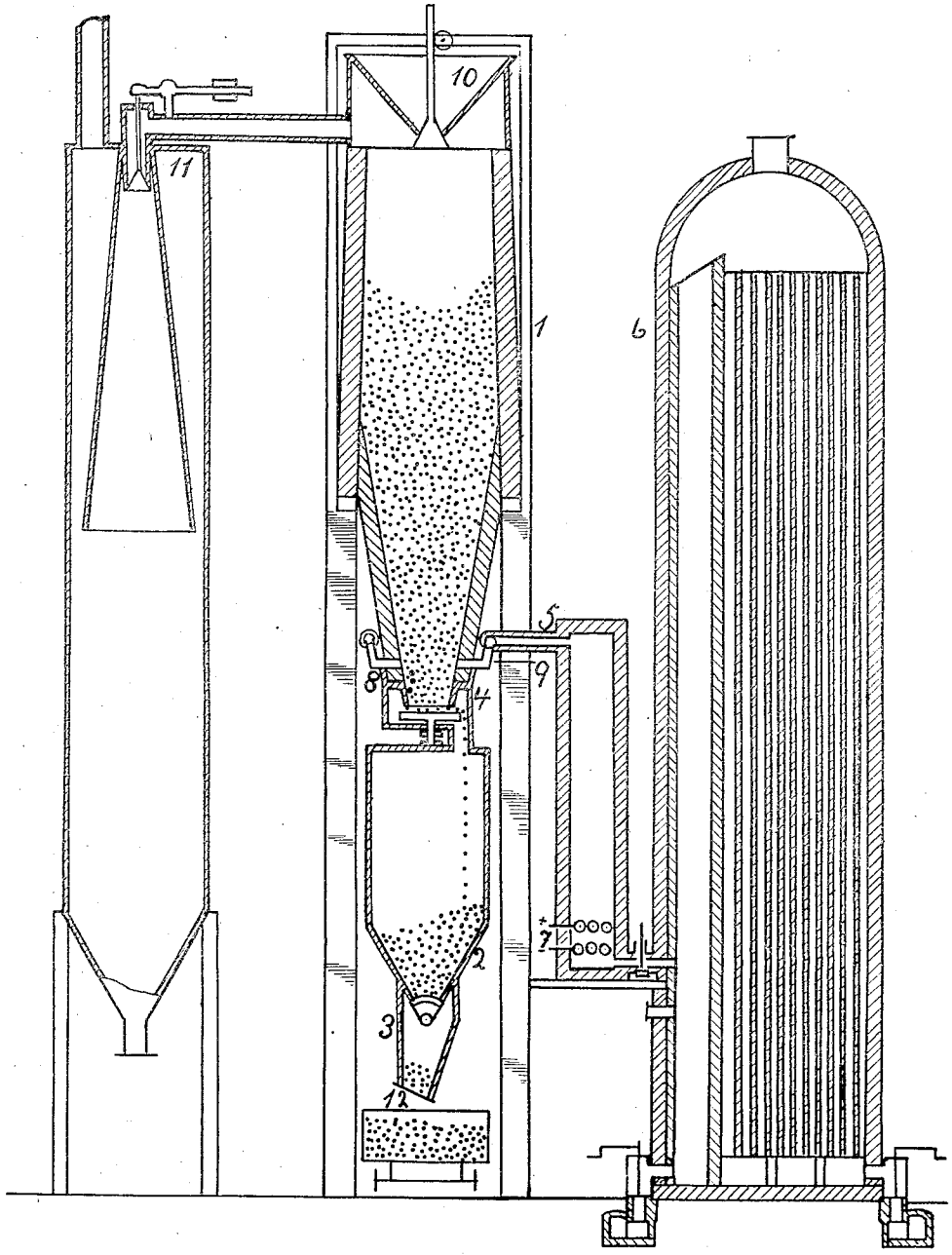
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APPARATUS FOR TREATING ORES

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APPARATUS FOR TREATING ORES

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This invention relates to the process and apparatus for extracting alumina and chromium compounds from iron ores which contain cromium as an impurity and which cannot well be worked up because the cromium is reduced and enters the iron. An object of the invention is an economical process for the simultaneous extracting of chromium compounds and clay (argillaceous earth) from such ores.

