

In 1885 a series of experiments was made in San Francisco with potassium-cyanide, and in 1886, when in Utah, another series, the results of which were published in the *Engineering and Mining Journal* for the 29th December, 1888. A caveat was filed on the 1st May, 1886, but this also was not pushed to the taking out of a patent, although my results were good with both gold and silver-ores.

The history of potassium-cyanide as a solvent for gold has thus been followed up to the period of Messrs. MacArthur and Forrest's experiments in Glasgow, which are said to have occupied over three years before and after the issue of their English patent (No. 14,174) on the 19th October, 1887. After patenting their process in England—the particulars of which will be described later on—they applied for patents in nearly every other country which contains gold and issues patents. Their application for an American patent was dated in November, 1887, but their claims were so badly worded and so ridiculously comprehensive, and their discoveries withal so ancient, that, after numerous emendations and modifications of their claims, their patent (No. 403,302) was not granted until the 14th May, 1889, when their claims were limited to the use of a dilute solution of potassium-cyanide, described as follows:—

The invention consists in subjecting the auriferous or argentiferous ores to the action of a solution containing a small quantity of cyanide, as hereinafter set forth, without any other chemically active agent, such quantity of cyanide being reckoned according to its cyanogen, and the cyanogen being proportioned to the quantity of gold or silver, or gold and silver estimated by assay or otherwise to be in the ores under treatment. By treating the ores with the dilute and simple solution of a cyanide, the gold and silver are obtained in solution, while any base metals in the ores are left undissolved, except to a practically unappreciable extent; whereas when a cyanide is used in combination with an electric current, or in conjunction with another chemically active agent—such as carbonate of ammonium, or chloride of sodium, or phosphoric acid—or when the solution contains too much cyanide, not only is there a greater expenditure of chemicals in the first instance, but the base metals are dissolved, to a large extent, along with the gold or silver, and, for their subsequent separation, involve extra expense, which is saved by our process.

In carrying out our invention, practically we take the ore in a powdered state, and mix it with the solution of cyanide in a vessel made of, or lined with, any material not appreciably acted on by the solution. We regulate the quantity of cyanide so that its cyanogen will be in proportion to the quantity of gold or silver in the charge of ore, but in all cases we dissolve it in sufficient water to keep the solution extremely dilute, because it is when the solution is dilute that it has a selective action such as to dissolve the gold or silver in preference to the baser metals.

In dealing with ores containing 20oz. or less of gold or silver, or gold and silver per ton, we find it most advantageous to use a quantity of cyanide, the cyanogen of which is equal in weight to from one to four parts for every thousand parts of the ore, and we dissolve the cyanide in a quantity of water of about half the weight of the ore. In the case of richer ores, while increasing the quantity of cyanide to suit the greater quantity of gold or silver, we also increase the quantity of water, so as to keep the solution dilute. In other words, the cyanide solution should contain from two to eight parts by weight of cyanogen to a thousand parts of water, and the quantity of solution used should be determined by the richness of the ore. After the solution has been decanted or separated from the undissolved residues, the gold and silver may be obtained from it in any convenient way, such as evaporating the solution to dryness and fusing the resulting saline residue, or by treating the solution by sodium-amalgam.

Having fully described our invention, what we desire to claim and secure by letters patent is: The process of separating precious metal from ore containing base metal, which process consists in subjecting the powdered ore to the action of a cyanide solution containing cyanogen in proportion not exceeding eight parts of cyanogen to a thousand parts of water.

Some time after this patent was issued patents covering the use of zinc, preferably filiform, or thread-like, for a precipitating agent, and the use of caustic alkalies for neutralising ores, containing acids or acid salts were granted to Messrs. MacArthur and Forrest. It may be seen, therefore, that their patents cover substantially three points: The use of dilute solutions of cyanide—not more than eight parts of cyanogen to a thousand of water; the use of zinc, preferably filiform, as a precipitate; and the employment of caustic alkalies for neutralising an acid-ore. As shown in this record, these several claims were antedated by other inventors, and are not now patentable. For years zinc had been used by electroplaters for recovering gold or silver from cyanide solutions and on the 29th April, 1884, an English patent, No. 5,125, was issued to Astley Paston Price, of London, for certain improvements in the extraction of the precious metals from their ores, covering the use of zinc as a precipitating agent. His method of extraction, upon which he laid little stress, has no bearing on the case; but the manner of precipitation is of consequence. Mr. Price claims as follows:—

I wish it to be distinctly understood that I do not claim as any part of my invention the methods or processes for effecting the solutions of the gold or of the silver when contained in ores or metallurgical compounds or products; but what I do claim is effecting the precipitation of the precious metals—*videlicet*, of gold or of silver—resulting from the treatment, substantially as hereinbefore mentioned, or otherwise of ores of metallurgical products, such as or similar to those hereinbefore referred to, by the employment, when in a fine state of division, of zinc or of other metal or metals other than copper, which are capable of precipitating gold or silver, the same being brought in contact with the solution.

The use of caustic alkalies as neutralising agents is almost as old as the art of metallurgy itself, and, if it has not been patented before, it is not because it has not been known, but because few metallurgists are willing to claim as their invention what is known to the whole profession. It has been, however, made the basis of a prior and untenable patent by E. H. Russell for use in hyposulphite lixiviation. The narrow claim for the use of solution containing not more than eight parts of cyanogen (twenty parts of chemically pure potassium-cyanide and thirty parts of commercial cyanide) to a thousand parts of water is no better than Simpson's worthless claim