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METHOD OF PRODUCING MOLYBDENUM-BEARING IRON

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The invention relates to a novel and useful method of producing molybdenum-bearing pig iron, and therefrom producing molybdenum alloy grey, white, malleable and semi-steel castings.

The objects and advantages of my invention are stated hereinafter in part and in part will become obvious herefrom to those skilled in the art, or may be ascertained through practicing the invention.

The invention consists in the novel steps, sequence of steps, processes and procedures hereinafter disclosed and exemplified by a full description of the present preferred practice thereof.

The invention is directed primarily to producing a molybdenum-bearing pig iron, and usually the product will be a low-percentage of low grade molybdenum-bearing pig iron. Such a molybdenum-bearing pig iron has inherent properties and advantages of great direct value in the arts. This product of my process, for example, is an exceedingly efficient and satisfactory material suitable for use in making the so-called hot-metal alloy iron additions in the manufacture of molybdenum steel.

Another very important use and availability of this molybdenum-bearing pig iron of my invention is in the further process of producing grey, white, malleable and semi-steel castings from metal melted in the cupola furnace.

Referring now in detail to the present preferred manner of practicing my process, and having in view primarily the production of the molybdenum-bearing pig iron, I use a proportional quantity of a molybdenum compound as an ingredient of the blast furnace charge to give the desired percentage of molybdenum in the pig iron, and subject it with the remainder of the charge to the smelting operation, whereby practically the entire molybdenum content of the charge is introduced as an alloy into the pig iron.

Various molybdenum compounds may be employed in my process, as may be found convenient or desirable, such as molybdenum oxide, calcium molybdate, or molybdenum sulfide. If desired, there may be added to an ordinary blast furnace charge sufficient of the molybdenum compound of known metallic content to secure the desired or predetermine percentage of molybdenum in the pig iron, as for example, to introduce four pounds of molybdenum for every one hundred pounds of iron contained in the charge. In view of the continuous operation and periodic charging the blast furnace with predetermined quantities of the charging materials, the molybdenum bearing compound, in predetermined amount, may be included with any one of the charging materials. The percentage of molybdenum obtained in the pig iron will be found practically equivalent to the predetermined percentage introduced into the furnace charge.

The molybdenum-containing compound introduced into the blast furnace charge in the manner described or any other suitable manner during the operation goes down through the furnace with the other ingredients of the charge and is progressively subjected to the smelting or reducing operation of the furnace. As the surface operation proceeds and the charge materials are subjected to the gradually increasing temperatures and progress to a state of complete fusibility, the molybdenum is released from its compound and is absorbed practically completely into the liquid iron as a permanent alloy thereof in the predetermined percentage proportion. I do not wish to be bound by any definite theory of the alloying process which proceeds concurrently with the blast furnace operation, but it would appear that due to the relatively low affinity of molybdenum for oxygen, and possibly due to the presence of powerful reducing agents, and the gradual and progressive temperature increase downwardly through the furnace, the molybdenum either directly or indirectly is completely reduced to the metallic state, and absorption thereof by the iron is insured, even at the temperatures prevailing in the blast furnace. In any event, substantially the entire molybdenum content of the molybdenum bearing compound introduced into the charge will be transmitted as an alloy into the pig iron.

The low percentage molybdenum pig iron

of my invention possesses the advantages, among others, that it has a relatively low melting point, as compared with ferro-molybdenum. By reason of its low melting point, it lends itself most flexibly to the manufacture of alloy iron and steel, even at relatively low temperatures. Furthermore, it carries no molybdenum, and probably no other, carbon compounds which are not dissociable at ordinary steel or iron furnace temperatures.

In producing molybdenum bearing steel, the pig iron of my invention may be run in the molten state from the blast furnace and be mixed with the molten metal in the steel making furnace to produce a steel containing the desired or predetermined percentage of molybdenum alloy. This iron also provides a molybdenum alloying agent which contains a very low percentage of impurities and which requires no reducing action to effect the desired percentage alloy.

The molybdenum pig iron of my invention likewise provides a most excellent and suitable material for addition to the charge of the cupola furnace to produce a desired molybdenum alloy for casting. It may be introduced as a part of the original charge of the cupola furnace in such relative proportion as to effect the desired percentage alloy of molybdenum in the product from the cupola furnace. It insures uniform distribution of the alloy throughout the product and without the introduction of any harmful impurities whereby castings made from such alloy iron are of very superior quality and purity. Should it be desired, the molybdenum pig iron may be melted in a separate cupola, and the molten molybdenum-bearing pig iron therefrom be added in desired proportion to the output of a cupola which is melting ordinary iron to effect the desired alloy.

Alloy additions to iron produced from cupola melting are sometimes made in the cupola ladle before pouring the castings. This practice is not productive of the best or most uniform results and this is especially the case with high-temperature melting metals, such as molybdenum or ferro-molybdenum. Molybdenum-bearing pig iron has a relatively low melting temperature and by adding it to the usual charge of the cupola furnace, a uniform distribution of this alloying agent insures uniform distribution of the alloy throughout the molten iron, and without the introduction of any harmful impurities, there results a superior molybdenum alloy iron for casting.

It will be understood that variations may be made from the details of my process as herein exemplarily disclosed without departing from the principles of the invention and without sacrificing the chief advantages thereof. It will be understood also that the term "pig iron" is used herein as a convenient term to designate the product of a blast furnace irrespective of whether it is molten or has solidified, one of the characteristics of the molybdenum-bearing iron of my invention being that it is fusible at the usual steel and iron furnace temperatures.

What I claim is:—

1. The process of producing molybdenum containing cast iron which comprises melting together iron and a molybdenum bearing alloy having a melting point so that it will melt at substantially the same time as the iron and a molybdenum content such that the desired percentage of molybdenum is substantially uniformly distributed throughout the cast product.

2. The process of producing molybdenum containing cast iron which comprises melting together iron and a molybdenum bearing cast iron, the molybdenum content of which is such that it has a melting point whereby it will melt at the same time as the iron and the cast product will contain the desired percentage of molybdenum.

3. The process of producing molybdenum containing cast iron which comprises melting iron and an iron having a molybdenum content such that their melting points are relatively close and causing them to intermix in the molten state that the resultant castings will contain the desired percentage of molybdenum.

4. The process of producing molybdenum containing cast iron which comprises melting non-molybdenum bearing iron and separately melting a molybdenum bearing cast iron and mixing the two molten substances in such proportions that the resultant castings will contain the desired percentage of molybdenum.

5. The process of producing molybdenum containing cast iron which comprises melting non-molybdenum bearing iron and separately melting a casting iron having a relatively low molybdenum content and a melting point relatively close to that of the iron, and mixing the two molten substances in such proportions that the resultant castings will contain the desired percentage of molybdenum.

In testimony whereof, I have signed my name to this specification.

ALAN KISSOCK.