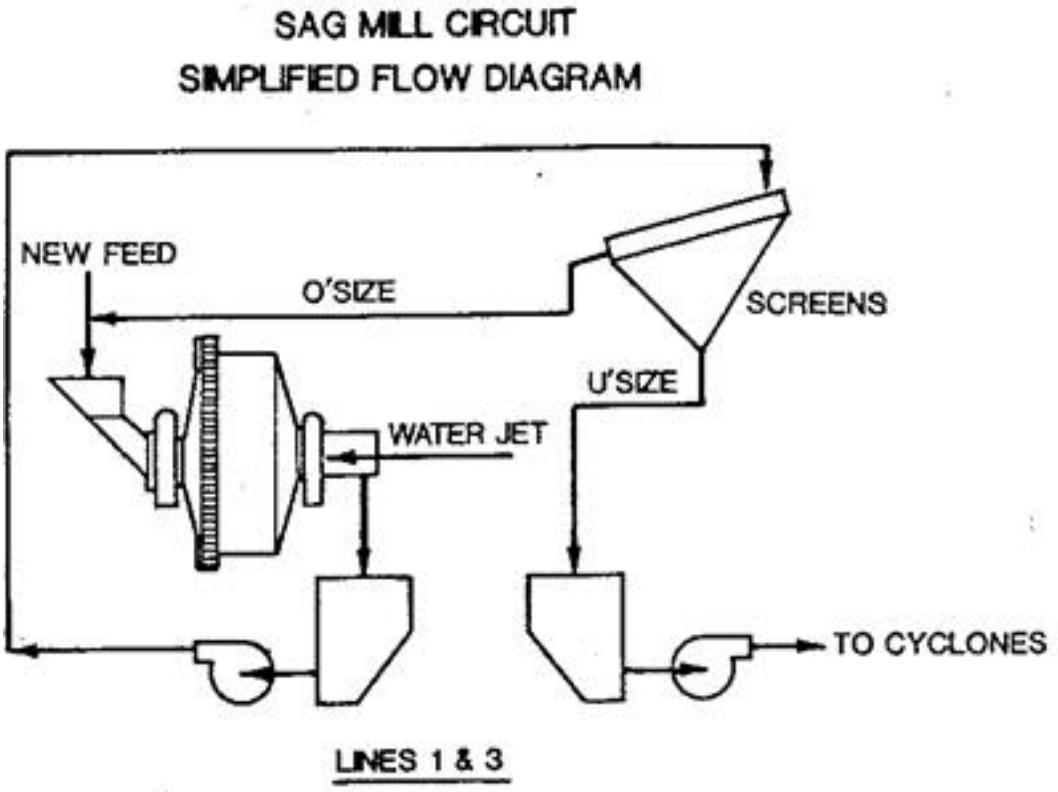
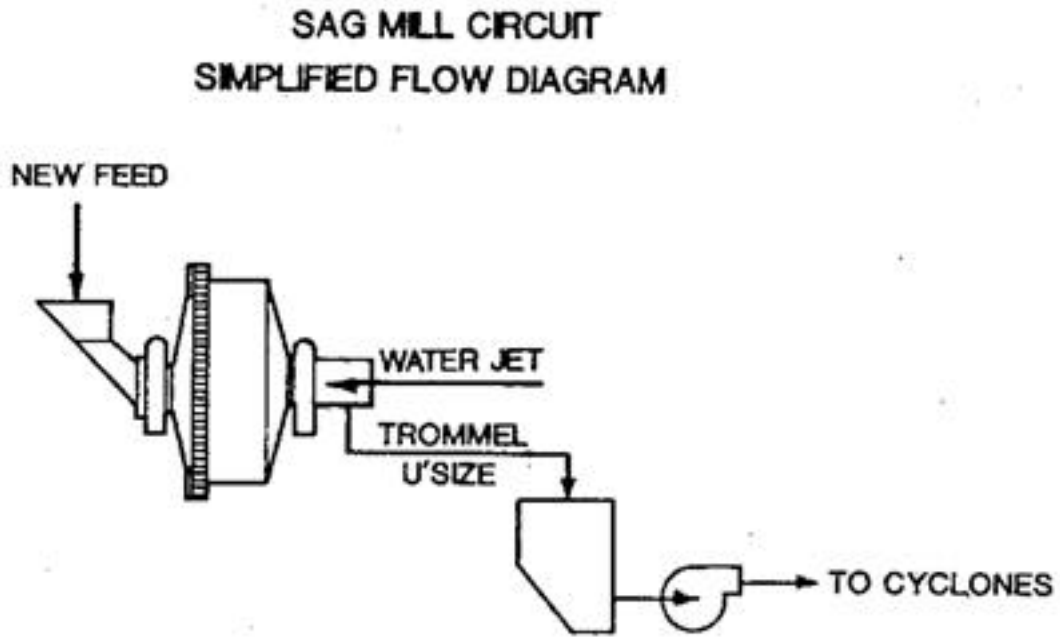
SAG MILL DISCHARGE SCREENS-TROMMEL vs. VIBRATING
Tony Moon, RTZ

