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AGGLOMERATING ORES IN THE BLAST FURNACE

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6 Claims. (Cl. 75—41)

This invention relates to the use of a cementing agent in the blast furnace for the purpose of keeping down the quantity of fine iron ore which is blown out the top of the furnace by the exit furnace gases. It is obvious that the cementing action can also be used to cut down on the amount of other fine materials, such as coke breeze and flux material, which are also blown out the top. In most installations the fines which are blown out are caught in a dust catcher, sintered at a high temperature to increase the particle size, and subsequently re-charged into the furnace. The extra handling, fuel used, and capital investment are expensive items.

The percentage of ore normally blown out the top of the furnace by the gases amounts to five percent or more of the charge when ordinary hematite ore is charged and as much as sixty percent when finely ground concentrated taconite ores are charged. Water is normally sprayed on the ore in an attempt to cut down on the blow over. It has very little effect. Thus it can be seen that the fine ores are not a satisfactory charge. Of course this fine ore can be sintered or briquetted to make it coarse. In both cases extra handling, extra capital investment in equipment, and fuel are necessary to do the coarsening job.

My invention relates to the adding of a cementing agent, either in suspension, emulsion or solution to the water which is sprayed on the ore. The percentage of cementing agent needed will vary with the amount of fines in the ore being charged into the furnace. When a sodium silicate solution such as water glass, approximately 40° Baumé, is used, as little as .1 to 10% may be used. The amount used is not critical. Other cementing agents might be starch, flour, molasses, or bituminous emulsions, etc. A surface tension depressant or so-called wetting agent can be added to the aqueous solution to improve the wettability of the ore. This will raise the efficiency of the cementing agent. The amount of surface tension depressant used will of course vary with the individual chemical used, but an amount of .01 to .2% of the aqueous solution used is generally satisfactory.

Inasmuch as the iron making capacity of a furnace is reduced by the amount of flue dust formation, the amount of binder or cementing material used in the original charge must be small enough to compensate for its own volume and cost, including coke and flux. This situation puts a practical limit of approximately five percent (5%) on the binder or cementing agent used. Economically, less than three percent (3%) should be sufficient. Of course the actual amount needed is directly dependent on the percentage of fines in the ore charge and the efficiency of the mixing technique. As little as one tenth (0.1%) binder such as sodium silicate will show a measurable difference in flue dust formation. In order to take into consideration future changes in the art, I limit my invention to the use of between one tenth percent (0.1%) and ten percent (10%) of cementing compound to the weight of the ore charged, excluding the water content. The use of a combination of sodium silicate with molasses or other sugary substances such as glucose has been claimed by Holz in U. S. Patent No. 2,373,244. It is not my intention to claim this specific combination of cementing agents.

The temperature in the top of a blast furnace is of the magnitude of 500° F. At this temperature, the moisture content of the charge is rapidly evaporated. Merely watering down the ore is of little advantage because of the rapid evaporation. However when a cementing compound is added to the water used to wet down the ore, the cementing compound is left in the ore and acts to agglomerate the fines, thus cutting down on the blow over.

It is obvious that this process can help to reduce the amount of fine materials, such as ores, fluxes, and reducing agents which are blown out the top of any blast furnace used for reducing ores to the metallic state, all of which are intended to be included in the scope of my invention.

I claim:

1. The process of agglomerating iron ore inside the blast furnace which consists of adding to the iron ore being charged into the blast furnace a solution containing from one tenth to ten percent cementing agent and then charging the iron ore and cementing agent into the blast furnace.

2. The process of agglomerating iron ore inside the blast furnace which consists of adding to the iron ore being charged into the blast furnace a solution containing from one tenth to ten percent sodium silicate and then charging the iron ore and sodium silicate into the blast furnace.

3. The process of agglomerating iron ore inside the blast furnace which consists of adding to the iron ore being charged into the blast furnace a solution containing from one tenth to ten percent molasses and then charging the iron ore and molasses into the blast furnace.

4. The process of agglomerating iron ore inside the blast furnace which consists of adding to the iron ore being charged into the blast furnace an aqueous suspension containing from one tenth to ten percent flour and then charging the iron ore and flour into the blast furnace.

5. The process of agglomerating iron ore inside the blast furnace which consists of adding to the iron ore being charged into the blast furnace an aqueous suspension containing from one tenth to ten percent starch and then charging the iron ore and starch into the blast furnace.

6. The process of agglomerating iron ore inside the blast furnace which consists of adding to the iron ore being charged into the blast furnace an aqueous emulsion containing from one tenth to ten percent bituminous material and then charging the iron ore and bituminous material into the blast furnace.

References Cited in the file of this patent

UNITED STATES PATENTS

520,377	Nienstaedt	May 22, 1894
794,153	Price	July 4, 1905
1,103,400	Cooper	July 14, 1914
1,154,980	Exbrayat	Sept. 28, 1915
1,334,331	Vogel	Mar. 23, 1920
1,536,033	Stillman	Apr. 28, 1925
1,680,107	Marquard	Aug. 7, 1928
1,994,379	Williams et al.	Mar. 12, 1935
2,363,371	Vignos	Nov. 21, 1944
2,373,244	Holz	Apr. 10 1945