The Canadian Engineer

VOL. II.—No. 5. TORONTO, SEPTEMBER, 1894. PRICE, 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

MECHANICAL, ELECTRICAL, MARINE, LOCOMOTIVE, STATIONARY AND SANITARY ENGINEER, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION:

Canada and the United States, $1 00 per year, Great Britain, 5s. Advertising rates on application.

Offices: 62 CHURCH ST., TORONTO. FRASER BUILDING, MONTREAL.

E. B. BIGGAR, PUBLISHER R. R. SAMUEL, BUSINESS MANAGER *Fraser Building, Montreal.*

Toronto Telephone, 1892. Montreal Telephone, 2589.

All editorial correspondence should be addressed to the Montreal Office.

CONTENTS OF THIS NUMBER:

For THE CANADIAN ENGINEER.

FROM IRON ORE TO STEEL.

A SKETCH OF IRON MINING AND MANUFACTURING IN PICTOU COUNTY, NOVA SCOTIA.

BY JOSEPH DIX FRASER, FERRONA, N. S.

(Concluded from last issue.)

I will now describe the process of converting iron ore into pig iron: The brown ores of the East River are best adapted for steel making on account of their containing small percentages of sulphur and phosphorus. During the last year, the ore used has come principally from the Macdonald & Grant mines. Tramways extend from the mines to the washer, where clay, the principal impurity, is easily and cheaply separated from the ore. It is then taken to Ferrona, and stored in the stock-house, ready for use. An average sample of these ores yields from 50 to 53 per cent. of metallic iron.

In order to reduce this ore, it is necessary that there should be present some substance which is capable of ready union with its mineral impurities. These earthly or mineral impurities generally consist of various admixtures of oxides of silicon and alumina, and other metals. The substance which is provided for the removal of these impurities is termed a "flux." By the union of the latter with the former a compound is formed, which is in essential character a sort of fusible glass. The substance used at the Ferrona furnace for fluxing is limestone of a very superior quality, averaging 95 per cent. of carbonate of lime, and obtained alongside of the railroad at Black Rock.

A very important factor in the manufacture of iron is fuel, for upon the quality and quantity of it depends the quality and quantity of the iron. At Ferrona the quality of the coke is such as compares favorably with the "Connellsville coke," which is a standard in the United States. The Ferrona coke yields 84.78 per cent. fixed carbon, 14.20 per cent. ash, and 1.02 per cent. sulphur. As already stated, the three classes of materials used in the manufacture of pig iron are: 1st, the ore which yields the metallic iron; 2nd, flux or carbonate of lime, by which the process of smelting is aided; 3rd, fuel, which supplies the high degree of heat necessary to act upon them both and to produce what may be called the chemical combination effected in the interior of the furnace.

As a rule the proportion of ore in the charge is such as to give about 50 per cent. of iron. Keeping before us this proportion, three parts of ore, two of coke and one of limestone may be given roughly to indicate the average ingredients of material charged.

The blast used at the old furnace in 1829 was simply cold air, but in the present case we have the hot blast or highly heated air; this air is passed from the blowing engines through a large iron pipe, termed "the cold blast main," and is at the temperature of the ordinary atmosphere. It is then passed through the hot blast stoves, and after being highly heated from 500 degrees up to as high as 1,500 degrees, it enters the furnace through another range of iron pipes lined with firebrick, to protect the pipe and to maintain the heat as near as possible to that produced by the stoves.

Let us suppose that everything is in readiness, that the furnace has been successfully lighted, and has, after proper treatment, been dried sufficiently to add more fuel and blow harder. Little by little the burden is increased, that is, charged with ore coke and limestone, until the furnace has obtained her utmost capacity. Beginning at the top of the burden, we find a veritable process of calcination or roasting taking place. The ore is not only affected by the heat of the gases which are evolved from the material below, but it is acted upon by them chemically. The chief substances comprising these gases are carbonic oxide, which is inflammable, burning with a blue flame and forming carbonic acid, which is incombustible; cyanogen and hydrogen, which burns, forming water. Besides these, there are always present various hydro-carbons, more or less numerous. Immediately below the point at which this calcination takes place the ore commences to undergo a certain amount of reduction, which is mainly effected by the carbon of the carbonic oxide in the gases.

Below this region of reduction, we come to the part of the furnace where it is said to be a full red heat, *i.e.*, about the middle of the body or cone of the furnace. At this zone the iron is exceedingly porous and spongy, and so extremely active that it will seize upon and combine with the elements of the nearest substance surrounding it; for this reason it is termed the zone of