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ALUMINUM-CALCIUM ALLOYS

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This invention relates to aluminum base alloys containing calcium and it is more particularly concerned with a means of producing sound castings.

5 Aluminum base alloys consisting of aluminum and 2 to 15 per cent calcium find commercial use both as material from which certain articles are made and as a source of calcium in the manufacture of other alloys.

10 In making aluminum base alloys containing calcium it is preferable to add this element as a constituent in a rich alloy rather than in elemental form to avoid undue loss and excessive oxidation. Hence it is the customary practice to
15 employ a calcium-bearing alloy of the kind mentioned above.

The manufacture of the aluminum-calcium alloys themselves involves some difficulty by reason of the readiness with which they oxidize in the molten condition and their marked tendency
20 to sorb gas from the atmosphere. The oxide particles formed on the surface of the metal appear to hold onto considerable gas when they become mingled with the molten metal and thus in effect become a source of gas when conditions
25 change and the particles are no longer able to retain their gas charges. This phenomenon of gas release is manifested during the solidification of the alloy. During this process the affinity
30 between the metal, the oxide particles and the sorbed gas is greatly reduced and the gas forms bubbles in the liquid metal. If the metal is in a sufficiently fluid state the bubbles may escape, otherwise they are trapped and form spaces in
35 the casting. Furthermore, in the case of the rich alloys, the void spaces contain gas which is released in the melt to which the alloys are added. The deleterious effect of gas is thus transferred to other alloys.

40 Aluminum-calcium alloys also exhibit another disadvantageous feature when solidifying, namely, the formation of excrescences on the head or upper surface of the castings which necessitates discarding this portion of the casting.

45 My invention is accordingly directed to a means of eliminating or greatly reducing the formation of the void spaces in aluminum-calcium alloys, and their attendant results without impairing the desirable properties of the alloys.

50 I have discovered that the addition of from about 0.005 to 0.1 per cent of sodium to molten aluminum-calcium alloys containing from 2 to 15 per cent calcium greatly diminishes, if it does not completely eliminate, the formation of void
55 spaces in the solidifying alloy and does away with

the protuberances normally occurring on the top surface of the frozen alloy. I have found, for example, that the addition of 0.05 per cent sodium to an alloy composed of aluminum and 14 per cent calcium completely removes the objection-
5 able porosity ordinarily occurring in such an alloy. I have also found that such a sodium treated alloy does not introduce gas into other aluminum base alloys to which it may be added, thus carrying over the benefit of sodium into the
10 final product.

In order to be effective the sodium should be added shortly before the aluminum-calcium alloy is poured into the mold. In this manner the
15 maximum amount of sodium is retained in the alloy. This element must remain in the alloy, especially where the latter is to be added to another melt. I am aware that sodium has been heretofore employed in modifying the structure
20 of aluminum alloys containing substantial amounts of silicon, and in certain treatments when it is completely removed from the alloy after it has been added. My invention, however, is clearly distinguishable from such prior
25 uses of sodium in that I employ it to suppress the action of the calcium, and it is necessary to retain the sodium in the alloy to accomplish this purpose.

In referring to the proportions of sodium to be added to the molten alloy, allowance must be
30 made for the escape of a certain portion of the element because of its volatility at the temperature of molten aluminum and its great tendency to burn. It is therefore usually necessary to add more sodium than is ultimately desired in the
35 alloy to compensate for any losses. In stipulating that 0.005 to 0.1 per cent sodium should be added to the herein described aluminum-calcium alloys, I mean that at least this amount of sodium should remain in the final product. The
40 sodium is in fact a positive constituent of the alloy. If smaller amounts of this element than 0.005 per cent are employed, the benefit in respect to reducing porosity is negligible. On the
45 other hand, amounts larger than about 0.1 per cent do not show any commensurate effect upon the gas content of the alloy. For most purposes, however, I prefer to use no more than 0.05 per cent sodium because of the difficulty of adding
50 and retaining a larger amount of the element in the alloy.

The sodium should be added to the molten aluminum-calcium alloy in the elemental form. This is preferably done by wrapping pieces of the metal in aluminum foil, placing them in a per-
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forated container and thrusting the charge to the bottom of the molten metal bath. It is necessary to hold the sodium in the bottom of the bath because it would otherwise rise to the surface because of its lower specific gravity than aluminum.

Where the aluminum-calcium alloy is to be employed as a source of calcium in making other alloys it may be desirable to include other elements in the rich alloy such as copper, nickel, silicon, and the like. These elements do not suppress the action of calcium in promoting the formation of oxide particles and the sorption of gas. My invention is applicable to treating such alloys also since it pertains primarily to inhibiting the action of calcium. These alloys as well as the binary aluminum-calcium alloys are characterized by a relative freedom from gas and the resultant porosity of the casting when 0.005 to 0.1 per cent sodium is present.

The term aluminum as herein employed refers

to the metal containing the usual impurities of iron, silicon and the like. The calcium also may contain impurities usually associated with this metal.

I claim:

1. An aluminum base alloy containing from 2 to 15 per cent calcium and 0.005 to 0.1 per cent sodium, said alloy being characterized by substantial freedom from porosity attributable to the presence of gas in the metal.

2. An aluminum base alloy composed of from 2 to 15 per cent calcium, 0.005 to 0.1 per cent sodium, and the balance aluminum.

3. An aluminum base alloy composed of from 2 to 15 per cent calcium, 0.005 to 0.05 per cent sodium, and the balance aluminum.

4. An aluminum base alloy composed of 14 per cent calcium, 0.05 per cent sodium, and the balance aluminum.

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