

due to changing solutions and discarding excess, is believed to be greater than that destroyed when solution is used for crushing. At the Dome, however, where the ore is quite clean, one would not expect any detrimental results from solution crushing.

The very tall and narrow Pachuca tanks used at the Dome mill have always appeared to me expensive to operate, but they have been considered necessary in view of the extremely heavy nature of the pulp. With the change of treatment system, however, these tanks would seem to be made unnecessary, as only the true or natural slime will have to be agitated, the granular, sandy portion going to leaching tanks. A less expensive agitation system ought to be available under the changed conditions.

Whatever details I have discussed here are mentioned with the sole object of throwing more light upon cyanidation in general, using a well-considered, modern plant as a basis for argument. There is no room for doubt that the Dome mill has been successful in the past and will be more so in the future. Mr. Merrill and his associates are quite competent to conceive and produce a successful plant. Their handling of the metallurgy assures thoroughly practical and highly economical results.

Mr. D. L. H. Forbes: I desire to comment briefly upon Mr. Megraw's contribution to the discussion of my paper. The weighing and sampling of ore is a matter on which widely differing views are held. In all engineering measurements "Exactness" is unattainable, and it should be not so much a question of trying to obtain that which is beyond our reach as of obtaining results within limits of accuracy, yet close enough for the purpose to which the results are to be applied. It is true that there are automatic weighing machines which will weigh dry ore to within less than 1 per cent. error, but such a device is out of proportion and even inaccurate when applied to very wet ore coming from the mine. Besides the error introduced by wet ore sticking to the belt of such machines, there is an unavoidable large error in the estimate of moisture contained in the ore. There is no doubt that, in cases where ore coming from the mine is nearly dry, it is most economical and satisfactory to use either automatic continuous weighers of the Blake-Dennison type or registering car scales, but at the Dome mine conditions are such that neither of these methods was deemed advisable.

The matter of sampling ores going to the mill is also one that is a subject of much controversy. In general I am inclined to agree with Mr. Megraw's stand that it pays to sample the mill heads wherever it can be done with a reasonable degree of accuracy and without adding a heavy charge to the cost of milling. That it is possible to sample gold ores such as that of the Dome no one will deny, but an idea of the cost of obtaining results that are reliable can be gained by looking up the rates charged by customs sampling works. No manager who is not engaged in purchasing ores would care to add such heavy operating charges to his milling cost as this class of ore-sampling would involve; yet to install anything short of such methods would be wasting money when sampling ore that is lacking in uniformity of gold distribution.

Contrary to Mr. Megraw's impression, the losses of the mill used in calculating extraction are not alone those in the tailing, but every other possible source of loss is also taken into consideration and estimated as closely as practicable. All waste solution and sluicing

water issuing from the mill are regularly sampled and measurements of volume taken.

Mr. Megraw is entirely right in stating that the question of water crushing as compared with crushing in solution is one that can only be settled by a comparison of costs. It is precisely on this basis in combination with the total recovery of gold that the argument for the Dome mill practice rests.

MONELL METHOD OF SEPARATING NICKEL AND COPPER SULPHIDES

In specification of Letters Patent Mr. Ambrose Monell, president of the International Nickel Co., describes the method of separating nickel and copper sulphides.

In the reduction of ores containing nickel and copper where a matte is produced containing sulphides of nickel, copper, and iron, a process has been devised in which a separation of the nickel sulphide is effected by the use of sodium sulphide, advantage being taken of its power of dissolving the sulphide of copper and iron freely and forming a solution of less specific gravity than the nickel sulphide. The matte mixed with coke and sulphate of sodium has been charged into a cupola-furnace. When this charge is smelted the sodium sulphate is reduced by the coke to sodium sulphide and, forming a solution with part of the copper sulphide and iron sulphide, flows with the undissolved and melted sulphides of nickel, copper, etc., through the tap-hole, which is kept constantly open, into moulds, where the molten constituents separate in accordance with their specific gravity, the sodium sulphide containing the dissolved copper and iron sulphides floating on the surface and the undissolved sulphides settling to the bottom. When the contents of the mould have solidified, the parts are separated by fracture and the tops containing the copper and iron are recharged into a smelting furnace, where the sodium sulphide is fluxed off in an iron slag, being then lost. The bottoms contain most of the nickel sulphide of the original matte; but owing to the imperfection of the separation they also contain so much copper sulphide and iron sulphide that it is necessary to resmelt them with fresh additions of coke and sodium sulphate, and thus to repeat the smelting and separation to the fourth or fifth time before the bottoms are brought to sufficient degree of freedom from iron and copper to enable the resultant nickel sulphide to be economically subjected to the succeeding steps of the refining process. The process as thus carried on is slow and wasteful and because of the cost of materials and the amount of labour and handling required adds greatly to the expense of the nickel or nickel oxide which is the final product. I have discovered that these difficulties can be overcome and the separation rendered quick and inexpensive by the following process.

Instead of smelting the compound matte, as heretofore, in a cupola-furnace and running the product continuously into moulds I so smelt the matte that when melted it will remain in a molten state subject to the high temperature of a furnace for a considerable period of time, during which I find that the copper and iron sulphides will be thoroughly dissolved by the sodium sulphide, and in one melting a good separation can be effected, and by two such treatments results are obtained equal or superior to the results of the four or five meltings which have been employed heretofore. For this purpose I employ as the smelting-furnace an