

"8. Ammonia does not, by the aid of an air-jet, carry off the cyanogen from either the auro-, cupro-, or zinc-cyanide of potassium, nor yet from the cyanide of strychnine.

"In regard to this, I may state that, as far as I have gone, it appears to me that it is only the cyanides of the alkalies and alkaline earths that are decomposed by ammonia.

"9. Hydrocyanic acid does not, as is now alleged, attack gold.

"10. Gaseous ammonium-cyanide attacks gold in presence of oxygen very rapidly if the contact takes place in air—the speed being about three times as great as that at which the most potent solutions of the potassic cyanide operate.

"11. Mercury and platinum are dissolved, though very slowly, by potassic-cyanide solutions; for mercury at least the dilute solutions are far more potent than the strong ones are.

"This is contrary to the teachings of Gmelin; and the fact that platinum is also soluble in the cyanide proves that wherever this metal exists along with the gold that is won by the cyanide process it will be found to a more or less extent in the bullion thus obtained.*

"12. Auric cyanide is a powerful accelerator in the cyanide process, and this whether it is used in the strong or the weak cyanide-solution. Platino-cyanide of potassium is also a powerful accelerator.

"It will be seen from this that, once the process of dissolution of gold starts, it is greatly assisted by the auro-cyanide thus formed.

"13. Mercuric cyanide of potassium, though a rapid accelerator in strong solutions of potassic cyanide, acts as a retarder in dilute solutions.

"This, no doubt, is quite contrary to the opinion of the patentee of this salt for the process; but the fact appears that, although the gold quickly becomes amalgamated,† and there is every sign of a rapid dissolution of gold, it is not so. The mercury that has been deposited does not allow the gold to go into solution at all freely, nor, indeed, does it entirely go before all the mercury thus deposited has also dissolved. The process is, as I have said, really retarded instead of being accelerated, and this because mercury takes longer to dissolve in the cyanide than gold does, being, as it is, the more negative of the two metals.

"14. The bichromate of potash (patented as an accelerator for the cyanide process) is considerably inferior to the ferri-cyanide of potassium in this respect.

"15. Ferri-cyanide of potassium is, as the patentee of it states, an accelerator in the cyanide process, reducing, as it did in my experiments, the time about half."

"DETAILS OF CERTAIN OF THESE EXPERIMENTS.

"(1.) Two pieces of covellite (a mineral representing the copper-sulphides) of the same shape, size, and weight were placed in separate cyanide-solutions of the same strength, volume, and shape. One of these pieces was connected voltaically with a gold plate, when, after the lapse of two hours, both the pieces of covellite were nearly dissolved, and I could only detect a very minute difference in the weight of their residues in favour of that piece of covellite that had had contact with gold. The weight of each piece of covellite was 6 gr.; that of the gold dissolved was $\frac{1}{4}$ gr.

"Clearly, then, covellite is but very slightly conserved by being voltaically connected with gold; it is only conserved so far as this: it does not oxidize. Still, all the time it is, as it were, quietly melting in the cyanide-solution, without producing any electric phenomena that we can detect.

"The covellite that I used for this experiment I prepared in very thin translucent sheets or films upon glass by the process that I published a few years ago in the Transactions N.Z. Institute, Vol. xxi., page 361. Films prepared in this way may be had of precisely the same thickness, and absolutely pure.

"(8.) Doubting the accuracy of the statement that nitrogen gas driven through a potassic-cyanide solution decomposes it and carries off the cyanogen, I tried the effect of this gas on a solution of the cyanide of 10 per cent. After two hours I tested the solution, and could not observe any loss of cyanogen by the colour test in the ferro-cyanide process. I then tried the effect of nitrogen, as admixed with oxygen in the air, in conjunction with ammonia, when, in five minutes, all the cyanogen was carried off from the solution.

"Now, as a current of air driven through an ammoniated solution of bicarbonate of soda only reduces this carbonate to the monocarbonate, the affinity of cyanogen for the alkalies is less than that of carbonic acid for these bodies."

"NOTES ON THE BROMO-CYANIDE PROCESS.

"This process was first invented by Dr. Gaze, as an 'improvement on the cyanide process,' and consists in bromodizing a part of the cyanogen present in a cyanide-solution before applying it therein. Now, this is a real invention, and it could only have been made after much careful research in a direction that required a fair acquaintance with the laws of chemistry, and so is very creditable to Dr. Gaze, as an experimentalist in science, and he certainly deserves a reward for his 'improvement,' if it can be successfully applied. But, unfortunately for him, his improvement necessitated the use of cyanogen, an article which, both singly and in all its combinations, had already been patented by the patentees of the cyanide process—a process which some people think should never have been patented, as being a patent for an application only—a patent for the sole use of a principle known long before, and with not the least trace of invention on their part in it. This is said despite the opinion of the bench of learned Judges who sat upon the cyanide case recently in

* Since this report was written I was informed by Mr. Park, F.G.S., late Director of the School of Mines, Thames, that he has found mercury in some quantity in the cyanide-solutions that form with the tailings where mercury is present.
† This process was invented by myself in 1876 (see Trans. N.Z. Inst., Vol. viii.), and it was proposed by me as a good test for minute grains of gold in its matrices.