

though, that improvements then being made would enable them to do so eventually.

What then is the chief difficulty with the Scandinavian process? Primarily it requires too much power, and among the reasons for the extravagant use of power is the inability to condense a sufficiently large proportion of the zinc directly as spelter. The blue powder obtained is chiefly zinc, but in a non-commercial form. In order to get spelter from it a resmelting is necessary, and this adds greatly to the cost of treating the ore. The blue powder difficulty has perplexed everyone of the score or two score of investigators on electric zinc-smelting, save perhaps one who failed for other reasons.

We set out to learn how the condensation of zinc as blue powder could be reduced, and how the need for electric power could be otherwise cut down. We had no idea that blue powder could be wholly avoided, inasmuch as it is produced to a considerable extent in the ordinary process of fire smelting, and we could not hope to do better than that. Theory indicated that we might in this respect attain similar results to those from fire smelting; also that the requirement of electric energy might be otherwise reduced and possibly sufficiently to render power consumption no great obstacle to profitable operation. With that difficulty overcome, there were the chances of smelting in a unit of relatively larger size with possible economy of labor, and some other advantages as compared with ordinary fire smelting. Then, too, there was a possibility that silver-lead, copper matte and spelter could be produced by one furnace in a single operation, and that a higher percentage of extraction of the zinc, and especially of the silver and lead, could be made than in ordinary smelting. Moreover, it might be that some kinds of ore that at present it is not possible to treat—and there are such ores—would be found amenable to electric smelting. I say that these were possibilities; there was sufficient justification for spending time and money in testing them. However, they were never in my mind anything but possibilities, and I have never held out hope that they would be realized. On the contrary, I have been distinctly sceptical and guarded in what I have stated publicly concerning our results. I have been confident that metallurgical success would be attained, but herein I distinguish between metallurgical and commercial, although, of course, broadly speaking, a metallurgical success is not a real success unless it also be a commercial success.

In our work in the laboratory at McGill University, Montreal, where we tested our theory, experimented with different types of furnaces, and learned the A, B, C of the art, we succeeded in assuring ourselves that the production of blue powder could be reduced to something like the proportions of those of ordinary smelting, and we had some hopeful indications of reduced power consumption. Then we came to Nelson to try things on a larger scale. When in the laboratory we graduated from a 20-lb. to a 200-lb. furnace we encountered a new line of practical troubles. When we came here and graduated to a 2,000-lb. furnace, again we encountered new troubles, but magnified.

As I observe operations from day to day I experience the whole gamut of emotions. Some days, when things are going well, I am inwardly carried away with visions of what may be accomplished; on other days I am chastened in spirit. The fact is, electric smelting is a process of extraordinary delicacy. I know of nothing else in metallurgy that is compar-

able in its requirements to this one. In most processes, if things be set right, they stay right, with ordinary attention, but in this process there are at least eight different controls, all closely correlated, but more or less independent, which may change from hour to hour, and even more quickly, and make things go badly. The ordinary process of zinc smelting is one of delicacy, but electric smelting is far more so—at least, as we know it yet. A friend of mine, himself an experienced zinc smelter, can see no future for electric smelting, for this reason alone. I am far from being as pessimistic as that, but I will say to you positively that I cannot see any commercial possibility in a one-ton electric zinc furnace, nor a battery of such furnaces, and when I think of a 10-ton furnace I am appalled. Just as we have experienced new and magnified troubles in going from a 20-lb. to a 200-lb. furnace, and from a 200-lb. to a 2,000-lb., so we shall do in going from a 2,000-lb. to 20,000-lb. furnace. Indeed, the lines and working of a 20,000-lb. furnace are quite beyond my conception and, I am sure, that of the staff engaged here.

We have not yet got our furnace here running to our satisfaction. We seem now to be able to keep it going, and we make some spelter and matte and lead. If the work be continued, I think it probable that before long the control of the variables would be learned and metallurgical success be pronounced. At the annual meeting of the Canadian Mining Institute, held in Montreal, Quebec, early in March, Mr. W. McA. Johnson, who has been working for ten years on electric smelting of zinc ores, presented a paper entitled "The Commercial Aspect of Electric Zinc-Lead Smelting," in which he described a run with a 1-ton furnace at Hartford, Connecticut, which was a metallurgical success to a considerable degree. I saw that furnace in operation during that run and at the time of my visit it was working smoothly and encouragingly. Mr. Johnson deserves very great credit for what he has accomplished. We have been working on similar lines, but he is a lap or two ahead of us. He has organized a company which will erect a 10-ton furnace at some place in the United States and make a commercial test. He expresses himself confidently as to the result. Our own experience has led me to be much less sanguine, as you will have gathered from what I have already stated.

As you know, the money appropriated for our work has nearly all been spent. If the work is to be continued here, more money must be provided for it. I am speaking to you now merely as a consulting engineer, telling you squarely what the situation is from the technical standpoint and expressing to you very frankly what my opinions are, and I have been duly authorized by the Deputy Minister of Mines and the Director of Mines to do this. Of course I cannot speak for the Dominion Government. It is my understanding that more money was promised if necessary, and that that is recognized at headquarters in Ottawa. But it is my duty only to advise, and I cannot advise a Government any less honestly that I could a private client. I think that in due course of time the work being done here would, if continued, be brought to reasonable metallurgical success. I am positive, though, that even so there could be no commercial success expected from a 1-ton unit nor an extension of 1-ton units. What it would cost to go on and develop an 8-ton or a 10-ton unit is beyond human capacity to estimate. Those who promote such pioneering devel-