

*Ken
Service File*

COPY

Mr. C. E. Taylor, Office.

Mill Repairs & Changes---January 1938

The Hardinge mill ran with feed from the rake discharge of the 6x12 drag classifiers from Jan. 1 to Jan. 14. The drag classifier rake product includes the circulating load to the 6x12 Marcy mills and the initial feed which is the product of the Gyrasphere crushers. The rake discharges, east and west units, were each split, during this period, into three parts, one to the 6x12 Marcy mill, one to the 4x10 Marcy mills and one to the Hardinge mill. The feed included such coarse lumps (1/2" to 3/4") that it was necessary to increase the ball size from 1-5/8", which was the size of balls used in the Hardinge in the Old Mill, to 3" and larger, in order to break the coarse lumps and keep the Hardinge from filling up with them and overloading. On Jan. 1, 1000 lbs. of 3" balls were added, bringing the total charge to 13,000 lbs. -3" plus 1-1/4" balls; on Jan. 2 another 1000 lbs. of 3" balls was added. On Jan. 6 the Hardinge overloaded several times, so it was shut down to adjust the ball charge. Removed 2200 lbs. of small balls (-2") and added 3000 lbs. of -3-1/2" plus 2" balls. The power with that charge was 110 HP and since fears for the lining were expressed the mill was not operated that night. The next day unsuccessful attempts were made to segregate the coarse ore in the 6x12 classifier rake discharge and keep it out of the feed to the Hardinge. A Hardinge representative happened to come into the office on this day and he asserted that the pebble lining would stand the coarse balls, up to 15% of 3" balls. Thereupon a new ball charge was made up consisting of 5000 lbs. of -3-1/4" plus 2-1/4" balls and 9000 lbs. of -2-1/4" plus 1-1/4" balls. With this charge there was no difficulty in grinding the coarse ore that came to the mill. On Jan. 11 added 1000 lbs. of -3-1/4" plus 2-1/4" balls, total charge 15000 lbs. -3-1/4" plus 1-1/4". On Jan. 13 it was discovered that the wiring in the Hardinge starter was incorrectly hooked up and that one lead to the motor was dead. All previous power readings were incorrect. The ammeter before changing the wiring had shown 140 amperes to 150 amperes (122 amperes is full load for the 100 HP motor). The speed of the motor before changing wiring was 835 RPM and after changing it this rose to 860 RPM. The mill speed at 860 motor speed was 24.4 RPM. On Jan. 14 the Hardinge mill shell started leaking so it was shut down for inspection. 25% of the lining was found to be completely out, most of this being in the cylindrical portion of the mill. Our supply of Lumnite cement was insufficient to reline the mill and, since the purchase of this cement would cause 2 to 3 weeks delay, 40 bags of Incor quick setting Portland cement were ordered from Roanoke. While the mill was down for relining the shell was drilled to determine the thickness. The conical section at the feed end had one area about 8" diameter that had been patched before where the thickness was 1/8". Other parts of this section measured 5/16" to 3/8" in thickness. The cylindrical section and the conical section at the discharge end both measured 1/2". The thin section was patched by arc welding 4 pieces of 1/2" x 2" flat iron 20" long

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

on the outside of the shell. Each piece was welded to the shell and to the adjoining piece.

The mill was relined on Jan. 17 and 18, 1/2 on each day. 28 bags of Incor cement and about 4000 lbs. of 4" Danish pebbles (the largest pebbles left) were used. The old ball charge was weighed:

	6347 lbs.	-3-1/2" plus 2"
	1095 "	-2" plus 1-3/4"
	5417 "	-1-3/4" plus 1-1/4"
TOTAL	12859 lbs.	-3-1/2" plus 1-1/4"

It was decided to change the feed to the Hardinge to a size that 1-3/4" balls would crush. A launder was arranged at the rake discharge of the Dorr Duplex classifier, east mill, and the same at the west mill, to cut out 24" and 18", respectively, of the rake discharge. This was piped by 4" pipe to an existing centrifugal pump located at the dam in the subway. The discharge line as installed was a 3" pipe from the pump to the Hardinge dipper. The feed thus provided is finer than was the feed at the old mill.

The Hardinge was again started at 7:30 A.M., Jan. 22. The ball charge was 14000 lbs. of -1-3/4" plus 1-1/4" balls. Power was 81.24 HP. The mill was shut down on Jan. 25 and Jan. 29 to inspect the lining and at these inspections no holes were found. Incor appears to be softer than the Lumnite and may show good life, though it is doubtful if 12 months will be realized as when the old mill Lumnite linings were installed.

On Jan. 6 a dust collection system in the crushing end of the mill was started. An American Blower with 10" suction and 8" discharge was direct connected to a 7-1/2 HP 1760 RPM motor. The suction pipe consisted of two 7" light weight pipes, one from the discharge of each Telsmith crusher, and two 6" pipes, one from the discharge of each Gyrasphere crusher. Each pipe has a stove pipe damper in it for control of the suction. The pipes join into a 10" pipe which is connected to the suction end of the fan. The discharge pipe is an 8" diameter steel pipe for a short distance and at first this was connected to a 12" canvas pipe which was stuck out of a near window to the outside of the mill building. This, proving to be a nuisance, was later changed by installing 12" canvas pipe throughout the length of the mill and than by 14" steel pipe into the 18" tailings line to the Austin Meadow. When the bags filled with settled dust after several days run, the discharge pipe was led to a prepared settling chamber in the east table pit, the size of which is approximately 20' x 20' x 10'. An 18" pipe is connected to the outside to carry the unsettled dust to the outside atmosphere, about 70' away from the mill.

On Jan. 4 the west mill was shut down, with the exception of the 6x12 drag classifier and the Hardinge mill, to change the wearing parts of the Gyrasphere crusher. The set up limit had been reached on the Gyrasphere, necessitating the change of parts.

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

The mantle was worn out and the concave was partly worn out. Installed a new concave and a partly worn mantle. The life and cost data follow:

Lower Mantle: The #5 lower mantle removed 1/4/38 was installed 8/20/37. Life 4 months 14 days. Dry tons crushed, 109,506. This mantle had seen previous service of 2 months 29 days, in the 1-E unit, crushing 68,500 dry tons. Total dry tons crushed 178,006. Total life 7 months 13 days. This mantle was purchased on order GB-8836, dated 6/23/36, and cost delivered \$122.57. Final cost per dry ton crushed \$.00068857. Discarded weight 320 lbs. Pounds of metal lost 220. Percent of original weight lost, 40.74%. Pounds of metal lost per ton of ore crushed .0012359.

This mantle now has the record for number of tons crushed. The former record was 167,386 dry tons.

No. 8 Lower Mantle was installed 1/4/38. It had seen previous service of 4 months 27 days, crushing 114,532 dry tons. This mantle was purchased on order GB-9538, dated 11/27/36, and cost delivered \$122.50.

Concave Ring: The No. 8 Concave Ring removed 1/4/38 was installed 8/20/37. Life 4 months 14 days. Dry tons crushed 109,506. Cost per ton crushed \$.0015401. Weight when removed 424 lbs. Weight lost 141 lbs., or 24.96% of original weight. Pounds of metal lost per ton of ore crushed .0012876 lbs. This concave ring was purchased on GB-9704, dated 12/22/36, and cost delivered \$168.65.

No. 10 Concave Ring was installed 1/4/38. It was purchased on order GB-1552, dated 5/25/37. It weighed new 566 lbs. (Austinville weight). This ring is of the new design having reinforced lugs. It is about 3/8" shorter in depth, thus having thicker metal around the outside edge.

Changed the oil in the crusher and then found that ore had been getting into the oil (since the preceding shift) through a hole in the return oil pipe. A new return pipe was installed covered with a larger pipe, hard surfaced to protect it against wear. Installed a short piece of Rex flexible tubing in one of the 3/4" oil lines to suppress vibration. Examined the 6x12 Marcy rod charge and observed several rods worn to 1-1/2" diameter, but none broken or bent. Installed new bushings in the plug door spiders and put in larger bolts and protecting angles.

On Jan. 6 the east 6x12 Marcy pinion shaft broke. This shaft was made of chrome vanadium steel and was installed 11/17/37. It broke in the pinion, the same as the last one did. A new spare shaft pinion and coupling half were installed. The shaft was made of soft steel. Micarta bushings, while showing little signs of wear, in one case was warped. The babbitt in the cap was broken out and the pin holding the Micarta had sheared, allowing the bushing to distort. The gear growled when the mill was started, indicating

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

distortion of some kind at this point. The new pinion shaft was installed in 3-1/2 hours and the mill then started without jacking, even though it had stopped when the shaft broke without preliminary oiling. On Jan. 8 the east 6x12 Marcy was again shut down to examine the gears. Some of the gear bolts were loose. At the same time the wear on the Micarta trunnion bearings was gaged. Since 8/20/37 the feed end has gone down .115" and the discharge end has gone down .013". The main gear teeth were inspected for wear, which was found to be 5/16" off the face of each tooth. On the evening of Jan. 9 the south pinion shaft bearing of the east 6x12 Marcy was found to be loose on its foundation, indicating further advance of the trouble with gears and shafting on this mill. On Jan. 10 the mill was shut down to line and level the pinion shaft. The mill barrel was found to be level and 1/16" lower than when installed. The pinion shaft was found to be out of level with reference to the one fixed bearing (#2 from south end). The mill was found to be out of line with the pinion shaft, so that the pinion teeth hit the gear teeth only on the north end. Bearings #1, #3 and #4 were cut free from the concrete and were carefully levelled and lined and were grouted with Lumnite cement. The Micarta bearings were refastened to the bearing bases with bronze dowels and the cap of #2 bearing was rebabbitted. Lining and levelling the mill did not cure the growling of the gears and vibration. The trouble was eventually found on Jan. 15 when the gear was checked and found to be 1/4" out of round. There are four fitted dowel bolts and six loose-fitting bolts in each main gear holding it to the mill. 3 of the fitted bolts were found to be worn enough to allow the gear to slip the amount given above. The fitted bolts were reversed, the gear was trued up and the mill was moved away from the pinion 1/16". When started the vibration and noise had left. On Jan. 21 the mill was again shut down, all bolts were loosened, the gear was jacked to place so that it was true and the bolts were then tightened. 4 of the holes for the loose-fitting bolts were then reamed from 1-3/8" to 1-7/16" and four 1-7/16" bolts were driven in. We now have 8 fitted bolts instead of 4 to hold the gear true.

On Jan. 7 the east mill was shut down for repairs. Changed oil in Gyrasphere crusher. Removed all rubber hose connections in the oil pipe lines and replaced them with oil proof hose. Also installed one piece of Rex flexible all metal tubing which if successful will replace all rubber hose for connections in the oil lines for suppressing vibration. Tightened bolts on the 6x12 Marcy and changed the dipper lip. Tested the weightometer and found it to be correct. Installed a new feed screw on #3 Marcy mill and one on #4 Marcy mill. Installed a new dipper lip on #4 Marcy.

The warm water circulating system, providing water 20° to 25° F. warmer than make up water from the 500,000-gal. tank, operated during the whole month. The east crushing and flotation had the benefit of this warm water for the full month. On Jan. 13 additional water was procured by turning into the system the overflow of the zinc Dorr tanks and this change provided sufficient

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

water for the east and west units. The warm water pump handles 330 GPM on the day shift, while the Sullivan Air Compressors are running, and it is necessary to add a small amount of cold make-up water. During the night, when the compressors are down, a greater amount of cold water is used. The water to the grinding mills (all warm water except 35 GPM) was measured:

	<u>West</u>	<u>East</u>
6x12 Marcy Mills & Classifiers	65.4	85.8
4x10 " " " "	106.4	107.1
	<u>171.8</u>	<u>192.9</u>

The efficiency of the 4" Wilfley pump handling warm water from the lower end of the mill to the east top drag tank is 30%. A 25 HP motor is used to drive the pump and it is fully loaded.

On Jan. 7 a new set of stationary and swing jaw plates were installed in the mine crusher. Also installed new wedges over the swing jaw plates. Life and cost data of these parts follow:

Swinging Jaw: The two-piece set of swinging jaw plates removed 1/7/38 was installed 11/17/36. Life 13 months 20 days. Total dry tons crushed 650,221. Cost per ton crushed \$.000509. These plates were purchased on order GB-9114, dated 8/28/36. They cost new \$325.71. Estimated weight new 2217 lbs. Discarded weight 2048 lbs. (one piece 1000 lbs., other piece 1048 lbs.). Total weight lost 169 lbs. Loss of metal per ton crushed .0002599 lbs. Loss of metal 7.62%.

The two-piece set of swinging jaw plates installed 1/7/38 was purchased on order GB-2162, dated 9/23/37. They cost new \$368.52. Estimated weight new 2217 lbs.

Stationary Jaw Plates: The two-piece set of stationary jaw plates removed 1/7/38 was installed 2/11/36. Life 22 months 26 days. Total dry tons crushed 1,032,209. This is the record. Cost per ton crushed \$.0002909. The plates were reversed end for end 11/17/36. The plates were purchased on order GB-7761, dated 11/15/35. They cost delivered \$300.27. The plates weighed 1030 lbs., each, or a total of 2060 lbs. for the set. Discarded weight of plates was 785 lbs., each, or total of 1570 lbs. Total weight lost was 490 lbs. Loss of metal 23.69% of original weight. Loss of metal per ton crushed .0004747 lbs.

The two-piece set of stationary jaw plates installed 1/7/38 was purchased on order GB-9114, dated 8/28/36. Estimated weight new 2009 lbs.

The wedges removed 1/7/38 for stationary jaw plates weighed 31 lbs. each.

Average screen analysis of feed to flotation for the month of January:

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

East Unit: 6.0% on 48-mesh; 15.8% on 65-mesh; 29.2% on 100-mesh; 53.7% on 200-mesh; all cumulative.

West Unit: 7.7% on 48-mesh; 18.2% on 65-mesh; 31.4% on 100-mesh; 55.2% on 200-mesh; all cumulative.

TIME LOST BASED ON TELSMITH FEEDER RUNNING TIME

<u>East Unit:</u>	
1/1/38	25 minutes, 6x12 Marcy overloaded.
2	40 " ; ditto, 35 minutes; pan feeder chute choked 5 min.
3	25 " ; " 10 " ; 4x10 Marcys overloaded 15 min.
4	20 " , setting up Gyrasphere crusher.
5	25 " , 4x10 Marcys overloaded.
6	1 hour 55 minutes; 4x10 Marcys overloaded 1 hr 25 min, #4 Marcy dipper choked 30 min.
7	8 hours 5 minutes, General repairs, described above, 7 hrs 30 min. 6x12 Marcy overloaded 5 min; 4x10 Marcys overloaded 30 min.
8	45 minutes, 4x10 Marcys overloaded 25 min; installing water guard on 6x12 Marcy pinion shaft 20 min; part feed 1 hr repairing 6x12 Marcy mill described above.
9	1 hour 25 minutes, 4x10 Marcys overloaded 10 min; drill bit in Gyrasphere crusher 1 hr 15 min.
10	20 minutes, 4x10 Marcys overloaded 10 min, by-passing the 6x12 Marcy 10 min. Part feed 16 hrs 30 min, 6x12 Marcy mill down to line & level pinion shaft, described above.
11	45 minutes, 4x10 Marcys overloaded 20 min, 6x12 Marcy overloaded 10 min, setting up Gyrasphere crusher 15 min.
13	45 minutes, 4x10 Marcys overloaded.
14	40 minutes, ditto 20 min, setting up Gyrasphere crusher 20 min.
15	1 hour 25 minutes, 4x10 Marcys overloaded 55 min, 6x12 Marcy overloaded 10 min, #4 Marcy mill dipper choked 10 min, by-passing 6x12 Marcy 10 min, 6x12 Marcy down 1 hr 15 min adding rods & repairs.
16	45 minutes, 4x10 Marcys overloaded 40 min, 6x12 Marcy overloaded 5 min.
17	2 hours, 4x10 Marcys overloaded 10 min, 6x12 Marcy overloaded 30 min, Repairing Gyrasphere conveyor belt 1 hr 20 min.
18	40 minutes, 4x10 Marcys overloaded 10 min, 6x12 Marcy overloaded 5 min, Greasing Reeves transmission to pan feeder 5 min, measuring 6x12 Marcy mill gear 5 min, setting up Gyrasphere crusher 15 min.
19	40 minutes, 4x10 Marcys overloaded 15 min, 6x12 Marcy overloaded 15 min, repairing Gyrasphere conveyor belt 10 min.
20	30 minutes, 4x10 Marcys overloaded 10 min, 6x12 Marcy overloaded 20 min.
21	3 hours 40 minutes, 6x12 Marcy overloaded 30 min, 4x10 Marcys overloaded 25 min, by-passing 6x12 Marcy 10 min, 6x12 Marcy down 2 hrs 35 min adding rods & repairing.
22	10 minutes, 4x10 Marcys overloaded.
23	35 " Ditto
24	5 " "
25	20 " ; " 5 min, setting up Gyrasphere crusher 15 min.
26	10 minutes, 4x10 Marcys overloaded 5 min, ore hung up in chute to pan feeder 5 min.

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

- 1/27/38 10 minutes, Greasing Reeves 5 min, tightening link on 6x12 classifier chain 5 min.
- 28 1 hour 5 minutes, 4x10 Marcys overloaded 5 min, adding rods 50 min, Telsmith feeder hung up 20 min.
- 29 30 minutes, 4x10 Marcys overloaded.
- 30 25 " Ditto
- 31 25 " "

West Unit:

- 1/1/38 15 minutes, 6x12 Marcy overloaded.
- 2 35 " , Chute under Telsmith choked.
- 3 1 hour 5 minutes, 6x12 Marcy overloaded 20 min; drive sprocket on pan feeder drive worn out 45 min.
- 4 7 hours 30 minutes, General repairs, described above.
- 5 35 minutes, 6x12 Marcy overloaded.
- 6 1 hour 10 minutes; ditto 45 min, 4x10 Marcys overloaded 5 min, working on rake discharge end of 6x12 drag classifier 20 min.
- 7 1 hour 10 minutes, 6x12 Marcy overloaded 45 min, setting up Gyrasphere 20 min, Repairs 5 min.
- 8 55 minutes, 6x12 Marcy overloaded 10 min, repairing leak in Gyrasphere oil pipe 15 min, chute under Telsmith choked 30 min.
- 9 30 minutes, 6x12 Marcy overloaded 10 min, repairing leak in Gyrasphere oil pipe 20 min.
- 10 35 minutes, 6x12 Marcy overloaded.
- 11 20 " 4x10 " "
- 12 15 " 6x12 " " 5 min, out of ore 10 min.
- 13 3 hours 5 minutes, 4x10 Marcys overloaded 5 min, 6x12 Marcy overloaded 30 min, oil pipe to Gyrasphere crusher broken 2 hrs 30 min.
- 14 1 hour 20 minutes, 6x12 Marcy overloaded 10 min, 4x10 Marcys overloaded 45 min, setting up Gyrasphere & tightening collar on Reeves 25 min.
- 15 2 hours 20 minutes, 4x10 Marcys overloaded 55 min, 6x12 Marcy overloaded 25 min, repairing leak in oil pipe to Gyrasphere & adding rods to 6x12 Marcy 1 hr.
- 16 1 hour 35 minutes, 4x10 Marcys overloaded 40 min, 6x12 Marcy overloaded 25 min, Gyrasphere crusher choked 30 min.
- 17 40 minutes, 4x10 Marcys overloaded 20 min, 6x12 Marcys overloaded 20 min.
- 18 40 minutes, 4x10 Marcys overloaded 5 min, 6x12 Marcys overloaded 15 min, setting up Gyrasphere 20 min.
- 19 45 minutes, 4x10 Marcys overloaded 5 min, 6x12 Marcy overloaded 40 min.
- 20 35 minutes, 4x10 Marcys overloaded 5 min, 6x12 Marcy overloaded 30 min.
- 21 2 hours 10 minutes, 4x10 Marcys overloaded 10 min, 6x12 Marcy overloaded 45 min, adding rods & repairs 1 hr 15 min.
- 22 25 minutes, 6x12 Marcy overloaded
- 23 20 " Ditto
- 24 10 " ; " 5 min, 4x10 Marcy mills overloaded 5 min.

X 1938 10-27

Mr. C. E. Taylor---Mill Repairs & Changes----Jan. 1938

COPY

- 1/25/38 30 minutes, 6x12 Marcy overloaded 15 min, setting up Gyrasphere 15 min.
- 26 1 hour 10 minutes, Gyrasphere choked 35 min, oil pipe to Telsmith crusher broken 5 min, 6x12 Marcy repairs 2 hrs 25 min, Gyrasphere & Telsmith choked on pieces of wood 30 min, Tightening belts on Gyrasphere 10 min.
- 28 2 hours, Telsmith choked 10 min, 4x10 Marcys overloaded 15 min, adding rods & repairing 1 hr 35 min.
- 29 20 minutes, 6x12 Marcy overloaded 10 min, feed pipe to subway pump choked 10 min.
- 30 25 minutes, 4x10 Marcys overloaded 20 min, 6x12 Marcy overloaded 5 min.
- 31 20 minutes, 4x10 Marcys overloaded 15 min, 6x12 Marcy overloaded 5 min.

HARDINGE MILL LOST TIME

- 1/1/38 25 minutes, Overloaded.
- 2 1 hour 30 minutes, Tightening drive belt.
- 3 4 hours 30 minutes, Adding balls & changes.
- 5 1 hour 5 minutes, Discharge pipe from pump choked.
- 6 4 hours 40 minutes, Removing small balls, adding balls & pump discharge choked.
- 7 14 hours, Sorting ball charge & considering what steps should be taken to get greater benefit from the Hardinge.
- 11 35 minutes, Adding balls.
- 13 45 minutes, Tightening belt & repairs to starting equipment.
- 14 12 hours, Lining out of mill.
- 15 24 " Ditto.
- 16 24 " "
- 17 24 " , Relining mill.
- 18 24 " Ditto
- 19 24 " , Waiting for lining to set.
- 20 24 " Ditto
- 21 24 " "
- 22 8 hours 30 minutes, Ditto.
- 25 35 minutes, Examining lining.
- 29 2 hours, Ditto, & repairs.

