

ore has to be crushed down to less than say 20 mesh before it can be separated. Take the case of the banded jasper ore in the Temagami district, which would require very fine grinding to effect an economic recovery of iron; the Gröndall Process could do this where no other could. But it is also obvious that such fine ores must be briquetted.

THE GRÖNDALL BRIQUETTING PROCESS.

Concentrates produced by this process, iron sands, pyrites, residues, small ores generally, as well as ores containing a high percentage of sulphur, which are unsuited for use in the blast furnace, are next briquetted.

The material is conveyed to the briquetting process. These are drop presses—the height of the drop being from $6\frac{1}{2}$ to $7\frac{1}{2}$ inches, and the briquettes receive three blows, the falling weight being about 1,800 pounds. The briquettes may be of various sizes, but are usually made 6 in. x 6 in. x 3 in., weighing from 8 to 10 pounds each. Each press requires 3 e.h.p., and will make from 500 to 750 briquettes per hour. The pulverized ore is pressed into briquettes without any binding material whatever, the moisture in the ore being so adjusted as to obtain briquettes sufficiently firm to be removed from this press to the cars used in the furnace.

The briquettes are taken from the press and placed on the furnace cars. These are made of iron and covered with fire brick. Along each side of the car is a deep flange which dips into a channel filled with sand placed along the sides of the furnace, thus forming a gas-tight seal. The ends of adjacent cars are fitted with a groove and projecting rib respectively. By this means the surface of the cars forms a gas-tight partition and thus prevents the lower portion of the cars, frame, wheels, etc., from becoming heated. The cars measure 3 ft. 6 in., and hold from 15 to 16 hundredweight of briquettes arranged on edge in two tiers.

THE FURNACE.

The furnace is fired by gas derived preferably from gas producers, although blast furnace gas can be used. The combustion chamber is situated about one-third of the length from the intake end. The air needed for combustion is introduced below and traverses the row of cars, thus helping to keep the wheels and framework cool, and at the end of the furnace is diverted to the top of the row of cars, traversing the burnt briquettes, cooling them, and becoming itself heated before reaching the combustion chamber. The products of combustion pass over the entering cars, assist in drying and heating the briquettes, and finally escape through a stack at a temperature of only 150 deg. Centigrade. The furnace being thus constructed on the regenerative principle, has a very good thermal efficiency, radiation is small, and the chief loss of heat is due to the evaporation of the water contained in the briquettes (5 to 7 per cent.) A car of finished briquettes is drawn about every half hour, depending somewhat on the degree of desulphurization required. Recently, furnaces have been arranged so as to give a continuous movement to the cars, increasing the capacity of the furnace considerably.

The temperature in the combustion chamber of the briquetting furnace reaches 1,300 deg. to 1,400 deg. C. At this heat the particles agglutinate sufficiently to form a firm, hard briquette, able to stand rough handling and long transport. The briquettes, though hard, are very porous, and are consequently far more easily reduced in the blast furnace than ordinary lump ore. The briquette made from Herräng ore, previously mentioned, has a porosity of 23.9 per cent. of its volume.

When briquetting iron ore concentrates and using producer gas for fuel, the consumption of coal has been found to average 7 per cent. of the weight of briquettes burnt.

GRÖNDAL BRIQUETTES.

The Gröndal Briquette is unique in that it does not contain an added binder, and, therefore, there is no foreign material such as lime, to be heated and slagged off. In the case of magnetic oxide concentrates the particles are completely peroxidized, owing to the very free supply of air given to the furnace during the process of burning the briquettes. Such peroxidized ore is very easily reduced in the furnace, thus introducing a certain fuel economy.

TREATMENT OF PYRITES RESIDUES.

Briquettes made by this process from pyrites residues and purple ore have proved to be entirely satisfactory in the open hearth steel furnace. At Cwmavon, ores containing 2 to 4 per cent. sulphur, and sometimes more, are being successfully treated by this process.

CAPACITY OF FURNACE.

The output of one furnace varies from 30 to 80 tons in 24 hours, according to the class of ore used, and the degree of desulphurization required; for in addition to its mechanical action this furnace acts as an exceptionally efficient calciner for removing practically all of the sulphur.

The following analyses of crude ore, concentrates and briquettes will give an idea of the results obtained by the use of the Gröndall Processes:

TABLE II.

Results of Gröndal Treatment.

	Iron.	Sulphur.	Phosphorus
Herräng, Sweden.			
Shown in Table I.			
Gellivare, Sweden.			
Crude ore	58.96	0.036	1.29
Concentrates	72.38	0.003	0.005
Briquettes ..	69.49	0.002	0.006
Salangen, Norway.			
Crude ore	36.43	0.021	0.318
Concentrates	71.76	0.015	0.008
Briquettes			
Pitkaranta, Finland.			
Crude ore	28.40	2.60	0.260
Concentrates	69.59	0.132	0.007
Briquettes	67.98	0.011	0.008
Cornwall, Penna.			
Crude ore	30.65	1.603	0.012
Concentrates	69.95	0.036	0.003
Briquettes	69.90	0.010	0.005

The results from Cornwall ore were obtained with a ten ton sample sent to Herräng about a year ago, as there is not yet a plant available on this side of the Atlantic.

SEPARATION OF TITANIUM

At the FitzGerald & Bennie Laboratories, Niagara Falls, Ontario, a small separator of the Gröndal type was installed in June of last year, and some tests were made on the separation of titanium from ore, working with what are known as Moise Beach sands, from the St. Lawrence River. The following results were obtained:

Original ore	16.57 per cent. TiO ₂
Concentrate	4.21
Middling	19.48