The Cyanide Solution.—The weak caustic-alkali solution is allowed to remain in contact with the ore the length of time found necessary, and when drawn down to the surface is followed by a charge of the strong working solution which replaces the alkali solution. The alkali solution is allowed to run away until it gives a reaction for cyanogen by any of the well-known tests, such as ferrous sulphate. The outlet is then stopped, and the cyanide solution allowed to fill the tank to a point just above the surface of the ore. This solution, like the preceding ones, remains in contact with the ore for at least twelve hours. The strength of the solution varies, according to the ore, from a fourth of 1 per cent. (5lb. of cyanide to the ton of water) to eight-tenths of 1 per cent. (16lb. of cyanide to the ton of water). The pressure or absence of base metals determines this point. In general, it may be said that an excess of cyanide above the amount which is found to work most advantageously is deleterious, as greater opportunity is given for the decomposition of the solution by the atmosphere and carbonic acid and for the extraction of base metals. After the necessary time has elapsed, this first solution, which carries the greater portion of the gold extracted, is allowed to flow away to the precipitation-boxes and is replaced by other solutions. This lixiviation is continued, according to the rebelliousness of the ore, from twelve to twenty-four hours, these being practically the extremes. To determine whether extraction is still going on, a sieveful of bright zinc shavings is exposed to the action of the solution. If the zinc is discoloured after an hour's time by metallic precipitates, leaching must be kept up until there is no such deposition. The rate of leaching depends entirely upon tho physical condition of the ore—the finer it is the slower the rate. It varies between 1in. per hour with fine material to 9in. per hour with coarse quartzose granules.

The Weak Solution.—The solution after leaving the zinc-boxes frequently contains an appreciable percentage of free and active cyanide of potassium. This is utilised by pumping it back into the ore after the first one or two charges of strong solution have gone through. The saving effected by this is considerable, as it lessens the amount of strong solution required over the consumption by decomposition.

If the weak solution is used the operation is continued as described, except that this solution, after leaving the tanks, is diverted to its own separate precipitation-boxes, where the precipitates formed are decidedly poorer.

Agitation of the Ore and Solution.—As this was the original method proposed, although it has been invariably unsuccessful wherever tried, it is still attracting some interest. There are, however, several objections to its use. First, the decomposition of the cyanide, exposed to the action of the atmosphere more than in the lixiviation system, is abnormally high; the tailings assay low, showing a large apparent extraction, but all of the gold cannot be recovered, as it is impossible to free the ore from solution after it is run into the leaching-tanks. The power required to stir a large quantity of ore is also considerable, being at least one-horse power per ton. The method has been attempted unsuccessfully with several wet processes, notably the Russell hyposulphite lixiviation process, at Bullionville, Nevada.

Circulation of the Solution.—This consists in pumping the solution flowing out of the tank back again without precipitating the gold already in solution. This method has been adopted at several South American works, but in the absence of any definite data upon the subject the financial success of the method is open to doubt, although, as stated before, it has several favourable features. Similarly, when circulation is used in the Russell hyposulphite process a precipitate is found on the top of the ore which contains considerable gold and is ultimately lost. The pumping heats the solution, causing more rapid decomposition and a greater solvent energy for the base metals. Lixiviation and precipitation with or without a return of the solution freed from its contents of precious metals must be considered the approved method.

Final Wash-water.—When it is found that the solution leaving the tanks no longer contains an appreciable amount of gold, the cyanide solution is allowed to rise to the surface of the tank, and wash-water in a sufficient quantity to displace the cyanide solution is added. Seven to nine cubic feet per ton, or from 437·5lb. to 562·5lb., is usually required. This fills the tank to a certain depth, known by experience. The outlet is then opened, and the solution allowed to flow to the zinc-boxes, until the wash-water has sunk to the surface of the ore, after which the water is allowed to run to waste. An appreciable loss of cyanide occurs here, which cannot be well avoided.

Sampling the Tailings and Ore.—Before the tanks are discharged samples of the tailings are taken for assay. This is usually done with a long-handled semi-cylindrical probe, which is driven to the bottom of the tank and then lifted out with the tailings adhering. Samples should be taken from different parts of each tank, and those from each tank, with the sample taken after the first wash-water and before the cyanide solution is run on, must be kept separate for a check on the working of each tank. The original value of the ore is determined from samples taken at the rolls.

It is well to often assay, separately, samples from the bottoms of the tanks and from the sides, to determine if the extraction has differed locally, for the solution in an improperly charged tank has a tendency to flow down the sides. This is remedied by tamping.

Discharging the Tailings.—In a mill constructed as before described the tailings are sluiced out by water under head, or by the pressure of a fire-pump should a natural head be wanting. The operation is simple and rapid. The sluice-gates are opened and the head of water partially turned on. The sluice-ways carrying the tailings must be large enough and have a sufficient fall to allow the stream to run rapidly away to the dump. If the tanks are discharged by hand the cost is much greater, being 5d. to 8d. per ton, while it is less than ½d. per ton where water under a head is abundant.

Precipitation of the Gold.—Since the cyanide process has been used on a large scale a number of precipitants are being tried, but, with the possible exception of the Malloy process, which will be spoken of later, the only one which was proved successful is metallic zinc in the form of shavings. Zinc dust precipitates the gold, but it is impermeable to the solution. Sheet zinc offers