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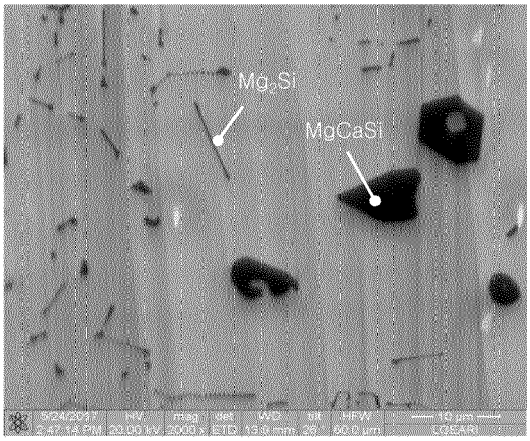
(54) **HIGH THERMAL CONDUCTIVE MAGNESIUM ALLOY AND HEAT SINK USING THE SAME**

(57) A magnesium (Mg) alloy having lightweight and excellent thermal conductivity, and a heat sink including the magnesium (Mg) alloy are provided. The magnesium (Mg) alloy may include one or more alloy additive elements selected from the group consisting of silicon (Si), calcium (Ca), tin (Sn), yttrium (Y), iron (Fe), nickel (Ni), copper (Cu), cerium (Ce), cesium (Cs), antimony (Sb), cobalt (Co), thorium (Th), and silver (Ag). Some of the alloy additive elements may be dissolved in the magnesium alloy to form a solid solution. The alloy additive elements that form the solid solution at room temperature may account for 2 wt% or less, based on the total weight (100 wt%) of the magnesium alloy, and the alloy additive elements that do not form the solid solution may be in crystalline phases.

FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 18 18 0043

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GIL-SANTOS ANDREA ET AL: "Microstructure and mechanical characterization of cast Mg-Ca-Si alloys", JOURNAL OF ALLOYS AND COMPOUNDS, ELSEVIER SEQUOIA, LAUSANNE, CH , vol. 694 8 October 2016 (2016-10-08), pages 767-776, XP009508836, ISSN: 0925-8388, DOI: 10.1016/J.JALLCOM.2016.10.059 Retrieved from the Internet: URL:https://epo.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwrV1LSwMxEB6qIOrBRxWsL3Lwmu7D7CNHXd16sBdbQU9Lkt1IS63F6sF_78w-agXxIO5twwSW-cLMt2S-GYAzjU9oXcOlkJaLKA55rKXhirh57MtAltMbHhMx7EV3PXHbgqTRwlBZZR37q5heRut6xam96cxGI2fgSp_u_GJkFCTnfigV7AGd8vTqchGNkaCUU_PQmJP1l4rHGXfHajKhohHMgmGXiryoZelP-Wkp56Tb__K [retrieved on 2018-10-22] * the whole document * * chapters 2, 3.1 and 3.2; tables 1, 2 *	1-7,12, 13	INV. C22C23/00 C22C23/02 C22C23/04
			TECHNICAL FIELDS SEARCHED (IPC) C22C

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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	12 March 2019	von Zitzewitz, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	AJITH KUMAR K K ET AL: "Changes in Solidification Morphology of Mg-Si Alloys by Ca Additions", TRANSACTIONS OF THE INDIAN INSTITUTE OF METALS, TRANSACTIONS OF THE INDIAN INSTITUTE OF METALS (2012), 65(6), 695-699 CODEN: TIIMA3; ISSN: 0975-1645, TRANSACTIONS OF THE INDIAN INSTITUTE OF METALS (2012), 65(6),695-699CODEN: TIIMA3; ISSN: 0975-16, vol. 65, no. 6, 11 October 2012 (2012-10-11), pages 695-699, XP009508838, ISSN: 0975-1645, DOI: 10.1007/S12666-012-0212-Z * the whole document * * chapters 2 and 3; figure 2 *	1-7,12, 13	
X	AI YANLING ET AL: "As-cast microstructure and its formation mechanism in Mg-based alloys containing Ca and Si", JINSHU XUEBAO / ACTA METALLURGICA SINICA, KEXUE CHUBANSHE, CN, vol. 41, no. 1, 31 January 2005 (2005-01-31), pages 49-54, XP009508833, ISSN: 0412-1961	1-7,12	TECHNICAL FIELDS SEARCHED (IPC)
A	* the whole document * * abstract; table 1 *	13	

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-7, 13

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 18 18 0043

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7, 12(all partially)

This invention relates to the problem of increasing thermal conductivity (p.4, bottom; p.6, top; etc.). The feature solving this problem is the addition of Si and/or Ca as defined in claim 1.

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2. claims: 1-7, 12(all partially)

This invention relates to the problem of providing an alternative alloy to increase thermal conductivity (p.4, bottom; p.6, top; etc.). The feature not known from the prior art and solving this problem is the addition of Sn, Y, Fe, Ni, Cu, Ce, Cs, Sb, Co, Th and/or Ag as defined in claim 1.

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3. claims: 8-10

This invention relates to the problem of increasing strength (p.9, bottom). The feature not known from the prior art and solving this problem is the addition of 0.1-6.0% Zn as defined in claim 8.

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4. claim: 11

This invention relates to the problem of providing an alternative alloy to increasing the strength (p.10, bottom). The feature not known from the prior art and solving this problem is the addition of 0.1-1.0% Al as defined in claim 11.

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5. claim: 13

This invention relates to the problem of providing a specific use of the alloy. The feature solving this problem is to use the alloy in a heat sink as defined in claim 13.
