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# UNITED STATES PATENT OFFICE.

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CAST IRON AND THE METHOD OF MAKING SAME.

No Drawing.

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The present invention relates to the treatment of metals, and, more particularly, to the treatment of molten metal in the manufacture of castings.

An object of the invention is to provide a process for the manufacture of castings of special strength and uniformity, such as will insure the quality sought in the finished castings.

Heretofore, when deemed essential, it has been the practice in the manufacture of grey iron castings to add to the molten metal a suitable agent in order to obtain the carbon in the desired forms.

In the breaking down of the iron carbide in the metal during solidification, ferro-silicon generally has been used as a graphitizing agent in order to provide the proper ratio of combined and graphitic carbon in the casting, and in a treatment of molten metal such as would upon solidification produce a casting white in fracture, into metal for castings the fracture of which would be grey, the use of the silicide substantially free from iron is suggested in my Patent 1,499,068, granted June 24th, 1924.

My investigations have disclosed that the character of gray castings may be materially improved by the treatment of molten metal already suitable for making the same, through the introduction in the molten metal of a silicide substantially free from iron. It has been found that a silicide of an alkaline earth metal, such as calcium or magnesium, or other alkaline earth metal, will materially improve the casting, even though it contains an amount of graphitic carbon that was not precipitated by the silicide referred to, and would have been gray in fracture without the introduction of the silicide.

The introduction of such a silicide, even in molten metal which when cast ordinarily would be gray in character, is readily soluble and workable, and acts to precipitate additional carbon in spite of which the tensile and transverse strength will be materially increased. It has been found that the silicide produces this effect in molten iron adapted to produce a casting containing approximately 3% of combined carbon, and even in iron containing less than 1% of combined carbon.

By the statement that the silicide is substantially free from iron, is meant that the iron content of the treating agent or alloy is relatively inconsiderable.

I have also found that in the production of

castings, the silicide agent may be accompanied to advantage by a second alkaline earth metal, such as magnesium, strontium, barium, etc. For example, an alloy agent of calcium, silicon and an inconsiderable amount of iron may also include to advantage either magnesium or strontium or barium, etc.

The agents described above, when used separately or combined as alloys, have been found to be of increased or intensified value if accompanied by nickel, or aluminum, or chromium, or titanium or vanadium.

The following alloys are given as examples of ones that have been found to be satisfactory:

## Example 1.

	Per cent.	
Calcium	33 to 35	
Silicon	62 to 65	75
Iron	3	

## Example 2.

	Per cent.	
Calcium	33	
Aluminum	8	80
Iron	3	
Silicon	56	

## Example 3.

	Per cent.	
Silicon	53	85
Calcium	32.60	
Nickel	3.60	
Iron	2.60	

## Example 4.

	Per cent.	
Calcium	35	90
Magnesium	9	
Silicon	56	

## Example 5.

	Per cent.	
Silicon	51	95
Nickel	5	
Magnesium	9	
Calcium	35	

These agents may be introduced into the molten metal, in any suitable manner, either in combination, i. e., as alloys, or separately. Ordinarily the alloy or separate elements are reduced to relatively small particles, although the alloy may be used in brick or briquette form, and a few ounces of the same used to a small percentage of the metal treated. The agents may be added in the spout as the molten metal runs from the furnace, or thrown into the stream of metal where it enters the ladle from the spout, or else added to the metal in the furnace.



Although the percentages given in the foregoing examples may be varied considerably, it is to be understood that where reference is made in the specification and claims to the use of a silicide, such as calcium or magnesium silicide, I mean an amount of the same sufficient to produce an appreciable graphitizing effect. Since the molten iron will vary in its characteristics, the amount of silicide needed, in particular instances, will be governed accordingly, the silicide being used, of course, in sufficient amounts to produce the desired graphitizing effect.

By "molten white iron," I mean such molten iron as will produce castings substantially free from graphitic carbon. By "white iron" I mean such castings as are substantially free from graphitic carbon. By "gray molten iron" I mean such molten iron as will produce castings in which more or less graphitic carbon will be present. By "gray iron" I mean castings in which more or less graphite is present.

I claim:

1. That improvement in the art of making cast-iron which consists in adding to gray molten metal a silicide containing an alkaline earth metal, and another graphitizing agent such as nickel.
2. That improvement in the art of making cast-iron which consists in adding to molten metal a silicide containing an alkaline earth metal, and another graphitizing agent such as nickel, and a second alkaline earth metal.
3. That improvement in the art of making

cast-iron which consists in adding to molten iron calcium silicide, a graphitizing agent such as nickel, and a second alkaline earth metal.

4. That improvement in the art of making castings which consists in adding to gray molten iron, a silicide substantially free from iron in an amount sufficient to produce a graphitizing effect.

5. That improvement in the art of making castings which consists in adding to gray molten iron, calcium silicide in an amount sufficient to produce a graphitizing effect.

6. That improvement in the art of making castings which consists in adding to gray molten iron, a silicide substantially free from iron in an amount sufficient to produce a graphitizing effect, and another graphitizing agent.

7. That improvement in the art of making castings which consists in adding to gray molten iron, a silicide substantially free from iron, in an amount sufficient to produce a graphitizing effect, and another graphitizing agent in the form of an alkaline earth metal.

8. That improvement in the art of making castings which consists in adding to gray molten iron, calcium silicide in an amount sufficient to produce a graphitizing effect and another graphitizing agent in the form of an alkaline earth metal.

In testimony whereof I have hereunto set my hand.

AUGUSTUS F. MEEHAN.