(Signed) L. J. Weintz

11/2/38

30" x 42" Buchanan Crusher.

Swinging jaw. The two piece set of swinging jaw plates removed 1-7-38, was installed 11-17-36. Life 13mo 20 days. Total dry tons crushed 650,221. Cost per ton crushed \$.000509. These plates were purchased on order GB 9114, dated 8-28-36. They cost new \$325.71. Estimated weight new 2217 pounds. ~~Estimated weight 2543 lbs.~~ (one piece 1000 - other piece 1043). Total weight lost 169 lbs. Loss of metal per ton crushed = .0002599 lbs. Loss of metal 7.6%.

The two piece set of swinging jaw plates installed 1-7-38 was purchased on order GB 2162 dated 9-23-37. They cost new \$368.52. Estimated weight new 2217 pounds.

Stationary jaw Plates. The two piece set of stationary jaw plates removed 1-7-38, was installed 2-11-36. Life 22mo 26 days. Total dry tons crushed 1,032,209. This is the record. Cost per ton crushed \$.0002909. The plates were reversed end for end 11/17/36. The plates were purchased on order GB 7761 dated 11/10/35. They cost delivered \$300.27. The plates weighed 1030 lbs each or a total of 2060 pounds for the set. Estimated weight of plates was 785 lbs plus on total of 1570 lbs. Total weight lost was 190 lbs. Loss of metal 23.69% of original weight. Loss of metal per ton crushed .0004747 pounds.

The two piece set of stationary jaw plates installed 1/7/38 was purchased on order G.B. 9114 dated 8/28/36. Estimated weight now 2009 pounds.

The wedges removed for 1/7/38, for stationary jaw plate weighed 31 pounds each.

1/10/38

Km

1/10/38

1/7/38

Kickling Springs.

The last Kickling springs ordered for the radiographs or weightometers are not giving very good service. Much trouble has occurred the last month due to their frequent breakage. A spring now lasts from two days to a week. Formerly, they lasted from 60 to 90 days.

When a Kickling spring breaks, the three way switch of either the radiograph or weightometer fails to function properly. In case of the radiograph, it simply means that no record of the tonnage is made. In case of the weightometer, the trouble may be more serious.

In case of the weightometer, the rotating cam 11c breaks. This stops the integrator disc from rotating and when this occurs, no tonnage is recorded on the counter. The force exerted by the integrator disc, in its effort to rotate, can ruin the cam 11c, bell crank 11e and movable contactors 11d. (These parts are shown on photo 498 of radiograph repair part list.)

The Kickling spring broke in the 15 weightometer in previous necessitating renewal of parts 11e and 11c due to their being bent.

Two Kickling springs have broken on the next visit this week. No parts needed replacement except the spring.

KM/1/7/38.

2/26/38

Weightometer Chains.

The weightometer chains, used in testing the weightometers, were measured for length and also weighed, in order to ascertain a ~~correct~~ figure for weight per foot of chain.

The chain for the 100 weightometer was weighed Feb 26, 1938. It was weighed on the scales in the mill office and also on the scales ~~on~~ the sodium silicate floor. The weight on both scales checked. The chain weighed 130 pounds on each scale. Before weighing the chain, the scales were balanced and then checked by using test weights.

The chain weighed 130 pounds and the length was 120 ft 0 $\frac{1}{4}$ inches. The new weight per foot, ~~to be~~ used, is 6.493 lbs.

The old figures were 19.98 ft long, and 6.531 pounds per foot. This made the chain weigh 130.49 lbs.

According to the above figures, the chain stretched $\frac{1}{2}$ inch and lost a total of $\frac{1}{2}$ pounds.

The error introduced is .59% in the minus direction.

The east weightometer chain was weighed only on the scales at the mill office. These were graduated by $\frac{1}{2}$ pounds while those on the sodium silicate floor were graduated in pounds.

The length was 20 ft 0 $\frac{1}{4}$ inches and weight, 130 $\frac{1}{2}$ pounds. The new weight per foot to be used is 6.506 lbs.

The old length was stamped as 19.98 ft and a weight of 6.553 pounds per foot given. Based on these figures, the original weight was 130.93 pounds.

The chain stretched $\frac{1}{2}$ inch in length and lost approximately $\frac{1}{4}$ of a pound.

The error introduced is .63% in the reverse direction.

The above error, based on milling 50,000 tons a month, of 6% zinc ~~loss~~ when making a 90% recovery and a 60% zinc concentrate, would amount to 27 tons of zinc concentrate.

Respectfully submitted
K. Mesloh

1
Feb 126, 1938

Sampling of Zinc Ore Shipments for Moisture.

It was decided to check the moisture on the zinc shipments in order to determine whether there was very much variations in the moisture between samples taken by different methods.

The results were as follows.

Hand Sample Taken from each wheelbarrow:

Moisture 16.4% - Per Cent dry 83.6%

Auger Sample.

Moisture 16.5% - Per Cent dry 83.5%

Sampling by Method as used by Palmerton.

Material was too wet. The holes could not be dug to the floor as the concentrates kept sliding in.

Pipe Sample.

Moisture 14.6% Per Cent dry 86.4

Sample no good as only the first 4 to 14 inches of the concentrates would be forced into the pipe.

In every method of sampling, various factors, depending on the method used, will influence results.

In hand sampling the wheelbarrow, a spoon was used. In hand sampling, three factors must be watched. The first is that the samples must be taken in proportion to the weight loaded in the barrow. The second factor was

is that the sample taken should be representative of the material in the wheelbarrow.

Hand sampling cannot be used if water separates ~~from the solids~~ and stands on top of the solids.

In hand sampling the barrow when loading see P. RR 57-592, etc.

In sampling with an Auger and Pan, other factors to be watched out for is to follow a regular pattern, and the auger should be turned thru the solids being sampled without exerting pressure. Cars can be sampled that have water standing on top of the solids.

The pattern to be followed is important so that holes are uniformly spaced thruout the car. In this manner, the ^{weight of} sample taken from each hole will be representative to the depth of the material. Then, each sample will be in its proper relation to the whole. This pattern is determined by the manner in which the car is loaded, and the nature of the material, ^{and} whether it varies sharply in values and moisture.

The auger is not foolproof. It needs to be turned so it will work its way thru the material and feel the flutes. No other method is foolproof. If the sampler is not careful and conscientious, and does not have a knowledge of what it is all about, he can secure a poor ~~and plain~~ leading sample by any method.

Palmerton is quite correct in saying that the auger will push aside hard lumpy material (providing it is larger than $\frac{3}{8}$ of an inch), but incorrect in regard to pushing aside dry material. ~~However~~ the only hard, lumpy

Sampling by method used by Palmenton. The first requisite is that the material that is being sampled is wet enough so it will stand vertically but not so wet as to slide in when digging the hole. If the holes can be dug, they should be put down on a uniform pattern; the amount of sample taken must be uniform up the face and in proportion to the volume represented by the hole.

Palmenton has an excellent opportunity to get a good sample as the excess water has risen to the top and drained off. The moisture should be uniform thru out the car as the concentrates have been in close contact for three or four days, and joggled removing excess water.

This method was tried at Austinville but the concentrates were too wet to stand. They kept caving and sliding in while attempting to dig the hole.

Mr Taylor requested a pipe sample study tried. A $1\frac{1}{2}$ " dia pipe, same size as formerly used, was obtained. The pipe was sharpened on the end. This sample was no good. From 6 to 12 inches of the top material was caught. The remainder was pushed to one side as the pipe was driven to the floor of the car. Thirty holes were put into concentrates, all holes uniformly spaced. Attached the data, the information as to quantity of sample taken from each hole, will be found.

For good moisture samples, good accurate weighing is necessary. The present balances in use are the best on the plant. Care must be taken in the manner in which pans are placed on the pan rest. A difference in weight of 30 grams can be obtained if this matter is not watched. As two or more weighings are necessary, the possible error is quite large. To avoid this error, marks are placed on the pan rest and the pans are placed accordingly.

In the winter, during freezing weather, the concentrates freeze. As the car is loaded, the sampler chips off pieces of frozen material. After the car is loaded, he uses the auger and rakes as many holes as possible. Under these conditions, it is difficult to get a true moisture sample.

The sample boys are instructed and have been following out the instructions that when any condition is observed to prevent obtaining a good sample, a note is made on the slip that accompanies the sample to the laboratory. There are two factors that are encountered, (1) The car contains some areas entirely loaded with frozen clumps (2) Water standing on top of the car.

data.

Samples taken on Zinc Concentrate loaded in car P.R.R. 572592.
Car Sampled Feb 25, 1938.

Hand Sample

	Wet Weight	Dry Wet
Gross	34570	29137
Tare	<u>1377</u>	<u>1377</u>
Net	33193	27760

% dry 83.6

Copper Sample

	Wet Wet	Dry Wet
Gross	26842	22637
Net	<u>1418</u>	<u>1418</u>
Tare	25424	21219

% dry 83.5

Palmerton Muck. Holes could not be sunk so no sample available.

Pipe Sample

	Wet Weight	Dry Wet
Gross	14750	12934
Net	<u>1368</u>	<u>1368</u>
Tare	13382	11566

% dry 86.4

The pipe was 51 inches long at start and 50½ long and end of sampling. In calculating depth of sample taken, 51" was used thru out.

Paper Sample Count'd.

Distance from top of Paper
to top of sample in Paper.
inches

Distance of sample
in Paper.
inches

Distance from Top of Paper
to top of one outside of Paper
inches.

45 $\frac{1}{2}$ "		5 $\frac{1}{2}$ "		14
46"	43"	5"	8"	17
	45		6	16 $\frac{1}{2}$
42		9		18
	45		6	19
45		6		17 $\frac{1}{2}$
	42		9	17 $\frac{1}{2}$
45 $\frac{1}{2}$		5 $\frac{1}{2}$		21 $\frac{1}{2}$
	43 $\frac{1}{2}$		7 $\frac{1}{2}$	22
44		7		33 $\frac{1}{2}$
	45 $\frac{1}{2}$		6 $\frac{1}{2}$	33
47		4		34 $\frac{1}{2}$
	43		8	35 $\frac{1}{2}$
44 $\frac{1}{2}$		6 $\frac{1}{2}$		32 $\frac{1}{2}$
	47 $\frac{1}{2}$		3 $\frac{1}{2}$	37 $\frac{1}{2}$
45		6		24 $\frac{1}{2}$
	46 $\frac{1}{2}$		4 $\frac{1}{2}$	33 $\frac{1}{2}$
46		5		35
	42		9	30
42		9		23
	42		9	20
42 $\frac{1}{2}$		8 $\frac{1}{2}$		17
	39 $\frac{1}{2}$		11 $\frac{1}{2}$	19 $\frac{1}{2}$
40 $\frac{1}{2}$		10 $\frac{1}{2}$		18 $\frac{1}{2}$
	40		11	18
39		12		17 $\frac{1}{2}$
	37		14	17

3/4/38

1C Long Classifier

28 Tooth Manganese Steel Head Sprockets The three manganese steel head sprockets removed Feb 25, 1938 were installed Oct 15, 1936. Life in service 16 mo 10 days. These sprockets cost \$150.00 delivered. Total dry tons handled 385,180. Cost per dry ton \$.00038943

The sprockets reinstalled 2/25/38 cost \$175.07 delivered.

4" Square Head Shaft. The shaft installed 10-15-36 removed 2-25-38 was in service 16 mo 10 days. The shaft cost delivered \$21.50. Total dry tons handled 385,180. Cost per dry ton \$.000055818 The cost of machining this shaft and assembling the sprockets has not been taken into consideration in these figures.

The shaft installed with the sprockets on Feb 25, 1938 cost \$25.09 delivered.

KM,
March 4-1938.

3/7/38

#2 Truss Mill.

The set of 8 Kayton Log Belts removed 2/4/38 were installed 10/9/39. Life 8 years 3 mo 25 days. This set was purchased on order GB 6580 and cost delivered \$128.71.

The set put on 2/4/38 cost \$126.42 delivered. They were purchased on order GB 8368 dated 3/7/36.

Rm.
3/7/38

Belts worked off

6-1-29	8	129.15	GB 5676	
9-20-29	8	129.15	6358	
11-4-29	16	257.43	6580	1 set put on #2 mill.
8-18-30	8	130.10	1317	
8-21-34	8	126.22	5780	*3 mill 7-16-34
11-1-35	8	126.42	7675	*7 mill 11-8-35
3-17-36	8	126.42	8368	*2 mill 2-4-38

3/10/38

Tonnages to Hardinge Mill.

The flow to Hardinge mill was measured and per cent solids determined. From the above, the dry tons per hour was calculated.

Flow measured at 1:30 P.M. 3/10/38

Flow per hour = 109.8 gals at 34.5% Solids = 12.36 Dry Tons per hour.

Tonnage measurements Taken at 3:25 P.M. 3/10/38

Flow per hour = 155.8 gals at 30.0% Solids = 14.68 Dry Tons/Hr.

The rates of the ~~Aspex~~ ~~son~~ classifiers were carrying a heavier load at 3:25 P.M. than at 1:30 P.M.

K.M.

3/10/38.

a jaw crusher, the size being reduced to minus $\frac{1}{8}$ inch. The next step was to thoroughly mix each sample on a rolling cloth, reduce in size ^{by means of a Jones riffle} ~~to~~ about 600 to 800 grams, which was pulverized. Then the samples were again mixed, and again reduced in size by means of a Jones riffle, to about 170 grams in weight. This final sample was passed thru a 100 mesh screen, again thoroughly mixed, and sent to the chemical laboratory for analysis.

The test was run from 9:00 AM to about 10:15 AM on March 9, 1938.

Weightometer Readings

-2" Product	+2" Product	Lead Rock.
1888.3990	3659.5155	3660.4360
<u>1882.3492</u>	<u>3654.4972</u>	<u>3659.5155</u>
6.0498 Wet Tons	5.0183 Wet Tons.	0.9205 Wet Tons.

Samples

	-2" Product		+2" Product		Lead Rock.	
	Wet	Dry	Wet	Dry	Wet	Dry
Gross	1336	13254	9600	9554	5807	5794
Tare	<u>765</u>	<u>765</u>	<u>379</u>	<u>379</u>	<u>379</u>	<u>379</u>
Net.	12571	12489	9221	9175	5428	5415
	0.65% H ₂ O.		0.50% H ₂ O.		0.25% H ₂ O.	

$6.0498 \times .9935 = 6.01$ Dry Tons -2" Product.
 $5.0183 \times .9950 = 4.99$ Dry Tons +2" Product
 $0.9205 \times .9975 = 0.918$ Dry Tons Lead Rock.

	Wt of in Tons. Dry.	% DAkt.	Assay			Tons of Metal.			Per Cent of Total.		
			Zn	Pb	Fe.	Zinc	Lead	Iron	Zinc	Lead	Fe.
Dead Rock	.918	7.70	1.55	.22	.80	.014229	.002019	.007344	2.58	2.50	4.63
-2" Ore	6.01	50.43	4.50	.57	3.56	.270450	.034257	.213956	48.98	42.46	44.69
+2" Ore	4.99	41.87	5.36	.89	5.16	.267464	.044411	.257484	48.44	55.04	53.78
Total.	11.918	100.00	4.63	.68	4.02	.552143	.080687	.478784	100.00	100.00	100.00

Assuming the dead rock discarded, the assay of the feed would be

Tons of -2" and +2"	Assay.		
	Zinc.	Lead.	Iron.
-2"	11.00	4.89	0.72

Assuming dead rock discarded.

% of Feed discarded 7.70 7.70
 % of Total Zinc lost in dead rock 2.58
 % of Total Lead lost in dead rock 2.50
 % of Total Iron lost in dead rock 1.53.
 % Increase of Zinc in Remains of ore 5.62
 " " " " " " 5.88
 " " " " " " 6.72

Respect fully submitted.
 K. Misch

March 11, 1938.

3/14/38

Tailings Samples.

The tailings samples at the new mill have been filtered, and then, while still wet, reduced in size by quartering. One sample of about 2000 grams is dried. From this dried sample, the sample for laboratory analysis and also monthly composite ~~are~~ cut out. Another wet sample is cut out and put ^{on the} under the table for inspection, or for a check assay if desired. The rejects are discarded.

It is difficult to thoroughly mix a wet sample. Also, when emptying the sample from the container onto the filter, segregation of mineral values may take place. It was decided to try ~~the~~ the rejects from a shift sample ~~and~~ cut out an assay sample for checking the shift work.

The sample to be checked was picked at random, which ever one happened to be most convenient. This sample was from the 11-7 shift dated 3-9-37. The shift assay ran .61 zinc and .08 lead. The rejects were dried, then mixed, and an assay sample cut out on the Jones riffle. This sample, marked on ^{the} assay report as Special Tailings Sample, ran .52 zinc and .10 lead. Assuming the dried sample to be correct, the zinc assay ran .09% high or 17.3% ^{error}; the lead assay .02% low or 20% error.

The percentage ~~error~~ seems high ~~but~~ due to the small percent of zinc involved, in the final analysis, the error is not so great. On routine analysis, these results are about as close as the laboratory ~~will~~ assay.

Based on this one sample, if all tailings samples are handled equally carefully, no great error is introduced due to cutting ^{out} tailings samples, ~~but~~, by quartering.

The wet shift sample was sent out by Joe Bradley.

Respectfully submitted.

K. F. Meech

3/14/38

4/1/38

6x12 Manay mill dipper.

A new dipper was installed on 1C mill 7/23/37 with soft steel scroll made of $\frac{1}{2}$ " thick metal. The dipper scroll was patched 10/27/37. Life before patching 3 mo 4 days. Total dry tons crushed 74048.9. The scroll is abt 17ft 1" long and 12 inches wide. Wt per ft 20.40 lbs. Wt of scroll 348.5 lbs. Made of Jumbo steel @ cost of 2.66 per hundred pounds, the scroll would cost \$9.27.

A new dipper was installed on 1W mill 11/23/37 with manganese steel scroll made of $\frac{1}{4}$ " thick metal. The dipper scroll was patched 4/1/38. Life before patching 4 mo 8 days. Total dry tons crushed 107,064. The scroll is about 17ft 1" long and 12 inches wide. Wt per ft 10.2 lbs. Wt of scroll 174.25 lbs. The first lot of rolled manganese steel plate cost 25¢ per pound. The lot received in March 26, 1938 cost 17¢ per pound.

Wt of scroll @ 25¢ per pound \$43.56
Wt of scroll @ 17¢ per pound \$29.62

Km

4/1/38.

4/2/38

Sandal Pine Oil.

Sandal Pine Oil was used for the first 16 days of March and #5 Pine Oil for the last 14 days. The cost per day for #5 Pine Oil was less than for the sandal.

For purposes of comparison, the uses from March 3 to 16 inclusive were used for sandal and the ~~first 14 days~~ of March, from 13 to 31 inclusive were used for #5 Pine. The discrepancy as found when inventories the reagents was added to the daily usage.

	Sandal Pine Oil	#5 Pine Oil.
Price per gallon (Present Price).	49¢	54¢
Wt per gallon at 60°F	7.81 lbs	7.79 lbs.
Cost per pound.	6.274¢	6.932¢.
Pounds Used by daily report ^(for 14 day period)	6377 lbs	5662 lbs
Pounds added from inventory	$\frac{14}{12} \times 441 = 386$ lbs	$\frac{14}{12} \times 142 = 133$ lbs
Total Used.	6763 lbs	5795 lbs
Cost of Oil.	\$ 424.31	\$ 401.71
Total dry Tons Crushed	23112	23377

The price of the two pine oils has been reduced. When the first sandal was purchased, the sandal cost 64¢ ^{8.19+6} per gallon while the #5 pine oil cost 74¢ ^{7.49+3} per gallon. On this basis, sandal would be cheapest to use by 4¢.

Respectfully submitted
R. Mueloh

Sawd Pine Oil.

7 Sawd			#5 Pine Oil		
Date	Pounds Used	Tonnage.	Date	Pounds Used	Tonnage.
3/1/38	487	1824	3-17-38	388	1589
2	480	1876	3-18-38	378	1545
3	559	1817	19	382	1686
4	434	1490	20	345	1361
5	409	1495	21	365	1639
6	425	1507	22	372	1734
7	406	1578	23	432	1592
8	460	1678	24	449	1760
9	450	1620	25	419	1588
10	496	1797	26	415	1745
11	444	1665	27	410	1798
12	455	1772	28	411	1805
13	443	1770	29	398	1770
14	480	1882	30	437	1817
15	452	1732	31	442	1843
16	464	1661			
17	25	1589			
18					

Total Sawd Used 3¹² to 16¹² inches. 6377 lbs. plus $\frac{14}{16} \times 441 = 386$ lbs.

441 lbs short on inventory. Dry Tons milled 23112, at 60°F

One gallon weighs 7.81 lbs Present Price 49¢ per gallon, or 6.27¢/lb.

Total #5 Pine used 18¹² to 31 inches. 5662 lbs plus. 133 lbs.

142 lbs short on inventory. Dry Tons milled 23377, at 60°F,

one gallon 7.79 lbs. Present Price 54¢ per gallon, or 6.93¢/lb.

We received new solutions of Cresol Red and Thymol Blue. In using the old indicator and new indicator of Thymol Blue, the same results were obtained on the same sample of water.

Whenever possible, that is, when the range of the indicators overlaps, in order to check the pH determination, Cresol Red was used. Checks were not obtainable with Cresol Red. When checking against Thymol Blue, range 8.0 to 9.6, the Cresol Red gave readings of about .4 pH higher than found with Thymol Blue.