As the percentage of chromium is very low, the processes hitherto used for working the chromium hematite were not found to be satisfactory or economical. This being so, the only successful process is one of simultaneously extracting chromium compounds and pure argillaceous earth (clay) from the said iron ores.

This object is attained by combining the several reactions to give economy in the process, the argillaceous earth is separated and the cromium is dissolved.

As there are considerable deposits of iron ores containing chromium and alumina, these ores can be obtained for working in large quantities. But the apparatuses and devices hitherto used for extracting chromium and alumina compounds from the ores are insufficient. In the invention, I use my new apparatus hereinafter described which enables an economical treatment of large quantities of these ores, in keeping with a regular blast furnace service.

The process is carried out thus, the ores, in order to eliminate moisture and hydration water are heated and ground with the necessary quantity of soda (alkaline hydrate or alkaline carbonate or bicarbonate) to a fine powder. This mixture is then exposed to treatment with red-hot gases which contain oxygen whereby the sesquioxide of chromium and a portion of the alkali react together and form alkali metal chromate. At the same time the alumina reacts with some of the alkali liberating CO_2 and forms alkali metal aluminate. The chromate and the aluminate so formed are dissolved from the hot roasted mixture, by treating with water and the solution is separated from the insoluble residue containing iron and gangue.

In order to separate the alumina from the aluminate and chromate solution, carbonic acid is introduced into the solution at about 50° C., (and the carbonic acid may be separated from the alkali-carbonate when heating a further quantity of the mixture). In this way the alumina is separated, completely pure, and alkali metal carbonate is formed. The precipitate is separated from the solution and carbonic acid is again introduced into the solution, preferably under pressure in order to separate alkali metal bicarbonate. The bicarbonate is separated from the solution, mixed with ore and ground and then the mixture is worked up in the above described manner.

The solution will then contain only alkali metal chromate and non-separated bicarbonate. In order to concentrate or improve the solution in chromate, it is boiled and used to leach further quantities of the heated mixture and then the same process, as above indicated, is repeated until a concentrated solution of alkali metal chromate has been formed. From this solution alkali metal chromate or bichromate is obtained in the well known manner. If, instead of alkali-chromate it is intended to produce sesquioxide of chromium, coal is added to the solution, the latter evaporated to dryness, the residue is heated and by means of lixiviation the sesquioxide of chromium is separated from alkali metal aluminate. Alumina is separated from the aluminate solution by means of carbonic acid and then soda or bicarbonate is made out of the solution in the well known manner.

The process is such, that the alkali-carbonate or bicarbonate required for extracting the alumina is formed again when the alumina is separated and can thus be used again for extracting alumina from more of the ore, as above described. When thus separating the alumina, the chromium is simultaneously eliminated from the iron ore.

When blowing a gas current through powder, channels are formed in the powders through which the gas current can pass without completely influencing the particles of the powder and considerable quantities of the

powder are carried along with the gas current and for this reason the powdered ore is, before roasting with the alkali, made into little porous lumps, as porous as possible and the hot gas current will pass through the pores of said lumps and thus influence the whole of the ore.

Such porous lumps are made by moistening the mixture of ore and soda with, say, a solution of caustic soda or caustic potash in such a manner that a plastic mass is formed out of which balls are automatically made by rotating in a rotary tube and these balls will harden (in a highly porous state), when drying by the vaporization of the water, so the gases will completely permeate said little porous balls. During their travel through the pores of the balls, the hot oxidizing gases will effect the firm structure of the porous balls of ore and transform the sesquioxide of chromium into chromic acid which will combine with the alkali so as to form alkali metal chromate. For the formation of alkali metal alumiate the influence of oxygen is not necessary but the presence of oxygen in the hot gases is not harmful. The shape of a ball is also here preferable because it prevents the pulverized mixture from flying about when being heated.

