UNITED STATES PATENT OFFICE.

WILLIAM G. KRANZ, OF SHARON, PENNSYLVANIA, ASSIGNOR TO THE NATIONAL MALLEABLE CASTINGS COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

METHOD OF PREPARING IRON FOR CASTINGS.

1,132,661. Specification of Letters Patent. Patented Mar. 23, 1915.

No Drawing. Application filed April 17, 1911. Serial No. 621,723.

To all whom it may concern:

Be it known that I, WILLIAM G. KRANZ, of Sharon, Mercer county, Pennsylvania, have invented a new and useful Method of Preparing Iron for Castings, of which the following is a full, clear, and exact description.

My invention relates to the treatment of iron intended to be made into castings which may be malleableized or otherwise treated; and is designed to overcome the difficulties resulting from the presence of relatively high sulfur in the castings. The presence of considerable percentage of sulfur (.06–.10) causes a considerable proportion of the castings to crack so that in ordinary malleable work the loss by cracking is an important item of expense. For this reason it has been customary to employ for malleable working pig iron low in sulfur and consequently of relatively high cost.

My invention is designed to utilize any grade of iron or scrap irrespective of its sulfur content, thus enabling low grade and low cost material to be used; since by my process the sulfur is reduced to a low content so that the liability to crack from this cause is greatly reduced or eliminated.

In carrying out my method, the pig iron or scrap, or both, which may be high in sulfur and of relatively low cost, are melted at a relatively low heat in any suitable furnace, such as a cupola, open hearth furnace, or the air furnace now commonly used in malleable iron work. In this melting, for which I prefer to use the cupola, it is practically impossible to remove sulfur. This premelted material is then charged in molten condition into an electric furnace of any desirable type, such as the electrode type (Heroult or Girod for example), or of the induction type. In this electric furnace, lime is added either in raw or burnt form, preferably the latter, and the temperature raised to remove the sulfur, preferably in connection with carbon additions. I prefer to test the premelted material for carbon, and to add sufficient carbon in the electric furnace so that after the oxids are practically eliminated, the carbon will react with the lime and form calcium carbid. The formation of this carbid enables me to test for elimination of oxids, and when the temperature of the metal is relatively high the sulfur is reduced to a small content or practically eliminated. If the carbon is low in the melted material, I also preferably add sufficient carbon in the electric furnace to raise the carbon content to about the per cent. desired in the product.

After the sulfur and oxids are substantially removed, I can make any desired additions, such as carbon, to give the carbon content desired, or an alloying metal, if desired, such as titanium or vanadium. As the oxids have been removed, there will be practically no loss in these additions. The metal which is white iron is then tapered out and taken to the molds, after which the castings are malleableized in any desired manner common in this art. My product contains from 1½ to three per cent. of carbon, .5 to 1 per cent. of silicon, sulfur .05 or under, and manganese under .5.

The advantages of my new process will be apparent to those skilled in the making of malleable iron castings, since the troubles arising from sulfur are practically done away with; and a better grade of iron for malleableizing or other purposes obtained from the poorest and cheapest grade of material, than is now obtained from relatively high grade pig iron.

Changes may be made in the apparatus employed in carrying out my invention; other ways of testing for elimination of oxids may be used, than the calcium carbid test above recited; carbon may or may not be added, when feeding into the electric furnace, or after the treatment therein; alloying materials may or may not be added; and other changes may be made in the process without departing from my invention.

I am aware that the electric furnace has been used as a finishing step in the manufacture of steel by the open hearth or Bessemer process; but such steel processes are entirely dissimilar from mine, since in such processes the carbon is reduced to a relatively low point or substantially eliminated, thus giving reduction of phosphorous and sulfur in the oxidizing step prior to using the electric furnace; where in my process the carbon must be kept high throughout the process, the electric furnace enabling me to substantially eliminate the sulfur while keeping high carbon.

I claim:—

1. The method of preparing iron for castings, consisting in treating molten iron rela-

tively high in carbon, by feeding molten iron into an electric furnace, raising its temperature and treating it with lime in the electric furnace to reduce the sulfur content, while maintaining a relatively high carbon content therein, substantially as described.

2. The method of preparing iron for castings, consisting in treating low grade molten iron high in carbon and sulfur, by feeding the molten iron still high in carbon and sulfur into an electric furnace, raising its temperature and treating it therein with lime which forms a basic slag to receive the sulfur content, while maintaining relatively high carbon content, substantially as described.

3. The method of preparing iron for castings, consisting in treating low grade molten iron high in carbon and sulfur, feeding the molten iron still high in carbon and sulfur into an electric furnace, raising its temperature and treating it therein with lime which forms a basic slag to receive the sulfur content, while maintaining a relatively high carbon content, and adding carbon to the molten iron in the electric furnace, substantially as described.

4. The method of preparing iron for castings, consisting in treating molten iron high in carbon, by feeding the molten iron still high in carbon into an electric furnace, raising its temperature therein, treating it with lime to remove the sulfur and continuing the treatment while maintaining a relatively high carbon content until oxids are substantially removed, substantially as described.

5. The method of preparing iron for castings, consisting in treating molten iron high in carbon and sulfur, by feeding the molten iron still high in carbon and sulfur into an electric furnace, raising its temperature therein, treating it with lime to remove the sulfur, continuing the treatment until calcium carbid is formed showing the elimination of oxids from the metal, and then making additions of carbon and tapping out, substantially as described.

6. The method of preparing iron for castings, consisting in treating molten iron high in carbon and sulfur, by feeding the molten iron still high in carbon and sulfur into an electric furnace, raising its temperature, treating it with lime therein, removing the sulfur until the oxids are substantially removed, and then adding carbon and tapping out, substantially as described.

7. The method of preparing iron for castings, which consists in treating molten material high in carbon, by feeding the molten material high in carbon into an electric furnace, raising its temperature and treating it therein until the oxids are substantially removed while maintaining a relatively high carbon content, and then making additions and tapping out, substantially as described.

8. In the making of high grade pig iron the process which consists in introducing into an electric furnace iron in a molten condition containing sulfur, maintaining it molten therein in a non-oxidizing atmosphere and under non-oxidizing conditions and treating it basically therein to remove sulfur.

9. In the treatment of iron, the process which consists in introducing into an electric furnace iron in a molten condition containing sulfur; maintaining it molten therein in a non-oxidizing atmosphere and under non-oxidizing conditions; and treating it basically to remove the sulfur.

In testimony whereof, I have hereunto set my hand.

WILLIAM G. KRANZ.

Witnesses:
W. G. BAILEY,
J. H. SLAWSON.

Corrections In Letters Patent No. 1,132,661

It is hereby certified that in Letters Patent No. 1,132,661, granted March 23, 1915, upon the application of William G. Kranz, of Sharon, Pennsylvania, for an improvement in "Methods of Preparing Iron for Castings," errors appear in the printed specification requiring correction as follows: Page 1, line 68, for the word "tapered" read *tapped;* same page, line 70, for the word "desired" read *desirable;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of April, A. D., 1915.

[SEAL.]

J. T. NEWTON,

Acting Commissioner of Patents.