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ALLOY FOR ADDITION TO MOLTEN CAST IRON

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This invention relates to an alloy for addition to molten cast iron in order to improve the microstructure and physical properties of the castings and to eliminate or minimize the occurrence of pinholes in the castings.

Heretofore, ferrosilicon has been added to molten cast iron in order to control the amount and form of graphite in iron castings. Occasionally, however, it has been found that the beneficial effects achieved by addition of ferrosilicon were, to some extent, vitiated by the occurrence of pinholes, particularly on the cope side of the casting. These pinholes accompanied the introduction of substantial amounts of aluminum, a normal impurity in ferrosilicon even though present in small percentage. At the same time, the presence of a certain amount of aluminum was desired for deoxidation of the metal. Furthermore, it was found difficult to control the microstructure of the iron by the addition of silicon or ferrosilicon alone. Frequently, considerable variations in the strength of the iron have been observed as a result of a non-uniform distribution of graphite, often occurring in coarse flakes, especially where slow cooling permitted aggregation. Also, pearlite tended to crystallize under such conditions in large grains and sometimes there were zones of weakness which led to failure under low stress. When such conditions prevailed, the microstructure of the iron became purely a function of the cooling rate and was dependent on cross sectional variations in the casting. The graphite contained in the iron was then subject to wide variations ranging from coarse, large flakes to fine graphite. Similarly, the microstructure of the matrix then ranged from sorbitic or harder structures through fine pearlitic to coarse pearlitic and free ferrite.

I have invented a silicon-containing alloy which causes the iron to solidify with a microstructure of short, thick particles of graphite uniformly distributed in a largely pearlitic matrix and does so quite uniformly over a considerable range of casting sections. Furthermore, the castings are free from pinholes.

The alloy of my invention consists essentially of 60 to 80% silicon, preferably 65 to 75% silicon, 15 to 25% manganese, preferably 17 to 20% manganese, 0.5 to 1.5% calcium, 0.2 to 1.5% aluminum, 1.5 to 2.5% barium and up to 5% iron.

A preferred example of an alloy according to my invention has the following composition:

	Percent
Si	72
Mn	20
Ca	1
Al	1
Ba	2
Fe	4

The barium content of my alloy has been determined to be critical by extensive experimentation and has been found to modify the effect of aluminum so as to permit the aluminum, in combination with the calcium, to act as deoxidizer but prevent the formation of pinholes in the casting. This feature may be attributable to the suppression of gas development or to the suppression of oxides which give rise to these deleterious effects or it may be attributable to other causes. Additionally, it is believed that the presence of barium in the amount specified exercises a beneficial influence in producing the graphite in the form of short, thick particles uniformly distributed throughout the section of the casting.

The addition alloy of my invention has a carefully balanced composition of active ingredients which produce the advantages obtainable by use of ferrosilicon but without developing the defects resulting from the use of ferrosilicon. Furthermore, the microstructure of the iron castings is consistently fine pearlite, even though the carbon contents of the castings and the thicknesses in different sections of the castings vary over wide ranges.

The alloy is added to molten cast iron in amounts between 2 and 35 pounds of alloy per ton of cast iron so as to add about 0.075 to 1.25% silicon and about 0.025 to 0.40% manganese. The barium addition thus effected amounts to about 0.003 to 0.04%. In spite of the small barium addition, I have determined that it critically improves the consistency with which I am able to produce a desirable microstructure in the iron over a wide range of cross sections and carbon levels.

The invention is not limited to the preferred embodiment but may be otherwise embodied or practiced within the scope of the following claims.

I claim:

1. An alloy for addition to molten cast iron, said alloy consisting essentially of 60 to 80% silicon, 15 to 25% manganese, 0.5 to 1.5% calcium, 0.2 to 1.5% aluminum, 1.5 to 2.5% barium and up to 5% iron.

2. An alloy for addition to molten cast iron, said alloy consisting essentially of 65 to 75% silicon, 17 to 20% manganese, 0.5 to 1.5% calcium, 0.2 to 1.5% aluminum, 1.5 to 2.5% barium and up to 5% iron.

3. An alloy for addition to molten cast iron, said alloy consisting essentially of about 72% silicon, 20% manganese, 1% calcium, 1% aluminum, 2% barium and 4% iron.

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