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BEARING ALLOYS

Josef Derntl, Linz (Danube), Austria, assignor to Vereinigte Osterreichische Eisen- und Stahlwerke Aktiengesellschaft, Linz (Danube), Austria, a firm

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9 Claims. (Cl. 75—140)

The present invention relates to bearing alloys comprising primarily aluminium, zinc and copper.

Bearing materials are known which consist of an aluminium-zinc-copper alloy containing 30% to 66% aluminium, a copper content which is at least one-sixth and at most one-quarter of the aluminium content present and in which the remainder is zinc. Further a similarly constituted bearing material is known which however contains less aluminium, namely 18 to 29%, in which the copper content is one-tenth to one-quarter of the aluminium content present and the remainder consists of zinc.

Cast bearing materials of the type referred to have a critical temperature at 90 to 100° C., while mouldable materials have a critical temperature at 70 to 80° C. Pressed-in sleeves which are heated above the critical temperature show on subsequent cooling a tendency to loosen. Moreover with these bearing materials adverse effects on shafts of smaller hardness is difficult to avoid.

It has now been found that the running properties of bearing materials of the aluminium-zinc-copper type are improved by the addition of antimony or tin, or antimony and tin. The content of antimony may range between 0.05 to 5% and of tin from 0.1 to 10%. Preferred values are 1 to 2% antimony and/or 2 to 6% tin. The copper content of the bearing material should not exceed 10%. Satisfactory results are obtained if the sum of the copper and tin fraction lies between 8 and 12% preferably 10%. This is however not absolutely necessary. A bearing material consisting of 20% aluminium, 60% zinc, 10% copper and 10% tin has very satisfactory running properties.

Other bearing materials which have been tested are shown in the following table:

Table 1

	Al	Zn	Cu	Sn	Sb	Cr	Be	Mg	Si
A	20	60	10	10					
B	30	60	5	5					
C	40	56	2	1	1				
D	50	38.9	5	5	1	0.1			
E	51	31.9	7	9	1	0.1			
F	59	29.9	8	2	1	0.1			
G	60	29.8	5	5		0.2			
H	60	30.9	8		1	0.1			
I	60	21.8	8	10		0.2			
J	60	26.3	8	4	1.5	0.2			
K	60	Residue	8	5	2	0.2	0.002	0.5	0.005
L	60	do	5	5	3	0.2	0.002		0.005
M	60	do	8	2	5	0.1		0.5	

Optimum running properties are shown by the materials F, G and H. The material H can also be used as a moulding material.

Running tests with the new materials show practically twice the load bearing ability as compared with known bearing materials. Only at loadings greater than 500 kg. per sq. cm. and a surface speed equal to or greater than 3 m. per sec. with oil drip lubrication (with the known materials and under the same conditions this figure cannot exceed 280 kg. per sq. cm.), is there an increase in the temperature and of the frictional resistance without the shaft being affected and a noticeable increase of wear occurring. Shafts of soft steel (for example St 50.11) show no scoring or erosion after 100 hours' running without lubrication.

Press-in tests have shown that the new material will only loosen after heating to 140° C. and following cooling. However according to the composition even higher temperatures, for example 160° and in one case even 190° have been reached, that is temperatures which are practically never reached in normal bearings.

The running properties of the new materials have been tested up to temperatures of 170° C. In these tests there has been no adverse effect on the shaft nor any tendency to seizure or welding of the bearing material to the shaft.

A further advantage of the new material is its outstanding workability with chip forming tools which becomes particularly apparent when machining on automatic tools.

The specific weight of the new material lies in general between about 3.6 and 3.8 gm. per cu. cm. and depends mainly on the aluminium content.

In the following table the most important properties for the materials F, G and H are given:

Table 2

	I, kg./sq. mm.	II, percent	III	IV, gm./cu. cm.	V, ° C.	VI, ° C.	VII, kg./sq. cm.
F	21.1	1.2	135	3.6	160	35	500
G	20.9	0.4	107	3.6	150	35	520
H cast material	30.6	1.8	130	3.6	160	40	480
H moulding material	42.0	7.2	118	3.6	110	40	500

In the above:
I signifies the strength in kg. per sq. mm.
II signifies the yield point $d5$ in percent (the designation d5 indicates that the length of the test rod used for the measurement is 5 times its diameter).
III the Brinell harnness HB10.
IV the specific weight in gms. per cu. cm.
V the temperature in ° C. at which on subsequent cooling loosening of the mounting of the pressed-in bearing occurs.
VI the running temperature in ° C. for v=0.8 m. per sec. and p=100 kg. per sq. cm.
VII the load-bearing ability at v=3 m. per sec. in kg. per sq. cm.

The new material can be readily cast in sand moulds and in shell moulds or by die casting. It requires no subsequent heat treatment.

The chromium content can range up to 3%. Instead of chromium, nickel up to 3% may be added.

Further components of the new material may be silicon, beryllium and magnesium. Their content individually should not exceed 3% and altogether 6%. A satisfactory

material is obtained if a portion of the zinc in material J of Table 1 is replaced by 0.1% silicon and traces of nickel, beryllium and magnesium.

I claim:

1. Bearing material of the aluminium-zinc-copper alloy type, characterised in that is consists essentially of 20 to 65% aluminium, 1 to 10% copper, 0.05 to 5% antimony and 0.1 to 10% tin, and the remainder zinc.

2. Bearing material according to claim 1 characterised in that the antimony content is 1 to 2%.

3. Bearing material according to claim 1 characterised in that the tin content is 2 to 6%.

4. Bearing material according to claim characterised in that a portion of the zinc is replaced by up to 3% of a metal selected from the group consisting of chromium and nickel.

5. Bearing material according to claim 1 characterised in that a part of the zinc is replaced by at least one of the

elements silicon, beryllium and magnesium, individually up to 3% and in all up to 6%.

6. Bearing material according to claim 1 characterised in that the sum of the content of copper and tin amounts to 8 to 12%.

7. Bearing material of the aluminium-zinc-copper alloy type, characterised in that it consists essentially of 20 to 65% aluminium, 1 to 10% copper, 0.05 to 5% antimony, and the remainder zinc.

8. Bearing material consists essentially of 59% Al, 29.9% Zn, 8% Cu, 2% Sn, 1% Sb, and 0.1% Cr.

9. Bearing material consists essentially of 60% Al, 30.9% Zn, 8% Cu, 1% Sb, and 0.1% Cr.

References Cited in the file of this patent

UNITED STATES PATENTS

2,243,489 Smith ---------- May 27, 1941

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,031,298 April 24, 1962

Josef Derntl

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 13, after "claim" insert -- 1 --.

Signed and sealed this 28th day of August 1962.

(SEAL)
Attest:

DAVID L. LADD
Commissioner of Patents

Attesting Officer