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PROCESS FOR THE PRODUCTION OF HARD BURNT PELLETS HAVING GOOD ABRASIVE STRENGTH

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This application is a continuation of application Ser. No. 397,279 filed Sept. 17, 1964, now abandoned.

The invention relates to a process for the production of hard-burnt pellets from iron ores and iron ore concentrates the fine grain content of which is less than 0.044 mm. (minus 325 mesh) and insufficient to form pellets having the necessary abrasive strength.

The abrasive strength is one of the most important strength factors of hard-burnt iron pellets because it determines whether and how the pellets withstand the treatment after hard-burning. In practice it is generally determined by the ASTM drum test. Sufficient abrasive strength is present when the pellets having an average diameter of 12 mms. do not show more than 6 to 8% fines with a grain size of less than 0.6 mm. (28 mesh) after an 8 minute continuous tumbling test in a standard ASTM coke breeze drum rotating at 25 revolutions per minute.

For forming and producing hard-burnt pellets possessing sufficient abrasive strength, a finess of the initial ore was hitherto considered necessary in which 80 to 90% of the total quantity of ore was less than 0.044 mm. (minus 325 mesh). It was also already pointed out that when grinding the ore to a content of only 60% less than 0.044 mm., the whole of the ore must be ground until all grain sizes are less than 0.2 mm. in diameter in order to be able to ball the ore.

In the U.S. Patent 2,960,396, particularly lines 49 et seq. of column 1, the determination of the ballability of iron ores by the percentage of particles less than 0.044 mm., is described as a relatively rough method and it is stated that the content of fine grain material which is less than 0.01 mm. is the determining factor for the ballability of the iron ore and, to a certain extent, also for the strength of the hard-burnt pellets formed thereform. Nevertheless this method which is described as rough is still employed in practice, which is explained by the fact that work in mining installations and steel mills is naturally rough. Furthermore, the rougher method is more economical because as a rule it is more tedious, complicated and expensive to grind a small portion of the ore by itself, that is separately from the whole quantity of ore to be pelletized, to a considerable percentage in minus 0.01 mm., and then to mix it again in suitable quantities with the ore to be pelletized, than continuously to bring the whole of the ore to a certain content of fine grain in minus 0.044 mm. by rougher methods, whereby at any rate, the effective fine content less than 0.01 mm. just also be present in sufficient quantity.

While a few years ago there was still a prejudice in the technical world against the production of iron ore pellets from ore mixtures in which the individual components possess different chemical and/or physical properties, the opinion in the technical world has changed recently in that it is admitted that it is possible to produce such mixed ore pellets also without disadvantage. However, the only advantages were considered to be that the ores could now be pelletized in steel mills, harbours and the like, where with economical storage and preparation, the mixing of different kinds of ores is practical.

It has now been found that the production of hard-burnt pellets with high abrasive strength from iron ores, iron ore concentrates and the like, using as initial material a mixture of ore components having different chemical and/or physical properties, considerable advantages over the state of the art can be achieved if, for forming the pellets, ore mixtures are used in which the quantity of fine-grained material which is less than 0.044 mm. amounts to only 20 or up to about 60% of the total quantity of ore and such mixtures are hard-burnt at temperatures of at least 1200° C. By mixing different ores and burning the pellets produced therefrom at the temperatures mentioned, not only abrasive strengths are obtained which are to be expected, taking into consideration the characteristics behaviour of the individual components of the mixture, but the pellets obtained according to the invention have considerably higher abrasive strengths. Furthermore, it was found that these higher abrasive strengths are also obtained when the content of fine-grained material less than 0.044 mm. is less than would be considered necessary for obtaining sufficient abrasive strength in the case of the known state of the art. This presents the advantage that ores of coarser consistency need not be ground to the same extent which was considered necessary in the case of the known state of the art, with the result that the pelletization is considerably simplified and less expensive. In such cases a quantity of fine grained material less than 0.044 mm. amounting to 45% of the mixture is sufficient and as a rule it is not necessary to go beyond about 60% of such fine grained material.

The fine-grained content can be regulated in any suitable manner. For example, by mixing different kinds of iron ore with suitable fine grain content or by suitable partial or complete grinding of the ore mixture. In any case it is not necessary to employ uneconomical means for the purpose, such as, for example, tedious, expensive grinding of the whole quantity of one of the components to a grain size less than 0.07 mm.

