

134 A STUDY OF ELECTRIC FURNACES AS APPLIED

DISCUSSION.

Mr. J. Härdén said the use of a bottom electrode was of great interest from the electrometallurgical point of view, but to have a water-cooled apparatus beneath a steel furnace constituted to his mind an element of great

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danger. If such an apparatus were operated to the extent, say, of the open hearth or Bessemer furnace, the risk of explosion would become very great indeed. Mr. Keller is evidently of opinion (see p. 133) that as between non-electrode and electrode furnaces, the future is with the latter. But where are the electrodes to come from? They will either have to be made by the consumer, at the expense of a special factory costing more than a small foundry, or they will have to buy them from an existing factory, which is a drawback, especially in cases where large electrodes are to be used, in view of the scarcity and uncertainty of the supply of such large blocks. This will impose strict limitations on the use of electrode furnaces. Another drawback of these furnaces is the great variation in the power consumed, amounting to some 30 or 35 per cent. A public supply company would not submit to such variations, and therefore power would have to be generated in the steelworks. Taking these extra items of capital expenditure into consideration, the actual total cost of running the induction and electrode type of furnaces is about the same.

Mr. W. Murray Morrison, referring to what Mr. Härdén had said, remarked that the cost of electrodes was a very small item in the running of an electric furnace, and the relative superiority of electrode and induction furnaces certainly did not hinge on that question. It would not pay a smelter to put up a special factory to make electrodes unless he worked on a very large scale, but the supply of electrodes need cause no uneasiness as there were numerous electrode factories abroad, and two large factories in this country, from which practically unlimited quantities could be obtained at a low cost.

Mr. P. R. Cobb said he would like to add one remark that would have some practical bearing. He had seen that day the manager of a large steel-works, who had been touring the Continent to find a really satisfactory electric steel furnace. There was one thing he had quite definitely decided, namely, not under any circumstances to have a furnace with a water-cooled bottom electrode.

M. Keller (*communicated reply*): In reply to Mr. Härdén's remarks, I will deal at length with the question of the cooling of bottom electrodes when I come to the observations of Mr. Cobb.

As regards the fear which Mr. Härdén manifests on the subject of electrodes, I can assure him most decidedly that these fears are not justified, because there are to-day a number of makers of electrodes whose principal preoccupation it is to search out customers. The situation described by Mr. Härdén not only does not exist, but the circumstances are the very reverse of what he imagines. It is possible to obtain, almost daily, any shape of electrode one may desire. In France, for example, there are three makers of electrodes who possess hydraulic presses of considerable power, and whose capacity is much greater than the French consumption (*Société Française des Electrodes*, at Venissieux, near Lyons (Rhône); *Société des Carbures métalliques*, at Nôtre-Dame-de-Briançon (Savoie); *Société Anonyme Electrometallurgique des Procédés P. Girod*, at Ugine (Savoie)).

In Germany there are at Nuremberg two important manufacturers of electrodes (Conradty and Lessing). In Austria there are the Hardtmuth works at Ratibon, and the works of Messrs. Schiff at Vienna. Here is, then, a list of works which can supply almost at a moment's notice enough electrodes to supply the world, and this without taking into consideration the American works, which easily furnish America with all its demands in the way of electrodes. Besides these, there are the works in which the manufacture of electrodes constitutes an accessory to other metallurgical industries and which

furnish yearly their quota. As to the prices of electrodes, this varies from about 26–34 frs. per kilo at the works.

After these explanations I believe that one can with safety conclude that the danger of a dearth of electrodes is quite an illusion.

As regards variations in consumption of energy, I estimate that these are of the same order as those which ordinarily occur in many works using electrical energy. The electric supply companies have to be satisfied with a consumption of current other than in fixed resistances; the problem of electric distribution to-day is normally conditioned by variations as large as those existing in an electric furnace of the electrodes type. On the other hand, those variations are not as large as Mr. Härdén supposes; in a furnace with a conducting bottom the variation would be very small, because the heating is more certain and constant than in other systems of electric furnaces.

It is hardly necessary still further to add that if there were any reality in the observations of Mr. Härdén, steel works would also have to be in close proximity to an electric supply system. This is a rare enough case, and the ordinary case is precisely that in which the steel manufacturer generates his own electric energy, and that whether he employs induction or electrode furnaces.

Mr. Cobb records the unfavourable opinion of the manager of a large steel works concerning the employment of a furnace with a water-cooled bottom electrode. It would be desirable to know what construction the gentleman has in mind, because if there is a circulation of water in the base of the furnace itself it is indisputable that there is in this case a grave possibility of danger. If, on the other hand, it is only the external wall of the furnace which is cooled the danger does not exist. It is no new thing in metallurgy to find water-cooling installations in the walls and tuyères of furnaces; the water-jacket furnace employed, for example, in the fusing of copper ore is of very great value and has quite an undeniable reputation.

In the furnaces I have described the cooling is entirely based on the water-jacket principle; that is to say, it is the sheathing of the base which is cooled and not the internal section of the base. I would add that this sheathing is made up of cast plates in which are embedded iron tubes through which the cooled water circulates; under these conditions the breaking of the sheathing does not involve the fracture of one of the water-tubes. I am persuaded that if he had been acquainted with this method of water-cooling and this mode of construction, Mr. Cobb's friend would have reason to have modified his opinion, because under these conditions there is obviously no danger, and of this the best proof is the existence of enormous metallurgical processes which employ water-cooled furnaces.