UNITED STATES PATENT OFFICE.

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TWIN-CUPOLA PROCESS OF MAKING SEMISTEEL CASTINGS.

No. 843,197. Specification of Letters Patent. Patented Feb. 5, 1907.

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To all whom it may concern:

Be it known that I, JAMES C. DAVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Twin-Cupola Processes for Making Semisteel Castings, of which the following is a specification.

This invention relates to improvements in the art of making semi-steel castings, which are commonly made by the admixture of pig iron of any given composition, and carbon steel scrap; the practice being to vary the proportions of the two metals to suit the requirements in the casting to be made from the semi-steel, the usual method heretofore practiced being to charge the pig iron and the carbon steel scrap in a cupola in sufficient quantity to produce total charges adapted to the size or capacity of the cupola and in proportions predetermined so as to have the component parts of the casting best adapted for its intended uses.

This method has been found to be very unsatisfactory, because there is so much variation in the resulting product, due to the different melting points of the material charged together in the cupola. The pig iron, having a low melting point, is the first to melt and flow to the bottom of the cupola, carrying with it a certain proportion of the carbon steel, say for the first tap. In the time intervening between the first and second taps, with the blast applied, the temperature increases, thereby causing a larger amount of the carbon steel to melt and hence the next tap varies considerably from the first one, and so it would follow through from the beginning to the end of the heat, varying with each tap from the first to the last, and hence making it practically impossible to secure results even approximately uniform.

In one prior attempt to avoid these difficulties resort has been made to another process which has been more or less commonly practiced, which consists in charging the material, as before described, running the metal into pigs in order to get a more or less average mixture of the steel and pig iron, and, at a subsequent time sorting these pigs for the purpose of securing as practical uniformity as possible, charging them into the cupola, and putting them through another process of melting preparatory to casting, the results of which can be expected, as they have proven in practice, to be only a fair average as to the uniformity of the metal when cast.

The object of my invention is to avoid the uncertainty and non-uniformity, and the resultant, as well as initial expense of these prior methods by enabling the production of semi-steel castings of absolute uniformity as regards the proportion of pig iron and carbon steel, which proportions may be varied at will; by enabling the maintenance not only throughout the entire heat, but through any number of heats of this absolute uniformity of proportions; and by enabling the continuous production of semi-steel castings of practically uniform qualities, proportions and characteristics.

These objects are attained by the new practice in the art hereinafter fully disclosed and set forth in the claims.

In carrying out my invention I use two independent cupolas. In one cupola I place pig iron, of a given composition, and melted in the usual manner. In the other cupola I place carbon steel of a composition necessary to suit the requirements of the casting, and melted as I do the pig iron. In this way both the iron and the steel are reduced to a molten state before being brought together and the difficulty encountered in the old processes, by reason of the difference in the melting points of the pig iron and the carbon steel, is entirely obviated. As the composition of the two metals is known, it becomes a very simple matter to tap from one of the cupolas into a ladle, first a given amount, either by weight or measurement, of either molten pig iron or molten carbon steel, and afterward tapping into the same ladle from the other cupola the desired amount of either molten pig iron or molten carbon steel to fill out the total amount containing predetermined proportions of pig iron and carbon steel.

I have found in practice that the results may be improved by introducing about fifty pounds of white iron with each charge of, say, about five hundred to seven hundred and fifty pounds of carbon steel, the idea being to get the benefit of increased fluidity through the carbon and manganese contained in the white iron. When the molten

iron and steel are brought together in the ladle, a workman, by the use of an iron bar, may thoroughly and effectually complete the admixture of the materials so that the resulting product is practically uniform in its component parts throughout the entire body thereof.

One great advantage of my process is that from a single heat of the iron and steel, each and every tapping of the molten metals into a ladle may be exactly the same, as regards both proportions of the metals and the uniformity of admixture, or each tapping may differ from the others in these respects.

Furthermore, the pig iron and the carbon steel being melted in separate cupolas or furnaces, the conditions in each can be adapted to the requirements of each metal in the matter of melting, the operation of the two cupolas in this regard being entirely independent of each other. By my process absolute uniformity, as regards the proportions of iron and steel, can be maintained throughout the entire heat or vary at will during each heat, or the proportions can be maintained uniform throughout any number of heats where a large product is required possessing the same characteristics and proportions of iron and steel.

It will be understood that my invention is not directed to the production of any new kind of metal of new composition, but as a process whereby a skilled metallurgist, knowing the composition of the materials which he desires to mix or unite in a homogeneous mass of a given composition, may be assured of producing the desired result. In other words, it is well known to metallurgists that the average run of pig iron will contain about three and one half per. cent of carbon, one half of one per cent. of manganese and one to three per cent. of silicon, while ordinary carbon steel will contain two-tenths of one per cent. of carbon, six tenths of one per cent. of manganese and six hundredths of one per cent. of silicon. Now if it is desired to produce a metal from a mixture of the pig iron and carbon steel having a desired and predetermined proportion of these different ingredients, according to the use to which the metal is to be put and the way it is to be treated in casting, any skilled metallurgist would know to a practical certainty just what proportions of the pig iron and carbon steel should be used, but if the iron and steel were melted in a single cupola, no metallurgist can ever be certain of producing a uniform mixture and indeed such uniformity is almost impossible for reasons hereinbefore fully stated. By my process, however, providing for the melting of the pig iron and the carbon steel in separate cupolas before bringing the same together, the composition of the final product, by mixing the molten metal is rendered practically certain, while the carbon, manganese and silicon, or other ingredient would be distributed throughout the mass with practically perfect uniformity.

The purpose of adding the white iron to the composition is also well understood in metallurgy, being simply to reduce the melting point and therefore increase the fluidity of the steel so as to effect a more thorough, intimate and uniform distribution of the carbon, manganese and silicon. Other kinds of iron may be used for the same purpose, but I prefer the ordinary white iron because of its recognized superior characteristics.

The necessity of bringing the two metals together at temperatures which result in a mean that liquefies both in the ladle, makes it important to thus reduce the melting point of the latter and increase the fluidity of the mixture, as will be readily understood.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

In the art of making semi-steel castings, the process which consists in melting gray pig iron and carbon steel in separate cupolas or furnaces, adding to the steel while melting about ten per cent. of white pig iron, introducing into a mixing receptacle predetermined portions of the molten metal from each cupola or furnace, thoroughly mixing the same together in a molten state, and finally pouring the same directly into molds, substantially as and for the purpose described.

JAMES C. DAVIS.

Witnesses:
C. L. WOOD,
G. Y. DANKWARD.