What I'd like to talk about is probably one of the nastiest bits of mill design for a grinding circuit, and that is the choice of what do you use on a SAG mill discharge? Do you use vibrating screens or trommel screens? What many of you probably don't realize is that at Kennecott's Copperton concentrator, which we started up in 1988, two of the three grinding lines used both types of screens and on line two we used only a trommel.



I've got to explain this a little bit. This flowsheet is typical of lines 1 and 3. The SAG mill has a trommel on the discharge end of it. Oversize is returned to the mill by a bucket wheel and water jet. Trommel undersize was pumped to a vibrating screen where the screen oversize was sent back to the mill and the undersize was pumped to the cyclone circuit. Figure 2 shows the flowsheet for line 2 with only the trommel,

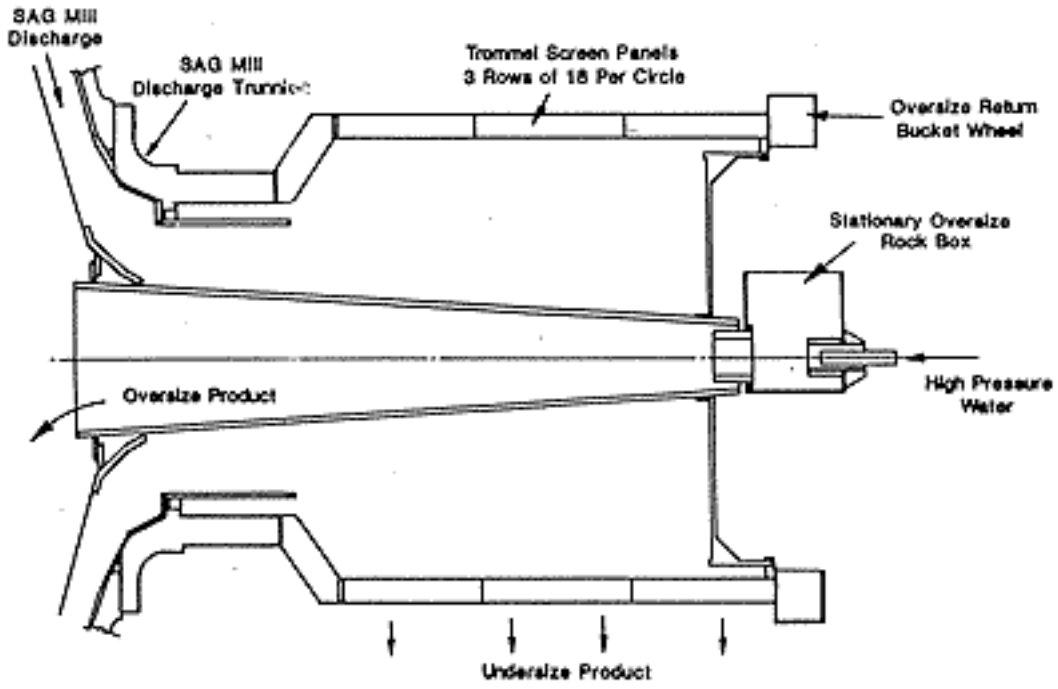


After about a year of operating the two lines with the vibrating screens, we basically pulled these screens out. The maintenance costs were very high. We had problems with screen deck support failures. We were using one-foot square panels, which is fairly typical. The screen manufacturer had supplied the decking underneath those one-foot panels and periodically they would collapse. We had pumping and pipe maintenance that was atrocious and the net result of all this was a run time that was at least one percent less than that on the mill with only a trommel. That was really the bottom line of the whole thing; that run time was so important to us. The result of all this was that the vibrating screens were taken out of the circuit. Now the trommel screen that we have is, frankly, a copy of Hibbtac's. We sent one of our engineers to visit all kinds of mills and told him to steal the best ideas he could

Preliminary operational tests inconclusive.

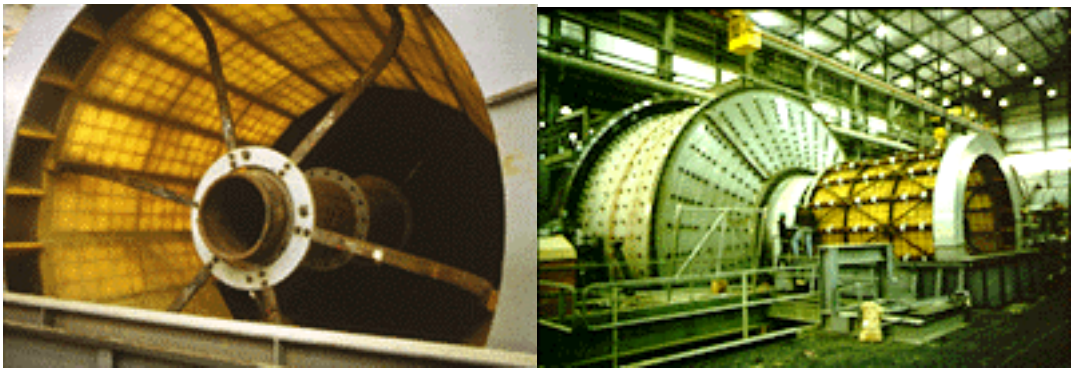
(The damn thing blew up when we threw the switch.)

This next picture is a scale drawing of one of the trommels. The slurry discharges out of the mill from the grates in the slot between the grates and the head. The oversize falls into a bucket wheel on the discharge end of the trommel, gets picked up as the trommel revolves and falls into the stationary rock box. A water jet then squirts that oversize back into the mill through the conical discharge tube.



