Precipitation.

Zinc Dust Used.—The cyanide solution in which the gold has been dissolved flows from the Merrill slime presses in so clear a condition that no clarification is necessary before precipitation. The gold carried by this pregnant solution varies from $2.50 to $6.00 per ton of solution. This gold is precipitated from the solution and recovered in filter presses by the Merrill zinc dust precipitation process. An emulsion of zinc fume and cyanide solution, prepared in a miniature tube mill, is fed in definite amount at a uniform rate to the pregnant solution at the suction side of the Aldrich triplex plunger pumps; these force the solution through precipitation presses in which the gold is trapped in the form of a black mud that has a value of about $40.00 per lb. Two triangular frame 52-in. Merrill precipitation presses are used. One has twenty frames while the other has ten frames—the frames of both presses being 2 inches in thickness. The cyanide solution flowing from the presses carries from a trace to 8 cents in gold, and is returned to the top of the mill for use in washing dissolved gold from the slime filter charges. A certain amount of solution has to be run out to waste from time to time: this solution is carefully precipitated so that its value may not exceed 3 cents per ton. The amount of this solution run to waste is the difference between the number of tons of water entering the system at the treatment tanks with the unthickened slime, and the number of tons of solution retained by the cakes of treated slime that are discharged from the filter presses.

In precipitating gold solutions with zinc dust, more zinc is used immediately after the clean-up of precipitate from a press than at any other time, regardless of the grade of pregnant solution to be treated. The practice at the Dome mill is to feed the zinc dust as follows:

For the first hour after a clean-up, ¾ lb. per ton of solution; for balance of first day after clean-up, ¼ lb. per ton; for second day after clean-up, 1.5 lb. per ton of solution; for third day and until following clean-up, 1.6 lb. per ton of solution.

The average consumption of zinc per ton of ore treated is about 0.37 lb.

Melting Gold Precipitate and Retorting Amalgam.

A separate building, made of brick and situated behind the mill, is used for the melting room and assay offices. The melting room contains an amalgam retort, an acid treatment tank, a briquetting press, a lead smelting furnace, cupel furnace, a tilting oil-fired melting furnace, and a clean-up barrel for pulverizing litharge and cupel bottoms.

The gold from retorted amalgam is melted in the tilting furnace into bars of 990 to 995 total fineness, 890 of which is gold and about 100 silver. The melting of retort gold is done twice every month.

The precipitate, after being acid-treated to remove the large excess of zinc, is dried and then mixed with litharge, borax cake, and a small amount of fuel oil for binding the materials together when the mixture is pressed into briquettes. These briquettes are smelted in the lead furnace and the resulting lead cupelled. The slag, which assays from $40 to $100 to the ton, is re-melted in a later so-called "scavenger" run, together with cupel crusts and scrap metal, during which the slag tapped from the furnace carries only about $3.00 per ton in gold.

The cupel is oil-fired and has a bottom made of a mixture of one part Portland cement with three parts crushed limestone. The operation of cupelling is carried to the point at which about 25 one-thousandths of lead still remain with the precious metals. At this point the metal is brittle when cold, and may be easily broken into pieces for charging the tilting furnace, which melts the gold into bars for shipment. If cupelled beyond this point, however, the gold is tough and has to be divided into sections of convenient size, while molten, by means of iron dividing strips.

Without treating the precipitate by sulphuric acid before smelting, bullion of 900 to 950 fineness is produced, but, as the New York assay office objects to the presence of even 40 one-thousandths of zinc in the bullion, the acid treatment was rendered necessary and it is found that its cost is fully offset by the saving in fluxes and fuel, while the fineness of the bullion can be raised to 990.

Sampling and Weighing.

Daily samples are taken in the mill at the following points: (1) The broken ore delivered to the battery bin; (2) the pulp discharged from the batteries which is called the lip sample; (3) the slime leaving the amalgamation plates which is called "amalgamation tailings" sample; (4) the residues after filter pressing; (5) the sluicing water sent to waste with the residues; (6) the pregnant and barren solutions.

The average assay of the ore delivered to the mill during any month is calculated by dividing the sum of all the gold recovered in the plant, plus the gold lost in residues and sluicing water, by the tonnage treated during the month. The computed average is found to check reasonably well with the average of the battery lip samples but is usually quite at variance with the average of the broken ore samples.

The estimation of weight is calculated each day from a series of hourly measurements made on the flow of slime from the tube mill circuit to the slime thickening tanks. The entire flow of slime is diverted into a small steel measuring tank. The time interval is taken with a stop watch; the volume of the slime collected during this period is accurately measured and samples are carefully taken for the determination of the "solid to liquid ratio" before the slime has had any chance to settle. From these determinations a calculation, simplified by reduction to a formula in which the constants used have been incorporated, gives the rate of flow in tons of dry ore per day. Since this measurement deals with the tonnage of dilute slime, that is ten times the tonnage of dry ore being milled, errors of measurement are divided by ten when dry ore tonnage is deduced from it.

It may seem strange that after a careful consideration of the different methods and apparatus for weighing ore, such a one as the above should have been adopted at the Dome. However, a little consideration of the conditons here shows how unreliable would be the ordinary methods of weighing. Ore coming from the open cuts and delivered in cars to the crushing plant often contains from 5 to 8 per cent. of moisture, and car weights, even when corrected for moisture by taking a moisture sample, would be only as accurate as the number of tons of water estimated to be with the ore, while it is almost impossible to obtain such a moisture sample with any degree of accuracy. The same objection applies to the continuous automatic weighing devices of the Blake-Dennison type, in which