The transformation of sesquioxide of chromium into alkali metal chromate and the transformation of alumina into alkali metal aluminate can be effected in periodical or continuous process by means of apparatus shown in the accompanying drawing.

The accompanying drawing shows a vertical section of a suitable apparatus for this new process.

In the shaft furnace 1 there is, opening into it in the well known manner, a blast pipe 5 which is connected to an air heater 6, and in the circuit is placed an electric heating device 7 (or means for burning gas or other fuel) is arranged in such a manner that the hot compressed air, when introduced, can be heated by said heating device or gas or fuel fire, as may be required. The object of this arrangement is to automatically control the temperature of the air by means of the pyrometers 9 arranged in the nozzles 8. In its upper part the furnace is, in the usual manner, equipped with a hopper-feed 10 having a stopper. The flow of the gases is regulated by means of a valve 11 which also mantains a pressure upon the gases in the furnace, and thus accelerates the reaction.

At the lower part of the furnace there is a receptacle 2 to receive the material coming out of the furnace and closed by valve 3 and 12 in such a manner that the air passed into the furnace under pressure cannot escape into the outer atmosphere.

The furnace is emptied by means of a device 4 which, when turning the plate, will bring out the material, conveying the same into the receptacle 2.

The process will go on in the following way; first the furnace is filled with the little porous lumps made of the said mixture, then hot air is produced in the air-heater and passed under pressure through the furnace. In this way the lumps are heated and aluminate and chromate are formed. When the reaction is finished, the furnace is emptied and a new charge is filled in. The process can be operated continuously by continuously operating slowly the emptying device 4 and supplying new material to the furnace 1, from time to time from above.

The duration of the reaction will depend (among other things) on the kind of ores and on the blast pressure. In most cases it will be sufficient to expose the lumps for about four hours to the influence of an air current at about 800 to 1200° C., to transform the alumina and the sesquioxide of chromium contained in the ore, completely into aluminate and chromate.

The lixiviation of the ore mixture after the roasting step is performed in the well known manner, according to the methods used when extracting copper, etc.

I claim:

1. Apparatus for working up iron ores containing aluminum and chromium compounds, which comprises a blast heating device, means for introducing porous agglomerates into the upper part of such blast heating device, and for closing such inlet means, means for introducing a strongly heated air blast into the lower part of such blast heating device, means for drawing off the exit gases from the upper part of such blast heating device, while throttling such exit gas outlet to maintain a superatmospheric pressure in such blast heating device, means for continuously withdrawing heated agglomerates from the bottom part of the blast heating device to the exterior thereof, while holding the superatmospheric gas pressure therein, and a receiving receptacle having a valve controlled outlet arranged beneath the heating device and into which the agglomerates are deposited from said device.

2. Apparatus for working up iron ores containing alumina and chromium compounds, comprising a blast heating device, means for introducing porous agglomerates into the upper part of said device, and for closing such inlet means, means for introducing a strongly heated air blast into the lower part of said heating device, means for drawing off the exit gases from the upper part of the heating device, while throttling such exit gas outlet to maintain a superatmospheric pressure in the heating device, a receiving receptacle arranged beneath the device, and having a valve controlled outlet, and into which the agglomerates are deposited from said heating device, and means including a rotatable plate for continuously discharging

the agglomerates from the device into said receptacle.

3. Apparatus for working up iron ores containing aluminum and chromium compounds, comprising a blast heating device, means for introducing porous agglomerates into the upper part of said device, and for closing such inlet means, means for introducing a strongly heated air blast into the lower part of the heating device, means for drawing off the exit gases from the upper part of said heating device, while throttling such exit gas outlet to maintain a superatmospheric pressure in the heating device, means for continuously withdrawing the heated agglomerates from the bottom part of the heating device and including a rotatable plate, a receiving receptacle depending from the device and into which said agglomerates are deposited, said receptacle having a valve controlled outlet, and a relatively small discharge receptacle depending from and surrounding the outlet of the first mentioned receptacle and also having a valve controlled outlet.

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