When checking against Bromthymol Blue, pH Range 6.0 to 7.6, the Cresol Red gave readings .2 pH lower. Cresol Red is used for a range of 7.0 to 8.8.

Two things are possible. First, the Cresol Red may enter into chemical reactions, which would affect the result.

Second, as the standards used for determining the pH value of the sample needs checking. These standards have not been checked since they were purchased. The La Motte people will check standards. It may be possible to arranged for a loan of the set of standards while ours are being checked.

Keep tall
blanks are
filled in
Keep after the
at shop to get
weights so
I will have
them early
in May

IE Gyrasphere Crusher.

4/16/38

Concave Ring: #9 concave ring removed 4/14/38 was installed 9-17-37. Life in service 6 mo 27 days. Total dry tons crushed 170,422. Cost per ton crushed $\$.0009328$. This concave ring was purchased on order GB 1196 dated 3/23/37. This is the first concave ring of the new design, which consists of reinforced lugs and is about $\frac{3}{8}$ " shorter in depth. It cost new $\$158.97$ and weighed new 527 lbs. Weight when removed 316 lbs. Pounds of metal lost. 211. Pounds of metal lost per ton of ore crushed. .0012381. Percent of original weight lost. 40.04% This ring has the record for the number of tons crushed.

The concave ring installed 4/14/38 was #8. This ring had 4 mo 14 days of previous service, crushing 109,506 dry tons. It was purchased on order GB 9704 dated 12/22/36.

Lower Mantle #9 lower mantle was installed 9/17/37 and removed 4/14/38, Life 6 mo 27 days. Dry Tons crushed 170,422. Cost per dry ton crushed $\$.00085376+$. It was purchased on order GB 1196 dated 3/23/37. It cost $\$145.50$. It weighed new 556 pounds. Weight when removed 360 lbs. Pounds of metal lost. 196 lbs. Pounds of metal lost per ton crushed. .00115009. Percent of original weight lost 35.25%.

#10 Lower mouth was installed 4/14/38. It was purchased on order GB 1196 dated 3/23/37 and cost delivered \$145.50 It weighed new 543 pounds.

Buchanan Jaw Crusher.

Safety Toggle. The ^{25" long} safety toggle removed 4/15/38 was installed 9-10-37. Life 7mo 5days. - Total dry tons crushed 352,138. Cost per ton crushed \$.00023002. The toggle was purchased on order GB 9114 dated 8/28/36 and cost delivered \$81.00.

The 25" long safety toggle installed 4/15/38 was purchased on order GB 2162, dated 9/23/37. It cost \$98.00

Solid Toggle. The 36" solid toggle with renewable ends removed 4-15-38 was installed 9-10-37. Life 7mo 5days. Dry tons crushed 352,138. Cost per ton crushed \$.000154428. The ends were purchased on order GB 5605 dated 4/4/34 Estimated cost of toggle ends and their machining \$54.38

The solid toggle installed 4/15/38 had renewable ends. The length was 36½". The toggle had seen previous service of 13mo 3day, crushing 594,222 dry tons. The toggle ends were smoothed and trued up by grinding.

Toggle Bearings. The 4 bearings removed 4/15/38 were installed 9-10-37. The bearings were purchased on order GB 9114 dated 8/28/36 and cost delivered \$152.00. Tons crushed 352,138. Cost per ton crushed \$.000 43165

The toggle bearings installed 4/15/38 were purchased on order GB 2162 dated 9/23/37 They cost new \$188.00.

#2 Marcy Mill.

Shell Liners. The shell liners removed 4-15-38 were installed 7-2-34. Life 45 mo / 13 days. There were 30 wave liners purchased on order GB 5661 dated 4/10/34. They cost \$1176.36 delivered. Invoice weight was 11870 pounds. Austinville weights 11958 lbs. Weight when removed 3462 pounds. Pounds of metal lost 8408 pounds or 70.83% of original weight. Slightly tons crushed 832796 or 416,898 Cost per ton crushed \$.00 28217. Metal lost per ton crushed .020168+ lbs. Tonnage ground by the 6x12 Marcy Mill not deducted from the above total.

11870
3462
8408
11958
3462
8496

lots so removed

120	208
230	113
145	137
118	145
145	222
240	217
208	122
155	188
203	216
163	197
3462	

lots new liners

557	604
545	618
562	600
558	615
558	594
628	547
608	550
594	545
614	543
610	555
11605	

The shell liners installed 4/15/38 were 30 wave liners. These liners extended to within $\frac{3}{4}$ " of the end shell. The head liners of both were fit over the top of the shell liners. They were purchased on order GB 2314 dated 10/23/37. They cost delivered \$1312.00. The mirrored weight was 11725 lbs. Austinville weights were 11,605 lbs.

Rubber Backing. New rubber backing, purchased on order GB 2471 dated 11/27/37 was installed 4/15/38. The backing was purchased from the Manhattan Rubber Co and cost delivered \$130.84.

Feed End Head Liners. The liners removed 4/15/38 were installed as part of the original equipment 10/20/27. Life in service 125 mo. 25 days. Total dry tons crushed 991239. Estimated cost of the liners \$ 137.45. Estimated weight of the liners, new 1470. Weight of the removed liners. 589 pounds. (^{155 132}/_{169 133}). Cost per ton crushed \$.00013866 + weight of metal lost 881 pounds or 59.93 % of original weight. Pounds of metal lost per ton of ore crushed. .0008888 -

and furnished on order GB 10643 dated 2/2/36

The head liners installed 4/15/38, were purchased on order GB 1723, July 1937. They cost new, delivered, \$139.14. The invoiced weight was 1210 lbs. Rustonville weights was 1154 lbs. (^{272 - 270}/_{307 - 305}) Old belting was split and used for backing for these liners. These liners fitted over the end of the shell liners. In the other mills, the shell liners butt against the face of the end head liners.

Discharge End Head Liners. The liners removed 4/15/38 were installed 3/2/37. Life 13 mo 13 days. Dry Tons crushed 166090. The liners were purchased on order GB 9703 dated 12/22/36. They cost delivered \$136.46 per set. Invoiced weight 1283 lbs. Weight when removed was

1162 pounds $\left(\begin{smallmatrix} 201 & 277 \\ 281 & 303 \end{smallmatrix} \right)$. Weight lost 121 pounds. Percent of original weight lost 9.43+ Pounds of metal lost per ton of ore crushed .00072852. Lost per ton of ore crushed \$.0008216

The discharge end liners, installed 4-15-38, were purchased on order GB 2314, dated 10-23-37. They cost delivered \$133.05 The nominal weight was 1090 lbs. Austinville weights was 1073. $\left(\begin{smallmatrix} 252 & 254 \\ 282 & 285 \end{smallmatrix} \right)$ These head liners fitted over the ends of the shell liners were formerly, the shell liners butted against the head liners. Old belting, split, was used as backing for the liners.

A complete set of bolts was installed for holding the liners of No 2 Nancy mill.

East Drag Classifier.

124 Chain. The chain installed 7-8-37 was removed 4-15-38. Life 9mo. 7 days. Dry Tons conveyed 224,425. The cost of the chain was \$494.86 lost per dry ton conveyed \$.002205.

The 124 manganese detachable link chain installed 4/15/38 was made up as follows:-

3 pair of couplers.	@ \$ 1.61 each.	4.83
435 attachment links	@ \$ 0.80 each	348.00
438 plain links	@ 0.35 each.	<u>153.30</u>
Total cost of new chain.		506.13

The old flights were replaced. Total flights used 145.

11K Gyrophone Crusher Conveyor Belt.

The belt removed 4/10/38 was installed 11-2-36. Life 17 mo 13 days. Total dry tons conveyed 419,854. This belt was part of the 18" wide, 4 ply conveyor belt from the rock conveyor, the other part was from a dismantled portable conveyor, used in the new mill for conveying ore.

The belt installed 4/15/38 was manufactured by the U.S. Rubber Co. It is their Amazon Brand. The belt is 18" wide, 4 ply, 32 g. duck, $\frac{1}{16}$ " Top cover, $\frac{1}{32}$ " Bottom cover P 3041. The belt was furnished on order G.B. 1816 dated July 19, 1937. It cost delivered \$1.5974 per lineal foot. The length of the belt as installed was 54'-0" long. It cost \$86.26.

IE Gyrosphere Crusher.

4/16/38

Concave Ring: #9 concave ring removed 4/14/38 was installed 9-17-37. Life in service 6 mo 27 days. Total dry tons crushed 170,422. Cost per ton crushed \$ 0.009328. This concave ring was purchased on order GB 1196 dated 3/23/37. This is the first concave ring of the new design which consists of reinforced lugs and is about $\frac{3}{8}$ " shorter in depth. It cost new \$158.97 and weighed new 527 lbs. Weight when removed _____ Pounds of metal lost. _____ Pounds of metal lost per ton of ore crushed. _____ Percent of original weight lost. _____ This ring has ^{the} record for the number of tons crushed.

The concave ring installed 4/14/38 was #8. This ring had 4 mo 14 days of previous service, crushing 109,506 dry tons. It was purchased on order GB 9704 dated 12/22/36.

Lower Mantle: #9 lower mantle was installed 9/17/37 and removed 4/14/38, life 6 mo 27 days. Dry Tons crushed 170,422. Cost per dry ton crushed \$ 0.0085376+. It was purchased on order GB 1196 dated 3/23/37. It cost \$145.50. It weighed new 556 pounds. Weight when removed _____ Pounds of metal lost. _____ Pounds of metal lost per ton crushed. _____ Percent of original weight lost _____.

#10 Lower mouth was installed 4/14/38. It was purchased on order GB 1196 dated 3/23/37 and cost delivered \$145.50 It weighed new 543 pounds.

Buchanan Jaw Crusher.

Safety Toggle. The ^{25" long} safety toggle removed 4/15/38 was installed 9-10-37. Life 7mo 5days. - Total dry tons crushed 352,138. Cost per ton crushed \$0.0023002. This toggle was purchased on order GB 9114 dated 8/28/36 and cost delivered \$81.00.

The 25" long safety toggle installed 4/15/38 was purchased on order GB 2162, dated 9/23/37. It cost \$98.00

Solid Toggle. The 36" solid toggle with renewable ends removed 4-15-38 was installed 9-10-37. Life 7mo 5days. Dry tons crushed 352,138. Cost per ton crushed \$0.00154428. The ends were purchased on order GB 5605 dated 4/4/34 Estimated cost of toggle ends and their machining \$524.38

The solid toggle installed 4/15/38 had renewable ends. The length was 36½". The toggle had seen previous service of 13mo 3day, crushing 594,222 dry tons. The toggle ends were smoothed and trued up by grinding.

Toggle Bearings. The 4 bearings removed 4/11/38 were installed 9-10-37. The bearings were purchased on order GB 9114 dated 8/28/36 and cost delivered \$152.00. Tons crushed 352,138. Cost per ton crushed 9.000 43165

The toggle bearings installed 4/11/38 were purchased on order GB 2162 dated 9/23/37. They cost new \$188.00.

#2 Marcy Mills.

Shell Liners. The shell liners removed 4-15-38 were installed 7-2-34. Life 45 mo 13 days. There were 30 wave liners purchased on order GB 5661 dated 4/10/34. They cost \$1176.36 delivered. Invoice weight was 11870 pounds. Austinville weights 11958 lbs. Weight when removed 3462 pounds. Pounds of metal lost 8408 pounds or 70.83% of original weight. Dry tons crushed 833796 or 416,898. Cost per ton crushed 9.00 28217. Metal lost per ton crushed .029168+ lbs. Tonnage ground by the 6x12 Marcy mill not ~~deducted~~ from the above total.

The shell liners installed 4/11/38 were 30 wave liners. These liners extended to within $\frac{3}{4}$ " of the end shell. The lead liners of both ends fit over the top of the shell liners. They were purchased on order GB 2314 dated 10/23/37. They cost delivered \$1312.00. The invoice weight was 11725 lbs. Austinville weights were 11,605 lbs.

lbs to be removed	
130	208
230	113
142	137
118	145
145	222
340	217
208	122
155	138
203	216
163	197
<hr/>	
3462	

lbs to be removed	
557	604
545	618
562	600
558	615
558	594
<hr/>	
628	547
608	550
594	545
614	543
610	555
<hr/>	
11605	

Rubber Backing. New rubber backing, purchased on order GB 2471 dated 11/27/37 was installed 4/15/38. The backing was purchased from the Manhattan Rubber Co and cost delivered \$130.34.

End Head Liners. The liners removed 4/15/38 were installed as part of the original equipment 10/20/27. Life in service 125 mo. 25 days. Total dry tons crushed 991239. Estimated cost of the liners \$ 137.45. Estimated weight of the liners, ⁸ 1470. Weight of the removed liners, 589 pounds. (^{155 132}/_{169 133}). Cost per ton crushed \$.00013866 Weight of metal lost 881 pounds or 59.93 % of original weight. Pounds of metal lost per ton of ore crushed. .0008888

and furnished on order GB 10643 dated 3/24/36.

The head liners installed 4/15/38, were purchased on order GB 1723, July 1937. They cost new, delivered, \$139.14 The original weight was 1210 lbs. Current weight was 1154 lbs. (^{272 - 270}/_{307 - 305}) Old belting was split and used for backing for these liners. These liners fitted over the end of the shell liners. In the other mills, the shell liners butt against the face of the end head liners.

Exchange End Head Liners. The liners removed 4/15/38 were installed 3/2/37. Life 13 mo 13 days. Dry Tons crushed 166090. The liners were purchased on order GB 9703 dated 12/22/36. They cost delivered \$136.46 per set. Original weight 1283 lbs. Weight when removed was

1162 pounds $\left(\begin{smallmatrix} 201 & 277 \\ 281 & 303 \end{smallmatrix} \right)$. Weight lost 121 pounds. Percent of original weight lost 9.43+ Pounds of metal lost per ton of ore crushed .00072852. Lost per ton of ore crushed \$.0008216

The discharge end liners, installed 4-15-38, were purchased on order GB 2314, dated 10-23-37. They cost delivered \$133.05. The invoice weight was 1090 lbs. Austinville weights ~~was~~ 1073. $\left(\begin{smallmatrix} 252 & 254 \\ 282 & 285 \end{smallmatrix} \right)$ These head liners fitted over the ends of the shell liners were formerly, the shell liners butted against the head liners. Old belting, split, was used as backing for the liners.

A complete set of bolts were installed for holding the liners of No 2 Tracy mill.

East Drag Classifier.

124 Chain. The chain installed 7-8-37 was removed 4-15-38. Life 9mo, 7 days. Dry Tons conveyed 224,425. The cost of the chain was \$494.86. Cost per dry ton conveyed \$.0022050

The 124 manganese detachable link chain installed 4/15/38 was made up as follows:-

3 pair of rollers.	@ \$ 1.61 each.	4.83
435 attachment links.	@ \$ 0.80 each	348.00
438 plain links.	@ 0.35 each.	<u>153.30</u>
Total cost of new chain.		506.13

The old flights were replaced. Total flights used 145.

11st Synophus Crusher Conveyor Belt.

The belt removed 4/15/38 was installed 11-2-36.
 Life 17 mo 13 days. Total dry tons conveyed 419,854. This belt was part of the 18" width, 4 ply conveyor belt from the rock conveyor and part was from a dismantled portable conveyor, used in the new mill for conveying ore.

The belt installed 4/15/38 was manufactured by the U.S. Rubber Co. It is their Amazon Brand. The belt is 18" wide, 4 ply, 32 g. duck, $\frac{1}{16}$ " Top cover, $\frac{1}{32}$ " Bottom cover P 3041. The belt was furnished on order G.B. 1316 dated July 19, 1937. It cost delivered \$1.5974 per lineal foot. The length of the belt as installed was 54'-0" long. ~~cost~~ cost \$ 86.26.

124 Manganese Steel Chain Links.

4/22/38

The 124 chain links were re-ordered 4/21/38

<u>Attachment Links</u>	464	Mfg by Taylor Wharton.
	55	A.M. Co
	15	Taylor Wharton.?
	<u>534</u>	Total on hand.

The supply records call for 538

<u>Plain Links.</u>	363	Mfg by Taylor Wharton
	96	Mfg by A.M. Co.
	<u>459</u>	

The supply records call for 476

There are 4 pair of complers on hand Mfg by Taylor Wharton.
The supply records call for 3.

A chain of chains for the drag under present spacing of flight (and 146 flights) requires 438 attachment links, 438 plain links, and 3 pair of complers. To make up these chains using links all of the same manufacturer, require a few more plain links made by Taylor Wharton.

R.M.

4/22/38.



4/25/38

Boring Bar - from Palmetum.


Box No 1.


- One driving Pinion assembly. (1 Pinion, 1 shaft, 2 Bearings).
- One Train of Gears in Frame. (3 Gears, 1 Frame, 1 Guard over small pinion).
- One driving Chuck with one safety set screw. Provision for two set screws.

Round Bore.

- One chuck, square bore with set screws.
- One guard for driving pinion.
- One $1\frac{1}{2}$ " square Ice Socket Wrench.
- One $\frac{7}{8} \times 3$ Machine Bolt with 2 washers and one nut.
- One Ice Bar. $31\frac{1}{2}$ " long
- One 6" Tool Holder with 2 Cap screws.
- One 7" Tool Holder with 2 Cap screws and one adjusting screw.
- One $6\frac{1}{2}$ " Tool Holder, set screw over key and one tool set screw.
- One Collar for chain pinion shaft.
- Four pieces marked 2297. End spacers.
- One bearing. 
- One Gear. $\frac{3}{4}$ Face $1\frac{1}{8}$ Bore 26 Teeth. $5\frac{3}{4}$ O to O dia.
- One Piece $6\frac{3}{8}$ " long. $1\frac{1}{2}$ " wide 1" high. 
- One Piece. Feed Nut $4\frac{7}{8}$ " long $1\frac{1}{2}$ " wide $1\frac{1}{4}$ " high.

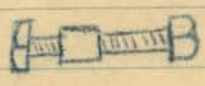
Box No 2

- Four Wedges. $\frac{1}{8} \times \frac{3}{4} \times \frac{1}{8}$ 
- Four Wedges. $\frac{5}{16} \times \frac{15}{16}$
- Four Wedges. $\frac{1}{2} \times 1\frac{1}{8}$
- Four Wedges. $\frac{3}{4} \times 1\frac{5}{16}$
- Four Wedges. $1' \times 1\frac{1}{2}$
- Four Wedges. $1\frac{1}{2} \times 1\frac{13}{16}$

- 20 Cutting Tools - Straights. Received 19 shipping 20.
 7 Cutting Tools, Ends bent.
 1 Cutting Tool, Round
 One Feed screw drive mechanism. (4 Gears. Crank wheel with handle)
 One End Bearing. 

- Seven Keys $\frac{7}{8} \times \frac{7}{8} \times 2"$
 Four Keys $\frac{7}{8} \times \frac{7}{8} \times 2"$
 One Key $\frac{3}{4} \times \frac{7}{8} \times 3\frac{1}{2}"$
 One Piece of Steel $\frac{1}{16} \times \frac{13}{16} \times 7\frac{1}{2}"$.

- One Tool Holder. - $8\frac{3}{8}$ OS dia. with one screw to hold tool.
 One Wedge Holder with washer and nut.
 One Puller $11\frac{1}{4}"$ long. $8\frac{1}{2}"$ SAE Threads. Shaft with nut, nut $4\frac{1}{2} \times 3\frac{1}{4}"$. Two $\frac{1}{16}"$ holes in nut. $7\frac{1}{16}"$ hole in the shaft.
 Two Poring Bar Holders with spacers in the center. seven adjusting screws with lock nuts. - One screw without nut.

- One End Wrench - W $\frac{1}{2}$ S.
 One End Wrench $\frac{7}{8}$ and $\frac{1}{2}$ inch.
 One Star Feed.
 Two $\frac{3}{4} \times 2$ Cap screws.
 Four $\frac{1}{2} \times 2\frac{1}{2}"$ " "
 Three $\frac{1}{2} \times 2\frac{1}{4}"$ " "
 Two $\frac{7}{8} \times 1\frac{1}{2}"$ " "
 One $\frac{1}{2} \times 1\frac{1}{2}$ Cap screw.
 One set screw $\frac{3}{4} \times 4$
 One set screw $\frac{1}{2} \times 2$.
 Four studs. - nuts on each end. $7\frac{1}{2} \times 5"$ 

Box 2. Cont'd.

Four studs $\frac{3}{8}$ " x $3\frac{3}{4}$ " }
One stud $\frac{3}{8}$ " x 5 } (MHW APPROX)
One stud $\frac{3}{4}$ " x $4\frac{1}{2}$ " }

One Track Bolt with Thin Flat Head. $\frac{3}{8}$ " x $3\frac{1}{2}$ ", with nut.

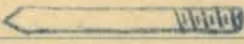
Nine 1" Plate Washers.

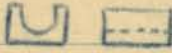
Three $\frac{3}{8}$ " Plate Washers. Received 2 shipping 3.

One $\frac{3}{8}$ " Plate Washer with side cut off. Received 2 shipping one.

Two $\frac{3}{8}$ " Hex Nuts U.S. Thread.

One Brass Bearing for end of feed screw. $1\frac{1}{8}$ " long $\frac{3}{4}$ " bore.

One Bolt End. $8\frac{1}{2}$ " long $\frac{3}{8}$ " dia. 

One Piece $1\frac{1}{2}$ " long $1\frac{1}{2}$ " wide. $\frac{3}{8}$ " high 

Box #3

One Boring Bar with 23" Extension.

One Feed Screw for Short Boring Bar.

Km.

4/20/38.

5/2/38

Production of Zinc Concentrate for April.

The production of zinc concentrate for April, as shipped, was in excess of the production found by calculation.

