

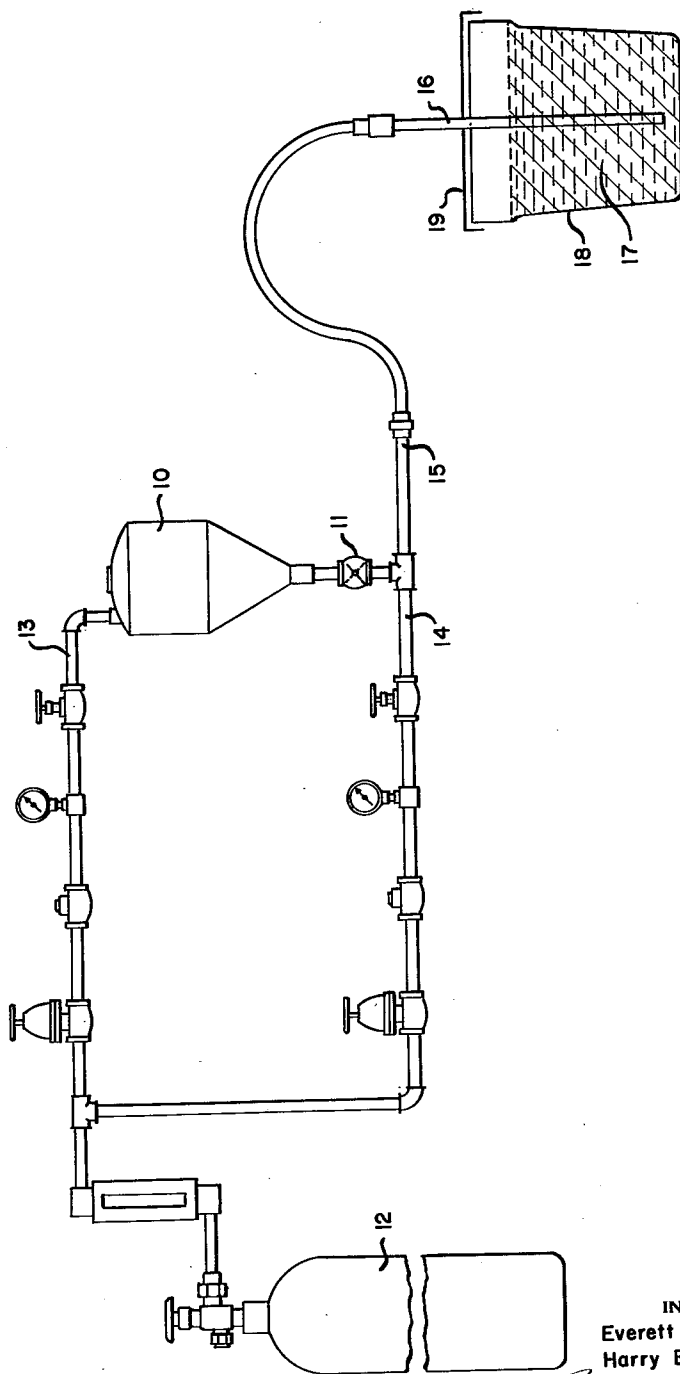
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E. W. HALE ET AL

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PROCESS FOR THE PRODUCTION OF CAST IRON

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INVENTORS
Everett W. Hale &
Harry B. Laudenslager

*By Hopa, Leonard & Quill
their attorneys*

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PROCESS FOR THE PRODUCTION OF CAST IRON

Everett W. Hale, Falconer, and Harry B. Laudenslager, Jr., Jamestown, N.Y., assignors to Blackstone Corporation, Jamestown, N.Y.

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3 Claims. (Cl. 75-130)

This invention relates to a process for the production of iron and particularly to a process for adding magnesium to iron to form a workable base iron.

It has long been known that the addition of magnesium to cast iron would result in forming graphite in nodular form and providing a ductile iron. For example, Patents 2,485,760 and 2,485,761 specifically teach the advantages which may be achieved by the presence of magnesium in cast iron. The problem of adding the magnesium has, however, been one of considerable complexity, primarily because of its high vapor pressure and high reactivity and many efforts have been made to devise some satisfactory means or method of placing the magnesium where it would effect the desired result. For example, it has been proposed to form the magnesium into various alloys such as magnesium ferro silicon prior to adding to the bath. It has also been proposed to inject the powdered magnesium or magnesium alloy mixed with a diluent into the bath under pressure as described in Patent 2,870,004. In every case carrier agent or diluent is necessary in order to overcome the high volatility and high reactivity of the magnesium. These diluents are in many cases undesirable in the finished iron but are necessary in order to carry the magnesium into the bath. As a result, the addition of magnesium has been limited to those irons where the diluents could be tolerated.

