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THE GRONWALL STEEL REFINING FURNACE.

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In recent years great advances have been made in the electric smelting of steel and several types of furnaces have proved themselves capable of making good steel economically.

One of the latest types to be introduced and one that possesses several distinct advantages over any other is the "Grönwall" furnace.

This furnace, the invention of three Swedish engineers, Messrs. Grönwall, Lindblad, & Stalhare, of Ludvika, is of the arc type as opposed to the induction type; but it is the only arc furnace employing two phase current.

It will be seen from the illustration (Fig. 1) that the furnace has two carbon electrodes, carrying separate phases, passing through the roof. The current arcs from these on to the slag and metal, passing through this, then through the basic lining to the neutral return, which is a carbon block fixed in the bottom of the furnace.

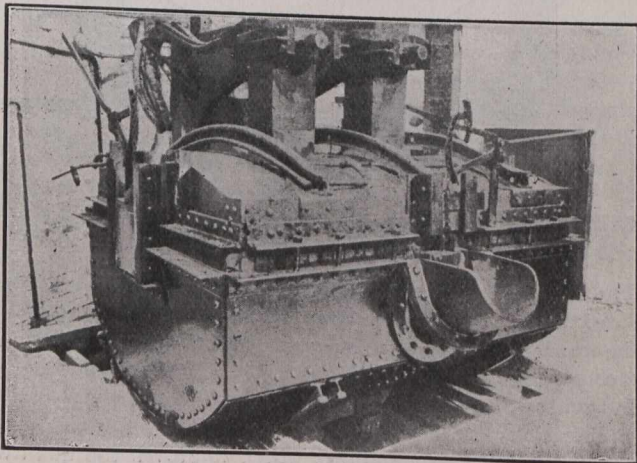


Fig. 1. Exterior View of Furnace.

Furnace Construction.

The iron tank of the furnace is lined with magnesite bricks and inside this lining the hearth of dolomite or magnesite is rammed. (See Figs. 2 and 3.)

The carbon block forming the lower terminal is held in an iron casting bolted to the furnace bottom, and just comes level with the brickwork, so that it does not project into the basic lining. In this way, the bottom of the furnace is not broken by any projections, and after each charge, the bottom can be repaired exactly in the same manner as that of an open hearth furnace.

The roof consists of a channel iron framework holding silica bricks and is detachable, so that when the bricks are worn thin, it can be taken off and replaced by a new one, this operation of changing only requiring about twenty minutes.

There is a working door at each end of the furnace and another one at the tapping spout. At the back of the furnace are the cranes for raising and lowering the electrodes, which can be done either by hand or by automatic regula-

tors. The electrodes are of a new type and are so constructed that they can grip the electrodes at the points where they enter the roof. This reduces the electrical energy losses in the electrodes to a minimum.

The furnace is mounted on curve rails and is tilted by hand-wheel gearing or by hydraulic cylinders. The furnace construction although simple, is cheap, strong and efficient.

Electrical Equipment.

The high tension supply, if three phase, is transformed by means of two single phase transformers with Scott's connections to low tension two phase current at 50 to 70 volts. The voltage can be altered by changing the number of primary windings.

The switch gear consists of one two pole oil switch in circuit with the high tension mains. There is an ammeter on each phase and one on the neutral return. A volt meter with a 3-way switch shows the voltages of each phase and also that between phases.

The current is conveyed to the electrode holders by means of bare flexible cables from the bottom casting to the transformers by similar cables.

Regulation of the current is brought about solely by raising and lowering the electrodes, in this way increasing and decreasing the resistance of the arc gap.

Advantages of the Two Phase Furnace.

Compared with single phase furnaces, the Grönwall furnace has the advantage of allowing the current to be taken direct from the mains of either a two or three phase system without the intervention of motor generators, which compared with static transformers are not only very inefficient but have high initial cost and running expenses.

A marked feature of the two phase arrangement is that when melting cold charges, the furnace runs very smoothly. One of these furnaces is working in Sheffield, Eng., and is supplied with power from the municipal station. The working is so smooth that the authorities permit the furnace to be started on a cold charge during their peak load.

Apart from electrical considerations, it has been found that this system has decided metallurgical advantages.

The passage of the current through the basic lining keeps the bottom of the furnace well heated all over, using to do this very little energy, and without damaging the lining in any way.

Unlike a single or three phase arrangement, the two phase current induces horizontal and vertical movements in the charge, the result of this being that the metal from the bottom of the bath is constantly being brought to the hot surface where it comes into intimate contact with the refining slag thus reducing time and current consumption for refining. In this way, equality of temperature tends to be established all through the charge. In addition, heat is taken away from the very hot region below the electrodes by this movement, so that the reflection of heat from this part on to the roof is much less than with single or three phase surface heating, the result being to prolong the life of the roof.