URMISCB/73-78

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NOTES ON MILL OPERATION. MT. BISCHOFF TIN MINE. 9/9/47.

The determining factor with relation to mill throughput is the crushing capacity of the batteries. Operating batteries No's 3 and 5, ie. the batteries equipped with challenge feeders, under present conditions with ½" aperature screens, gives an output of approx. 4000 tons per month, allowing for reasonable stoppages. With good rejection of sulphides by flotation the wilfley concentrating tables could safely handle the output from one extra battery when sulphide content of the ore is normal and two extra batteries ie. a total of 25 head of stamps when sulphide content of the ore is high. With a possible small decrease in % recovery 25 head of stamps could be used at all times. Output is fairly consistently 13 tons per stamp per 24 hours actual operation.

The present bin capacity and 5 day mining week restricts the mill to operating from midnight Sunday to 8a.m. Saturday. Day shift Saturday has been used for milling when ore stocks permit and for mill maintenance.

Bin capacity at the mill could be very considerably increased by making provision to tip trucks in front of bins ie. the side nearest the battery instead of the back of the bins as at present.

In order to obtain 1000 tons per week however stamps have had to be operated at maximum drop with the ore level in the battery boxes as low as can be maintained with safety. Fastest crushing has been obtained when operating with zero height of discharge and screens with ½" aperature. Some good effect has been obtained by increasing the weight of stamps in 3 and 4 battery by adding an extra tappet to each stamp. Longer heads and/or heavier shanks would, of course, be more satisfactory as a permanent measure. Some slight increase in battery speed has also been under consideration and would no doubt assist. Present speed is 91 drops per min. for batteries 1 - 4 and 93 for No.5 battery. No. 1 - 4 batteried have a nominal weight of 1050lbs. per stamp and No. 5 1250 lbs. per stamp.

Two cams on No. 3 battery require the Blanton cams repositioning around the cam shaft.

No. 1 and 2 batteries are at present hand fed. The installation of challenge feeders to these bins would also entail some slight ore bin modification.

HUMOUR SCREENS.

The only operating difficulty experienced with these units has been a decided tendency for the bolts holding the armature bracket to the armature post to come loose.

Under normal conditions no serious blinding of the screens has been experienced. However serious blinding did take place during a trial period when the battery discharge was routed direct to the ball mill and only the B.M. discharge passed over the screens. The screens cleared themselves again after a short period when the normal circuit was reverted to.

The launders carrying the pulp from the pulp distributor to the screens are not entirely satisfactory. Redesigning these to reduce the pulp velocity on to the screens should be advantageous.

The actual life of a set of screens has not yet been established. The screens now in use were reversed after handling 4670 tons of new feed and have since handled a further 4318 tons making a total of 8990 tons. Wear is not yet serious.

BALL MILL.

The scoop in use is not a standard type and will not feed balls into the mill. It has been necessary to open the mill for the addition

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of balls. Both scoop and scoop box are badly worn and need replacing at an early date. The question of a suitable scoop and matching piece for the ball mill trunnion has been under discussion with Messrs. Chas. Ruwolt. Reference their Drawing No. X1786M.

Liners generally are in good condition. The only noticeable wear is on several only of the feed end liners.

Ball consumption has varied somewhat but should average less than 0.5 lbs. per ton.

The motor now in use for driving the mill is at reasonably full load. The ball mill however is not fully loaded with balls and if it should be necessary to increase the grinding capacity of the mill, the new motor purchased for the ball mill, but not installed, could be put into use. This would be desirable in any case as the brush gear on the present motor has been giving some trouble.

FLOTATION

Froth from straight flotation of this ore carries some tin and the bulk of this has been found to be cassiterite particles coated or partly coated with talc. Depression of the talc produces a sufficiently clean froth to be discarded. Laboratory work has indicated that lime is a satisfactory depressant for this purpose. Other more generally used depressants for talc have not been tried out on a mill scale.

Primarily to conserve reagents and for safety in operation two stages of flotation have been adopted. The froth from the rougher float after conditioning with lime is refloated without additional reagents in the cleaner set of cells and the froth discarded.

ROUGHER FLOTATION.

Some concentration of tin takes place in the bottom of the 10' x 6' conditioner. Heavy pulp builds up to a depth of approx. 16" at outer edge of the tank bottom tapering off to Zero at the centre. This space could be filled with concrete to minimise any concentration and a scuttling valve fitted to the centre and piped to the desliming cone. The impellor speed in No.1 and 2 cell has been increased from 300 to 340 R.P.M. in an attempt to get more satisfactory flotation of the larger particles of sulphides. This new speed is the maximum recommended by Messrs Chas. Ruwolt for this type of cell. The appearance of the froth appears to have been improved somewhat with this increase in speed, but any improvement in actual flotation efficiency is not apparent.