SAG MILL TROMMEL SCREEN

The next two photographs show the trommel prior to startup before the cover and the stationary rock box were installed. The bucket wheel and the urethane panels can be clearly seen. Screen panel size is 28 by 54 inches. The oversize return tube turns with the trommel



These things are not small. The diameter of the trommel for the 34-foot mill is 13.5 feet and the screen surface length is almost 13 feet. This gives us about 550 square feet of screen area, for roughly 30,000 tons a day or 1,300 tons an hour. These trommels were the first of their size for the tonnage handled. Hibbtac trommels handle about 400 tons per hour. The size is also dictated by the open area of the urethane panels which is only 22 percent. We have tried all kinds of screen openings. The original design was half inch. We are currently using a five-eighths inch wide slot. We have even tried three-quarter

inch openings and we are planning to go to three-eighths if we ever get a pebble crushing circuit. On the new line 4, we are treating 40,000 tons per day and the trommel is 15 feet in diameter by 15 feet long.

Over the years, several things have evolved. We are probably on the third iteration of those return tube support arms. The first ones, which are shown in the photograph were designed to be flexible. That was not a good idea. It was just one of those things. They gradually got beefier and beefier over the years and we've moved them back toward the mill so they get further away from the trommel oversize. We have also gone to thicker screen panels. We now use a polyurethane panel that is two inches thick versus the first ones which were one inch thick.

Screen panel life is about four months. Each mill goes down once a month, so each Wednesday one mill is down. We have actually got our polyurethane cast in two different colors. The translucent effect you saw in the photograph is now the bottom layer. The top layer is cast of dark urethane. If on the down day, the white is exposed, we know that the panel will not go another month and we change it out. Even if we could get another couple of weeks wear, we change them out anyway because it's run time again. You don't want to be shutting down a mill just to change a couple of panels, that's nonproduction.