Grinding the whole of the ore to the fineness mentioned has been found most advantageous, especially as a very thorough mixing of the ores is generally obtained thereby.

Particularly good pellets with high abrasive strength are obtained according to the invention if a mixture of as many as possible different kinds of ore components, that is a mixture of more than two components, is used as initial material. By so doing not only increased abrasive strength but also improvement of other properties, such as for example the ballability of the initial material, increase of the compression strength of the hard-burnt pellets and so forth, are effected. Of great importance for producing the above-mentioned technical effect is the use of sufficiently high burning temperatures. Actually temperatures of 1200° C. and higher are known for the hard-burning of iron pellets. However, a whole series of cases are mentioned in literature and known in practice in which other temperatures of, for example 1100 or 1150° C. are proposed or employed in the case of certain ores and for the production of pellets for specific purposes.

An increase of the abrasive strength is not possible at these other temperatures even in the case of ore mixtures. The process according to the invention and the technical effect attainable thereby are hereinafter explained with the aid of practical examples.

Example 1

A mixture of the following ores was pelletized:

(a) Mano River
(b) Bong Range
(c) Nimba
(d) Itabira
(e) Carol Lake Concentrate.

The mixture had the following composition:

(a) 10%
(b) 40%
(c) 10%
(d) 20%
(e) 20%

Its chemical composition was:

	Percent
Fe	65.5
SiO_2	3.34
CaO	0.34
MgO	0.41
Al_2O_3	1.06

Before pelletization the ores or the mixture were or was wet ground to a fineness of 60% less than 0.044 mm. in a ball mill. Subsequently the water was removed on a drum filter until the moisture content was such that subsequent pelletization was possible. In all cases 2% limestone was added, as can be assumed to be known.

The pellets were produced on a plate 0.8 m. in diameter. Their average diameter was 12 mm. The pellets were burnt on a pan, about 56 to 59 kgs. being charged at a time. The burning temperature amounted to 1,300 or 1,350° C.

The quality of the pellets was tested by the ASTM Drum Test generally used today.

The following abrasive strengths were obtained for the single ore pellets and mixed ore pellets respectively:

(a) 7.4%
(b) 7.2%
(c) 5.3%
(d) 5.2%
(e) not worked into pellets with sufficient dry strength
Mixture: 4.8%

The tests showed clearly that the mixture produced pellets having a better abrasive strength than the pellets of the individual components.

Example 2

As in the case of Example 1, pellets 10 to 15 mm. in diameter were produced. For this purpose a magnetite concentrate and a minette ore mixture were used, having the following compositions:

	Magnetite Concentrate	Minette Ore Mixture
Fe	68.3%	31.2%
SiO_2	3.2%	13.0%
CaO	0.2%	12.2%
+0.2 mm	27.0%	40.5%
+0.09 mm	23.3%	29.0%
+0.06 mm	16.5%	5.0%
+0.04 mm	6.3%	5.3%
−0.04 mm	51.2%	20.2%

The burning temperature was between 1250 and 1300° C. No binding agents were used. While the minette ore mixture was too coarse to enable pellets of useful quality to be produced therefrom alone, pellets with 7.7% minus 0.6 mm. could be produced from the magnetite concentrate. If the two components were mixed in a ratio of 2:1, whereby there was 41% minus 0.044 mm., the abrasive strength of the burnt pellets amounted to 6.1%. In the case of a mixture in a ratio of 1:1 and 20.0% fines minus 0.044 mm., the abrasive strength of the burnt pellets was 6.5%, which is also higher than could be attained in the case of pelletization of the individual concentrates.

We claim:

1. Process for the production of hard-burned pellets having high abrasive strength from iron ores, iron ore concentrates and the like, and using an initial material composed of a mixture of ores having different chemical and/or physical properties, comprising grinding all the ore components together to a fine grain material in which from 20 to 60% has a fineness of less than 0.044 mm., forming moist rounded pellets of said material, and then hard burning the pellets at a temperature of at least 1200° C.

2. Process as in claim 1, said initial material composed of the mixture of ores being composed of more than two kinds of iron ore.

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