Crowding boards have been tried in No. 1 and 2 cells but were removed as they appeared to be serving no useful purpose.

The natural air produced by these cells is somewhat below requirements and additional air has been provided by means of a centrifugal fan. This resulted in some improvement in flotation.

The sulphide content of the ore is mainly pyrrhotite and has proved rather erratic in its response to flotation at a natural p.H. of 6.5 using Ethyl and Amyl Xanthate either alone or in combination, copper sulphate and eucalyptus. Insufficient sulphur assays are available to indicate whether the degree of floatability of the sulphides varies or if the apparently more complete flotation at times is due entirely to a lesser proportion of sulphides in mill feed.

However by acidifying the pulp with sulphuric acid to a p.H. 4.5 - 5 excellent flotation has been obtained. This has been in operation for just two weeks at the cessation of operations and some

further work is necessary in order to get the whole story. The acid required to get good flotation varies considerably, dosage up to 10 lbs per ton has been necessary at times while for long periods 2½ - 3 lbs/ton has been sufficient. The average dose has been 4.5 lbs/ton. The p.H. with these varying doses of acid range from 4.5 to 5. It has not been found possible to get good results at any time at a p.H. higher than 5. Insufficient knowledge has been gained to date to indicate that operating at a fixed p.H. is the most economical method of regulating the acid dose. The best general guide to the acid dose found to date has been the appearance of the pulp in the 10' x 6' conditioner. The presence of a talcy scum on the surface of the pulp has been a fair indication that additional acid was required.

Since the introduction of the acid float xanthate addition has been reduced from approximately 0.6 to 0.2 lbs/ton. Minimum possible dose has not yet been ascertained. The quantity of copper sulphate required can no doubt also be reduced from the 1 lb/ton used. Investigation of these points was interrupted by the closing of the mill. At the time of closing the mill minimum requirement of eucalyptus was approx. 0.2 lbs/ton.

The small proportion of sulphides not floated by the acid float is mostly coarse, approximately 65 mesh.

Flotation is not as rapid as might be desired and cells have to be run fairly "fast" under present conditions to prevent undue flotation in the last cell. This tendency is not noticeably affected by changes in tonnage.

Pulp density of the flotation feed is 22 - 25% and is determined by the density of the battery box discharge.

CLEANER FLOTATION.

With this bank of cells flotation is very much faster and cells have ample capacity. The froth from the first three cells is discarded and the froth from the last three returned via the middling return pipe to the first cell.

Depressant which is added as milk of lime is kept in suspension by pump circulation. The required quantity is added to the float by splitting the quantity circulated by the pump. In order to get satisfactory depression of the talc p.H. is maintained at a minimum of 11. A check is kept on this by titration liquor in cleaner flot. feed with N/50 Hydrochloric Acid.

An appreciable quantity of pyrrhotite is dropped in the cleaner flot. no doubt due to the depressing effect of the lime. Extra xanthate has had no effect in improving this. While lime consumption has not increased to any extent since the introduction of the acid rougher float a rather greater quantity of sulphides appears to have been dropped in the cleaner circuit.

The bottom of the 6' x 6' conditioner for the cleaner float could also be concreted to prevent build up of cassiterite. The sand relief pipe arrangement recently fitted to the 10' x 6' conditioner for the rougher float has proved most satisfactory. The same type of pulp delivery and sand pipe fitted to the cleaner float conditioner would also be worth while. A 1½" sand pipe should deliver sufficient pulp to leave a small amount to overflow the top outlet of the conditioner.

REAGENT FEEDING

The present disc and bucket feeder is not entirely satisfactory. The shaft carrying the discs should be moved back say 2" in order to prevent the present loss by splashing. The trays which carry the measured reagent away should be altered so that reagent which gets on

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to the outside of them will run back into the tank, instead of being lost as at present.

The copper sulphate saturater is quite satisfactory.

Xanthate has been made up in 10% solution and fed alternatively from two 44 gallon drums which are made up on day shift and contain sufficient for the next two shifts.

DESLIMING AND SIZING TABLE FEED.

Flotation tailings from both rougher and cleaner flots is deslimed in a 6' x 6' cone and the cone underflow then flows to two two compartment hydrosizers. Sizing by these units leaves very much to be desired. Both the cone and the hydrosizers appear to be at fault. A small proportion of oversize material is present at all times in the slime section with far too great a range of sizes in the spigot product from the hydrosizers. The addition of wash water at the apex of the cone has been of some advantage. This has been operated with the valve opened four full turns.

The levelling strip on the cone overflow needs replacing.

WILFLEY TABLES.

The tables are in good mechanical order. No. 10 tables is giving poor concentration and needs the linoleum removing and the wooden top of the table dressing. The condition of the surface of No's 6 and 8 tables is not serious but their operation will no doubt be improved by some attention.

