After the charges in the pots are run down, more of the mixture may be added from time to time, and, everything being fused until perfectly liquid, the contents of the pots are poured into moulds. Conical-shaped moulds are best suited for this work. The metal settles to the bottom, and, after cooling, may be turned out and freed from slag by breaking off the latter with a hammer. The several pieces of bullion thus obtained at one clean-up are subsequently remelted with borax and run together into one ingot. The remelting should be done at as low a temperature as possible, so that the metal may solidify. Almost as soon as it is in the mould other liquation results, and it becomes exceedingly difficult to obtain anything like a representative sample of the bullion for assay. The slags, which generally contain a considerable amount of gold in beads, are crushed up and panned or cradled to obtain the metal.

One of the great bugbears of the cyanide men on the Witwatersrand has been the treatment of slimes, by which is meant the very fine, or, in case of free-milling ores, the clayey portion of the tailings. Many suggestions have been made for their treatment, but the only real practical scheme so far appears to be to allow them to dry thoroughly, and be screened, or otherwise to reduce them to a fine powder. This powder is thoroughly mixed with sandy tailings, and the solution will usually percolate fairly well. The trouble is that if these slimes go into the vats in half-dried lumps they will absorb the solution and not yield it up again. There is no chemical difficulty in the way. Another plan suggested is dry-crushing, and direct treatment of the powdered ore with cyanide.

To economise labour, the experiment is being tried of running tailings direct into leaching-vats after separating the slimes by means of spitzkasten or similar contrivances. The objection to this is that the tailings run in direct have a tendency to pack so close in the vats that it is impossible to obtain a thorough contact with the solution.

Many things which have been said about discrepancies between assays and actual returns are probably due to carelessness or incorrect methods of sampling. By the common methods of taking samples we are very liable to obtain an undue proportion of the upper part of the residues, and consequently show a better extraction than has actually taken place.

An important discussion is now going on relating to the question of removing the pyrites from tailings by concentration before treating the latter by cyanide. Some maintain that it must be more economical to treat the tailings as they leave the plates without passing them over any form of concentrator; on the other hand, many claim that it is best to collect the pyrites first, and subject them to separate treatment, either by cyanide or by chlorination. The main question is, of course, whether the gold contained in the pyrites can be extracted by so short a treatment as is ordinarily applied to tailings. It is most probable that the best plan is to be decided in each particular case by experiment. Tests ought to show whether the value of the gold contained in the residues is more than sufficient to cover the cost of concentrating. If it is, it is clear that preliminary concentration will be of commercial advantage.

The cost of treating tailings by the cyanide process is necessarily determined in large part by local conditions, the nature of the ore treated, and the special facilities for handling it. The biggest item of cost is generally the cyanide of potassium, which probably averages on the Witwatersrand about 2s. per ton of ore treated. A good deal of economy can be effected by a careful chemist in charge of the plant. He must note the nature of the ore, and know when it is necessary to use lime or caustic soda to neutralise any acid present. Further, by keeping solutions of different strengths separate, he must so regulate matters that the last weak solution applied to the ore is really a weak wash; otherwise, of course, a certain amount of cyanide is thrown out-of-doors with the residue.

Economy in handling the ore has to be provided for at the time of the erection of the plant by a judicious selection of site, especially providing for a good dump for residues, and efficient facilities for filling and discharging the tanks. According as those facilities are favourable or otherwise, handling of the ore may vary anywhere from 9d. to 1s. per ton.

It is important to have at least one man who—whether he has to do the assays or not—possesses a rudimentary knowledge of chemistry. For small works, treating, say, 2,000 tons per month, and given a convenient plant to work, a chemist and one shift-man will generally be found sufficient to do all the solution-work. In addition to these at least one Kaffir ganger is employed on plants of this size on the Witwatersrand.

It is obvious that the expense per ton will be lower in a large plant than a small one. The average total cost on the Witwatersrand is somewhere about from 4s. 2d. to 4s. 6d. per ton in large works treating, say, upwards of 10,000 tons per month, whereas in small plants it may be put down at 6s. 3d. per ton.

Experiments have been and are being made in the way of obtaining a substitute for zinc-precipitation. So far, no measure of success appears to have attended these efforts, as all other proposed methods seem to be either more expensive or less effective, or both. The objections to the zinc-precipitation have been stated to be the troublesome work of cleaning up and smelting the precipitate, and the cost. As a matter of fact, the clean-up is not much more troublesome, if intelligently gone about, than a mill clean-up, and the cost of the zinc-precipitation, which amounts to from 1½d. to 3d. per ton of ore treated, will be hard to improve on by any other method.

As illustrating differences in the general design of plants with regard to the relative position of the different parts, three outline sketches are given. In Fig. 9 the leaching-vats are placed highest. The solution gravitates from these through zinc boxes into storage-vats, there to be made up to strength ready for pumping up to the leaching-vats again, as shown in the sketch. The discharging of tanks is assumed to be done over the side.

In the second design the solution is either pumped direct from the leaching-vats or run into a small sump, or into an airtight receiver—as shown in Fig. 10—and is pumped from there into zinc boxes, and runs thence into overhead storage-vats. Having been made up to the strength,