

and, indeed, unassailable, until we take cognisance of the fact that we can, by the very slight modification in the process just described, get an evolution of hydrogen—that is, by transferring the negative gold—the negative pole—from its alkaline to an acidic solution. A careful consideration of this fact leads me to think it is not in reality the potassic cyanide but the hydrocyanic acid that is decomposed.

We must consider that in the cyanide-solution we have not the simple compound potassic cyanide to deal with, but the hydrocyanide of potash, corresponding to the hydrochloride of potash. As I have already stated, the cyaniding of gold produces electricity, thus necessitating for its continuance the presence of an electrolyte, and for this hydrocyanic acid should, I think, be as well suited as hydrochloric acid, which, as we well know, is capable of acting this part, although not so easy to decompose as the former acid. Why not, then, look upon this compound as the one that is decomposed in the process? It is true that the decomposition of potassic cyanide may also result in the liberation of hydrogen by a secondary action in which water is decomposed, as McArthur's theory supposes; but to my mind this is hypothecating a complexity in the process that we have no necessity and no warranty for doing.

On the hypothesis I have here advanced the cyanodizing of gold is a very simple operation, or, rather, a combination of two very simple operations. The affinity of gold for cyanogen and that of oxygen for hydrogen in the presence of an alkali conjointly determine the decomposition of the hydrocyanic acid, a gold-cyanide forming at the one pole and water at the other. This constitutes the first operation. The dissolution of the cyanide by a portion of the remaining potassic cyanide is the second operation. In the first operation there is no precedence in action at either pole; the electric action at each pole commences simultaneously. True it is that to the old idea of voltaic electricity as a current (a false idea which our every-day use of old terms perpetuates) it is not easy to reconcile one's-self to the thought of a simultaneous start of electricity at each pole; but by charging one's-self with a full and a trusting belief in Faraday's theory, that such electricity is only a polarisation, one clearly perceives that this is the only way the action is started.

NOT ALWAYS THE "DILUTE SOLUTION" THAT MOST RAPIDLY ATTACKS GOLD.

A very singular phenomenon may be observed in regard to the action of the cyanide-solution upon gold such as that which Professor Faraday used for his experiment. This gold is deposited from very weak solutions of its chloride by phosphorus or hydrogen* in such finely-divided particles that they are indistinguishable—in fact, invisible—under the highest-powered microscope of that time, and they are able to remain in suspension in water for an indefinite period, and it is only by reflected light Faraday could observe them. Now, if we neutralize, or slightly alkalyze, this red-looking auriferous fluid (we cannot designate it as a solution), then divide into two parts, and mix one part with, say, three volumes of the dilute solution, and mix the other part with a strong cyanide-solution—say, the concentrated solution—it will be found that it is the gold in the strong cyanide that first disappears from view. Nor is it a neck-and-neck affair by any means, for in the strong solution three seconds may suffice to complete the operation, while in the case of the orthodox dilute solution the time required will be about five minutes—that is, about one hundred times longer. This is, of course, just what one would have expected a few years ago, before our working cyaniders had taught us the extraordinary potency of the dilute solution over the strong solution as a gold-dissolver. Both the blue and the red gold of Faraday give these results.†

These results clearly prove that even in the supposed inert solutions of the cyanide the strong solutions rapidly act upon gold to a limited extent. It is not a matter of superior causticity, for it was found that strongly alkalizing the weak cyanide did not hasten the dissolution.

The explanation of this enigma is, I think, this: In the strong solution cyaniding goes on at once, but only so far as to produce a colourless cyanide of gold that is insoluble, or but very slowly soluble, in the liquid. I have before‡ shown that gold taken out of a strong cyanide-solution refuses to amalgamate, or, at least, but very slowly amalgamates, showing, as I said, that an insoluble saline film of some gold-cyanide has enveloped it. In further support of this idea I would note here the fact (which may or may not have been observed before) that gold-leaf upon a strong cyanide-solution, in disappearing, leaves floating thereon a pale white ghostly-looking figure of its departed self, exact to the shape, and reminding the student of ancient history of the sad metamorphosis of Lot's wife. In the case before us, however, there is no transmutation of a vast number of metals—nor even of one: the white floating mass left by the gold is its cyanide, and it is this substance that, I believe, always forms upon gold in strong cyanide-solution, thus preventing or retarding its dissolution.

In the strong solution, then, we have not only the limited supply of oxygen against the cyanider, as Maclaurin has shown, but we have also the rapid enfiling of the gold by a salt that is but very slowly removed therefrom.

THE RELATIVE SPEED AT WHICH THE CYANIDE DISSOLVES FINELY-DIVIDED GOLD AND GOLD IN THE MASSIVE FORM.

It will be taken as granted that the finer the state of division in which gold is presented to the cyanide-solution the more speedily, weight for weight, will it dissolve—that it is all a matter of superficies. No cyanider would, I think, doubt this any more than some eight years ago he would have doubted the statement that generally the stronger the solution of the cyanide the quicker would any gold therein dissolve. However, as I have before remarked, "the chemistry of the cyanide process is full of surprises," and I think that another surprise awaits our cyanider here. Thus, if to any one of those blue- or red-coloured liquids of Faraday's, containing gold diffused

* Coal-gas may conveniently be substituted for hydrogen.
 † Administration of salt to the red gold reverts to the red gold in weak cyanide, also chlorine—a change that Faraday failed to produce, though he long sought for it.

‡ The blue gold that Faraday got by the administration of salt to the red gold in weak cyanide, also chlorine—a change that Faraday failed to produce, though he long sought for it.
 † Twenty-ninth Laboratory Report, 1895, p. 45.