After a certain amount of trial and error a satisfactory packing for the gland of the head motion drive has been found in "Petso" Packing made by James Walker & Co.

Operation of the tables has been so satisfactory since the introduction of the acid flotation circuit that steps had already been taken towards retabling the table concentrate to produce a sale concentrate. If this could be done satisfactorily it should considerably reduce the amount of work entailed at present in the dressing shed. By reducing the grade and/or quantity of material handled in dressing shed contamination of the main circuit by comparatively high grade rejects from the dressing shed during day shift would be considerably reduced and some improvement in recovery obtained.

THICKENER

This unit is much too small in diameter to obtain a clear overflow. It has been functioning as a deslimer rather than a thickener. The enlarging of this unit to its original size has been considered. This could be done fairly simply as the base of the old thickener body is still in position.

The maximum density obtainable in the thickener U/f at normal mill output with the 4" Dorrco Simplex pump at its present speed is approximately 30% solids. As the material being handled by the thickener does not consolidate readily on settling both the thickener and Dorrco pump can be stopped under load for comparatively lengthy periods without causing any concern.

DENVER BUCKMAN TILTING DECK CONCENTRATOR.

This equipment comprises two sets each of five tilting tables.

When the new plant was started up these tables were tried as a two stage unit, the concentrate from the first set of tables being cleaned on the second set. The thickener U/f was tried at 30% and 15% solids. It was found that 30% solids gave a somewhat better recovery.

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They have since been changed over to two units in parallel with improvement in recovery. Optimum density of feed under these conditions has not yet been established but operation to date has been at 20 - 25% solids.

Some trouble has been experienced with the wash water jets becoming corroded with rust. In order to improve this position it had been intended to replace the present steel water jets with brass ones and to install a strainer in the feed water line to remove any suspended material.

A levelling strip is required on the overflow of the small cone above the tilting deck distributor. This cone is used to stabilise the feed flow of pulp returning from the slime tables.

SLIME TABLING

Slime tabling is reasonably satisfactory but no doubt would be considerably improved if sulphides could be removed from the slime circuit ahead of the tables. Two fagergren cells have been placed on the landing above the No.1 slime table with the object of experimenting with this idea.

If the sulphides can be removed ahead of tabling the tilting deck concentrator product there is little doubt that a sale concentrate could be produced off No. 1 slime table.

A considerable amount of trouble has been experienced with the bearings in the 1½" warman pump returning slime table tailings back to the head of the tilting deck circuit. Ball races were cutting out sometimes in two days. Since installing roller bearings no further trouble has been experienced. However in order to get satisfactory pumping it has been necessary to operate this pump with a "breather" pipe in the top of the casing. The pump is operating at a very high lift for this size pump.

DRESSING SHED.

Present dressing shed practice is effective but somewhat tedious with a rather poorer recovery than could be desired.

With the better removal of sulphides with the acid float it should be possible to make a sale concentrate by retabling the concentrate from the main tables and only batch float the middlings from the redressing tables. Tailings from the redressing tables could be returned to the main circuit.

However if rejection of sulphides by flotation can be improved further, possibly by adopting a depressant for talc which does not depress sulphides to such an extent, it is likely that by redressing the table concentrate present dressing shed practise may be unnecessary. Recovery would no doubt be improved due to absence of circulating load of tin bearing flot. concentrate and tub toppings from the dressing shed.

TABLE MIDDLING DEWATERING CONE.

This requires a levelling strip. Its performance is quite satisfactory.

MILL SPILLAGE.

As a temporary measure this has been caught in a dam at the west end of dressing shed. The launder carrying the spillage could be provided with a screen to remove oversize and the undersize join the table middlings for return to the circuit.

CALCINER

Approximately 90 tons of pyritic concentrate is stored at the

calciner. Laboratory tests have shown that practically 100% flotation of the sulphides in this material is possible with the normal reagent combination used in the mill. It is possible therefore to handle this material either in the main plant or by roasting. However if left for any lengthy period or allowed to dryout, oxidation will take place with the formation of hard lumps making retreatment by roasting difficult.

The small roaster - No.2 - is in by far the best condition and could be put into operation without much difficulty. The larger roaster - No. 1 - which is in poor condition is very liable to break rabbles when put into operation after a prolonged shut down.

A 1½" Warman pump previously used to elevate calcined material to a hydrosizer ahead of the tables is at present in the fitting shop. Reinstallation of this pump could be avoided by repositioning the hydrosizer as all the tables would not be required with one roaster in operation.

Maximum capacity of each roaster is approximately the same and operating with reasonable dust loss is about 0.35 tons of feed per hour. The small or No. 2 calciner is somewhat harder to light and goes out more easily than the other roaster.

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