Patented Aug. 30, 1938 2,128,615

UNITED STATES PATENT OFFICE

2,128,615

PROCESS FOR THE PRODUCTION OF FERRO-MANGANESE

Adolf Krus, Sturzelberg over Neuss, and Hermann Steffe, Duisburg-Huckingen, Germany, assignors to Mannesmannröhren-Werke Aktiengesellschaft, Dusseldorf, Germany, and "Sachtleben" Aktiengesellschaft für Bergbau und Chemische Industrie, Cologne, Germany

No Drawing. Application June 13, 1935, Serial No. 26,514. In Germany July 23, 1934

3 Claims. (Cl. 75—131)

In the manufacture of ferro-manganese in the blast furnace, that is to say by the manufacturing process which has been hitherto usual, it is necessary, in view of the nature of the process, to select ores the manganese content of which is in a quite definite proportion to the iron content. Thus, for example, 80% ferro-manganese can be obtained by blowing in the blast furnace only if a manganese ore be employed the manganese content of which is at least 40% and the iron content whereof is at the most 4%. Ores having a lower manganese content, for example ores containing 43% iron and 8.5% manganese, produce when blown in the blast furnace a pig iron containing 11.5% manganese at the most. Apart from this necessity of selecting ores which contain a definite proportion of iron relatively to manganese, the process of manufacturing ferro-manganese in the blast furnace is also expensive due to the high consumption of fuel and the considerable wear and tear on the blast furnace.

The subject matter of the present invention is a process for the manufacture of ferro-manganese from manganese ores or manganese slags which, owing to the proportion of iron to manganese which they contain, cannot be worked up to ferro-manganese in one working stage. In accordance with the new process these ores or slags are worked up in an open hearth or rotary furnace to produce a low-melting manganous oxide slag. In this operation so much of the iron from them and the slag is reduced that an intermediate product is obtained having the proper proportion of iron to manganese for producing the ferro-manganese desired. This intermediate product is then worked up in the usual manner to produce ferro-manganese. The entire process proceeds by way of the liquid phase so that it can be carried out in a particularly simple manner and the separation of iron and manganese can conveniently be regulated in such a manner that an intermediate product is formed in which the ratio of iron to manganese is as desired for the final product.

With this separation of iron and manganese by way of the liquid phase, which alone produces a useful method for the manufacture of ferro-manganese, certain precautions should be taken when carrying out the process. Thus, in order to effect the reduction of the iron but not that of the manganese the charge should be mixed, in accordance with the invention, in such a manner that there is formed in the first place a low melting manganous oxide slag of such a neutral or weakly acid nature that a splitting-up of the manganese oxide does not occur at the temperature necessary for the reduction of the iron.

It will be understood that in defining the nature of the slag as to its basic, neutral or acid nature, the effect of the manganous oxide is not considered. In other words, while manganous oxide is sometimes elsewhere considered to be a base, it is not to be so considered for the purpose of the present specification and invention.

In the first stage of the process, that is to say during the manganese enrichment, therefore, an easily fusible slag which at the most may be neutral but is preferably slightly acid is aimed at and is worked at temperatures lying below the reduction temperature of the manganous oxide. In the second stage of the process, i. e. on the reduction of the manganese and of the iron to ferro-manganese, the temperature of the furnace is increased and so much lime is added to the product of the first stage, that is to say to the enriched manganous oxide slag, that it becomes highly basic, or alkaline.

The first stage of the new process is preferably carried out in a drum or rotary furnace. An open hearth furnace can, of course, also be used for this purpose. The iron which is reduced from the manganous oxide slag at a temperature below the reduction temperature of the manganese can be continuously or intermittently removed from the furnace. The two stages of the process, that is to say the manganese enrichment stage and the reduction to ferro-manganese, can be carried out one after the other in the same furnace. The manufacture of the ferro-manganese from the intermediate product may also be effected, however, in a second furnace.

The new process for the manufacture of ferro-manganese, as will be clear without further explanation, is simple to carry out and is considerably more adaptable than the known blast furnace process and the other method of manufacture hitherto known. The fractional reduction by way of the liquid phase affords a certain procedure which can be easily carried out in practice for manufacturing, in one process, ferro-manganese from manganous ores or slags in which the proportion of iron to manganese is such that they are not ordinarily suitable for this purpose. Therefore, the art is no longer dependent to the same extent as heretofore on the quality and the manganese content of the manganous ores. The value of manganese ore deposits, in which the ore is of a medium or low content of manganese, is therefore, greatly increased.

We claim:

1. Process for the manufacture of ferro-manganese from iron-containing manganese ores or manganese slags which, owing to the proportion of iron to manganese which they contain, cannot be worked up to ferro-manganese, in a single working process wherein the ore, after being mixed with limestone, is melted to form a low-melting manganous oxide slag of neutral or weakly acid reaction, and so much iron is reduced out of the slag at a temperature below the reduction temperature of the manganese as to form an intermediate product in which the proportion of iron to manganese is that required for producing the ferro-manganese desired, and the intermediate product is then reduced to ferro-manganese in the usual manner.

2. Process for the manufacture of ferro-manganese from iron-containing manganese ores or manganese slags which, owing to the proportion of iron to manganese which they contain, cannot be worked up to ferro-manganese in a single working process, wherein the ore, after being mixed with limestone and fluorspar, is melted to form a low-melting manganous oxide slag of neutral or weakly acid reaction, and so much iron is reduced out of the slag at a temperature below the reduction temperature of the manganese as to form an intermediate product in which the proportion of iron to manganese is that required for producing the ferro-manganese desired, and the intermediate product is then reduced to ferro-manganese in the usual manner.

3. Process according to claim 1, wherein the reduction of the intermediate product to ferro-manganese takes place in the same furnace after the enrichment process by imparting alkalinity to the slag and increasing the temperature at which the reduction takes place.

ADOLF KRUS.
HERMANN STEFFE.