THE ELECTRIC FURNACE: ITS EVOLUTION, THEORY AND PRACTICE

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Article VII.

Future Developments of the Electric Furnace.

In concluding this series of articles, an attempt may be made to indicate in what directions future developments of the electric furnace may be expected, and to what extent this development is likely to proceed. Such an attempt can hardly fail to prove incorrect, however, on account of the great changes that take place in the economic conditions of the world, as well as on account of the discoveries and improvements which are made with increasing frequency.

The following questions may be asked:—

1. How far will the electric current replace fuel in furnaces for the smelting and refining of metals?

2. What untouched fields of usefulness are waiting for the electric furnace?

3. What limits are there to the commercial development of the electric furnace?

Electric furnace operations may be roughly divided into two classes, first, those which can scarcely be effected in any other way, and in which electrical heating must always hold the field, such as the production of calcium carbide, carborundum, and aluminium. Second, those in which either fuel or electrical heat may be used with a fair measure of efficiency, and in which the price of the two sources of heat must be compared, in addition to the efficiency of each, before deciding which to employ.

The relative prices of coal and electrical energy, and the amount of electrical power that will be available, are considerations of the first importance in determining the future of the electric furnace.

Until a few years ago the electric current was a wonderful and expensive commodity, and the idea of using it for heating on a commercial scale was preposterous. About 13 tons of coal were needed to produce one electrical horse-power for a year, and this electrical energy, would furnish less heat than one ton of the original coal. Such a method of using coal was evidently extremely wasteful. The greater efficiency of electrical heating somewhat reduces this difference, and together with the smaller cost of water-power has made it cheaper in some cases to use "white coal" instead of black, in the furnace.

In comparing the supplies and prices of coal and electrical energy, it should be remembered that one short ton of good coal produces as much heat as 1¼ horse-power years of electrical energy, but that the efficiency of the electrical furnace is from 2 to 30 times as great as the efficiency of ordinary metallurgical furnaces, so that an electrical horse-power year will produce as much effective heat as several tons of coal. (The figures for different operations are given in Article III., page 170, May, 1906).

The world's production of coal at the present time is about 1,000 million tons a year, and is steadily increasing. The electric furnace draws its energy mainly from water-powers. The water-powers of the world that have already been utilized are very small in comparison with the present coal output, having in all only about 1 per cent. of the heating power of the latter.

In view of the fact that coal mining is a long-established industry, while the electrification of water-powers is only of recent growth, it is reasonable to suppose that the latter will increase more quickly in proportion than the former. In both cases there are limits, however; the coal mines will ultimately all be discovered and worked out to a depth at which the cost becomes prohibitory, while on the other hand the water-powers will all be developed, leaving only those that are too expensive to utilize. When these limits are reached the coal supply will have sunk to a small proportion of the amount needed for heating and power, but the water-powers will continue to give a steady supply of power for all time with only maintenance and interest charges.

The exhaustion of the coal supplies may not be reached for hundreds or thousands of years, but if the development of the mines proceeds, as at present, at increasing rates like compound interest, their practical depletion may be less distant than now appears probable. In any case it seems likely that as coal can only be used once, while water-powers are not deteriorated by use, the latter may be expected ultimately to largely replace the former for motive power and to some extent for furnace work.

The present age, especially on this continent, is one of the barbaric use of the mineral assets such as coal and ore. As the population increases and the development of mines is pushed to its limit, the increasing scarcity both of the ore and of the fuel to smelt it, will make it necessary to spend more money in utilizing these to the very best advantage, using the coal with the greatest economy and extracting every possible product from the ore. It has been suggested that the present enormous production of iron and steel for example can only represent a temporary condition, that of extracting the iron from its ore. When most of the iron ores have been converted into iron or steel our descendants will have to be content to use over again the metal so produced, merely making good the deficiency caused by rusting and the increase in population. Iron is, however, a very plentiful metal, forming perhaps 4 per cent. or 5 per cent. of the earth's crust, and the coal will last for a large number of years, but the time must come when it would be extravagant to use coal, mined at great expense, for the mere production of heat. As coal becomes more scarce it will be used for its chemical properties of reducing iron and other metals from their ores, while the necessary heat would be produced electrically. At that time Canadians may have to heat their houses electrically, or if, on account of the large population in Canada at that time, such method of heating were too expensive, they may have to live underground during the winter.

In the more immediate future there will no doubt be a great development of electrical power, which may in consequence replace coal to some extent in some furnace operations such as the production of steel and iron from certain ores, and in certain localities; on the other hand the rapidly increasing market for electrical power will tend to keep the price from falling, relatively to the price of coal, and it is therefore unlikely that coal and coke will be at all largely replaced for smelting purposes by the electric current for many years to come.

When the possibilities of the electric furnace have been more fully ascertained it is likely that some large water-powers that are situated conveniently with regard to metallic ores may be utilized for their reduction, the electric plant being available for other purposes after the exhaustion of the ore supply. At the present time such a large return can be obtained from capital in Canadian industries that only the most easily developed water-powers are considered. When the country becomes more thickly settled and when capital is more abundant, a smaller return will be expected and the interest charges on permanent developments such as hydro-electric plants will be less; thus enabling powers to be utilized that would be too costly under present conditions.

With regard to the probable future developments of the electric furnace it will be instructive to review shortly the progress that has already been made:—

I. The electric furnace has rendered available a range of temperature from about 1,800° C. to about 3,700° C., or