There are several places in which an error may occur to cause the discrepancy in the tonnage reports. An error introduced in weighing the ore will show off the results. If the conveyor belt is running too slow, the beam will hit the top stop when the belt is overloaded. The excess ore on the belt will not be weighed. This condition was observed to take place at times. It was corrected on April 8, 1938 by speeding up the belts. Since that time, the beam has not been observed to hit the top stop.

The tonnage (dry) of zinc concentrate produced in April, from the weighs figures, was 3539.09 tons. The tonnage as found by calculation, from the mill report, was 3,376.54 dry tons. The tonnage as found by calculation, ~~using~~ using mill report values in the Bismetallie formula, was 3391.05 dry tons. The tonnage as found by calculation, using zinc concentrate assay of the shipments and all other values same as the mill report, was 3,438.73 dry tons.

Tabulation

① April Weighs.	3539.09 tons	
② April Mill Report	3376.54 tons	+162.55
③ Bismetallie Formula - All Mill Report Values.	3391.05 tons	+148.04
④ Bismetallie Formula: Zinc Value of Shipments - Other from Mill Report.	3438.73 tons	+100.36

For purposes of comparison, the writer will use #4 smelt to be more correct of the calculations.

The total dry tons to the mill, ^{for April} was 47,200. To produce, the total tons of concentrates as found by the shipments, 48,578 tons of feed would be required as per #4 calculation. The scales would have to show an error of 2.84% minus. The weightometers were checked in May. The error was on the plus side, the most 1.2% plus, the rest .6% plus. Therefore, the error should have been $(\frac{1.2 + .6}{2}) = .95 + 2.84$ or 3.79% minus.

A one per cent error of the weightometer for an entire month amounts to 500 tons when milling 50,000 tons per month. 500 tons of ore would produce 36.4% of zinc concentrates as per #4 calculation, and a feed of 4.73% zinc.

The feed to the mill is assumed to have 1 1/2% moisture. The figure of 1% for moisture is more correct. The difference in the strength of ore, when using the lower moisture figure, amounts to 18.2 tons of dry units.

The zinc content of shipments varies from the mill report figure. For January, the zinc content was higher by about .6%. For February, the two figures checked. For March and April, the value of the shipments was about .7% lower than the mill report assay value. This difference in zinc value, used in the same formula, accounts for a difference of 47,68 tons of zinc concentrates (see #4 calculations).

The assays on the shipments have checked very close, on our samples and the samples taken by the smelter, when

zinc concentrates were deposited ^{of} outside of the company.

The assay value for the zinc concentrates, ^{as shown on the mill report} is an average of the values of the various shifts. The tonnage of zinc concentrates produced by each shift is not taken into account.

Another factor that will influence the assay value of the concentrates, is, that they are cut down wet on the filter table. Samples cannot be thoroughly mixed when wet.

From the above, it would seem that the car samples give the more correct assay value of the concentrates shipped.

The April production was shipped in 73.5 carloads, or 48.15 dry tons per car, average weights. The wet tons, by wheelbarrow weights was 4232.25 equal to an average of 57.43 wet tons per car. The average moisture was calculated to be 16.38% H_2O . Based on the tonnage by #4 calculation, the average dry weight per car would be 46.79 dry tons per car. The average moisture per car would then be 18.60%. To take our calculated production figure as correct would indicate an error in car sampling of 2.2% H_2O on the dry side.

The only figures we have for comparison of weights on our shipments are the five cars which Palmetton samples each month. For April, the difference between our dry weights and those found at Palmetton was 390 lbs. This would tend to show the sampling was not so poor as

indicated by the preceding paragraph.

A slight error in the feed to mill assay would greatly affect the results. The zinc in the feed for April was 4.73%. Assuming an error of 1% low, giving a zinc value of 4.78% and substituting this value in the formula, the total zinc concentrates produced by calculation would be 3478.77 dry tons. In other words, a 1% error in the feed to the mill zinc content was equivalent to 40.04 tons of concentrates, as compared to the result of the calculation.

An error in the tailings of 5%, in the minus direction, changing the zinc content of the tailings from .42 to .40 for April will give a calculated tonnage of 3453.22 of zinc concentrates. The formula was used with the mill report values, except that for zinc in the zinc concentrates and the tailing figures as ^(.42) and ^(.40) respectively. This small change in zinc content of the tails gave an increase in the tons produced, by calculation, of 14.59 tons as compared to the result of the calculation.

In assuming the above errors, the results, if obtained in the laboratory, would be classified as checks on the sample question. By results, it is meant, two different assays on the same sample giving 4.73 and 4.78% zinc and .42 and .40% zinc.

The daily average of the tailings is determined by adding to each the assay result for the shift and then dividing by the number of shifts. The tonnage treated is not taken into

consideration. If the tonnage per shift is the same or if the assay of the tails for each shift is the same, no error is introduced.

~~That~~ the Feed to Mill Sample and Tailings Sample are all dried. The only improvement, that can be suggested, would be to mix the entire sample in one container. The container would be made from two truncated cones, with veins on the inside. The veins would be so arranged so as to throw the ore to the center of the cone would be slowly revolved for a few minutes and thus insure thorough mixing of the ore. ~~That~~ the lumps must be broken up before the sample is put into the container.

The tabulation of the liquid production cleanup by pulps is attached. There does not seem to have ~~been~~ much of an error introduced when the weightometer belt was running slow. Some error was undoubtedly introduced but how much is difficult to judge.

In conclusion, it seems apparent that the greatest source of error lies in the mill sampling and assaying of mill samples. The next ~~greatest~~ source is in the weightometer. Frequent checking can keep this source of error to a minimum. In regard to car sampling and the wheelbarrow weights, there is not enough information available to check our results to determine the possible error at this point.

Respectfully submitted,
K. Mesloh

1/1. Gyro sphere Crusher.

5/20/38

Concave Rings. - #10 Concave Ring removed 5/2/38 was installed 1/4/38. Life 3mo 29 days. Tons crushed 98,309 cost per ton crushed, \$.00161674. This concave ring was purchased on order GB 1552 dated 5/25/37. It cost delivered \$158.94. It weighed new 566 lbs. The concave ring is not worn out and will be put in service again as the concave is of new design, having reinforced lips and being shorter in depth. The belts and zinc backing were in good condition, so the ring was not removed from the frame.

The #4 concave ring was installed 5/2/38. This is one of the old style concave rings. Before being reinstalled to the bowl, 3" of the lip was trimmed off, all making the new depth 10 3/8". The concave had seen previous service of 3mo 27 days crushing 80,911 dry tons.

Lower Muntles. #8 Lower Muntle removed 5/2/38 was installed 1-4-38. Life 3mo 29 days. Dry tons crushed 98,309. The muntle had seen previous service of 4mo 27 days crushing 114,532 dry tons. Total life of muntle 8mo 26 days. Total dry tons crushed 212,841. The muntle was purchased on order GB 9538 dated 11/27/36. It cost new \$122.50. It weighed new 544 lbs. Cost per

dry ~~metal~~ crushed. $\$.000575547$. Weight when
removed. 280 lbs.^{T-31} Pounds of metal lost 264.
Percent of original metal lost 48.53%. Pounds
of metal lost per ton crushed. 00124036.

The zinc backing of ~~the~~ ^{the} lower mantle had worked
out. The lower mantle was held in place by the upper
mantle.

N^o 11 Lower Mantle was installed 5/3/38.
It was purchased on order GB 2171 dated 9/27/37. It
cost new \$158.00. Its weight new was 547 pounds.

Km
5/20/38.

1E Weightometer.

The test weightometer was checked on ~~the~~ ^{May} 21, 1938. After checking, a small quantity of ore was run over the belt. The ore was caught in ~~two~~ barrels and then weighed.

The registered weight by the weightometer was .6450 tons or 1290 lbs. The material as caught in the barrels, weighed 1272.425 lbs. The per cent error registered 1.37% high for the weightometer.

The test weightometer belt does not run in the center of the rollers when empty. It does when it is loaded. The weightometer belt gradually works to the center of the rollers when a load is carried. ~~It is made~~ ^{It is made} to read correctly when the belt is in its normal running position with a load. During the above test, the duration of running time was so short that the belt never reached its proper position. This fact will account for the error as noted above.

Respectfully submitted

R. Nesbitt.

5/23/38.

May 21-1938

Hardinge Mill Discharge.

The discharge of the Hardinge Mill was measured
May 21, 1938 at 1:30 P.M. and 1:50 P.M.

At 1:30 P.M.

Flow 142.4 Gals per min.
43.45 % Solids.
21.9 tons per hour (dry)

At 1:50 P.M.

Flow 137.3 Gals per min.
47.4 % Solids.
23.7 tons per hour (dry)

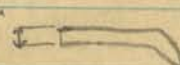

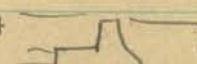
Respectfully submitted

K. Mueloh.

5/23/38.

Jelmintha Crusher Parts.

6 / 38

- ✓ 1 Set of Concaves.
- ✓ 1 Lower Head Plate. $\frac{1}{4}$ "  #6D3
- ✓ 1 Cast Iron Wearing Ring Part 3D7 thickness .753"
- ✓ 2 Brass Seal Rings $\frac{.450$ "
- ✓ 1 Upper Head Plate $\frac{.500$ "  $\frac{1.000$ " 6D6
- ✓ 1 Bronze Wearing Ring thickness .375' 3D9
- ✓ 2 Bevel Drive Gears for Oil Pump
- ✓ 1 Bevel Driven Gear for Oil Pump.
- ✓ 1 Upper Taper Bushing
- ✓ 1 Main Bevel Driven Gear. # 4D2
- ✓ 8 Precs Countershaft Babbit Bushing.
- ✓ 2 Oil sleeves. In the shop not machined.
- ✓ 6 Springs for Oil sleeves.
- ✓ 1 Mantle
- ✓ 1 Bevel drive Pinion One short.
- ✓ 2 Head Supports #6D5. $\frac{23}{4}$  $\frac{4}{4}$
- ✓ 4 Cut Pump Gears 8D2

Do head supporting ring? We took one out on Sunday. Belen we should order another. Give me a list of thicknesses ^{year} of wearing plates as given above with the part numbers. I think a blueprint giving part numbers (tracings) with thicknesses added in red pencil to be prepared and being in shop will be best.

6/25/38

Ironsmith Crusher Service.

The west Ironsmith Crusher is driven by a 1750 R.P.M. motor with a $7\frac{1}{4}$ " motor pulley to a 30" pulley on the countershaft. The countershaft operates at a speed of 423 R.P.M. The length of the endless belt on the west side is 35'-9" long.

The east Ironsmith Crusher is driven by a 1160 R.P.M. motor with a 16" motor pulley to a 42" pulley on the countershaft. The countershaft operates at a speed of 442 R.P.M. The present endless belt is 38'-2" long.

In changing the ^{east} motor to one with ^{a speed of} 1750 R.P.M., and keeping the same pulley on the countershaft, it would require a 10.6" dia motor pulley to maintain 442 R.P.M. of the countershaft. A 10" dia pulley gives a countershaft speed of 416.7 R.P.M. A 11" dia pulley gives a countershaft speed of 458.3 R.P.M.

Using a 10" pulley and 42" pulley with motor in present position, the belt length is 37'-3". There is not enough take up for using a 38'-2" belt so if desired to use this combination of pulleys, the motor would have to be mounted on a wooden foundation.

Using $11\frac{1}{2}$ " motor pulley, 48" driver pulley, 1750 R.P.M. motor, countershaft speed 479 R.P.M.; Belt length 38'- $3\frac{1}{2}$ "; the present foundation could be used. Pin speed of pulley 526.3 ft per min. This is above the recommended spin speed of a cast iron pulley. There is a 48" split cast iron pulley with 8" face in back of carpenter shop on the hill.

KM/6/25/38

1E Log Classifier

6/20/48.

Tail Sprockets The set of 3 sprockets removed 6/10/38 were installed 12/1/37. They were second hand sprockets when installed, previous life unknown. Total in service 6 mos 9 days. Tons conveyed 158,662.

The new sprockets installed 6/10/38 were purchased on order GB 9697 dated 12/2/36. The three sprockets cost a total of \$185.51 delivered.

K. M.

6/25/38

Telsmith Crusher Service.

The west Telsmith crusher is driven by a 1750 R.P.M. motor with a $7\frac{1}{2}$ " motor pulley to a 30" pulley on the countershaft. The countershaft operates at a speed of 423 R.P.M. The length of the endless belt on the west side is 35'-9" long.

The east Telsmith Crusher is driven by a 1160 R.P.M. motor with a 16" motor pulley to a 42" pulley on the countershaft. The countershaft operates at a speed of 442 R.P.M. The present endless belt is 38'-2" long.

In changing the ^{east} motor to one with ^{a speed of} 1750 R.P.M., and keeping the same pulley on the countershaft, it would require a 10.6" dia motor pulley to maintain 442 R.P.M. of the countershaft. A 10" dia pulley gives a countershaft speed of 416.7 R.P.M. A 11" dia pulley gives a countershaft speed of 458.3 R.P.M.

Using a 10" pulley and 42" pulley with motor in present position, the belt length is 37'-3". There is not enough take up for using a 38'-2" belt so if desired to use this combination of pulleys, the motor would have to be mounted on a wooden foundation.

Using $11\frac{1}{2}$ " motor pulley, 48" driven pulley, 1750 R.P.M. motor, countershaft speed 419 R.P.M.; Belt length 38'-3", the present foundation could be used. Rim speed of pulley 526.3 ft per min. This is above the recommended rim speed of a cast iron pulley. There is a 48" split cast iron pulley with 8" face in field back of carpenter shop on the hill.

KM/6/25/38

6/10/38

Mechanite Impeller.

The mechanite impeller installed in the 4" Wilfley tailing pump on the west side 3-5-38 was removed 6-8-38. This impeller was in actual service for 2mo 28 days 6 hrs and 45 min. The impeller weighed 42675 grams or 94.08 lbs when removed. A new mechanite impeller in the shed was weighed. It weighed 66300 grams or 146.16 lbs.

Its weight was 23625 grams or 52.08 pounds.

K.M.

6/10/38.

Tests in Drinking Water System in the Bottoms

1/12/38.

Two valves were installed in the drinking ^{water} line. One valve was put in ^{the} line leading to the supply house, while the other valve was put into the main line, leading to the houses on the upper bottom. While the valves were being installed, the water was cut off by a valve, in the line near the pumping plants. The line to Migger town was cut off. The meter was read at the start and finish of the period, while the water was shut off.

In 87 minutes, 470 gallons were consumed, which is at the rate of 5.4 gallons per minute. The meter was also read at two five minute periods. The rate of consumption was 4 gallons per minute for these two periods.

The water was turned on all over the bottoms, except to Migger town, at 12:00 P.M. The meter was again read at 1 P.M. In 57 minutes, 400 gallons were used, which is at the rate of 7 gallons per minute.

At 1 P.M., the water was shut off by the valves at the store and the line to Migger town. These houses were furnished with water for $\frac{1}{2}$ hour. The usage was 144 gallons in 30 minutes, approximately .47 gallons per minute. The meter registered intermittently.

Between 1:30 P.M. and 2 P.M., water was available from the store to the hydrant between wells and Shackles houses. The line to Migger town and the upper bottom were cut off.

6/14/38

Elevations on Tailing Pile East of Mill.

The elevation of the top of the 6" dia pipe discharging tailings at the lower pit, was assumed to be 100.00. This makes the elevation of the bottom of the pipe 99.45'. The elevation of the land, 950 feet east of the pipe and on line with it, was 65.26 ft. The difference in elevation is 34.19 feet which is equivalent to a slope of $(.03597 \text{ ft})$ ~~per foot~~ $\frac{7}{16}$ per foot.

If a pump is placed upon the ground ^(with) about 4 feet head, the difference in elevation becomes 30.19 feet which gives a slope of $(.03178 \text{ ft})$ ~~per foot~~ $\frac{3}{8}$ per foot.

K M

6/14/38.

6/18/38

Lining Hardinge Mill

	4/6/938	12/6/28
Hoisting Mill	\$ 4.98	3.40
Cutting out Lining	10.32	11.15
Handling Pebbles	7.28	
Lining Mill	21.64	21.15
Sprinkling	7.36	
Luminate Cement 38 bags @ 2.40	91.20	³⁶⁰ 2.5 ² 90.72
Pebbles 5625 ^m = 2.8125 Tons @ \$33.00 per ton	92.81	^{536⁵²} 1.44 77.26
Truck 2 Hours.	2.00	7.05
	<u>237.59</u>	<u>210.73</u>

Km / 6/18/38

Telsmith Crusher

7/15/38

Telsmith Crusher Concaves. The Telsmith crusher concaves removed from the 16 crusher 7-15-38 were installed 8-30-37. Life 10 months 15 days. Total tons crushed 262,384. These concaves had seen previous service. ~~The previous set of concaves.~~ The set was made up from the best of the previous three discarded sets. Cost per ton crushed cannot be calculated.

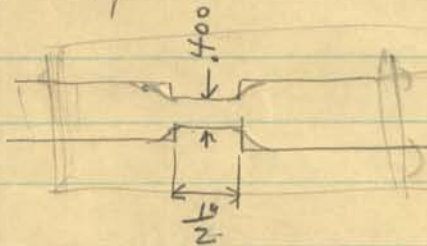
The set of 12 concaves installed in the spare head were purchased on order GB 2161 dated 9/23/37. They cost ~~at a cost of~~ \$167⁴⁶. Estimated weight, ~~was~~ 900 pounds. was used concaves.

K. Mueloh

Test Made on Steels. about 8/10/28

Test specimens were made of soft steel, chrome vanadium as received, chrome vanadium annealed, and chrome vanadium tempered by W.B. Fulford.

The specimens were machined as small



soft steel	10 tons
annealed	10 tons
as shipped	12 "
tempered	18 "

So arranged in press as to obtain pull.

$.12 \overline{) 25600000}$. 125664 of in.

20 000	159,154
24 000	190 985
26 000	286 478

Hardinge Mill Discharge

Aug 15-1938

The discharge of the Hardinge mill was measured at 1:30 P.M. and 1:45 P.M. The radiograph showed 43 tons on the west and 42 tons on the east.

At 1:30 P.M.

Flow measured 152.62 Gals/min
 43.15% Solids
 23.28 Tons/Hour.

At 1:45 P.M.

Flow measured 155 Gals/min
 46% Solids
 25.91 dry Tons/Hour.

The flow was not constant. It would pump a large quantity at a time over a period of about .15 minutes and then the flow would be reduced for a period of about the same time.

Measuring these flows by periods and averaging them.

72.8 Gals/min	x 32.3 % Solids	=	2350.8
206.0 Gals/min	x 44.0 % Solids	=	9064.9
<u>278.8 Gals</u>			<u>11415.7</u>

Average 139.4 Gals/min @ 40.94% Solids = 11415.7

On the basis of the above flow, dry tons of feed to the Hardinge mill per hour = 19.8 dry tons.

The rakes and the dredges down classifiers were not loaded very heavy.

Respectfully submitted, K. Mueloh

Seta.

Flow at 1:30 PM.

$31'' - 3\frac{1}{4}'' = 27.75''$ of pulp in barrel.

Period of Flow .31 min

lit of solution = 1705 grams = 43.15% solids = 5.085 lbs dry solids/gal.

Tonnage on radiograph West +3 East 42.

Flow at 1:45 PM.

$31'' - 4\frac{7}{8}'' = 26.375''$ of pulp in the barrel.

Period of Flow .29 min.

lit of solution = 1740 grams = 46.0% solids = 5.570 lbs dry solids/gal.

Tonnage on radiograph West +3 East 42.

Flow at slack period.

$24\frac{1}{8}'' - 15\frac{3}{4}'' = 8.375''$ of pulp in the barrel } $15\frac{3}{4}'' - 7'' = 8.75''$ of pulp.

Period of flow = .265 minutes.

Period of flow = .205 min.

lit of solution = 1585 grams = 32.3% solids.

Flow at peak period.

$31'' - 5\frac{7}{8}'' = 25.375''$ of pulp in the barrel.

Period of flow = 21 minutes.

lit of solution = 1715 grams = 44.0% solids.

$$.069 = .014$$

$$\begin{array}{r} 3 \\ 0.42 \\ .47 \end{array}$$

$$\frac{160}{2000} = \frac{60,000}{6000} \cdot 0.3$$

$$31 - 3\frac{1}{4} = \frac{27.75 \times 1.705}{.21} = \frac{47.31375}{.31} = 152.62 \text{ Gals/min} \quad \underline{23.28}$$

$$31 - 4\frac{5}{8} = \frac{26.375 \times 1.705}{.29} = \frac{44.969}{.29} = 155.06 \text{ Gals/min}$$

$$31 - 24\frac{1}{8} = \frac{6.875 \times 1.705}{.12} = \frac{11.722}{.12} = 97.68 \text{ Gals/min} \quad ?$$

$$24\frac{1}{8} - 15\frac{3}{4} = \frac{8.375 \times 1.705}{.21} = \frac{14.279}{.21} = 68.0$$

$$15\frac{3}{4} - 7 = \frac{8.75 \times 1.705}{.205} = \frac{14.919}{.205} = 72.78$$

$$31 - 5\frac{7}{8} = \frac{25.375 \times 1.705}{.21} = \frac{43.264}{.21} = 206.02$$

$$68.0 \times 32.3 = 2196.4$$

$$\underline{206.02 \times 44.0} = \underline{9064.9}$$

$$274.02 = 11,261.3$$

$$= 4,110\% \text{ } \frac{1}{8}$$

$$72.78 \times 32.3 = 2350.8$$

$$\underline{206.02 \times 44.0} = \underline{9064.9}$$

$$278.80 = 11,415.7$$

$$139.40 = 40.94\% \text{ } \frac{1}{8}$$

Hardinge Mill Flows

8/18/38.

