of this kind, and until lately nine-tenths of all the gold of the world was gotten out in this way. An enormous quantity was then produced by crushing the rock and smelting it. This, however, is a very expensive process, costing $14 and upward to the ton of rock, and ore which does not contain more than $20 per ton seldom pays the cost of smelting. By the new processes, if there is $10 worth of gold in a ton of rock it can be gotton out with a profit. There are immense ore bodies near Salt Lake City, which can be profitably mined for $2.50 a ton, and there is one mine there where the cost of reduction is not more than 75 cents. I am told that mills are now being put up in Parke county, Col., which will treat ore for 75 cents per ton and save 96 per cent of the gold, and more than half a million of the gold which would have been wasted has been gotten out of Cripple Creek rock by the cyanide mill, which I describe further on. Then there is the chlorination process, by which certain kinds of ore are treated with chemicals and gases, and out of them are finally taken ignots of pure gold. There is the bromination process somewhat similar, and a method has lately been invented in Germany for getting the gold out of the rock by electricity.

The most important process, however, is the extraction of the gold by means of cyanide of potassium. Cyanide of potassium is a chemical which looks for all the world like alum. It now costs from thirty to fifty cents per pound. It is made of the hoofs, horns and refuse of cattle, and it is deadly poison. It has, however, a wonderful affinity for gold, and when mixed with water and applied to the ore in a certain way it will suck all of the gold out of the rock. This process of extraction was invented by two Scotchmen, and the first mill was put up in Australia in 1889. Then one was put up in South Africa and in 1892 the first cyanide mill of the United States was erected in Boulder county, Colorado. There are now more than fifty cyanide plants in South Africa. There are twenty-four in Australasia and something like twenty in different parts of the United States, with a number of others going up all over the world.

The biggest and most perfect of all so far erected is that of the Metallic Reduction Works near Florence, which I visited the other day. Into this mill are poured car loads of what looks like cobble stones, railroad ballast or broken granite, and out of it every month as a result comes a brick of solid gold, worth $40,000 New works are now being added, and by the time this letter is published it will be four times as large as it is now. It will then be able to reduce 400 tons of gold ore a day, and, supposing the rock to have only one-half ounce of gold to the ton, its output will be at the rate of $6,000 per day, or about $2,000,000 worth of gold per year. The works are situated on the edge of the Rocky mountains within two miles of the oil town of Florence. They look much like an immense wheat elevator or rudely built Pennsylvania barns, but they contain the finest machinery of their kind in the world. They suck 97 per cent of the gold out of the rock which passes through them, whereas the mills of South Africa, it is said, are able to save only 60 to 80 per cent. These mills use petroleum as fuel, and the Florence Cripple Creek railroad brings the Cripple Creek ore directly to them.

Let us now take a train load of gold-bearing rock and follow it through this great mill. How the gold is gotten out of the mine I will describe in another letter. Our freight cars are filled with the ore. It is a mixture of broken granite, porphyry and other stones of different colors. There is gravel in it. It contains dirt, and it is for all the world like a pile of broken up rocks mixed with the refuse of a quarry of rotten granite. There is no sign of gold anywhere. You can take up a piece of rock from any part of the car load and examine it through a microscope and you will not see a glint of yellow or anything which to your eyes would indicate gold. Still, that rock will average a half an ounce of gold to the ton. In those car loads one atom in every 48,000 is gold, but this atom is almost evenly mixed throughout the whole, and the question is to get it out.

