In the wider portions of the fissure the ore is mixed with more or less horse-matter from the walls. The clean ore is white, massive quartz, with from 8 per cent. to 12 per cent. on sulphurets; the latter being pyrite, sphalerite and galena, the predominance being in the order given. The precious metal tenor is variable, the gold more closely following the pyrite, the silver, the galena. The present mill supply is practically all from below the oxidized zone.

The unavoidable admixture of horse-matter and stope filling, with the ore as mined, affects more or less the character of the mill feed, which sometimes contains from 10 per cent. to 25 per cent. of slate. During the last three months of 1902 the mill feed carried 0.3977 ounce gold and 1.903 ounce silver per ton of 2,000 pounds, 2.65 per cent. and 2.92 per cent. zinc. The iron, unfortunately, was not determined.

The ore, which will pass a 2-inch grizzly, is fed into sixteen 5-stamp batteries. The mortars are narrow; the stamps average 850 pounds and drop 6.5 inches from 98 to 100 times per minute. The height of issue ise from 3.5 to 5 inches, and the screens (diagonal slot) are No. 9 or 11, depending upon the height of issue. The crushing capacity is from 2.5 to 3 tons per stamp per twenty-four hours. There are no inside plates, and but one 50 by 144-inch apron plate to each mortar. The saving on the plates was 61.9 per cent. of the gold and 9.4 per cent. of the silver.

The plate tails from each ten stamps were, without classification, put over three Frue vanners. A slightly variable concentrate was made, averaging 20.6 per cent. lead; 1.17 ounce gold and 12.5 ounces silver per ton; and, approximately, zinc, 12.9 per cent; iron, 23 per cent. and insoluble, 6 per cent. There was an extra smelting charge on zinc in excess of 8 per cent.; and it was a delicate matter to determine how high the grade of the vanner tails could be raised with profit, so as to throw over the zinc and reduce the concentrate tonnage. The gold saving in the concentrates was 16 per cent, the silver 35.4 per cent., and the lead 42 per cent. The total saving in the stamp mill was thus 77.9 per cent. of the gold and 44.8 per cent. of the silver. These totals were higher before the tailings plant was installed, when both battery and vanner work were necessarily closer.

The vanner tailings during the quarter ended January, 1903 (and all the figures here given, unless otherwise stated, are for that period), assayed 0.0882 ounce gold and 1.051 ounce silver per ton; lead, 1.3 per cent., and zinc, 2.2 per cent. Of this material, 65 per cent. would pass a 100-mesh screen.

The vanner tailings being of comparatively low grade, the writer felt himself practically confined to the adoption of the system of direct filling and percolation; and, as slimes treatment was not at the same time to be provided for, the object was to treat as large a proportion of the slimes as possible with the sands; or, in other words, to make charges having the lowest practicable rate of percolation. This minimum rate is usually stated as 2 inches per hour.

It is also a current conception that a much larger proportion of slimes can be handled in an intermediately settled charge than in a directly filled one. To determine whether this possible difference in tonnage was important enough to justify the increased cost of installation and operation of a plant with settling vats was an important problem, which our experimental plant decided.

After the usual laboratory tests, the experimental plant, consisting of two 35-ton leachers, 5 feet deep, with solution tanks, zinc boxes, etc., was erected. One leacher was charged direct from a Butters' distributor, which was fed by the bottom discharge of a pointed box carrying the vanner tailings from twenty stamps. The box got rid of excess water and a little of the finest slimes. The second leacher was charged from a two-compartment box in which the vanner tailings were settled, the sands being dropped from the compartments alternately as filled, and shovelled in the leacher as in ordinary intermediate filling plants. We were thus enabled on a commercial scale to compare results of the two systems of filling with the same character of material. A comparison of results from fifty-two charges is here given, screen tests being 100-mesh.

Charged.	Fines. Per Cent.	Gold Recovery. Per Cent.	Silver Recovery. Per Cent
Direct	44.2	76.5	52.2
Intermediate	39.8	77.2	54.1

The average minimum rate of percolation in the direct filled charge was 1.9 inch per hour. In the intermediately filled charges the rate was quite variable, but the average minimum was over 3.25 inches.

Owing to structural difficulties in the experimental plant, which had to be squeezed into an unoccupied corner of the stamp mill, we could not give the settling boxes area enough to settle regularly charges carrying the same proportion of fines as the direct filled ones; but eight of these charges, made when some of the stamps were hung up, carried 43.7 per cent. fines, and the gold and silver recoveries averaged, respectively, 73.6 per cent. and 46.5 per cent.

These results led to the rather unexpected conclusion that direct filling, when properly done, not only leaves a charge in as good condition for treatment as the intermediate method, but renders it possible to treat a larger proportion of the slimes. It may be suggested as an explanation that in a charge settled under water the grains of sand are free to arrange themselves most compactly, with a minimum of voids and the slimes are held near where they originally settled, because the interstitial currents are not marked enough to disturb them; whereas, in charges shoveled into a vat with less than 15 per cent. of moisture, the voids are a maximum, and the slimes which originally coated each grain of sand are washed off and settle through the charge, and, thus segregating, prevent uniform percolation. The fact that direct filled charges never pack nor settle more than 1 per cent., while indirect ones frequently contract over 10 per cent., during treatment, tends to confirm this view.