The discharge from the Hardinge mill was measured in the afternoon of August 17, 1938 and in the morning of August 18, 1938.

The flow was measured by turning the stream into a large tub, located to one side of the distributor. The flow was caught for two cycles of maximum and minimum pump discharges.

The sample for per cent solids was caught at the point of discharge of the Hardinge Mill. The sample caught at this point overcame the inaccuracy due to the fluctuation in the pump discharge.

The results of the various tests are tabulated on the following page. Only one sample was caught in the morning of August 18 as the mill was shut down before a check could be obtained.

Tabulation of the Flow Measurements.

Date.	Time of Day.	Tons shown on Rateograph East	Tons shown on Rateograph West.	Flow in Gallons per Min.	Dry Tons per Hour.	% Solids	Time of Day
8/17/38	1:40 PM.	43	44	185.3	40.76	55.1	1:45 PM.
					38.90	53.5	2:00 PM.
8/17/38	2:15 PM.	41	40	187.6	38.25	52.5	2:15 PM.
					36.36	50.8	2:30 PM.
8/17/38	2:45 PM.	42	40	186.8	37.64	52.1	2:45 PM.
					40.74	54.8	2:00 PM.
8/18/38	8:20 AM.	40	41	209.4	48.29	56.75	8:20 AM.
					42.07	52.00	8:40 AM.

Aug 17-1938 2:45 P.M. Period of flow .785 min.

35 7/8 - 17 1/8 = 18.560

35 1/2 - 16 1/2 = 19.000

35 7/8 - 17 = 18.625

35 3/4 - 17 = 18.750

∑ 74.875 (18719" depth in tub)

% Solids 2:45 P.M. 1824 wt = 52.1 % S. = 6.716 lb/gal. dry solids

% Solids 3:00 P.M. 1865 wt. = 54.8 % S. = 7.270 lb/gal. dry solid

Tonnage East Retiograph 42 West Retiograph 40.

146.645

$\frac{18.719 \times 7.834}{.785} = 186.8$ gal/min. $\times 6.716 = 1254.5$ lbs/min. $\times .03 = 37.64$ dry tons/hr.

7.270 = 1358.0 "

= 40.74 "

Aug 18-1938 8:20 A.M. Period of flow .92 minutes.

35 7/8 - 10 15/16 = 24 1/6 = 24.6875

35 1/2 - 10 3/8 = 25 1/8 = 24.1250

35 7/8 - 10 15/16 = 24 1/6 = 24.6875

35 3/4 - 10 7/8 = 24 3/8 = 24.8750

∑ 98.3750 (24.594"

% Solids 8:20 A.M. 1894 gr 56.75 % S = 7.686 lb/gal dry solids

% Solids 8:40 A.M. 1823 gr. 52.00 % S 6.696 lb/gal " "

Tonnage East Retiograph 40 West Retiograph. 41

192.669

$\frac{24.594 \times 7.834}{.92} = 209.42$ gal/min. $\times 7.686 = 1609.6$ lbs/min. $\times .03 = 48.29$ dry tons/hr.

6.696 = 1402.3 "

42.07

Data.

Flow at 1:40 P.M.

Period .97 min.

$$35 \frac{7}{8} - 12 \frac{3}{8} = 22 \frac{3}{8}$$

$$35 \frac{1}{2} - 12 \frac{3}{8} = 23 \frac{1}{8}$$

$$35 \frac{7}{8} - 12 \frac{3}{4} = 22 \frac{3}{8}$$

$$35 \frac{3}{4} - 12 \frac{3}{4} = 23$$

Tub 4 ft in dia = 7.834 Gals / inch.

4) 91.75 (22.94" depth in tub.

% Solids 1:45 P.M. 1869 g wt 55.1% Solids = 7.333 lbs / per Gal dry solids.

% Solids 2:00 P.M. 1845 53.5% Solids = 6.998 lbs / Gal dry solids.

Tonnage East Petrograph 43 West Petrograph. 44.

179.712

$$\frac{22.94 \times 7.834}{.97} = 185.3 \text{ gals/min.} \times 7.333 = 1358.8 \text{ lbs/min.} \times .03 = 40.76 \text{ tons/hr.}$$

$$\times 6.998 = 1296.7 \text{ " } \times .03 = 38.90 \text{ "}$$

Flow at 2:15 P.M.

Period 1.04 min.

$$35 \frac{7}{8} - 10 \frac{3}{8} = 24 \frac{3}{8}$$

$$35 \frac{1}{2} - 10 \frac{3}{8} = 25 \frac{1}{8}$$

$$35 \frac{7}{8} - 10 \frac{3}{4} = 24 \frac{3}{8}$$

$$35 \frac{3}{4} - 10 \frac{3}{8} = 24 \frac{3}{8}$$

4) 99.625 (24.906" depth in tub.

% Solids 2:15 P.M. 1330 wt 52.5% S. = 6.796 lbs / gal. dry solids

% Solids 2:20 P.M. 1306 wt. 50.8 % S. = 6.460 lbs / gal. dry solids.

Tonnage East Petrograph 41 West Petrograph. 40

195.114

$$\frac{24.906 \times 7.834}{1.04} = 187.6 \text{ gals/min.} \times 6.796 = 1274.9 \text{ lbs/min.} \times .03 = 38.25 \text{ dry tons/hr.}$$

$$6.460 = 1211.9 \text{ " } = 36.36 \text{ "}$$

Hardinge Mill Discharge

8/24/38.

The flow from the Hardinge Mill discharge Pumps was measured in the afternoon of Aug 24, 1938. The tons per hour of solids in the discharge of the mill was found by measuring the total flow from the pumps, less the gals/min of clear water being added to the discharge pulp, and using the per cent solids as caught by the discharge sump of the Hardinge Mill.

Time of Day	Total Pump Discharge Gals/Min.	Gals/Min H ₂ O Added to Discharge.	Gals/Min. Disch. of Hardinge Mill.	% Solids	Dry Tons per Hour.	Tons Shown on Rateograph		Time of Day
						East	West	
1:50 PM.								
1:50 PM.	203.19	33.5	169.69	48.8	30.96	43	36	1:55 PM.
				47.1	29.37	39	37	2:15 PM.
2:25 PM.	194.53	33.5	161.03	47.8	28.50	39	37	2:25 PM.
				46.8	27.60	38	38	2:40 PM.

Respectfully submitted

K. Mesloh.

Data.

8/2+38.

$$35\frac{1}{2} - 6\frac{7}{8} = 28\frac{7}{8} \quad 28.625$$

$$35\frac{5}{8} - 7\frac{1}{8} = 28\frac{1}{2} \quad 28.500$$

$$35\frac{3}{4} - 7\frac{1}{8} = 28\frac{9}{8} \quad 28.625$$

$$35\frac{7}{8} - 7\frac{1}{4} = 28\frac{3}{4} \quad 28.375$$

114.125 average = 28.531

7.834 Gals/Inch Depth.

Time 1:50 P.M. Percent of flow 1.00 min.

Time 1:55 P.M. Wt 1777 grams - 48.8 % Solids - 6.082 lbs solids/ft. E 43 - W 36.

Time 2:15 P.M. Wt 1755 grams - 47.1 % Solids - 5.769 lbs solids/ft. E 39 - W 37.

$$\frac{28.531 \times 7.834}{1.00} = 203.19 \text{ Gals/min} \times 33.5 = 169.69 \text{ Gals} \times 6.082 = 1032.05 \times .03 = 30.96$$

$$\times 5.769 = 978.94 \times .03 = 29.37$$

$$35\frac{1}{2} - 12\frac{3}{8} = 23\frac{1}{8} = 23.125$$

$$35\frac{7}{8} - 12\frac{1}{2} = 23\frac{3}{8} = 23.125$$

$$35\frac{3}{4} - 12\frac{1}{2} = 23\frac{1}{4} = 23.250$$

$$35\frac{7}{8} - 12\frac{3}{4} = 22\frac{7}{8} = 22.875$$

92.375 Average = 23.094

Time 2:25 P.M. Percent of flow .93 min

Time 2:25 P.M. - Wt 1765 - 47.8 % Solids - 5.900 lbs solids/ft. E 39 W 37.

Time 2:40 P.M. - Wt 1750 - 46.8 % Solids - 5.714 lbs solids/ft. E 38 W 38.

$$\frac{23.094 \times 7.834}{.93} = 194.53 \text{ Gal/min} \times 33.5 = 161.03 \text{ Gals} \times 5.900 = 950.08 \times .03 = 28.50$$

$$5.714 = 920.13 \times .03 = 27.60$$

Flush water to Hardinge Mill discharge.

$$19\frac{1}{4} - 10 = (9.25 \times .51) \div .14 \text{ min} = 33.7 \text{ Gal/min}$$

$$19\frac{1}{4} - 10 = (8.75 \times .51) \div .1325 \text{ min} = 33.7 \text{ Gal/min}$$

$$19\frac{1}{4} - 9\frac{1}{2} = (9.75 \times .51) \div .15 \text{ min} = 32.2 \text{ Gal/min}$$

Average = 33.5

Spiegel Flights.

7/6/38.

The weight of a new speigel flight, selected at random from the pile, was 16,275 grams. The weight of a new special speigel flight was 15,600 grams.

Two special speigel flights were removed from the shift and weighed. For comparison, the weight of the standard speigel flight, in service between the two special flights was also weighed.

	Original wt assumed to be same as above	Weight when Runned	Weight lost.	% Total lost.
#3 Special Speigel	15,600	13050	2550	16.34
#5 Special Speigel	15,600	13475	2125	13.62
Standard Speigel	16,275	14350	1925	11.83

The special flights do not seem to be as good as the standard lot of speigel. The original weight of the flights was ^{not} measured so the weight lost is only approximate. The indication, however, shows nothing outstanding between the wearing qualities of the two different mixes of metal.

R. Mueloh

11th Synchronous Crusher

9/8/38.

Concave Ring. The concave ring, #4, removed 9/7/38 was installed 5/3/38, life 4mo 4 day, dry tons crushed 110,609. Before putting this ring in service, 5/3/38 ^{part} of the lower edge was trimmed off. This ring had seen previous service of 3mo 27 day crushing 80,911 dry tons. Total life in service 8mo 1 day. Total dry tons crushed 191,520. Cost per dry ton crushed was \$1.00072676. The ring was purchased on order GB 8374-17 dated 3-18-36. It cost delivered \$139.19. Weight new 562 pounds. ^{higher than} ~~original~~ weight = 287 Pounds of metal lost. 27.5 lbs Per cent of the original weight lost. 48.93. Pounds of metal lost per ton crushed. .00143588

#10- The concave ring installed 9/7/38 had seen previous service of 3mo 29 days, crushing 98,309 dry tons. It was of the latest design. It was purchased on order GB 1552 dated 5/25/37 and cost delivered \$158.94.

Lower Mantle #11. The mantle removed 9/7/38 was installed 5/3/38. Life in service 4 mo 4 days dry ton crushed 110,609. Weight when removed 446 pounds. Pounds lost 101 pounds. The mantle was purchased on order GB 2171 dated 9/27/37. It cost delivered \$158.00. It weighed new 547 lbs. lost per dry ton crushed. .00142845. Percent of original weight lost 18.46. Pounds of metal lost per ton crushed. .000913126. This mantle is not worn out but will be put in service again.

#12 Lower mantle, installed 9/7/38 was purchased on order GB 3204 dated 5/4/38. It cost delivered \$158.61. It weighed new 540 pounds.

KM

9/8/38.

Sept 13-1938.

Limestone Flows Measured Sept 13-1938 starting at
4:10 P.M. ending at 4:45. 7

The flows were ~~measured~~ after changing the middle flow
volume.

Rake Discharge,

111.1 Gals per min.

55.2% Solids

1.5825 Sp. Gravity of the Pulp.

24.28 Tons dry Solids per Hour.

Note.- In calculating the
percent solids, a specific
gravity of 3.0 was assumed
for the tailings.

Feeding Pump.

76.9 Gals/min.

387.2 " "

464.1 Gals/min Total.

Middle Flow.

76.9 Gals per min.

58.4% Solids

1.6385 Sp. Gr. of the Pulp.

18.41 Tons dry Solids per Hour.

Over Flow to Crested Meadows

387.2 Gals/min.

27.1% Solids

1.2213 Sp. Gr. of the Pulp.

32.06 Tons dry Solids per Hour.

Estimated Feed 3 wet tons or 81.76 dry tons per hour.

Summary.

24.28 Tons Rake disch.

18.41 Tons Middle Flow.

32.06 Tons Overflow.

6.90 Tons Loss per hour Estimated.

80.85

81.76

1.91 Tons not accounted for.

Respectfully submit
K. Muehl

1.594
1.564
3 11 11/20

55
56
 $\frac{58}{1.579}$
1.590

Peak Disch

$\frac{10}{.09} = 111.1 \text{ Gals/min} \times 8.34 = 926.6 \times 1.5825 = 1466.3 \times .552\% \times .03 =$

$\frac{2801}{1770} = 1.5825 = 55.2$

24.28 Tons

58
1.630
91.647
17

Middle Flow

$\frac{10}{.13} = 76.9 \text{ Gals/min} \times 8.34 = 641.3 \times 1.6385 = 1050.8 \times .58.4\% \times .03 = 18.41$

$\frac{2933}{1790} = 1.6385 = 58.4\% \text{ Solids}$

386.1
76.9
363.0

Overflow =

$\frac{34.625 \times 1.7}{.152} = 387.2 \text{ Gals/min} \times 8.34 = 3229.2 + 1.223 = 3943.8 \times .27.1\% \times .03 = 32.06$

$\frac{2174}{1780} = 1.2213 = 27.1\% \text{ Solids}$

28 1.229
27 1.229

24.28
18.41
32.06
74.75

83 x 81.76

Pumps In Service Sept 19, 1938

Six, 4" Welfley Pumps

Material on hand for 4" Welfley Sept 19, 1938

- 3- 16" Impellers.
- 2- Follow-up Plates
- 1 Casing

Material on order:

		date Placed	delivery date Required.
2-	Hi-Hard Casings - AGB 1043	8-27-38	Oct 1-1938
6	" " Follow-up Plates AGB 1161	8-12-38	Sept 1-1938
3	" " Casings AGB 1161	8-12-38	Sept 1-1938
3	" " Impellers } AGB 1161	8-12-38	Sept 1-1938

to be belittled + balanced

26 - 3" Cent Line Pumps In Service.

18 pumps Cent from Volute

8 pumps Kroyh frame using Volute Adaptive Cases

Cases on Hand.

23 stuffing Box cases for the C.I. Volute.

6 stuffing Box ^{adaptor} cases for the Kroyh.

25 sections cases for any of the 3" C.I. Pumps.

Items on order.

Impellers for the 3" East Iron Pumps.

- 3 Pumps use 12" Impellers.
- 6 Pumps use 11" Impellers.
- 17 Pumps use 14" Impellers.

Impellers on Hand

- 11 - 14" Impellers in Hand.
- 2 - 14" Impellers 60% Frigol
- 4 - 11" Impellers.
- 0 - 12" Impellers

Impellers on order.

			Order No	Date Placed	Delivery Requested	Received
6	Impellers - 60% Frigol	11" dia	AGB 1044	July 25-1938	Aug 12-1938	
12	" "	14" dia	AGB 1045	July 25-1938	Aug 15-1938	
6	" in Hand	12" dia	AGB 1162	Aug 12-1938	Sept 1-1938	

Pumps Material ordered from Palmyton showing date of order placed, delivery requested and date Received

		Order No	Order Placed	Delivery Requested	Received
12	Suction half Casings	AGB 1046	July 25-1938	Aug 15-1938	Sept 16-38
10	Suction half Casings	GB 2329	Oct 25-1937	Nov 25-1937	Feb 4-1938
10	Stuffing Box half Casings	GB 2329	Oct 25-1937	Nov 25-1937	Feb 4-1938
5	Suction half Casings	GB 2750	Jan 24-1938	Mar 10-1938	May 4-1938
5	Stuffing Box half Casings	GB 2750	Jan 24-1938	Mar 10-1938	May 4-1938
6	Impellers 11" dia Plus pattern	GB 2929	Feb 28-1938	Mar 18-1938	April 27-38
12	Impellers 14" dia	GB 3061	March 23-38	April 25-1938	April 27-38
12	Pieces of Casings - 6" stuffing Box 6" Suction Box	GB 3344	May 23-38	June 30-38	July 30-38

Perfectly submitted K. H. H. H.

Lower Mantles on Hands

9/23/38

# of fanle	Original Weight	Present Weight	Weight lost.	% Weight lost.	Thickness of Thinnest Part
# 4	554	388	166	29.96	$1\frac{3}{16}$ "
# 5	540	320	220	40.74	$\frac{13}{16}$ "
# 6	558	340	218	39.07	$\frac{7}{8}$ "
# 8	544	280	264	48.53	$\frac{11}{16}$ "
# 9	556	360	196	35.25	$\frac{7}{8}$ "

Km

1E Squasphere Crusher.

9/23/38

#8 Concrete Ring The concrete ring was installed in the 1E Crusher 4-14-38 removed 9/16/38. Life 5mo. 2 days. Dry tons crushed 135, 299. The ring had seen previous service of 4 mo. 14 days, crushing 109, 506 dry tons. Total life 9mo 16 days. Total dry tons crushed 244, 805. This is the record to date. Cost per dry ton crushed \$.0006889. Total weight lost 295 pounds. Percent of original weight lost 52.21%. Weight of metal lost per ton crushed .00120504 lbs. This ring was purchased on order GB 9704 dated 12/22/36. It cost delivered \$168.65. It weighed new 525 pounds. Discarded weight 270 pounds.

#11 Concrete Ring was installed in the 1E Crusher 9/16/38. It was purchased on order GB 1552 dated 5/25/37. It cost new \$158.95. Weight when new 556 pounds.

#10 Lower Mantle removed 9/16/38 was installed 4/14/38. Life 5mo 2da. Dry tons crushed 135, 299. Cost per dry ton crushed \$.00105207. Pounds of metal lost 133. or 24.49 of its original weight. Pounds of metal lost per ton of ore crushed .00096168. This lower mantle was purchased on order GB 1196 dated 3/23/37. It cost new \$145.50. It weighed new 543 lbs. The mantle is not

worn out and will be put into service again at a
later date.

#11 Lower Mangle installed in the 1E Crusher had
seen previous services of 4 mo 4 days, crushing
110,609 tons. It weighed 446 pounds when put in service
this second time. The mangle was purchased under
an order G/B 2171 dated 9/27/37.

Km

Telsmith Crusher Drive Belt.

9/27/38.

The drive belt installed 8/25/36 was removed 9/11/38. Life 24 mo. 16 days. This belt was an endless Condor Brand belt, manufactured by the Manhattan Rubber Co. It was 8" wide, 5 ply, and fit a drive 35 ft 10 inches around. The belt cost \$38.45 delivered. It was purchased on order GB 8658 dated May 19, 1936.

The belt, installed 9/11/38, was a Goodyear Compers Endless Belt #40. It was furnished on order GB 2723 dated 1/18/38 by the Meiers-Andres Belting Co. It was 8" wide, had 4 ply, and 35'-9" long, endless. It cost delivered. \$64.43.

K.M.

Data Flow Measurements Oct 1, 1938

Pulse discharge - Sands to the Mine - Taken @ 9:15 AM.
 Carbide Can 19.25" deep = 9.82 gallons when full.

.08	mm.	
.075	"	
.075	"	
.095	"	
.065	"	
.090	"	
<u>.060</u>	"	

$\frac{9.82}{.077} = 127.53 \text{ Gals/Min}$

.077 min average to catch 9.82 gallons.

Percent solids as read on chart at the zinc section 1907 gms wt = 57.50% solids.

Percent solids taken by weight - dried Sands used for screen test.

Gross wet wt	2769	Gross dry wt	1808
Tare	<u>320</u>	Tare	<u>320</u>

Net wet wt.	2449	Net dry wt	1488
-------------	------	------------	------

Percent solids = 60.76

Classifier Flow - Taken on the Tailings Pile - Taken at 10:20 AM.

Barrel 34.375" deep = 58.44 gals when full.

Three flows measured, each took .15 min to fill the barrel.

$\frac{58.44}{.15} = 389.6 \text{ Gals/Min}$

Percent solids as read on chart at the zinc section 1512 gms wt = 24.5% S.

Percent solids taken by weight - dried Sands used for screen test.

Gross wet wt	2970	Gross dry wt	1068
Tare	<u>315</u>	Tare	<u>315</u>

Net wet wt	2655	Net dry wt	753
------------	------	------------	-----

Percent Solids = 28.36.

Flows, Tailings to the Mine and to the Pile 10/1/38.

Discharge of the drag Classifier. Flow taken at 9:15 am.

Flow measured 127.53 gals/min.

Per Cent Solids 60.76 by weight.

Dry Tons solids to the mine per hour = 32.59.

Gallons of water per hour to the mine = 84.12

Sp. Gravity of solids taken as 3.0.

Flow of the drag Classifier. Flow measured at 10:20 AM.

Flow measured 389.6 Gals/Min.

Per Cent Solids 28.36 by weight.

Dry Tons solids to tailings pile per hour 34.11

The net storage tonnage between 8 AM and 8:15 AM.

18 40

1W 36

76 net tons per hour. or 74.86 dry tons per hour.

10% of the feed is concentrate = equals 7.49 dry tons.

67.37 dry tons of tailings per hour

66.70 dry tons of tails in the flows.

.67 dry tons not accounted for.

The storage was about 40 tons per hour, for each unit. before 8 AM. and after 8:15 AM.

Based on 80 net tons per hour, equals 78.8 dry tons of feed.

78.80 - 7.88 ton units = 70.92 tons of tails.

70.92 - 66.70 = 4.22 tons of tails not accounted for.

