Patented Sept. 1, 1925. 1,551,554

UNITED STATES PATENT OFFICE.

FRITZ GREINER, OF CANNSTATT-ON-THE-NECKAR, GERMANY.

PROCESS FOR SMELTING IRON ALLOYS.

No Drawing. Application filed February 2, 1921. Serial No. 441,819.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, FRITZ GREINER, citizen of the German Republic, residing at Cannstatt-on-the-Neckar, Germany, have invented new and useful Improvements in Processes for Smelting Iron Alloys and on which foreign applications have been filed in the following countries: Germany, filed November 19th, 1917, Patent No. 315,323, February 12th, 1919, Patent No. 322,947; October 2nd, 1919, October 3rd, 1919, and October 24th, 1919, not yet patented; Austria, filed January 23rd, 1919, Patent No. 83,531, April 16th, 1919, Patent No. 83,532; Bohemia, filed January 25th, 1919, Patent No. 4,312, May 31st, 1919, Patent No. 4,971; Hungary, filed January 25th, 1919, Patent No. 78,554, May 16th, 1919, Patent No. 80,476; Switzerland, filed January 24th, 1919, Patent No. 82,086, April 22nd, 1919, Patent No. 88,324, July 25th, 1919, Patent No. 84,089; Belgium, filed May 2nd, 1919, Patent No. 280,175; France, filed May 6th, 1919, Patent No. 524,446; Italy, filed May 28th, 1919, Patent No. 539/166; Holland, filed December 1st, 1919, Patent No. 7,489; Spain, filed November 10th, 1919, Patent 71,460; Finland, filed September 29th, 1919, Patent No. 8,035; Denmark, filed May 6th, 1919, Patent No. 29,430; Norway, filed May 12th, 1919, Patent No. 23,783; and Sweden, filed April 28th, 1919, Patent No. 53,532, of which the following is a specification.

The present invention relates to a process for protecting iron alloyed with a high percentage of elements having a great affinity to oxygen, as for instance silicon, manganese, phosphorus or like ingredients, against burning when smelted. When iron is smelted in a cupola or hearth furnace with one of the aforementioned substances a large amount of the admixtures is always lost because the oxygen contained in the furnace gases oxidizes the said valuable parts of the alloy and converts them into oxides that are worthless as far as the smelting process is concerned. Thus it is just the more valuable parts of the alloy that are lost because their chemical affinity to the oxygen of the air is considerably greater than that of the iron. Hence the ingredients are attacked in a much greater degree than the iron so that the proportion between the parts of the alloy changes greatly and in a degree which cannot be judged beforehand from the proportion between the parts contained in the original mixture of the parts applied. The losses thus caused by overheating represent not only a serious economical drawback, but they are also exceedingly disadvantageous from the technological standpoint as they render it very difficult, and in many cases even impossible, to produce iron containing a definite percentage of silicon, manganese, phosphorus or the like.

The object of the present invention is to remove these evils and it is accomplished by enveloping the alloy of which I cite ferrosilicon as an example, in the form of fragments or powder, or in the form of a mixture of fragments and powder with a fireproof coating which protects the alloy during the smelting process, against the action of the oxygen of the air. The inventor applies the term "fire-proof" to any inert mineral matter the melting point of which is so high that it does not melt or drip away at or slightly above the temperature constituting the melting point of the alloy. The fire-proof substance to be considered first in this connection is lime, pure or with admixtures of any material not affecting the fire-proofness of the lime; or any calcareous material of the same properties furnishing lime in the course of the reaction. The proportion of the admixture should be as small as possible. Lime is particularly adapted for the said purpose because apart from its high melting point it must be added in any case to bind the sulphur and effect the formation of slags. Large pieces of metal then only need to be dipped into the paste of calcareous material which will soon form a hard coat. Such substances as tar for example do not form suitable enveloping agents because they would immediately burn away in the furnace and would therefore be incapable of protecting the alloys against the action of the hot air in the furnace. Hence tar can only be used as a binding agent for powdered lime.

Now, in enveloping the said alloys in the above described manner it is advantageous to also adopt a briquetting process, especially if the material to be handled is fragmentary or pulverized, or of different degrees of coarseness. The preferable form of lime for the briquetting of the alloys is

that contained in Portland cement; I use this mixture because it has a high melting point, contains much lime, and is a good binding agent. The fragmentary or pulverized metals to be dealt with are molded with the aid of Portland cement into the shapes usually made with cement, and gravel or sand. If lime instead of Portland cement is to be used for briquetting, tar should be added to the lime as a binding agent. Although the tar will be burnt away the briquets do not fall apart when heated up to the melting point so that the oxygen contained in the furnace gases does not harm their contents.

I know that the solution of the problem of protecting the constituents of iron alloys, like silicon, manganese, phosphorus etc., which have a great affinity to oxygen, during smelting operations, has been sought for some time. Attempts in this direction were made by forming cakes of for instance ferro-silicon merely by pressing together iron or steel fragments such as filings or turnings under a high pressure, or by working the fragmentary metal up into shapes with the aid of coal tar. But these two processes have not been proved to be advantageous for in the case of the former there was no enveloping coating that could have protected the ferro-silicon against overheating in the furnace. In the second process a coating was present at first, but it was useless, because it burned away immediately after it was placed in the furnace. To use a fire-proof coat, as for instance, cement as a binding agent instead of coal-tar was not by any means obvious because, under ordinary conditions cement loses its chemically bound water at temperatures of 500 to 600° centigrades and crumbles to powder. The cause of this new and unexpected behaviour of cement is probably a secondary reaction of the lime with one part or other of the ferro-alloy.

Another important point to be noted is that in cases in which the iron alloy to be worked is in large pieces, I prefer to break these pieces in any suitable way into pieces of the size of hazelnuts. These pieces are then worked together with any smaller pieces that might be present, or with powdered ferro-silicon, in the manner already described.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:

1. The process of smelting ferro-alloys having constituent parts with a considerably greater affinity to oxygen than iron has, said process comprising reducing the ferro-alloy to pieces of convenient size and coating said pieces with an inert material, having a higher melting point than the ferro-alloy, before charging them into the smelting furnace.

2. The process of smelting ferro-alloys having constituent parts with a considerably greater affinity to oxygen than iron has, said process comprising shaping pieces of the ferro-alloy of various degrees of fineness with an inert fire resistant material, having a higher melting point than the ferro-alloy, into a form of convenient size suitable for charging same into the smelting furnace.

3. The process of smelting ferro-alloys having constituent parts with great affinity to oxygen, said process comprising reducing the ferro-alloy to pieces of convenient size and coating said pieces with calcareous material before charging them into the smelting furnace.

4. The process of smelting ferro-alloys having constituent parts with great affinity to oxygen, said process comprising reducing the ferro-alloy to pieces of convenient size and coating said pieces with lime provided with a binding agent before charging them into the smelting furnace.

5. The process of smelting ferro-alloys having constituent parts with great affinity to oxygen, said process comprising reducing the ferro-alloy to pieces of convenient size and coating said pieces with lime before charging them into the smelting furnace.

6. The process of smelting ferro-silicon, said process comprising reducing the ferro-silicon to pieces of convenient size and coating said pieces with lime before charging them into the smelting furnace.

7. The process of smelting ferro-silicon, said process comprising reducing the ferro-silicon to pieces of convenient size and coating said pieces with Portland cement before charging them into the smelting furnace.

8. The process of smelting ferro-silicon, said process comprising shaping pieces of ferro-silicon of various degrees of fineness with Portland cement into a form of convenient shape suitable for charging into the smelting furnace.

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

FRITZ GREINER.