I guess the most serious thing that has happened is that we had one structural failure of a trommel in the ten years they have been operating. That's a pretty tragic and sickening thing to see. After that failure, which occurred after about six or seven years, we had Doug Farnell of Farnell-Thompson Applied Technologies Inc look at the structure again and it was redesigned and beefed up. We changed some of the things at the return tube where it goes into the mill. It had a tendency to come loose so we beefed it up. We also added a ring at the discharge end, where the oversize comes off, to keep the oversize from going where it shouldn't.

So our trommels have evolved quite significantly. The advantage, in my view, and I think everyone at the concentrator agrees with me, is that it is a simple device. From a design standpoint, it saves an awful lot of headroom when you compare it to a vibrating screen. The disadvantage is a possible structural failure. If a structural failure occurs, you had better have a spare trommel on hand or you are going to be down for a while.

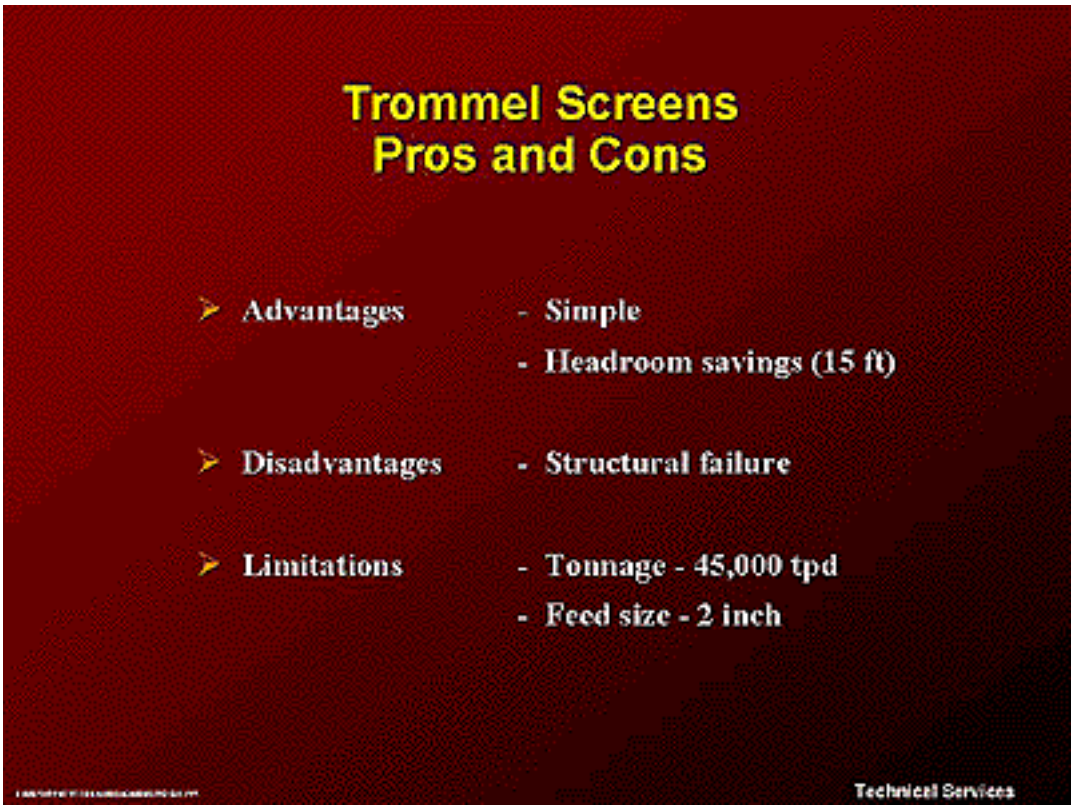
Figures 4 and 5 show our trommel improvements and trommel pros and cons.