Report fully submitted, K. Muelohs

$$60.76 = 60 = \begin{array}{r} 1667 \\ .76 \\ \hline 114 \\ 133 \\ \hline 1444 \end{array} \quad \begin{array}{r} 1667 \\ 14 \\ \hline 1681 \end{array} \text{ spgr. of pulp.}$$

dry tons/ft

$$1681 \times 8.34 = \underline{14,020} \times 60.76 = \underline{8,519} \times 127.53 = \underline{1,086.43} \times .03 = \underline{32.59}$$

$$\begin{array}{r} 28.36 \\ 1230 \\ 1234 \\ \hline 1240 \end{array}$$

$$1234 \times 834 = \underline{10,29} \times 28.36 = \underline{2,918} \times 389.6 = \underline{1,136.85} \times .03 = \underline{34.11}$$

$$.76 \text{ tons} \times .985 = \begin{array}{r} 74.86 \\ 7.49 \\ \hline 67.37 \end{array} \text{ dry tons}$$

$$\begin{array}{r} 14,020 \\ 8,519 \\ \hline 5,501 \end{array} \begin{array}{l} \text{pulp per gal} \\ \text{tailings per gal} \end{array}$$

$$5,501 \text{ water per gal} = .6596 \text{ gals} \times 127.53 = 84.12 \text{ gals/min.}$$

$$\begin{array}{r} 1111 \\ 427 \\ \hline 1538 \end{array}$$

Spiegel Flights

10/7/58.

The weight of a new Spiegel flight, selected at random from the pile, was 15,775 grams. The weight of a new special Spiegel flight was 15,600 grams.

The two special Spiegel flights and the standard flight between the two specials, were removed and weighed. The parts broken off of the flights were compensated for.

Results.

	Original list assumed to be the same as above	Weight When Removed	Weight lost	% of Initial list.
Special Spiegel	15600	13675	1925	12.34
Special Spiegel	15600	12575	3025	19.39
Standard Spiegel	15775	14075	1700	10.78

The original weight of the flights was not measured so the weight lost is only approximate. The indication seems to be that the standard flights were better than the special flights.

Respectfully submitted,
K. Tinsley

Ilesmith Crusher

10/25/38

#10 Ilesmith Crusher Mantle - #11 Ilesmith Crusher Mantle

removed 10/7/28 was installed 12/9/35. Life in service 33 yrs 28 days. Total dry tons crushed 779,866 ^{14,000} cost per dry ton crushed \$.0002760-

The mantle was purchased on order GB 6931 dated 5/4/35. It had the small legs. It cost \$215.24 delivered at Anstrutville. It weighed 1025 pounds, weight taken from the freight bill. The backing was Horse Head Zinc.

This mantle holds the record for the number of tons crushed. Since operating the Spherule Crushers, the Ilesmith Crushers have not been set up as close as formerly, which helps reduce the wear and increases the life.

The mantle is still on the topsoil bed so data regarding weight is not complete.

#14 Ilesmith Crusher Mantle was installed on the 1W

crusher 10/7/35. Backing was Horse Head Zinc.

It was purchased on order GB 2161 dated Sept 23, 1937

It has long legs. The anchor cones were not to exceed $\frac{3}{8}$ " in depth. It cost \$281.18 delivered. It weighed 1074 pounds, weight was taken from the freight bill.

K.M

October 1938

Texaco Cup Grease #1

plus Outboard Ball Bearings of #2 W-Nash Comp

Grease Lubricated Rotor Bearings of Nash Hytor Compressors
Bearings of Dorco Pumps and Other Pumps Equipped
With Compression Grease Cups.

All Line shaft Bearings Equipped With Compression Grease Cups

All Line shaft Bearings Equipped With Dodge Timken Roller
Bearings for Pressure Grease Lubrication.

Bearings of Dorr Thickeners Equipped With Compression Grease Cups.

Alemite Fittings of Reeves Speed Reducers and Roller
Bearings of Conveyors.

All Compression Grease Cups and all Alemite Fittings

X

Texas Crater Compound XX

All Marcy Mill Gears and Hardinge Mill Gears

Altair Oil.

Gyrasphere Crusher.

Hardinge Mill ~~Frame~~ Bearings and Counter shaft Bearings

Filtered Oil - Altair. & Nabob

Telsmith ~~Reduction~~ Crushers Make up oil.

Trunnion Bearings of 4x10 Marcy Mill

Aleph C10 For 6x12 Marcy Trunnion bearings
& pinion shaft bearings when
shutting down.

Cetus for 6x12 Marcy Mill Motor bearings.

- Texas Nabok Oil. for Lubrication of

All Motor Bearings. (except 6x12 Motors)
Wilfley Pumps.

Bearings of Philadelphia Gear Speed Reducers

All Centrifugal Pump Bearings Equipped with Ring Oilers.

All Jones Speed Reducers

Counter shaft Bearings of A10 Marcy Mill.

Hardinge Mill Trunnion Bearings.

All Miscellaneous Bearings Equipped with Sight Feed Oil Cups.

Out Board Ball Bearings of Nash Hytor Compressors

except #2 W Nash

Telsmith Reduction Crusher. - New Charge.



Texaco Pinnacle Mineral Cylinder Oil.

For Gears of Philadelphia Gear Speed Reducers

↓ Exposed Worm Gear Drives of Vertical Shaft of Dorr

Thickeners and Dorr Bowl Classifiers.

↑ Drive gears on Dorr Duplex & Dorr Bowl Classifiers



Cetus

6x12 Marcy Mill Motor Bearings.

Aleph C10.

For 6x12 Marcy Mill Trunnion Bearings and Pinion Shaft
Bearings When shutting Down.

Test of the In Hard Impellers.

At the conclusion of the test of the 14" dia, 3 Vane Spiegel Impellers, made by Palmiston, two In Hard, 34" dia 3 Vane impellers was installed. These were furnished on order GB 3508 dated 6/2-38. These impellers did not have the properties of In Hard cast iron as the Brinell of test piece was 395, when a Brinell of 500 was expected.

#9 Impeller did not have any visible defects when new. When removed after 731 hrs 25 min, the impeller was just about worn out. The metal along the vane periphery, on both faces of the impeller, was worn away. Along the front sides, the slots were about $\frac{1}{2}$ " wide. On the back side, the slots were about $\frac{3}{4}$ " wide.

#10 Impeller did not have any visible defects when new. When removed after 731 hours 25 min of service, the impeller was badly worn. There were two small holes along the vane periphery on the front side. On the reverse side of the impeller, there were 3 holes, one about $\frac{1}{2}$ " x 2" long - one $\frac{3}{4}$ " x 2" long and the other 1" x 2 $\frac{1}{2}$ " long.

Respectfully submitted,
 Karl Mesch.

110 Kenneth Carter.

11/11/38.

CONCOVES. The concoves removed 11/10/38 were installed 12/10/37. Life 11 mos 0 days. try Toms books 286, 181. Cost per day tax crushed \$1,0004965. These concoves were purchased on order GB 7742 dated 12/14/35. They cost delivered \$142.10. Weight when new, 900 pounds, taken from the freight bill.

The concoves, installed 11/10/38 were purchased on order GB 2111 dated 1/23/37. They cost new \$117⁴⁵. Estimated weight new 900 lbs taken from the freight bill.

K.M.

Nov 14, 1938.

Anthracite Coal from Mine Near Martinsburg, Va.

A car of breakheat coal was received from the new mine opened by the Anthracite Coal and Piquetting Co. The mine is located near Martinsburg, Va. ~~The coal was~~ ~~was~~ permitted to run low so that there would be little very little mixing of the coal being tested, with the old coal. At 8 AM, Nov 9th, the depth of the coal in the bunkers was measured. It had been previously leveled. Then the counters for the stoker grate drive shafts were read. All other ~~data~~ ~~was~~ used for this report was taken from the daily power reports.

In observing the burning of the coal on the grates, it was noted that the coal did not burn uniformly over the grate area. Black areas of unignited coal could be seen. At the same time, there would be areas of ~~ignited~~, also areas of blazing white. As the grates carried the coal under the arches, the ^{unburned} coal would ignite, but there would still remain the dull red and blazing white areas. This effect was more noticeable in No 1 boiler than No 2. No 1 boiler has the wide throat and short arch while No 2 boiler has the narrow throat and long arch. The

The depth of the coal on the grates was varied in order to obtain the best rate of combustion. At the same time, the speed of grates would be varied as well as the drafts, in order to find the best combination. No 2 boiler was operated with a thinner bed and higher grate speed. No 1 boiler was operated with a denser grate speed and thicker bed of coal. It appears, at times, that the grate speed was so

slow and the bed of coal too thick, ^{for hot boiler,} so that by the time it was ready to be discharged into the ash car, the coal would still be ignited.

In observing the ashes, after they were dumped, the same black coal was observed. The clinker also appeared to be much harder ^{and larger} than that formed by the old coal.

The rate of combustion was so slow and uneven, it was difficult to keep up steam for good operation, when both engines were operating.

In checking over the charts of the stack temperatures, the coal under test gave about 50° lower stack temperature.

Data -

	Coal Under Test	Old Coal	
Dates used.	Nov 9 th 8 AM to Nov 12 th 8 AM.	Nov 9 th 8 AM to Nov 9 th 8 AM.	
Tons of Coal Consumed.	36.88	50.64	
Average Daily Usage.	12.293	10.128	"
Cu feet of Water Evaporated.	6850	10560	
Pounds of Water per pound of Coal	5.795	6.506	
Cars of Ashes dumped.	26	37	
Cars of Ashes per ton of Coal	.7077	.7306	
Tons of Skips Hoisted.	887	1342	
Daily Average of Skips Hoisted.	295.7	308.4	} Information furnished by the mining department.
Hours spent Hoisting.	19.75	31.25	
Daily average of Hours Hoisting.	6.583	6.25	
Cars of Loads Hoisted	1849	1732	
Daily average of Loads Hoisted.	616.3	346.4	

Respectfully submitted.

K. Mesloh

1W Drag Classifier

11/19/38.

Head Sprockets The head sprockets removed 11/17/38 were installed 11/4/37. The sprockets were mounted on a new shaft. The three manganese steel sprockets were purchased on order GB 9851 dated 11/2/37. and cost \$ 157.37. Life in service 12 mo. 13 days. Dry tons conveyed 321,897. Cost per dry ton crushed \$.0004389

The three new sprockets installed 11/17/38 were purchased on order GB 2446 dated 11/19/37 and cost delivered \$.175.65 They were mounted on a new shaft, purchased on order GB 2447 dated 11/19/37. Cost of shaft delivered \$ 25.09. Trunking not included.

Tail Sprockets The tail sprockets removed 11/17/38 were installed 11/4/37. These sprockets were reconditioned. Previous service unknown. Life in the last period of service 12 mo. 13 days. Dry tons conveyed 321,897. Total life and tons conveyed are unknown.

The three ^{new} sprockets installed, were purchased on order GB 1527 dated 10/27/37. The delivered cost was \$.187.60

124 chain The chain removed 11/17/38 was installed 11/4/37, life in service 12 mo. 13 days. The three strands of chain had an attachment link alternating with a plain link, making the flights on 8" inch centers.

The chain cost \$492.72 as follows:

3 pair of couplers	71.43 each	=	4.20
438 attachment links	.78 each	:	341.64
432 plain links	.34 each	=	146.88
Total			\$492.72

Total tons conveyed 321897. Cost per dry ton conveyed \$.00153068

The chain as installed was made up of 3 pairs of couplers, 435 attachment links, 432 plain links. Six links, plain, made by the Rex Chain Co. of their "Z" type, were installed in the chain. They are numbers 11 and 13 back of the couplers.

any alternating link
is an attachment
link.

Cost of chain

3 pair of couplers @ 1.61	4.83
435 attachment links @ .79	343.65
432 plain links @ .35	151.20
Total Cost of New Chain \$499.68	

Flights On May 22, 1937, 97 flights were installed. 32 flights were made of 3/4 x 4 x 36" long 1045 steel and the remainder 65 flights were soft steel 1/2 x 4 x 36" long. On Nov 4, 1937, 49 new flights of 1/2 x 4 x 36" long 1045 steel were

added, making a total of 146 flights. Total life
of flights 17 mo 25 days. Total dry tons conveyed 455,034.
Estimated cost of the 146 flights \$ 82.41 but for ton conveyed
\$.000811073.

There were 145 new flights installed 11/17/38
made of 1045 steel $\frac{3}{8}$ " x 4" x 36' long. These cost \$ 72.21

Respectfully submitted

Karl Tjersloh

Test of 4 Vane, 12" dia. Ni Hard Impellers.

Dec 1-1938

At the conclusion of test of the 1A" dia, 3 Vane Ni Hard Impellers, Nos 9 and 10, two Ni Hard, 12" dia, 4 Vane impellers were installed. These were furnished on order AGB 1162 dated 8/12/38. The impellers had made of Ni Hard cast iron. The Brinell of the metal was in the neighborhood of 600.

#13 Impeller was installed in the feed pump to the hardinge mill. As installed, there were two small cracks at the hub. Two of the vanes showed cracks along the edge of the vane and shroud, on the working face of the vane. Two other vanes had cracks along the edge of the vane and shroud, on the back of the vane. It weighed new 14981 grams. After being in operation 736 hours 35 min, it was removed, weighed, and replaced in service. The impeller was in good condition, no holes visible. It showed signs of wear along the side of the vane and shroud. A groove was worn in the metal. The impeller lost 1472 grams or 9.83% of its original weight. The speed of the impeller remained the same as for previous tests.

#14 Impeller was installed in the ^{feed} pump for the hardinge mill. As installed, three vanes showed cracks at the edge of the working face and the shroud opposite ^{the} section. Four vanes had cracks at the edge of the vane, backside, and the

shroud opposite the suction. It

This impeller was removed after 7 1/2 hours and 35 minutes of service. There were four holes, one at each vane, worn thru the back shroud. The holes were about $1" \times \frac{3}{4}"$ in size. They were located at the point of the vane. Another hole was just starting thru. This hole was due to the fact, that, when the riser was broken off, a piece of the metal was broken out of the shroud, which did not leave much metal for wear.

The impeller lost 9.33% of its original weight. It weighed now 15063 grams, when removed 13657 grams, losing 1406 grams.

The impeller speed was changed from 782 RPM to ^{34,728.40"/min} 920 per minute at the start of this test. The peripheral speed of the impellers remained the same.

Respectfully submitted

Karl Mestoh

Rice Coal in No 2 Boiler.

Dec. 6, 1938.

Rice coal from the mine of the Great Valley Coal Co., Great Valley, Va. was hauled to the boiler house and dumped on the ground. It was wheelbarrowed into the boiler room and weighed.

The buckwheat coal was cut off from No 2 Boiler and the pipes and hoppers permitted to run empty. At 9:18 AM, rice coal was fed on the grates from the hoppers in front of the stoker. The water meter and the counter on the stoker drive shaft were then read.

The rice coal was fed into the hopper, dry. It ran very freely. It would run back, in a few places, and pass thru the stoker fingers before they were properly seated. In burning the coal, if the draft at the head of the stoker was opened, fine coal would be blown from the front of the stoker. The coal was wet down which stopped the passage thru the grates.

When the coal first comes in contact with the fire box, long flames issue forth. The flames die away after the first 3 or 4 inches. The coal burns evenly with a white hot fire. There was a tendency for the coal to be kept in agitation by the induced draft and some of it worked its way to the head end of the fire box.

The amount of ashes produced was about the same as the buckwheat coal now in use. One car of ashes was produced. The clinkers were small, about the same as for buckwheat.

Some unburned coal was seen as the ashes were dumped. When first starting the test, some coal was carried over, still burning.

Hoisting was interrupted once in the first part of the run, due to low steam pressure. After the steam pressure was again at the hoisting level, hoisting was rapid. The ^{steam} pressure was adequate even with both hoists in operation.

The test was stopped at 11/2 noon. The same meters were then read.

Total coal burned 3390 pounds.

Water evaporated 5.4485 pounds per pound of coal.

Pounds of coal per revolution. 6.9184

Respect fully submitted.

R. Musick

data

Test started at 9:18 AM, ended at 12 Noon, 12/6/38 Time 2 hrs 42 min.

Water Meter Reading at the start 6664731 at the end 6665323.

Total water used for both boilers 592 cuft. or 296 cuft per boiler.

Steam Shaft Counter Reading at the start 46891, at the end 47381, Total Revolutions 490.

Total Coal Consumed 3390 pounds.

$$\text{Water evaporated per pounds of coal} = \frac{62.4 \times 296}{3390} = 5.4485.$$

One car of ashes dumped.

$$\text{Pounds of Coal per Rev.} = 6.9184.$$

1/6/38

114 Gyrosphere Crusher.

Lower Mantle. The #5 lower mantle removed 1/4/38 was installed 8/20/37. Life 4 mo 14 days. Dry tons crushed 109,506. This mantle had seen previous service of 2 mo 29 days, with 16 unit, crushing 68,500 dry tons. Total life 7 mo 13 days. Total dry tons crushed 178,006. This mantle was purchased on order GB 8836 dated 6/23/36 and cost delivered \$122.57 ^{fund} Cost per dry ton crushed. \$.00068857. Discarded weight. 320 Pounds of metal lost. 220 % of original weight lost. 40.74% Pounds of metal lost per ton of ore crushed. .0012359

This mantle now has the record for number of tons crushed. The former record was 167,386 dry tons.

No 8 lower mantle was installed 1/4/38. It had seen previous service of 4 mo 27 days, crushing 114,532 dry tons. This mantle was purchased on order GB 9538 dated 11/27/36 and cost delivered \$122.50.

Concave Ring. The #8 concave ring removed 1/4/38 was installed 8/20/37. Life 4 mo 14 days. Dry tons crushed 109,506. Cost per ton crushed \$.0015401. Weight when removed 424 lbs. Weight lost 141 lbs or 24.96% of original weight. Pounds of metal lost per ton of ore crushed. .0012376 lbs. This concave ring

was purchased on GB 9704 dated 12/24/36
and cost delivered \$168.65.

No 10 Concrete ring was installed
1/4/38. It was purchased on order GB 1552
dated 5/25/37. It weighed now 506 pounds.
(Custer ville weights.) This ring is of the
new design having reinforced lips, with
being about $\frac{3}{8}$ " shorter in depth, thus having
thicker metal around the outside edge.

KM

1/6/38

1E Drag Classifier.

Jan 16, 1938.

On May 14, 1937, 98 flights, $\frac{1}{2} \times 4 \times 36$ long, 1045 steel were installed. These flights cost \$77.97. On July 8, 1937, 48 additional flights were added. These flights were made of soft steel, $\frac{1}{2} \times 4 \times 36$ long and cost \$30.36.

The total cost of the 146 flights was \$108.33.

The flights were removed December 16, 1938. Life in service 19 mo. 2 days. Total dry tons conveyed 482,700. Cost per dry ton conveyed = \$.000224425.

141 flights were installed 12/16/38, made up of 47 flights $\frac{1}{2} \times 4 \times 36$, soft steel, and 94 flights $\frac{3}{8} \times 4 \times 36$, 1045 steel. A soft steel flight $\frac{1}{2} \times 4$ followed by two 1045 steel flights, $\frac{3}{8} \times 4$ were installed, in that manner, throughout the length of the drag classifier. The cost of the soft steel flights was \$31.16. The cost of the 1045 steel flights was \$47.60. Total cost of the flights was \$78.76.

Km

1/5/39

98 Old flights $\frac{1}{2} \times 4 \times 36$ - 1045 steel.

$$6.80 \times 3 = 20.40 \text{ lbs/flight} \times 98 = 1999.2 \text{ lbs. @ } 3.90/100 \text{ lbs.}$$

Cost of 98 flights = \$77.97.

48 New flights $\frac{1}{2} \times 4 \times 36$ - soft steel.

$$20.4 \text{ lbs/flight} \times 48 = 979.2 \text{ lb @ } 3.10/100 = \$30.36$$

$$\begin{array}{r} 30.36 \\ 77.97 \\ \hline 108.33 \end{array}$$

$$1045 \text{ steel } 3 \times 4 = 15.30 \text{ lbs/flight} \times 94 = 1438.2 \text{ lbs @ } 3.31/100 \text{ lbs.} = 476.0$$

$$\frac{1}{2} \times 4 = 20.4 \text{ lbs/flight} \times 47 = 958.8 \text{ lbs @ } 3.25/100 \text{ lbs.} = 31.16$$

$$\begin{array}{r} 476.0 \\ 31.16 \\ \hline 507.16 \end{array}$$

Dec 20/1938

Rice Coal.

Rice coal was burned under both boilers on Dec 13 and Dec 14, 1938. Wm. Lowell was fireman in both instances.

The coal was brought in by means of a wheelbarrow. Each load of coal was weighed.

At the start and close of each test, the readings of the stoker counters, water meter, and skip counter were read.

The first test was run with the coal bed deep, and the grates run on second speed. The second test was run with the coal bed thinner and the grates run in high speed. On examination of the steam pressure charts, there seems to be very little difference between the two tests. The stack temperatures were slightly lower than when burning best coal.

The No 1. test gave the best results, using less coal, and obtaining a better evaporation factor. The thinner the bed of coal on the grates, it seems reasonable to expect more coal to be blown away, falling in the

With either test, it was difficult to keep up steam when hoisting loads from the 7th level.

Respectfully submitted.

R. Mesloh

Sata on Pure Coal. Dec 13-1938

Net pounds to No 1 Boiler 6643 lbs.

" " " No 2 Boiler 6546 lbs.

Test started 9:16 AM off at 3:30 PM. Duration 6 hrs 14 min.

No 1 Stokes Counter start 54693 end 55472 779 Rev

No 2 " " start 57693 end 60569 876 Rev

Water Meter Reading start 6686950 end 6688260 1310 cu ft

Stokes Reading start 083 end 314 231 skips hoisted

Six cars of ashes dumped. Very little unburned coal.

