This invention relates to an improvement in desulfurization agent for ferrous melts, e.g., pig iron, cast iron and steel melts, and to an improved desulfurization process. It is acknowledged to be old to desulfurize ferrous melts by treatment with calcium carbide alone or in admixture with other inorganic compounds such as quicklime, sodium fluoride, calcium-silicate, lithium compounds, sodium chloride, as well as with sodium carbonate. In practice, solid desulfurizing agents are introduced into the melts, which are of higher specific weight, by use of carrier gases such as compressed air, nitrogen, argon, carbon dioxide or mixtures thereof. The demands of industry for lower and lower sulfur content in iron and steel keep increasing. Since low sulfur contents in the furnace can often not be achieved economically or with certainty, it has become increasingly important to provide for desulfurization outside the furnace.

Desulfurization with calcium carbide alone or in combination with the afore-mentioned compounds, as well as with sodium carbonate, leaves much to be desired from the standpoint of achieving the desired low sulfur content or economical operation, or both. In comparison with the other desulfurization agents mentioned, limestone is largely impractical.

There is, consequently, a demand for an improved agent for desulfurizing ferrous melts that does not have the aforesaid disadvantages. This demand is satisfied, in accordance with the invention, with a desulfurizing agent containing, in addition to calcium carbide, 2 to 40%, preferably 10 to 20% by weight of precipitated, carbon-containing calcium carbonate. The term "precipitated, carbon-containing calcium carbonate" refers to a mixture consisting essentially of finely divided calcium carbonate and carbon such as that obtained in the preparation of a dicyandiamide product, in the course of which an aqueous calcium cyanamide suspension is treated with carbon dioxide to precipitate the calcium carbonate in a very finely divided state intimately admixed with finely divided and co-precipitated carbon. This precipitate contains about 70 to 85% by weight calcium carbonate and about 8 to 12% carbon in addition to minor proportions of impurities, especially ferrous oxide, aluminum oxide and silicon dioxide.

While a desulfurizing agent containing in excess of 40% precipitated carbon-containing calcium-carbonate is operable, it is to be avoided because of difficulties caused by increasing generation of gas.

In use, the desulfurizing agent of the invention is added to a ferrous melt in an amount that depends upon the initial and desired final sulfur contents of the melt. With ordinary initial sulfur contents of the order of about 0.04 to 0.06% by weight, 1.3 kg. desulfurizing agent per ton of melt suffices to reduce the sulfur content by about 0.010%. If the initial sulfur content is lower, i.e., of the order of 0.02 to 0.03%, approximately 1.7 kg. per ton is required to obtain the same effect of reducing the sulfur content by about 0.01% at melt temperatures of the order of 1400° C.

One advantage of the desulfurizing agent of the invention is that it is available in very finely divided form. It is, therefore, entirely practical to add it to the melt by blowing or by stirring it in, the latter being accomplished with a shaking pan or a mechanical stirring device. Basically, however, introduction of the desulfurizing agent may take place in a manner suitable to any other pulverulent material and can also take place in the furnace.

While the reason for the synergistic effect of precipitated calcium carbonate and calcium carbide is not fully understood, it is assumed that the precipitated calcium carbonate has a structure which is particularly favorable for desulfurization due, perhaps, to increased intimate mixing and contact between the iron in the melt and the calcium carbide promoted by generation of carbon dioxide. In addition, the finely divided carbon contained in the precipitated carbonate compensates for the slight decarboxylation that takes place with desulfurization and, at the same time, provides the reducing conditions required for desulfurization.

The desulfurizing agent of the invention is positive in its desulfurizing function and is also more economical to use because the losses of iron into the slag are thereby reduced. In addition, the efficiency with which the calcium carbide component of the combination is consumed, as compared with the consumption of calcium carbide when used alone, is significantly greater.

The advantages of the desulfurizing agent of the invention are surprising because calcium carbonate alone is ineffective whereas the combination of the invention has appreciably greater desulfurizing activity than is obtainable by a like amount of calcium carbide, thus making it possible to attain preselected and desired desulfurization effects. The progress in the art achieved by the desulfurizing agent and the method of the present invention will become further apparent from the following examples:

EXAMPLE 1 (Prior art)

Charges of approximately 35 metric tons pig iron each were desulfurized at between 1260 and 1380° C. with a commercial grade of calcium carbide having a CaC2 content of approximately 80% by weight introduced into the melt with predried air at 5 atmospheres pressure as carrier gas. The carbide had granule sizes of 0.3 to 0.7 mm. in Charges Nos. 1 to 9 and 0.06 to 0.08 mm. in Charges Nos. 10 to 15. The amounts of carbide charged, the sulfur contents of the melt before and after desulfurization...
It is apparent, from a comparison of the data in the tables of Examples 1 and 2, that the method of the invention provides an average increase in efficiency of calcium carbide utilization of over 100%.

What is claimed is:

1. A desulfurization agent for ferrous melts essentially consisting of from about 60 to about 98% by weight calcium carbide and from about 2 to about 40% by weight precipitated, carbon-containing calcium carbonate.

2. A desulfurization agent as defined in claim 1 wherein the proportion of precipitated calcium carbonate is from about 10% to about 20% by weight.

3. A desulfurization agent as defined in claim 1 wherein the precipitated calcium carbonate contains about 70 to 85% by weight finely divided calcium carbonate intimately admixed with about 8 to 12% by weight co-precipitated carbon.

4. A process for desulfurizing a sulfur-containing ferrous melt which comprises treating said melt with between about 1.3 and 1.7 kg. of a desulfurization agent per ton of iron melt per 0.01% desired reduction in sulfur content, said desulfurization agent consisting essentially of from about 60 to about 98% by weight calcium carbide and from about 2 to about 40% by weight precipitated, carbon-containing calcium carbonate.

References Cited

UNITED STATES PATENTS

2,755,180 7/1956 De Laval ---- 75—58X
3,051,564 8/1962 Drenning ------ 75—58X

FOREIGN PATENTS

812,410 4/1959 Great Britain ------ 75—53

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