large size furnace in less than two minutes. These facts, when compared with the pig and scrap proposition, which takes considerable labor to handle, are apparent to those familiar with the steel business.

Seventh—The cost of refractories, repairs, etc., will be very much less, and there should be no interruption to continuous operation of a plant, because a complete furnace fully lined, ready to go into operation, can be kept as a spare, and with the proper crane arrangements can be set in the place of the furnace needing repairs, which furnace can be taken to another building for this purpose. Therefore, it is apparent that the cost, and care of checker work, producers, flues, etc., are entirely eliminated. Owing to the construction of the electric furnace the roof is very much stronger and better maintained.

Finally—The control of the heat for the elimination of impurities, and the handling of the steel, and the fact that the amount of impurities charged into the furnace is always known, gives a condition for the making of high-grade material that cannot be obtained by any other known process.

BATTERY AND CYANIDE GOLD SMELTING.

By A. Thomas (Member).

(Paper read before the C. M. and M. Society of South Africa.)

As it is some time since the subject of gold smelting has been discussed by this Society, the following notes are written with the object of giving a brief outline of some present practices, and of providing an opportunity during discussion, for members to bring forward other methods at present in vogue.

The separation of the mercury from the gold is done in cylindrical retorts, made of cast steel, measuring 53 in. long, 12 in. in diameter, and 1½ in. thick. The retorts rest on two water cooled bearers, with the usual water jacketed condenser for the mercury fumes. The flue of a retort furnace has three openings, measuring 11 in. x 8 in, arranged above the retort one over each end, and the other over the centre, thereby insuring a uniform temperature over the whole body of the retorts. This arrangement of the flue is necessary, as with the single flue retort furnace one part of the retort is generally heated too strongly, whilst other parts are insufficiently heated to volatilize the mercury completely. The capacity of this retort is 5,000 oz. of amalgam, and in charging, semi-circular trays are used. These are white-washed inside before receiving the amalgam, and care is taken not to fill the trays too full. The doors of the retort are sealed with a joint made of asbestos cord soaked in water. As soon as the mercury begins to come through the condenser the fire is checked and a uniform temperature maintained for about two hours, or until the mercury ceases to come off. The temperature is then raised to expel the remainder of the mercury.

If the temperature is too high in the early stages of retorting, the distillation will be too violent, and sputtering of amalgam in the retort is likely to ensue. The time required for retorting is from 4 to 4½ hours.

After removal from the trays, the gold is weighed into 1,000 oz. lots and smelted in No. 40 plumbago crucibles; a little borax is added as the gold melts down, but this is removed by skimming, after being thickened by the addition of a little fine sand. The bullion is afterwards cast into bars, which show a loss in weight of about .72 per cent. on the retorted gold. The mercury is afterwards weighed and returned to the mill. The difference between the weight of the amalgam charged into the retort and the weight of gold and mercury recovered is about .14 per cent. on weight of amalgam. Several assays of the retorted mercury have been made, and in each case only a trace of gold found. The coal consumption for retorting 5,000 oz. of amalgam is about 350 lb.

The fire boxes used for calcining the zinc gold slimes are rectangular in shape, measuring 44 in. x 22 in. A tray made of 2 in. cast-iron with three sides turned up 1½ in. is placed over the fire box. The trays in which the slimes are calcined are placed over these furnaces and are made of ⅛ in. mild steel, 48 in. long, 26 in. wide and 8 in. deep. Before receiving the slimes these trays are white-washed, as this prolongs their life and prevents the slimes from adhering to the bottoms, especially if the temperature has been too high during the calcination process. Great care must be taken in carrying out the calcination, as upon this the success of the smelting operation depends. The temperature is kept low at first and gradually raised as the operation proceeds. As a rule, about three hours is required for a successful calcination. The usual loss on this operation is about 42.4 per cent. of the original weight. Tests seem, however, to show that the bulk of the loss is due to moisture, which may run up to as much as 38 per cent., the remaining 4 per cent. may be due to the removal of carbonaceous matter, and other changes, which may cause a loss of weight. A curious feature of the calcined slimes is the presence of a purple color, which would seem, though I am not positive on the point, to vary in intensity in proportion to the richness of the slimes. Acording to Muller (see Metallurgy of Gold, by T. K. Rose, p. 35), gold in a very finely divided state gives a purple color i nthe presence of alkalies and alkaline earths, and it may be that this purple color is the same as mentioned by Muller. On completion of the calcination the tray is removed from the furnace, and when cool, taken to an enclosed room, where the calcined slimes are weighed and fluxed. Every precaution should be taken at this stage to avoid unnecessary handling and consequent dusting of the slimes.

The fluxing is carried out as follows:—The calcined slimes, which are more or less caked, are weighed direct from the trays without any grinding whatever. Plumbago crucibles No. 100 with clay liners are used for smelting. The slimes are weighed and placed in the pots with the required amount of manganese dioxide The pots are only filled to within 4 1-2 to 5 inches from the top, the rest of the space being used for the other fluxes, composed of borax and silica, old crushed liners being used as a source of silica. The following may be taken as a representative charge: Calcined slimes, 100 parts; manganese dioxide, 7.5 to 10 parts; crushed liners, 25 parts; fused borax, 20 to 25 parts.