-nickel system, this maximum content of nickel amounting to 0.6 % when 38 % aluminum are present, to 1.1 % when 50 % aluminum are present, to 1.7 % when 60 % aluminum are present, to 2.4 % when 70 % aluminum are present, and to 2.8 % when 75 % aluminum are present, and progresses continuously between the given values. The nickel content suggested by the invention causes in the cast product a structure without pores and of fine grain and an increase in hardness.

The alloy may, with advantage, contain also from 0.005 to 0.05 % of magnesium, by which addition the grain is rendered even finer. Furthermore, copper may be contained in an amount of maximally 6.5 % of the

aluminum content. This additional ingredient also effects an increase in hardness.

In the process for producing the alloys care has to be taken that starting materials with a purity of at least 99.5 % are used which are free from elements which form insoluble compounds with nickel, such as silicium or boron, and from elements which crystallize primarily and in the form of needles, such as iron, manganese, titanium, vanadium, molybdenum, tungsten and carbon.

The magnesium may be added, suitably in the form of a pre-alloy of high specific gravity, advantageously in the form of an alloy with 5 % aluminum, 3 % magnesium and 92 % zinc.

In the process for the production of shaped bodies from the alloy according to the invention care should be taken that during solidification the heat dissipation is kept lower than 0.2 Cal/sec/g, preferably between 0.05 and 0.1 Cal/sec/g. When this condition is fulfilled during solidification of the cast product the aims of the invention are attained in an optimal manner.

Shaped bodies produced from an alloy according to the invention may be cooled rapidly from temperatures of more than 350° C to room temperature and then be heat treated for a period of from 0.25 to 8 hours at temperatures between 80° and 275° C. During this heat treatment pure zinc crystals will separate from the alloy in most finely distributed form so that the emergency running characteristics (running without oil) of the bearing parts produced from the alloy according to the invention are materially improved.

The alloy according to the invention may be hot shaped at temperatures of from 200° to 400° C but may also be cold shaped. Thus it becomes possible to produce bearing bushings with thin walls by shaping cold rolled sheets made of the alloys according to the invention.

In the following examples the mechanical properties of some embodiments of the alloys according to the invention are given.

EXAMPLE 1

Bearing alloy for medium stress, annealed for 1 hour at 150° C, composition: Al 50 %, Zn 49.3 %, Ni 0.7 %.

Hardness as cast	H_B — 90 kp/mm²
hardness after annealing	H_B — 65 kp/mm²

EXAMPLE 2

Bearing alloy for higher stress, annealed for 1 hour at 150° C, composition: Al 58 %, Zn 40 %, Ni 1 %, Cu 1 %.

Hardness as cast	H_B — 110 kp/mm²
hardness after annealing	H_B — 90 kp/mm²

By adding 0.03 % Mg the hardness values are increased by 10 kp/mm².

EXAMPLE 3

Bearing alloy, hot rolled at 280° C from 30 mm to 6 mm, annealed for 3 hours at 150° C.

a. composition	Al 60%, Zn 38.3%, Ni 1.7%
HARDNESS AS CAST	H_B — 115 kp/mm²
hardness after annealing	H_B — 70 kp/mm²
b. composition	Al 60%, Zn 38%, Ni 1.7%, Cu 0.3%
hardness as cast	H_B — 130 kp/mm²
hardness after annealing	H_B — 85 kp/mm²

Alloys (a) and (b) were cold rolled and hardened at 150° C for 3 hours. In cases when two values are indicated one after the other, the first value refers to the result when the measurement was taken parallel to the rolling direction, the second value refers to the result when the measurement was taken perpendicularly to the rolling direction.

a. cold rolled			hardened	
yield point (kp/mm²)	27	31	18	18
breaking strain (kp/mm²)	34	36	23	24
elongation (%)	10	15	20	20
hardness H_B (kp/mm²)	70		55	

b. cold rolled			hardened	
yield point (kp/mm²)	36	34	22	23
breaking strain (kp/mm²)	44	44	26	28
elongation (%)	5	5	15	20
hardness H_B (kp/mm²)	95		70	

What I claim is:

1. An aluminum-zinc alloy consisting essentially of
38 to 75% aluminum;
0 to 0.05% magnesium;
0 to 4.8% copper, the maximum copper content amounting to 6.5% of the aluminum content;
0.05 to 2.8% nickel, the maximum nickel content being determined by the eutectic groove in the aluminum-zinc-nickel system and amounting to 0.6% when 38% aluminum are present, 1.1% when 50% aluminum are present, 1.7% when 60% aluminum are present, 2.4% when 70% aluminum are present and 2.8% when 75% aluminum are present, the eutectic groove progressing continuously between the given values; and
balance zinc.

2. An aluminum-zinc alloy consisting essentially of
50 to 65% aluminum;
0 to 0.05% magnesium;
0 to 4.2% copper, the maximum copper content amounting to 6.5% of the aluminum content;
0.05 to 2.0% nickel, the maximum nickel content being determined by the eutectic groove in the aluminum-zinc-nickel system and amounting to 1.1% when 50% aluminum are present and 1.7% when 60% aluminum are present, the eutectic groove progressing continuously between the given values; and
balance zinc.

3. The alloy set forth in claim 1, containing from 0.005 to 0.05 % of magnesium.

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