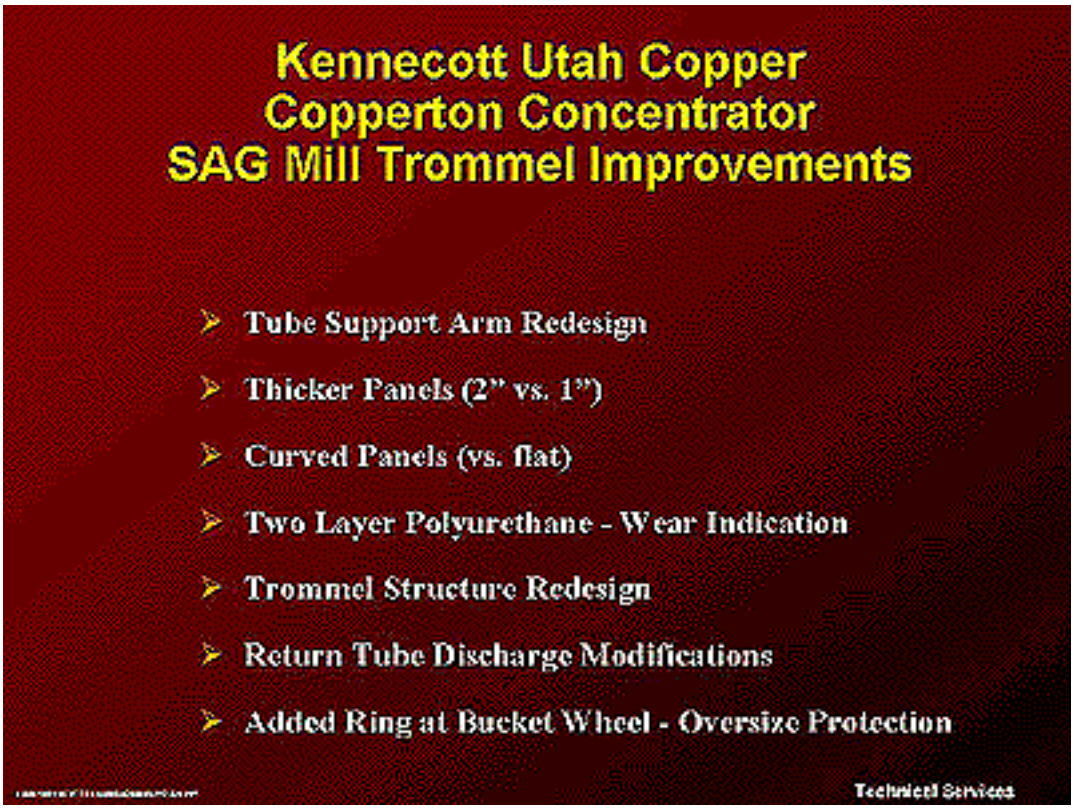
We have run our trommel up to 45,000 tons per day. When we were looking at what we call the super-fifth line (it will never happen, unfortunately) a 68,000 ton per day line was proposed. We were getting to the point where, given our criteria for sizing these