The superintendent of the works tells us this as we ride on the cars up to the mill. We are carried by the means of an engine on a trestle work track, which lands the ore at the top of the mill, for the rock is carried from one level to another by means of gravity. We look down at the load as we go up. There are speck of stones the size of the head of a pin, and there are immense boulders weighing hundreds of pounds. All this must be crushed to powder before it can be worked. The car stops at the top and the ore is loaded into what looks like a gigantic coffee mill, the top of which is as big around as a hogshead. As the rock falls into it the mill seizes the stones in its great steel teeth and grinds them to pieces. You hear them apparently groan as they are crushed and you shudder at the thought of getting into the jaws of the machinery. This mill grinds the ore to the size of a walnut. Another takes and reduces it to pieces the size of a pea, and it is then ready for the dryer. Every molecule of moisture must be taken out of the ore before it can be ground to powder. This is done by passing through enormous steel tubes of the length of an ordinary railroad passenger coach and as big round as a flour barrel. Through these tubes flames of gas continually blow. They are inclined at such an angle that the ore going in at the top as they revolve rolls slowly down to the bottom. As it rolls it has this fiery bath, and the heat takes all the moisture out of the rock. Then an elevator of iron buckets, much like that which carries wheat up in a flour mill, carries the ore to the top of the works, and it is emptied in steel crushers, which grind it to powder. The ore which we saw before as cobble stones and broken rock has now become a flour. It looks like dust, and it is composed of millions of grains, but each of those grains contains an infinitesimal quantity of gold, and this costly dust is worth a fortune. The rock was hard and rough. The dust is so soft and fine that you can rub it to and fro in your hands without scratching the skin, and it looks much like powdered pumice stone. It has, however, no gleam of gold, and were it on the road you would drive your carriage through it without thinking.

The dust is now ready for its cyanide bath. It is loaded into cars and wheeled into what might be called the bath room. This is an immense room, filled with circular tanks made of steel. Each tank is about thirty feet in diameter and as high as your waist. Each will hold 100 tons of this powdered dust. The cars run along a little railroad which leads from one tank to another and from which the dust is dumped into the tanks. Then the cyanide solution is introduced by means of pipes. The solution is a fluid as clear as crystal. It looks like water, but it is water containing the poisonous cyanide of potassium. It takes about one pound of the cyanide to get the gold out of each ton of ore, and as the stuff runs through the dust the mixture looks for all the world like brown mush. It is mush, but it is mush mixed with gold. Now, by the affinity which the cyanide of potassium has for gold, as the solution runs through the sandy dust, the gold leaves the earth and melts and assumes the form of a liquid and becomes a part of the solution. It is just as though you had a lot of salt or sugar mixed with dirt. If you should put water on the dirt the salt and sugar would be dissolved and go into the water. Well, this is the way the gold does with this mixture of cyanide of potassium and water. It takes some time, however, for the solution to soak all of the gold out of the sand, and it is left for several days upon it. At the end of this time the gold has all gone into the solution and you have this fluid made up of water and gold and cyanide floating around through the mush. The solution is still as clear as crystal, and there is no sign of gold. Now, each of these immense tanks has two bottoms. One is of solid material through which the water cannot pass and the other is of canvas. When the dust is first put in the bottom is double, with the solid bottom beneath. After the liquid has been long enough on the mush the solid bottom is taken away and the solution containing the gold drains out through the canvas and is carried away, leaving almost nothing but the dirt behind. One tank of dust at the estimate of half an ounce of gold to the ton contains a thousand dollars' worth of gold. Of this $970 worth has gone into the water, leaving a waste of only $30 in one hundred tons of ore.

We have now several hogsheads of golden water. It looks like common water. It is as clear as crystal, and were it in a pitcher you might drink it by mistake. We know, however, that it has that $970 worth of gold in it, and the question is how to get it out. If it were salt or sugar we might evaporate the water and the residue at the bottom would be a part of the sugar and salt within it. But gold is not to be gotten out in that way. It is taken from the water much on the same principle as that by which it has been extracted from the rock. Gold as it exists in the cyanide solution has a peculiar affinity for zinc. If there is an atom of zinc next to one of these molecules of gold it will leave the cyanide water and stick to the zinc. But zinc is expensive, and a large surface is needed to gather all these little molecules of gold. The surface is gotten by having the zinc prepared in circular disks of the size of a dinner plate and about as thick as the head of a pin. These, by means of a lathe, are turned into fine shavings, much like the excelsior used for packing dishes. This zinc excelsior is now