Weather was clear. Temperature varied 28. to 24° F.

Stokes Settings #1 Stokes 11, #2 Stokes 3.

Pounds of Coal Per Revolution #1 Boiler 8.5277 #2 Boiler 7.4726 Both Boilers 7.9692

Pounds of Water Evaporated/Pounds of Coal #1 Boiler 6.153 #2 Boiler 6.244 Both Boilers 6.198

Note. These figures too high due to the fact water to wet down the coal was used after it had passed the meter. Estimated .09 lbs high.

Sata Pure Coal Dec 14-1938.

Net pounds to No 1 Boiler 7789 lbs.

" " " No 2 Boiler 6472 lbs.

Test started 9:40 AM, ended 3:30 PM. Duration 5 hrs 50 min.

No 1 Stokes Counter, start 56106 End 57227 1121 Revolutions

No 2 " " start 61234 End 62254 1000 Revolutions

Water Meter Reading start 66894585 End 6690771 1318 cu ft of water.

Stokes Reading start 101 End 342 241 Skips Hoisted.

Six cars of ashes dumped, very little unburned coal.

Weather was clear. Temperature about 34.

Stokes Settings Coal Bed #1 - 8 #2 - 9 1/2

Pounds of Coal Per Revolution #1 Boiler 6.886 #2 Boiler 6.472 Both Boilers 6.691

Pounds of Water Evaporated/Pounds of Coal #1 Boiler 5.327 #2 Boiler 6.354 Both Boilers 5.788

Evaporation figures about .06 high due to water used in wetting coal.

Jewell Friedman } Out Jump 28
 } Clear

Race Pool to Britain 12/13/38.

Tax 83 ^{#5}

#1 Britain

#2 Britain

343
 350
 330
 335
 332

343

352

335

337

325

344

330

346

330

374

365

366

385

385

395

397

410

415

421

391

391

9427

2158

7269

329 lbs back

338

208

875

249

626

359

338

335

341

333

323

332

347

357

344

356

330

330

355

363

350

365

370

348

344

380

392

391

375

382

8800

2075

6725 262 pounds back.

83

179

6725
 179

 6546

7269
 626

 6643

Clear

Lead fireman

Run Coal to Boilers

12/14/38

Jan. 86

#1 Boiler

#2 Boiler

371
 369
 371
 375
 393
 362
 356
 379
 387
 380
 396
 381
 382
 382
 375
 374
 365
 399
 382
 360
 376
 379

 8364
 1892

 6472

371
 369
 371
 375
 393
 362
 356
 379
 387
 380
 396
 381
 382
 382
 375
 374
 365
 399
 382
 360
 376
 379

 8364
 1892

 6472

10 041
 2322

 7719

Coal to #2 Brite.

Whubbanow Tree 74 lbs.

237-65 lbs

339

326

320

364

335

340

361

354

326

353

327

351

4343

953

3390 lbs coal used.

55472
4693
779

0569
9693
876

88260
86950
1310

7.4726
8.5277
16,0003
8.0001

6643 | 8.52774
6232 | 779
4110
2895
2150
1558
5920
5353
5670
5253
3170

6546 | 17.4726
6132 | 876
4140
3504
6360
6132
2280
1752
5280
5356

13189 | 7.9682
11585 | 1655
16040
14895
11450
9930
15200
14895
3050

1310 x 62.4 = 40872 per bucket
312
2620
1310
3930
40872

6244
6,153
12,397
6,198

40872 | 11 | 6,153
3958 | 6643
10140
6643
34970
33215
17550

40872 | 07 | 6,244
39276 | 6546
15960
13092
28680
25184
24960

81744 | 6,198
79134 | 13189
26100
13189
129110
118761
104090

7227
6106
1121

2254
1254
1000

90771
89453
1318

7719 | 6886
6726 | 1121
9930
8968
9620
8968
6520

06

14191 | 6,691
12726 | 2121
14650
12726
19240
19089
4510

07

05

41121.6 | 5,327
38595 | 7719
25266
23157
21090
15438
56520
24033

41121.6 | 6,354
38832 | 6472
22896
19416
34800
32360
24400
19416

82243.2 | 5,788
70955 | 14191
112882
100337
125450
113528
119220
113528
56920

Km
This is Service File Copy

COPY

December 19, 1938.

Mr. C. E. Taylor, Office

Mill Repairs & Changes--November 1938

The east mill was shut down Nov. 3 for repairs. Tested weightometer and found it correct. Removed 11760 lbs. of $-1\frac{1}{2}$ " rods from the 6x12 Marcy and put in 41 new 3" rods, or 11808 lbs. All rods removed were worn smaller on the feed end than on the discharge end. Half of the remaining rods after removing the $1\frac{1}{2}$ " rods were turned end for end. Power has been high and the grinding rate low because of the 6x12 Marcy rod charge. Opened the Hardinge mill to examine the lining and found one hole about 1" x 3". Installed a new 12" 6-ply belt on the Hardinge drive. The old belt was torn.

The west mill was shut down Nov. 4 for repairs. Tested weightometer, .48% low. Added balls to the 6x12 Marcy. Set up the Gyrasphere and changed oil in this machine.

The east Telsmith Crusher refused to crush the ore on Nov. 7. It was dismantled and both inner and outer babbitts were found to be broken into many small pieces. The eccentric was stuck in the crushing head and had to be jacked out. The babbitts removed were made of lead base babbitt, water cooled and were installed 3/6/38; life 8 months, a record. Installed new inner and outer babbitts made of old crusher babbitt, water cooled.

The west mill was shut down for repairs on Nov. 10. Tested weightometer, .14% low. The Telsmith Crusher concaves were worn out. They were removed and a new set was installed. Concaves removed were installed 12/10/37; life 11 months; dry tons crushed 286,181; cost per ton crushed \$.0004965. They were purchased on order GB-7942, dated 12/16/35. Delivered cost \$142.10. The concaves installed 11/10/38 were purchased on order GB-2161, dated 9/23/37; delivered cost \$187.46. Installed a reconditioned oil sleeve. Cleaned the oil tank and put in a charge of new oil. Set up the Gyrasphere. Added balls to the 6x12 Marcy and rods to the 4x10 Marcys.

On Nov. 11 the east mill was shut down for repairs. Tested the weightometer, .19% high. Installed new head sprockets and new tail sprockets on the pan feeder to the Telsmith Crusher. Cleaned the Telsmith oil tank and put in a charge of new oil. Set up the Gyrasphere and changed the oil in it. No rods were added to the 6x12 Marcy as the power was too high even though the rod charge was low. Measurements were taken to determine the wear on the Micarta bearings and the feed end was found to be down .625" while the discharge end was down .015". The mill level was determined with an instrument and found to be $29\frac{1}{32}$ " low at the feed end. The feed end bearing cannot be seen without lifting the mill, but the evidence shows that this bearing is badly worn. The feed end trunnion was originally 21" diameter and is now $20\frac{7}{8}$ ". One new set of Micarta bearings was ordered consisting of one feed end bearing and one discharge end bearing. Removed one link from each chain in the 6x12 classifier and repaired the side boards.

Mr. C. E. Taylor----Nov.1938 Mill repairs & Changes-----12/19/38

COPY

On Nov. 11 the west TelSmith Crusher was opened 1/4" (shims 5/8"). The power was too high for the 15 HP motor which has been installed on this side.

On Nov. 14 six teeth were broken out of the large drive gear on #3 Marcy Mill (4x10). One tooth has been broken off at one end about 2" for the past two years. The teeth were all worn to less than half the original thickness. Installed a new gear purchased in Feb. 1937 when the broken tooth was first found. This gear was purchased on order GB-9877, dated 1/25/37.. The delivered cost was \$470.78. The first gear received on this order was defective and a replacement at no cost was made by the Mine & Smelter Supply Co. The defective gear can be used and if one or more teeth break off as is anticipated they can be welded back with the arc welder. The defective gear is the only present spare for the four 4x10 Marcy Mills. The worn pinion which is mounted on an alloy steel shaft was put back with the new gear.

On Nov. 16 the feed dipper came off #2 Marcy Mill. The bolts holding the feed end trunnion liner to the mill were sheared. The feed end trunnion liner was worn out and was replaced with a new one. It was cemented in with Lumnite cement and sand grout 1:2. Installed a new dipper, the old one being worn out. The mill was held idle till the next day to allow the Lumnite cement to set.

On Nov. 17 shut the west mill down for repairs. Tested the weightometer, .51% high. Rebuilt the 6x12 Classifier. Installed 3 new chains made of 432 plain links and 432 attachment links and 6 coupling links. Links #10 and #12 from the coupling links and not counting the coupling links are made of Rex Chain Co. Zee metal. Each special link is marked with a piece of 1/8" wire around one side of it. 6 links are so marked. Zee metal is cheaper than manganese steel and the manufacturer claims it will wear as good. Installed 3 new head sprockets and a new square head shaft. Installed 3 new tail sprockets and a new tail shaft. The bottom wearing plates were examined and found in good condition. Installed a set of new flights consisting of 145 - 3/8 x 4 x 36 flights made of #1045 steel. The chain removed was installed 11/4/37; life 12 months 13 days. The chains are built up of alternate plain and attachment links so the flights are 8" centers. The cost of chain was \$492.72 as follows:

3 pairs coupling links	\$ 4.20
438 attachment links	341.64
432 plain links	<u>146.88</u>
	\$492.72

Tons conveyed 321,897; cost per dry ton \$.00153.

The new chain installed was purchased at a cost of \$499.68 delivered.

The flights removed were installed on May 22, 1937, at which time the drag was equipped with 97 flights made of 3/8 x 4 x 36 #1045 steel (32 flights) and 1/2 x 4 x 36 soft steel (65 flights). On 11/4/37

Mr. C. E. Taylor----Nov.1938 Mill Repairs & Changes-----12/19/38

COPY

49 new flights 1/4 x 4 x 36 #1045 steel were added, making a total of 146 flights. Life of flights 17 months, 25 days; tons conveyed 455,034; estimated cost of 146 flights \$82.41; cost per ton \$.000811. The new flights installed 11/17/38 were made of 3/8 x 4 x 36 #1045 steel. The cost was \$73.21.

The head sprockets removed 11/17/38 were installed 11/4/37. The sprockets were mounted on a new 4" square shaft. The 3 sprockets were purchased on order GB-9851, dated 1/26/37, at a delivered cost of \$157.37. Life 12 months, 13 days; tons conveyed 321,897; cost per ton \$.0004889. The new sprockets installed 11/17/38 were purchased on order GB-2446, dated 11/19/37, at a delivered cost of \$175.65. They were mounted on a new shaft purchased on order GB-2447, dated 11/19/37. Cost of shaft, delivered, \$25.09, machining cost not included.

The tail sprockets removed 11/17/38 were installed 11/4/37. They were reconditioned, previous service unknown. Life 12 months, 13 days; tons conveyed 321,897. Total life unknown. The 3 new sprockets were purchased on order GB-1527, dated 5/20/37, at a delivered cost of \$187.60.

Installed a new dipper and a new elevator wheel on the 6x12 Marcy Mill and added balls.

On Nov. 17 the east 6x12 Marcy power was 167 to 170 HP, even though no rods had been added since Nov. 3. A small stream of Aleph C-10 water soluble oil was added to each trunnion bearing along with the usual quantity of water and power dropped immediately to 144 HP. It has been necessary to keep oil on the bearing since that time. Later oil was cut off the discharge end bearing and kept on the feed end bearing only. The normal weekly addition of rods was resumed after the use of oil was started on the bearings.

On Nov. 18 the east mill was shut down for repairs. Tested the weightometer, 1.15% low. Jacked up the 6x12 Marcy and shimmed up the feed end bearing by placing 2 pieces of 29/32" steel (finished surfaces) between the sole plate and the bearing. The mill was thus raised 29/32" at the feed end, which was the amount required to level the mill. The shim plates were 3-1/2" wide by 47" long. Installed belt guards over the hole in the dipper guard in which the dipper neck rotates to keep muck splashed out by the dipper from entering the feed end bearing. This muck in the bearing was the cause of the Micarta bearing wearing out. The discharge end bearing which was not exposed to this contamination shows very slight wear. The pinion shaft was tried for level and found to be 1/16" low at the south end. The pinion shaft has been vibrating badly and a search for the cause was undertaken. The Micarta bearings were only slightly worn. The mill was slightly out of line with the pinion. Installed 8 new Dayton Cog Belts in #3 Marcy Mill drive.

On Nov. 19 the Hardinge Mill was shut down to stop a leak in the feed chute to the 6x12 Marcy directly over the Hardinge. When the Hardinge was started it was noticed that the power was too high. After running one hour the motor became hot and the Hardinge was shut

Mr. C. E. Taylor----Nov. 1938 Mill Repairs & Changes-----12/19/38

COPY

down. One of the electric leads to the controller was found to be burned in two. After repairing the lead there was no further trouble.

On Nov. 24 the west mill was shut down for repairs. Tested the weightometer, .19% low. Installed a rubber guard on the 6x12 Marcy dipper housing to keep muck out of the feed end bearing, the same as installed on the east mill. Added 1500 lbs. balls to the 6x12 Marcy and rods to the 4x10 Marcy. The Hardinge mill belt lacing broke and while repairing it inspected the feed dipper and found it to be worn out. Patched it with 1/4 x 9 x 24 plates. A new feed dipper left from the old mill operation was located and will be installed later.

On Nov. 25 the east mill was shut down for repairs. Tested the weightometer, .32% high. Levelled the 6x12 Marcy pinion shaft. When the bolts holding down the south bearing were loosened the bearing and sole plate sprang up about 1/8". Grout was cut away from under the bearing and steel wedges were driven under it. The bolts were tightened after the shaft was adjusted to perfect level. The mill was moved 3/16" toward the east at the feed end to secure perfect alignment of the gear and pinion teeth. When started the vibration of the pinion shaft previously noticed had been eliminated. A new slide gate was installed between the #3 Marcy feed dipper and feed screw for turning feed to the Hardinge or to the #3 Marcy. This replaced a gate originally installed which had been giving trouble by leaking.

Screen analyses of feed to flotation for the month of November:

East Unit: 5.7% on 48-mesh; 16.2% on 65-mesh; 27.9% on 100-mesh; 53.2% on 200-mesh; all cumulative.

West Unit: 5.6% on 48-mesh; 16.2% on 65-mesh; 27.7% on 100-mesh; 52.2% on 200-mesh; all cumulative.

TIME LOST FOR REPAIRS

East Unit: (Based on TelSmith Running Time)

11/1/38	1 hour 5 minutes, 6x12 Marcy overload 15 min., 4x10 Marcy overload 25 min., setting up Gyrasphere 15 min., circulating water pump stopped and chutes choked 10 min.
2	50 minutes, 6x12 Marcy overload 45 min., 4x10 Marcy overload 5 min.
3	7 hours 15 minutes, Ditto 10 min., general repairs 7 hrs., 5 min.
4	55 minutes, 6x12 Classifier overloaded 10 min., feed pipe to 6x12 chute choked 40 min., screw to #3 Marcy choked 5 min.
5	15 minutes, 6x12 Marcy overload 10 min., feed chute choked 5 min.
6	5 minutes, 4x10 Marcy overload.
7	1 hour 5 minutes, TelSmith crusher repairs.
8	7 hours 35 minutes, Ditto, 6 hrs., 50 min., gyrasphere crusher springs loose 20 min., set up gyrasphere 15 min., warm water pump off 10 min.
9	10 minutes, 6x12 Marcy overload 5 min., warm water pump off 5 min.
10	10 minutes, " " " 5 " " " " " 5 "
11	6 hours, Feed off for repairs 10 min., General repairs 5 hrs., 15 min., changing feed from 6x12 Marcy to 4x10 Marcys 10 min., 6x12 classifier overloaded 15 min., 4x10 Marcy overload 10 min.

COPY

- 11/12/38 30 minutes, 6x12 Marcy overload 20 min., working on Tel-smith crusher motor 10 min.
- 13 20 minutes, 6x12 Marcy overload.
- 14 50 minutes, " " " 45 min., Duplex classifier stuck 5 min. 4x10 Marcy mills by-passed 4 hrs., 45 min., installing a new gear on #3 Marcy mill.
- 15 20 minutes, 6x12 Marcy overload 5 min., setting up Gyrasphere crusher 15 min.
- 16 50 minutes, Gyrasphere starter out of order.
- 18 5 hours, 6x12 classifier overloaded 5 min., 4x10 Marcy overload 15 min., feed off for repairs 15 min., General repairs 4 hrs., 25 min., 6x12 Marcy by-passed 45 min.
- 19 15 minutes, 6x12 Marcy overload 5 min., 4x10 Marcy overload 5 min., by-passing Hardinge 5 min.
- 20 15 minutes, 6x12 Marcy overload 10 min., 4x10 Marcy overload 5 min.
- 21 25 " Ditto 15 min., ditto 10 min.
- 22 1 hour 5 minutes, Repairing loose link on chain on 6x12 classifier 45 min., setting up Gyrasphere 20 min.
- 23 1 hour 30 minutes, 4x10 Marcy overload 15 min., feed chute choked 5 min., middle chain broken on 6x12 drag 1 hr., 10 min.
- 24 5 minutes, By-passing Hardinge.
- 25 5 hours 40 minutes, feed off for repairs 15 min., General repairs 5 hrs., 25 min.
- 26 10 minutes, 6x12 Marcy overload 5 min., by-passing 6x12 Marcy 5 min.
- 27 25 minutes, Greasing speeder 5 min., tightening springs on Gyrasphere 20 min.
- 28 15 minutes, 4x10 Marcy overload 5 min., feed chute choked 10 min.
- 29 5 minutes, Feed chute choked.

West Unit:

- 11/1/38 25 minutes, Circulating water pump stopped, chutes choked to 4x10 and 6x12 Marcys 10 min., set up Gyrasphere crusher 15 min.
- 2 10 minutes, Gyrasphere crusher filling up.
- 3 2 hours 45 minutes, 4x10 Marcy overload 20 min., Gyrasphere crusher filled up 10 min., circulating water pump stopped 25 min., 6x12 classifier chain broken 1 hour 50 min.
- 4 3 hours 30 minutes, Taking plate out of 6x12 Marcy discharge chute 10 min., feed off for repairs 20 min., sprocket chain off Reeves 5 min., repairing 2 hrs., 55 min.
- 5 30 minutes, Chain off sprocket on pan feeder drive 5 min., Gyrasphere crusher filling up 25 min.
- 7 5 minutes, Chain off sprocket on pan feeder drive.
- 8 30 " Ditto 5 min., set up Gyrasphere 15 min., Gyrasphere filling up 5 min., circulating water pump off 5 min.
- 9 15 minutes, Gyrasphere crusher filling up.
- 10 4 hours 35 minutes, General repairs 4 hrs., 20 min., Gyrasphere crusher filling up 15 min.
- 11 2 hours, Opening Tel-smith crusher.
- 12 5 minutes, 4x10 Marcy overload.
- 14 1 hour 40 minutes, Ditto 10 minutes, 6x12 classifier chain broken 1 hr., 15 min., Hardinge feed pump stopped 15 min.
- 15 1 hour 45 minutes, Repairing 6x12 classifier 6x12 Marcy by-passed 4 hrs., 10 min., repairing ball retainer.
- 16 20 minutes, 4x10 Marcy overload 5 min., 6x12 Marcy overload 5 min., changing feed off #2 Marcy 10 min., #2 Marcy down 8 hrs., dipper off.

Mr. C. E. Taylor----Nov. 1938 Mill Repairs & Changes-----12/19/38

COPY

- 11/17/38 12 hours 50 minutes, General repairs.
- 18 1 hour 5 minutes, 4x10 Marcy overload 30 min., tightening pulley on feeder 15 min., Reeves drive chain off 5 min., Tel-smith wearing plate loose 5 min., 6x12 Marcy plug door loose 10 min. 6x12 Marcy down 5 hrs. 15 min., working on discharge end.
- 19 20 minutes, 6x12 Marcy overload 10 min., Pan feeder shim off 5 min., by-passing Hardinge 5 min.
- 20 35 minutes, 4x10 Marcy overload 20 min., 6x12 Marcy overload 15 min.
- 21 20 minutes, 6x12 Marcy overload.
- 22 15 minutes, Setting up Gyrasphere 15 min.
- 24 4 hours 35 minutes, General repairs 4 hrs. 30 min., by-passing Hardinge mill, drive belt broken 5 min.
- 25 15 minutes, 6x12 Marcy overload 10 min., chute under Tel-smith crusher 5 min.
- 28 10 minutes, 4x10 Marcy overload.
- 29 3 hours 15 minutes, Setting up Gyrasphere 15 min., Tel-smith crusher switch burned up 3 hrs.
- 30 10 minutes, Tel-smith crusher filled up 5 min., Gyrasphere crusher filled up 5 min.

Hardinge Mill:

- 11/1/38 25 minutes, Belt off.
- 2 30 minutes, " "
- 3 5 hours 30 minutes, Examining lining and adding balls.
- 14 7 hours 50 minutes, Repairing pipe lines to Hardinge pumps.
- 24 3 hours 35 minutes, Repairing drive belt.
- 19 4 hours 5 minutes, Controller switch burned out.
- 28 3 hours, Weighing feed and discharge pump impellers. In-stalled new impeller in discharge pump. Inspected lining, found one hole.

LJWeintz/ESS

Grinding for November 1938.