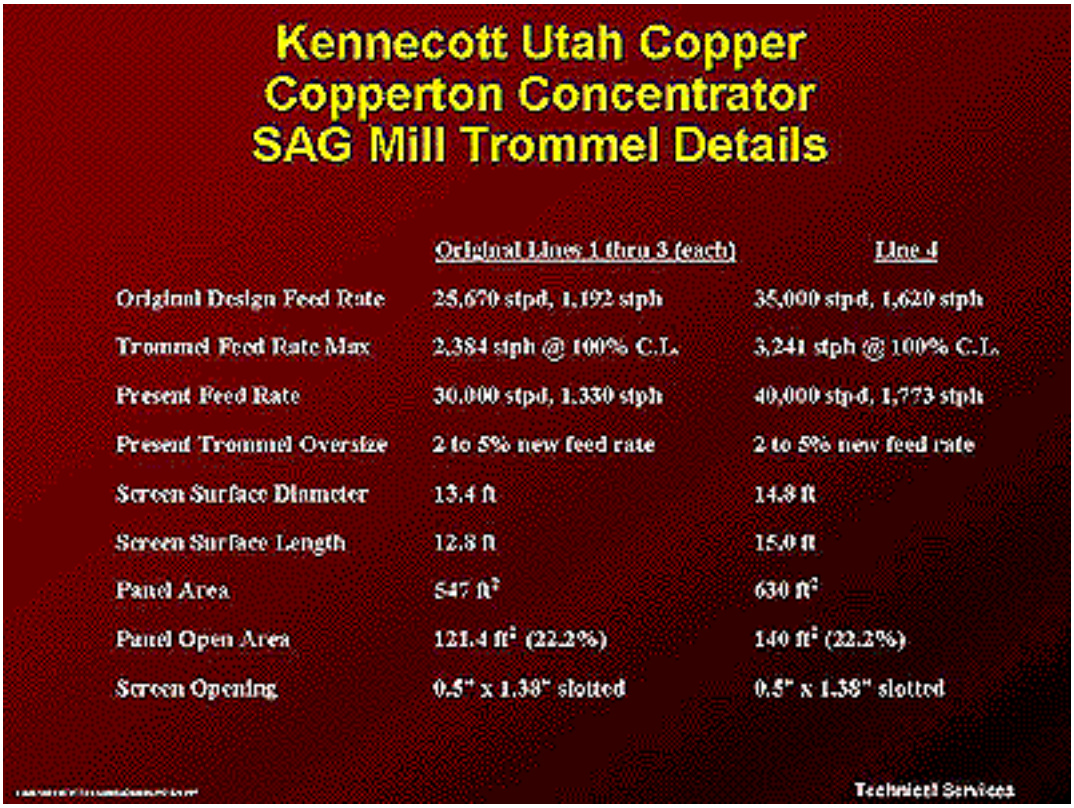
things, it was getting a little too big. I'm not sure where the limit is but it's somewhere in that range, maybe 60,000 tons.

We don't feel that the feed size to the trommel should be greater than about two inch. We currently use a 1-inch grate in the mill that wears out to probably 1-1/4-inch. We've had 2-inch grates in the mill and we've even had 2-1/2-inch grates just to see what they would do when we wanted to measure the circulating load. Our circulating load is pretty small, 5 percent is probably a good average number. We've seen it as high as 10 percent. It's impossible to measure but these results are from some special tests. We have seen up to 18 percent when we put in the 2-1/2-inch grates.

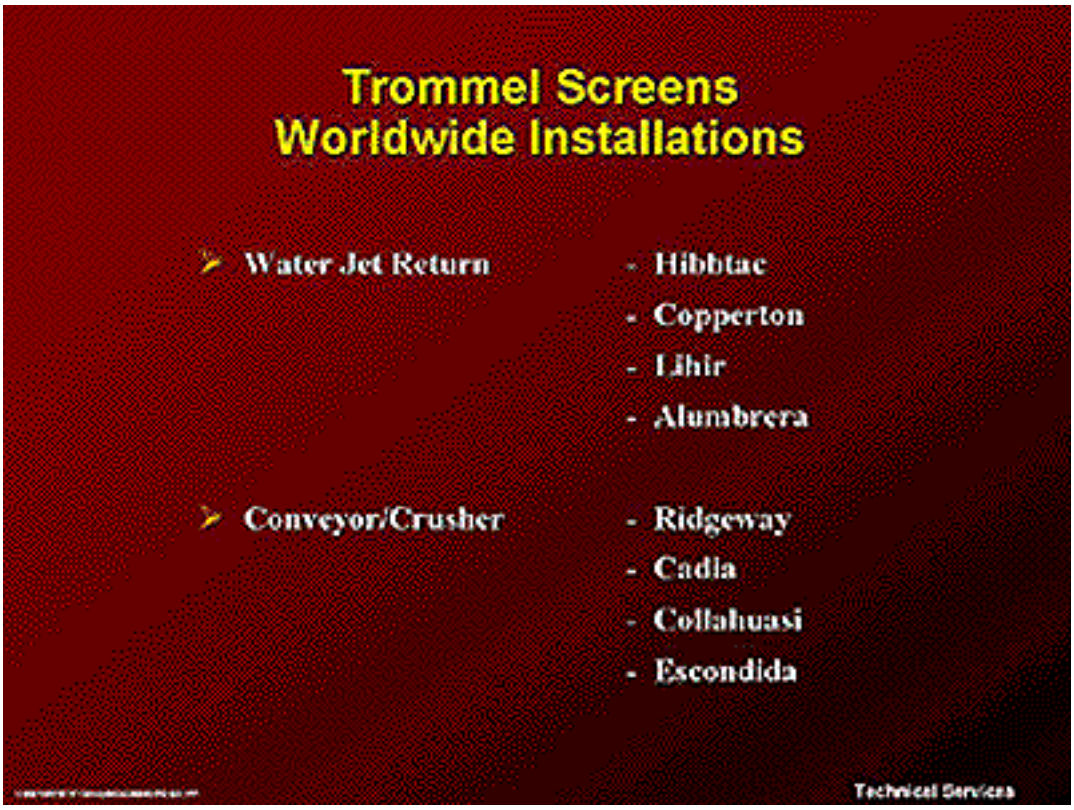
Figures 4, and 5 show trommel improvements and pros and cons. Figure 6 shows the details of the trommel operation at Copperton.