We have discovered a method of adding magnesium in the form of pure metal without the need for a diluent. We have found that magnesium metal spheres in the size range 6 to 100 mesh can be freely injected into a molten iron bath in a stream of non-oxidizing gas such as nitrogen. We have found that powdered magnesium, flake magnesium, magnesium chips and all forms of magnesium other than the afore-described spheres will plug the injection tube and cannot be used unless at least 50% of 6 to 100 mesh spheres are admixed with such other forms.

We have obtained satisfactory results by injecting the magnesium spheres through the apparatus illustrated in the accompanying FIGURE. The magnesium spheres are injected into the molten metal from a batch tank 10 through a control valve 11 by means of nitrogen from tanks 12 passing through line 13. The magnesium spheres are picked up by nitrogen in line 14 and carried through line 15 to carbon tube 16 from which they are discharged beneath the surface of the molten bath 17 in ladle 18 under hood 19. For most effective use of the magnesium we use a naturally low sulphur bath of iron or desulphurize by injecting calcium carbide into the bath prior to injecting the magnesium. However, magnesium can be used as the desulphurizer if one so elects.

The practice of our invention can perhaps be best illustrated by the following examples.

Example I

An air furnace iron having the composition

	Percent
Carbon -----	2.3
Silicon -----	1.5
Manganese -----	0.32
Sulfur -----	0.01
Phosphorus -----	0.01

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was tapped into a ladle and sufficient carbon and silicon were added in the ladle to give a final analysis of

	Percent
Carbon -----	2.9
Silicon -----	2.75
Manganese -----	0.32
Sulfur -----	0.010
Phosphorus -----	0.010

The ladle was transferred to the injection point, covered with a ladle cover, the tube 16 was inserted beneath the surface of the metal and 0.5% magnesium was injected in the form of 100 mesh spheres suspended in nitrogen at a pressure of about 32 p.s.i. This produces a flow of about 31 c.f.m. through a 1/16" orifice on the feed hopper and a feed rate of about 3 pounds of magnesium per minute so that the complete injection in a 1000 lb. bath consumed about 1.5 minutes and the residual magnesium was .03%. The iron was then cast into molds. Test bars of the material in the full ferritic state gave a yield of 48,000 p.s.i., a tensile of 67,000 p.s.i., a percent elongation in 2" of 25.00 and a Brinell hardness of 156.

Example II

In an iron of composition similar to that of Example I but containing .06% sulfur, calcium carbide was injected with nitrogen through tube 16 until the sulfur was substantially eliminated. The injection of calcium carbide was terminated and magnesium spheres were injected as in Example I with substantially identical results.

In no case have we had difficulty where the magnesium was at least 50% spheres between 6 and 100 mesh and a sufficient flow of inert gas maintained to move the spheres. On the other hand, we have been completely unsuccessful in injecting any other form of pure magnesium into the molten bath unless at least 50% of spheres in the range 6 to 100 mesh was present. We prefer to use all spheres when possible. We also prefer to use nitrogen as the carrier gas because of its cost advantage. However, where no adsorption or reaction can be tolerated one of the more inert gases such as argon may be used.

While we have set out certain preferred practices of our invention in the foregoing specification, it will be understood that this invention may be otherwise practiced within the scope of the following claims.

- We claim:
1. In a process for producing a workable base iron the improvement which comprises entraining a mixture of magnesium particles, at least 50% of which are spheres in the size range 6 to 100 mesh into a gaseous stream, injecting said stream into a molten bath of cast iron at a rate sufficient to maintain free injection of magnesium spheres into the metal and casting said molten iron.
2. A process as claimed in claim 1 wherein the gas is nitrogen.
3. In a process for producing a workable base iron the improvement which comprises entraining a mixture containing a major part of spheres of elemental magnesium in the size range 6 to 100 mesh into a gaseous stream, injecting said stream into a molten bath of cast iron at a rate sufficient to maintain free injection of magnesium spheres into the metal and casting said molten iron.

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