

UNITED STATES PATENT OFFICE

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ALUMINUM-SILICON ALLOY

No Drawing.

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The invention relates to aluminum-silicon alloys and is concerned especially with the improvement of the casting characteristics of such alloys.

Aluminum-silicon alloys are among the most useful of the aluminum casting alloys and have a very wide and varied application in the casting art. These alloys usually contain about 2 to 25 per cent of silicon, together with small amounts of impurities usually not exceeding about 1.5 to 2 per cent, as for example iron. The more useful alloys are found in the range between about 3 to 15 per cent of silicon, but higher and lower amounts of silicon are often used. Other alloying elements are added on occasion to produce in the alloys certain additional properties not obtainable in the binary aluminum-silicon alloys. Thus for certain purposes, suitable amounts of copper, nickel, zinc, magnesium, and other alloying elements are added in quantities depending upon the purpose for which the alloy is to be used, all of which is well known to those experienced in the art.

The known physical properties of aluminum-silicon alloys are highly desirable for many types of castings, but such alloys also possess inherent faults which are minimized by careful control of casting conditions but on the other hand are greatly accentuated by foundry conditions often encountered. Need has accordingly been felt for aluminum-silicon alloys which will exhibit under such circumstances the casting characteristics heretofore obtainable under the most careful foundry control.

The present invention therefore has as its chief object the provision of aluminum-silicon alloys which may be successfully cast under adverse foundry conditions. The invention is predicated upon the discovery that aluminum-silicon alloys containing beryllium have important advantages in respect to the stability of their casting characteristics, and in respect thereto we have found that in the

case of aluminum-silicon alloys containing at least 3 per cent of silicon, approximately, the addition of beryllium in suitable amounts markedly decreases the tendency of such alloys to develop surface shrinkage cavities when cast, thus eliminating one of the objectionable features often shown by aluminum-silicon alloys even when cast under carefully controlled conditions, and in many cases permitting the alloys to be successfully cast under conditions which would otherwise be prohibitory. We have further observed that the tendency for cracks to form when aluminum-silicon alloys are cast into intricate patterns, as for instance cracks at the junction of a heavy section and a thin section in the casting, is markedly decreased and in some cases entirely eliminated by the presence in the alloys of a small amount of beryllium.

A further desirable advantage in our new alloys is found in the fact that in general the alloys may be frequently remelted and may be held in the molten condition for a considerable period of time, even at a temperature considerably above the melting point, without undergoing the deterioration commonly noted in the ordinary aluminum-silicon alloys under like conditions. This is an important advantage where the alloys are to be used in the large scale production of small castings or under similar conditions where it is necessary to repeatedly remelt scrap, or to hold the molten metal in a holding furnace or pot for an extended period at a temperature either slightly above or even greatly exceeding the melting temperature.

In order to obtain the desirable advantages above mentioned, a small amount of beryllium is in general sufficient, improved casting properties being in some cases obtained by the addition of as little as 0.03 or 0.05 per cent and not more than about 0.1 per cent. In other cases larger amounts of beryllium will give better casting properties and we have found that amounts of 0.3 to 2 per cent are

very advantageous. Amounts somewhat greater than 2 per cent may be added without decreasing the beneficial effects obtained with lower proportions. In any case the amount needed for the results desired can be readily ascertained by trial under the given casting conditions, as for example the shape and size of the casting to be made, the presence of other metals in the alloy, the pouring temperature, etc. Although the effect of beryllium is pronounced when added to any of the known aluminum-silicon alloys containing large amounts of silicon, we have found its addition to be particularly advantageous in an alloy containing 5 per cent of silicon.

In addition to the above-mentioned advantages which are obtained by the use of these new aluminum-silicon alloys containing beryllium, other substantial advantages are developed when larger proportions of beryllium than 2 per cent are used. The extreme lightness of beryllium and its low coefficient of expansion are properties of the metal which advantageously affect aluminum-silicon alloys. Thus, while the alloying elements which are commonly added to aluminum-silicon alloys increase the density of the alloys, the addition of beryllium in any amount decreases the density. The metal beryllium has a low coefficient of expansion, as does also the metal silicon, and therefore the presence of both metals imparts to the alloy a considerably lower coefficient of expansion, thus decreasing the high coefficient of expansion which is usually characteristic of aluminum base alloys and which for some uses is an objectionable feature.

It is to be understood that the invention is not limited to the specific details herein described but can be carried out in other ways without departure from its spirit.

We claim—

1. An aluminum-silicon alloy containing 2 to 25 per cent of silicon and also containing about 0.03 to 2 per cent of beryllium, characteristically free from cavities due to surface shrinkage when cast.
2. An aluminum-silicon alloy containing about 3 to 15 per cent of silicon and about 0.03 to 2 per cent of beryllium, characteristically free, in the cast condition, from cavities due to surface shrinkage.
3. An aluminum-silicon alloy containing about 5 per cent of silicon and between approximately 0.03 and 2 per cent of beryllium, characteristically free from cracks and surface shrinkage cavities when cast.
4. An aluminum-silicon alloy containing about 3 to 15 per cent of silicon and about 0.1 per cent of beryllium, and characteristically free, in the cast condition, from surface shrinkage faults which are found in the same alloy devoid of beryllium when cast under the same conditions.
5. An aluminum-silicon alloy containing 2

to 5% of silicon and containing .03-1% of beryllium, the remainder being substantially all aluminum.

6. An aluminum-silicon alloy containing 2 to 25 per cent of silicon and also containing about 0.03 to 2 per cent of beryllium.

In testimony whereof we hereto affix our signatures.

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