West

East

	wt in Grams.	% Suet	% Cum.	wt in Grams.	% Suet	% Cum.
20	Trace	Trace	Trace	Trace	Trace	Trace
28	2	.2	.2	2	.2	.2
35	8	.8	1.0	10	1.0	1.2
48	46	4.6	5.6	45	4.5	5.7
65	106	10.6	16.2	105	10.5	16.2
100	115	11.5	27.7	117	11.7	27.9
200	245	24.5	52.2	253	25.3	53.2
-200	<u>478</u>	<u>47.8</u>	100.0	<u>468</u>	<u>46.8</u>	100.0
	1000	100.0		1000	100.0	

Weightometer Test for November

West

East

Date

Date

11/4/38 .48 Low

11/3/38 o/c

11/10/38 .14 Low

11/11/38 .19 High

11/17/38 .51 High

11/18/38 1.15 Low

11/24/38 .19 Low

11/25/38 .32 High

12/8/38

Km.

1W Drag Classifier

11/19/38.

Head Sprockets The head sprockets removed 11/17/38 were installed 11/4/37. The sprockets were mounted on a new shaft. The three manganese steel sprockets were purchased on order GB 9851 dated 1/26/37. and cost \$ 157.37. Life in service 12 mo. 13 days. Dry tons conveyed 321,897. Cost per dry ton crushed. \$.0004889

The three new sprockets installed 11/17/38 were purchased on order GB 2446 dated 11/19/37 and cost delivered \$. 175.65 They were mounted on a new shaft, purchased on order GB 2447 dated 11/19/37. Cost of shaft delivered \$25.09. Machining cost not included.

Tail Sprockets. The tail sprockets removed 11/17/38 were installed 11/4/37. These sprockets were reconditioned. Previous service unknown. Life in the last period of service 12 mo. 13 days. Dry tons conveyed 321,897. Total life and tons conveyed are unknown.

The three ^{new} sprockets installed, were purchased on order GB 1527 dated 5/20/37 The delivered cost was. \$. 187.60

124 Chain. The chain removed 11/17/38 was installed 11/4/37, life in service 12 mo. 13 days. The three strands of chain had an attachment link alternating with a plain link, making the flights in 8" nich centers.

The chain cost \$492.72 as follows

3 pair of couplers	\$1.40 each	=	4.20
438 attachment links	.78 each	=	341.64
432 plain links	.34 each	=	146.88
Total			\$492.72

Total tons conveyed 321,897. Cost per dry ton conveyed \$.00153068

The chain as installed was made up of 3 pairs of couplers, 435 attachment links, 432 plain links, six links, plain, made by the Rex Chain Co. of their "Z" metal, were installed in the chain. They are number 11 and 13 back of the couplers.

Cost of chain:

3 pair of couplers @ 1.61	=	4.83
435 attachment links @ .79	=	343.65
432 plain links @ .35	=	151.20
Total Cost of New Chain		\$499.68

Flights. On May 22, 1937, 97 flights were installed. $\frac{1}{3}$ or 32 flights were made of $\frac{3}{4} \times 4 \times 36$ " long 1045 steel and the remainder 65 flights were soft steel $\frac{1}{2} \times 4 \times 36$ " long. On Nov 4, 1937, 49 new flights of $\frac{3}{4} \times 4 \times 36$ " long 1045 steel were

any alternating link
is an attachment
link.

added, making a total of 146 flights. Total life
of flights 17 mo 5 days. Total dry tons conveyed 455,034.
Estimated cost of the 146 flights. \$ 82.41 per ton conveyed
\$.000811073.

There were 145 new flights installed 11/17/38
made of 1045 steel $\frac{3}{8}$ x 4" x 36" long. These cost \$ 73.21.

Respectfully submitted

Karl Mesloh.

1 W Jelsmith crusher.

11/11/38.

Concaves. The concaves removed 11/10/38 were installed 12/10/37. Life 11 mo 0 days. Dry Tons crushed 286,181. Cost per dry ton crushed \$.0004965. These concaves were purchased on order GB 7942 dated 12/16/35. They cost delivered \$142.10. Weight when new, 900 pounds, taken from the freight bill.

The concaves, installed 11/10/38 were purchased on order GB 2161 dated 9/23/37. They cost new \$167⁴⁶. Estimated weight new 900 lbs taken from the freight bill.

K.M.

5 24
0 2 0

KM
Shumal made only 1 ce
File this in Service File

1/10/39

Mr C E Taylor Office

Mull Repairs and Changes for Month of Dec. 1938.

On Dec. 1 the east mill was shut down for repairs and to add rods to the Marag Mills. The bottom lining of the chute from the 6x12 Classifier to the 4x10 Marag Mills was worn out. The chute was relined with 1/2" abrasion resisting steel. The life of this material is too short in this location but no other is available. The usual lining is made of worn Marag Mill shell liners which are made of manganese steel but we have none of these at present. The next time any of these chutes need relining we will line them with 1/2" #1045 rubber. This material is expensive but the life should be better than manganese steel.

The west mill was shut down on Dec 2 for repairs. Added balls to the 6x12 Marag, set up the Gyrophan and added rods to the 4x10 Marag. Relined the chute from the 6x12 Classifier to the 6x12 Marag. This necessitated shutting down the Hardinge for the full shift as it was not safe to work over it while running. Abrasion resisting steel was used for the lining, no

$\frac{1}{2}$ " #1045 rubber on hand. Installed a steel sled gate between the #2 Marcy diffuser and screen and installed a new lined launder from #2 Marcy to the Duplex Classifier. Installed Alligator belt casing on the 12" drive belt of the Hardinge Mill. Gaged the wear of Nicarta bearings on the 6x12 Marcy and found none since last August. When the mill was started the discharge trunnion bearing ^{of #3 - 4x10 Marcy Mill} ran hot and the power rose to 113 HP. Removed 108 rods and the power dropped to 78 HP.

On Dec 6 the Hardinge Mill distributor castings wore out and stopped rotating so the feed was unequally divided. The tonnage to the east side being low. Installed a new distributor. When the Hardinge was started the discharge pump would not handle the feed. The suction end casing was found to be worn in the recess in which the impeller runs. A new casing cured the trouble.

On Dec 8th west mill was shut down for repairs. Changed the oil in the Telamitt Crusher. Added balls to the 6x12 Marcy and rods to #2 Marcy. Jacked up #1 Marcy, removed the discharge trunnion ballbet and scraped it. Power has been high since.

Dec 2 when the bearing was injured in starting up. Welded leaks in the shell of #2 Macey with the arc welder.

On Dec 9 the east mill was shut down for repairs. Changed oil in the Telsmuth Crusher and in the Gyrophone Crushers. Added rods to the Macey Mills and set up the Gyrophone. Installed a new lined launder from #3 Macey to the Duplex Classifier. Removed the 6x12 Classifier overflow launder and built up the overflow edge 2" higher at each end for a length of 12". This limits the overflow to 74" in the center of the launder and removes the chance of contamination by coarse particles which were formerly bled up at each end of the launder by the force of water returning at high velocity along the ^{outside} edge of the Classifier from the point of the upper rake discharge. Relevelled the 6x12 Macey pinion shaft and drove steel wedges under the South bearing and cemented them in place with quick setting Smooth-A cement.

The east 6x12 Classifier Philadelphia Gear speed reducer failed on Dec 13 and was replaced with a spare. When the 6x12 Macey was shut down for this repair the pinion shaft was found to be broken between

The South bearing and the pinion. The broken shaft was made of soft steel and was installed Jan 7, 1938. A chrom. molybdenum steel shaft SAE 4140 was installed at this time. It was purchased on order A 613 1084 at a delivered cost of 43.87. The blank was 5" dia by 66 7/16" long. It takes 5 shifts to machine a shaft so the cost of the finished shaft is as follows:-

Rough blank	\$ 43.87
Lathe machining	30.40
Shop burden @ 40%	<u>12.60</u>
Total cost.	\$ 86.87

A new pinion was on the chrom. molybdenum shaft installed 12/13/38.

On Dec 15 the west mill was shut down for repairs. Added balls to the 6x12 Marcy and rods to the 4x10 Marcy. Set up the Graphite Crusher. Opened the Hardinge mill to inspect the lining and found one hole 5" x 4".

On Dec 16 the east mill was shut down for repairs. Added rods and set up the Graphite. Installed a set of 141 new flights on the 6x12 drag classifier. There were made up of 47 soft steel flights 1/2 x 4 x 36" and 94 #1045 steel flights 3/8 x 4 x 36". Flights were spaced one 1/2"

followed by two $7/8"$ flights throughout
 the length of the chain. Cost of soft
 steel flights was 31.16 and of the #1045
 flights 47.60. Total cost \$78.76. The
 flights ~~was~~ removed were installed
 on May 14, 1937 when 98 $1/2 \times 4 \times 36$ #1045
 steel flights were put on and on July 8, 1937
 when the number of flights was increased to
 147 and 48 flights $1/2 \times 4 \times 36$ made of
 soft steel were added. Total cost of flights
 \$108.33. Life 19 months, 2 days. Total
 dry ton emerged 482 700. Cost per ton \$.0002244.
 The chains and sprockets were not changed.

On Dec 22 the west mill was
 shut down for repairs. Added balls to the
 6×12 Marcy and rods to the 4×10 's.
 The plug door was removed from the 6×12 Marcy
 as small balls were beginning to come out.
 A reconditioned door was put in its place.
 The interior of the mill was inspected and
 cement around the feed end trunnion liner
 was found to have come out, partially.
 The space was filled with quick setting
 Smooth-On cement. Also patched a
 hole in the discharge trunnion liner with
 Smooth-On. Repaired the upper
 housings on #1 and #2 Marcy Mills to
 stop leakage of mud around feed end
 trunnion bearings. The Hardware Mill

6

was shut down to examine the feed pump and piping. The suction end casing was found to be worn and was replaced with one that was welded in the recess in which the impeller ring runs. The Hardware Muff pinion was found to be badly worn. Measurements were taken to be used for ordering a new pinion and pinion shaft.

On Dec 23 the east mill was shut down for repairs. Added rods to the Marcy Mills and set up the Gyroscopes. Installed a guard around the dipper neck of #3 Marcy to keep mud out of bearing. Removed one link from each chain of the 6x12 drag classifier. New links were put in place of worn links in the ten outside strands to equalize the length.

On Dec. 24 the east mill was shut down because of a broken link in the middle chain of the 6x12 drag classifier. While down the Gyroscope motor was dismantled and the bearing next to the sheave was found to be worn out. For several hours prior to then shut down fine bronze dust was discovered falling around the motor and crushed. This was from the grinding up of the bronze ball retainer. A new ball bearing was installed.

7

The mill was operated on Christmas Day which fell on Sunday this year.

The west mill was shut down for repairs on Dec 29. Added balls to the 6x12 Marcy and rods to the 4x10's. Installed a new lined steel launder from #1 Marcy to the Dorr Duplex Classifier. Opened the Hardinge Mill and repaired the one 2" x 4" hole in lining with Smooth-On Cement #1. This cement did not set up quickly as it does normally. The cement was in good condition as was proved by test samples mixed and allowed to set up in the open. The reason for not setting up inside of the Hardinge Mill is thought to be the most confined atmosphere. The mill was held idle for 11 hours waiting for the Smooth-On to set up but it did not do so. Installed a new feed screw to #1 Marcy Mill with 2 special flights to be reported to Palmyerton.

On Dec 30 the east mill was shut down for repairs. The 6x12 Marcy Mill was jacked up, after removing part of the rod charge, for the installation of a new feed end Micarta bearing. The feed end bearing ^{Micarta bushing} was found to be worn in two, one piece about 6" wide and the other

about 8"^{O.D.} The trunnion had worn into the bottom of the cast iron bearing $\frac{1}{8}$ ". This was the cause of high power on the mill for the past 2 months. New Mearns bushings were ordered as soon as it was found that the old one was worn but had been reserved only a few days prior to this date. The worn cast iron bearing was removed and taken to the shop where it was set up in the boring mill and was bored .270" larger in diameter than the original 22" dia.

A piece of #10 gage steel plate measuring .135" in thickness was rolled to 22 $\frac{1}{4}$ " O.D. to fit inside of the bearing between the bearing and the new Mearns bushing as a shim. The .135" shim was fastened to the west side of the cast iron bearing with 2 - $\frac{3}{8}$ " C&K head screws. The new Mearns bushing was then put in and was fastened to the shim and bearing by 2 - $\frac{1}{4}$ " brass flat head screws on the west side (the mill rotates from west to east in the bearing). The shim and bearing were both drilled for a $\frac{7}{8}$ " dowel pin in the bottom of the bearing. This hole was slotted to allow the shim and bearing to "creep" from west to east with the rotation of the mill. The east end of the

Micarta bushing was similarly fastened to the bearing by 2 - $\frac{1}{4}$ " flat head brass screws in slotted holes to allow for creeping. Two new thrust blocks of Micarta were fastened to the faces of the bearing. The Micarta bushing was $\frac{1}{2}$ " thick, 14 " wide, ^{22 " dia.} and was a 180° ^{bearing} was an exact duplicate of the original bearing, though the finish was very much better. Both edges parallel to the centerline of the mill were chamfered ^{when needed} about 1 " for the admission of oil or water. This chamfer was increased to 4 " on each side of the bearing and by so doing the contact surface was reduced from close to 180° to 135° . The cost of the new Micarta bushing was 63.00 and the cost of the 2 Micarta Thrust blocks was 33.00 . A new discharge end Micarta bushing was purchased on the same order AqB 1679 dated Nov-16, 1938 at a delivered cost of 177.50 . It was 44 " dia, 1 " thick 12 " wide and had 1 " chamfer on each edge. It will be kept as a spare. A feed end bushing to complete the spares for one mill has been ordered. The comparative cost of Micarta bushings and babbitt bushings for the 6×12 Marcy may be estimated by

Comparing the price of 4x10 Marroy
babbitts and quotation on Mearns
bushings for these mills:-

	Babbitt	Mearns	Quilke
Feed End	\$ 77.67	\$ 73.50	\$ 74.50
Discharge End	84.00	57.37 ^①	194.50 ^②

① To secure this price we would be obliged
to purchase 2 bushings

② This price includes a charge of \$150.00
for a special mould. Future prices
would be 44.50 each.

The feed end trunnion was worn and
scored. The original diameter was 21".
Measurements taken at 1" intervals from
the South end were: 20 ²⁷/₃₂" dia, 20 ¹³/₁₆"
20 ³/₄", 20 ³/₄", 20 ³/₄", 20 ²⁵/₃₂", 20 ²⁵/₃₂", 20 ²⁷/₃₂",
20 ²⁷/₃₂", 20 ²⁷/₃₂". Before installing the
new Mearns feed end bushing the mill
had been shimmed up ¹⁹/₃₂" at the feed
end to level it. These shims were
removed and shims made of #10 gal plate
.135" were placed between the sole plate
and bearing to compensate for the wear
on the trunnion. The mill was level
when the repair was completed. Measurements
of wear on both bearings in both 6x12
Marroy will be taken weekly hereafter.

to detect damage to their bearings in the early stages. The discharge trunnion was in excellent condition; no wear could be detected by measurement. The diameter was 44.00" at 1" intervals over the width of the bearing. The discharge end Micarta bushing was worn on a little less than half of its width at the North side. The South half was in excellent condition being polished smooth. The thickness at the South side was 1" and at the North side it was $\frac{15}{16}$ ". This bushing was put back for further service. When the mill was started, with a light rod charge, water soluble oil was dropped into the feed end and discharge end bearings. Power was 100HP at the start. Most of the rods removed were then added till the power rose to 152 HP. Rods were added at intervals in the breaking-in period in such quantities as not to exceed the motor capacity. At the end of a week the new bearing had broken in and a normal rod charge has been restored.

While making the above repairs a new wood baffle identical with the one on the west side was installed in the Dorr Duplex Classifier. The east

grinding size has been too coarse and changes are being made so that all adjustments in the east grinding department are the same as those in the west unit where the grinding size is satisfactory.

Weightometer Tests in Dec.

W.		E	
12/2/38	.57% high	12/1/38	.14% high
12/8/38	Correct	12/9/38	.43% high
12/22/38	1.10% high	12/16/38	.23% high
12/29/38	.63% high	12/23/38	Correct
		12/30/38	.42% low.

Average screen analyses of feed to flotation for the month of Dec. :-

East Unit: - 6.0% on 48 mesh, 16.8% on 65 mesh, 28.4% on 100 mesh, 52.2% on 200 mesh all cumulative

West Unit: - 4.7% on 48 mesh, 15.5% on 65 mesh, 27.2% on 100 mesh, 51.5% on 200 mesh, all cumulative.

Power for Grinding for Dec in KWH per ton

	W. W.	E	Total
Dry tons crushed	28763.6	27290.4	56054.0
Felsmith	.272	.256	.264
Gyrasphere	.632	.654	.643
6x12 Marcy	3.122	3.177	3.149
Hardinge	.966	1.017	.992
4x10 Marcy	3.234	3.398	3.316
Total	8.226	8.502	8.364

Water for Flotation in Dec.

	Avg.	Max	Min
Turbidity	34	55	12
pH	7.2	7.3	7.1

Total rainfall 1.63" for Dec.

(1)

Time List for Repairs, Based on Telemeth Running Time East Unit.

- 12/1/38 5 Hrs 15 Mins General repairs.
- 2 25 Mins Power off 20 mins. 4x10 Marcy overload 5'
- 3 5 Mins Feed chut choked.
- 4 10 Mins Working on 6x12 Marcy Mull pinion shaft bearing.
- 5 1 Hr 40 Mins Middle chain broken on 6x12 classifier
- 6 40 Mins Setting up Gyrophae 15', 4x10 Marcy overload 20', By passing Hardinge 5'
- 7 25 Mins 6x12 Marcy overload 15' Setting up Gyrophae 10'
- 8 5 Mins 6x12 Marcy overload
- 9 5 Hrs 35 Mins Feed off for repairs 15'. General repairs 5 hrs. 6x12 Marcy drag overload 20'
- 10 10 Mins 6x12 Marcy overload 5' Tightening clutch on pan feeder 5'
- 12 5 Mins Feed chut choked.
- 13 1 Hr 55 Mins 4x10 Marcy overload 15'. Changing speed reducer on 6x12 classifiers 1 Hr 20' Setting up Gyrophae 15' By passing 6x12 Marcy Mull, pinion shaft broken 5' 6x12 Marcy down 3 Hrs 45' changing pinion shaft
- 16 5 Hrs 55 Mins Shutting down for repairs 20' General Repairs 5 Hrs 20' Feed pipe to 6x12 Marcy choked 5'. Drag classifier overloaded 10'
- 17 15 Mins 6x12 Drag overloaded 10' By passing 6x12 Marcy 5' 6x12 Marcy down 55', dipper lip loose.

(2)

15

- 12/19 15 Mins 6X12 Marcy overload
20 20 Mins " " " 10' Setting
up Gyrograph 10'
- 21 15 Mins 6X12 Marcy overload
22 30 Mins " " " 15', 4X10 Marcy
overload 15'
- 23 4 Hrs 10 Min 6X12 Marcy overload 5' General
repairs 4 Hrs 5'
- 24 5 Hrs 15 Mins 6X12 Marcy overload 5'
Examining Gyrograph Crusher 10'
Gyrograph Crusher motor bearing worn
out, installing new ball bearing 3 Hrs 20'
Middle chain broken on 6X12 Classifier
- 25 5 Mins 6X12 Marcy overload
26 20 Mins " " " 5' Feed chute
choked 15'
- 27 25 Mins 6X12 Marcy overload 10' Setting
up Gyrograph Crusher 15'
- 28 15 Mins 6X12 Marcy overload 5' Feed chute
choked 10'
- 29 30 Mins 4X10 Marcy overload 25' 6X12 Marcy
overload 5'
- 30 8 Hrs 25 Mins Shutting down for repairs 20'
General repairs 7 Hrs 50' 6X12 Class. overload
10'. 4X10 Marcy overload 5'
6X12 Marcy Null down 16 hours repairing
feed end drum bearing
- 31 10 Mins By passing 6X12 Marcy 5 add rods
6X12 Marcy down 8 Hrs 40' repairing feed end bearing

West Unit

- 12/2/54 9 hrs Feed off for repairs 20' General repairs
8 hrs 15' 4x10 Marcy overload 5'
Drive chain off speed reducer 5'
Power off 15'
- 6 35 Min Setting up Gyropha 15' Chute
Choked under Telsmith Cr. 15'
Bypassing Hardware 5'
- 7 10 Min 6x12 Marcy overload
- 8 5 hrs 25 Min General repairs
- 9 45 Min Pan feeder drive chain off 5'
Repairing Gyropha conveyor belt 40'
- 10 20 Min 6x12 Marcy overload 15' 4x10 Marcy
overload 5'
- 11 5 Min Chute under Telsmith Crusher
choked with wet ore.
- 13 20 Min Setting up Gyropha
- 15 2 hrs 15 Min 6x12 Marcy overload 10'
General repairs 2 hrs 5'
- 16 15 Min 6x12 Marcy overload
- 18 5 Min Gyropha Crusher filling up
- 19 5 Min " " " " " "
- 20 15 Min Setting up Gyropha
- 22 6 hrs 30 Min General repairs
- 27 15 Min Setting up Gyropha
- 28 20 Min 4x10 Marcy overload 10' Gyropha
crusher filling up 10'
- 29 5 hrs 20 Min 6x12 Marcy overload 30' General repairs
4 hrs 45' Gyropha filling up 5'

Contd

4x10 Marays down 7 hrs 30 min
repairing feed chute

- 12/30 10 Min Feed chute choked 5' Gyraapher
Crusher hopper filled up 5'
- 31 10 Min Gyraapher Crusher filled up

Hardinge Mill.

- 12/2 7 Hrs 40 Min General repairs
- 6 2 Hrs 10 Min Installed new casing
on motor side of discharge pump
and installed new distributor.
- 11 1 Hr 55 Min Drive belt broken.
- 15 1 Hr 40 Min Inspecting lining, found
no hole 2" x 4"
- 22 7 Hrs 5 Min General repairs, painting,
over mill.
- 28 15 Min Belt broken on discharge pump.
- 29 11 Hrs Examined lining, patched one
hole with Smooth-On and steel balls