Kennecott Utah Copper
Copperton Concentrator
SAG Mill Trommel Improvements
Tube Support Arm Redesign
Thicker Panels (2" vs. 1")
Curved Panels (vs. flat)
Two Layer Polyurethane - Wear Indication
Trommel Structure Redesign
Return Tube Discharge Modifications
Added Ring at Bucket Wheel - Oversize Protection
Technical Services


Kennecott Utah Copper
Copperton Concentrator
SAG Mill Trommel Details
Original Lines 1 thru 3 (each)
Line 4
Original Design Feed Rate
25,670 stpd, 1,192 stph
35,000 stpd, 1,620 stph
Trommel Feed Rate Max
2,384 stph @ 100% C.L.
3,241 stph @ 100% C.L.
Present Feed Rate
30,000 stpd, 1,330 stph
40,000 stpd, 1,773 stph
Present Trommel Oversize
2 to 5% new feed rate
2 to 5% new feed rate
Screen Surface Diameter
13.4 ft
14.8 ft
Screen Surface Length
12.8 ft
15.0 ft
Panel Area
547 ft²
630 ft²
Panel Open Area
121.4 ft² (22.2%)
140 ft² (22.2%)
Screen Opening
0.5" x 1.38" slotted
0.5" x 1.38" slotted
Technical Services

In conclusion, we are not the only company to use trommels. Hibbtac, as I mentioned...that's where we got the original idea for Copperton. Lihir was a Kennecott property at one time; now Rio Tinto owns part of it. Lihir has the same water jet return, but that was totally influenced by Kennecott people involved with the design. Alumbrera, down in Argentina, --that's probably the one that I can think of that Kennecott had nothing to do with that uses the water jet. I believe Mount Isa may be another one. There's quite a number of trommels running with conveyor and crusher circuits. Ridgeway is another Kennecott property, although we got Amselco's part of it, so there was no Kennecott influence on the design of that plant, but it uses a trommel. They actually use 3-1/2-inch grates and the trommel works quite successfully. Cadia, as we heard this morning, is using a trommel with conveyors and a crusher. Collahuasi has a trommel and Escondida, on some of their lines, has trommels. Several trommel installations are shown in Figure 7.



I think the gentleman who made the presentation pointed out the advantage of a trommel on simplicity of the layout. You can tuck the sump under the trommel if you choose to. Ours is across the aisle, but you can get the trommel undersize directly into your cyclone feed sump without pumping.

That's about it. I've probably oversold trommels enough. If there is something you want to say about vibrating screens later, Jim or Charlie, we can hear the other side of the story.

Thank you. [Applause]

Doug Halbe; Thank you Tony. We will hold comments until we have our third speaker. Tony, my question is, if trommels are such a great idea, why doesn't everybody use them? We'll run that by Charlie Wilmot, I think you will get a rebuttal prety quickly.

Our next speaker on how to save bucks on crushing and grinding is Jim Vanderbeek. I don't think he needs much introduction to those of you who have been following the crushing and grinding business for a long time. Jim, as you know, is concentrator manager at the Chino Mines Division of Phelps Dodge. If you are going after Tony, come on up Jim.