On the other hand the total breaking ore cost for all the stopes is very much higher due to the fact that we operated stopes where the cost was over $2.00 per ton. If we had four or five stopes similiar to one under discussion, our breaking ore costs would be reduced 50% to 75%.

From the hanging drift mentioned above, we drilled a series of Diamond Drill Holes cross-cutting the formation and some ore was encountered. Four holes, #380, 384, 385 and 388, showed from 5 to 15 feet of high grade ore, and these holes being only a short distance apart, we might naturally expect the ore to be continuous, but instead we found separate little ore bodies. One of them was only about 7 feet in diameter. The largest one of the bunch cut out 15 feet above the level. Another hole drilled at the South end of the level encountered 7 feet of high grade ore right in line where we naturally expected to get #3 stope on its downward dip. After drifting in there, all of the ore was mined out in one cut. The discouraging feature of this level has been the barren condition of the hanging wall drift and the cutting out of the foot-wall ore stopes.

An examination of the maps shows that the ore areas in the Pascoe Shaft are gradually decreasing as shown in the following table for the last few lifts:-

LEVEL	ORE AREA ON THE SILL FLOOR
2172'	6,425 sq. ft.
2050'	12,000 "
1950'	17,100 "
1850'	26,625 "

PASCOE SHAFT.

2272' LEVEL:-

The drift here is in 35 feet from the shaft and headed for the #1 East and #1 West Stopes, 200 feet away. Another contract will start in a few days and drift back to the hanging. The hanging will be followed to the Northwest.

SHAFT SINKING.

No. 9 Shaft was bottomed in February 200 feet below the 2082' Level. Good progress was made in sinking this lift. The previous lift sunk in 1914-1915 from the 1935' to the 2082' Levels averaged only 15 feet per month. We averaged from 20 feet to 32 feet monthly, due partially to the softer nature of the ground that permitted us to use Jack Hammer machines.

The Pascoe Shaft was bottomed at the 2272' Level during the year and after the sinking was completed the back of the shaft started to give us trouble. We had to timber from the 2172' to the 2272' Level, which threw us back at least two months. The bottom of the shaft is now in Jasper and should give no further trouble. The last two lifts the hanging of the shaft has followed along a seam of Soaprock which has been the cause of all our trouble.

EXPLORATIONS.

Twenty-six Diamond Drill holes were drilled underground during the year.

No. 374 drilled to prove possible extension of ore found #366. Hole was blank.

No. 375 drilled to cross-cut formation on 2082' Level, No. 9 Shaft, one of a series of parallel holes located about 100 feet apart. Found 26 feet of Lean Ore and 2 feet of Bessemer Ore.

No. 376 drilled parallel to #375 cut 10 feet of Lean ore.

EXPLORING.

No. 377 drilled into the foot-wall from same set up as #376 cut 5 feet of good ore and 18 feet of lean ore. The good ore has been stoped out.

No. 378 drilled parallel to #377 cut 21 feet of fair grade Bessemer ore which was drifted upon and mined.

No. 379 drilled on the 1935' Level, No. 9 Shaft, cut 8 feet of Pascoe grade ore. No. 12 contract is now drifting for this ore.

No. 380 on the 2170' Level, Pascoe Shaft, drilled to look for possible downward extension of #6 stope encountered 5 feet of good ore near the collar of the hole, but showed up 13 feet of Soaprock where the ore should have been. The 5 foot seam of ore was mined out.

No. 381 on the 1935' Level, No. 9 Shaft, drilled parallel to #379 cut two small seams of Bessemer ore.

No. 382 on the same level and parallel to #379 showed up 5 feet of good ore only.

No. 383 drilled on the same level and parallel to #379 cut 23 feet of fair grade Pascoe ore which has been mined out.

Nos.: 384-385-386-387 and 388 on the 2170' Level, Pascoe Shaft, all drilled to cross-cut the formation from the hanging wall drift to the foot-wall, all found from a few feet to 13 feet of high grade ore, but all these lenses proved to be only small pockets.

No. 389 was drilled into the hanging to prove for certain that the drift had followed the hanging wall.

No. 390 to No. 392 drilled on the same level as Nos.: 384 to 389 to find the possible downward extension of #2 and #3 West Stopes, did not show up any thing worth while.

The ore found in hole #391 was mined out in one blast.

EXPLORING.

Nos.: 393 and 394 were drilled in No. 9 Shaft, 50 feet below surface to trace the ore found on surface just East of the Shaft. Nothing but Lean ore showed up in the drill holes.

No. 395 drilled to prove up ore found in an old hole cut only 2 feet of ore.

No. 396 drilled to look for possible downward extension of 1570' Level ore, which appeared to exist also on the 1710' Level in two holes, cut only two seams of ore, the largest being only 3 feet thick.

Nos.: 397 & 398 drilled in No. 9 Shaft on the 2232' Level to look for soft ore deposit found first on the 2082' Level were blank.

No. 399 on the 2082' Level to trace the ore found in the North drift got only 2 feet of good ore.

No. 400 was drilled on the 1935' Level to look for the downward extension of the large #1 Stope on the 1815' Level and was expected to show up a good ore body. This hole cut nothing but lean ore, being the biggest disappointment for the year. On the 1815' Level, the ore was 40 feet wide and on the 1935' Level, 10 feet wide. The hole was drilled to cut the ore half way between the levels and we got only lean ore. It did not seem possible that an ore body 40 feet wide and over 200 feet long could pinch out so quickly, but such has been our usual fortune in drilling during the year.

No. 401 drilled on the 2050' Level to look for #1 and #4 Stopes did not encounter any ore except at the collar of the hole.

No. 402 and No. 403 drilled down from the 2050' Level to trace the downward extension of the big block ore #2 North Stope, proved the ore to pinch out about 60 feet below the level.

EXPLORING.

An examination of the above holes reveals the fact that only one hole proved up over 10 feet of good ore; the rest of them showed narrow seams of good ore or Lean ore. It simply proves that our levels are in a barren zone and cheap ore and low costs per ton are absolutely impossible as long as these conditions exist.

ORE IN SIGHT.

The following statement shows the tons of ore in sight on December 31st, 1917.

NO. 9 SHAFT.

LEVEL	ORE BROKEN ON STULLS		ORE IN PLACE	SHAFT PILLARS	PROSPECTIVE ORE	TOTAL
	AVAILABLE	NOT AVAILABLE				
911'				2,520		2,520
1000'				3,000		3,000
1050'				6,000		6,000
1153'				3,200		3,200
1665'	29,492					29,492
1815'	550		1,500			2,050
1935'	6,223		1,610		15,863	23,696
2082'	6,673		59,510		12,815	78,998
2232'					6,415	6,415
TOTAL,	42,938		62,620	14,720	35,093	155,371

PASCOE SHAFT.

1500'			500		1,710	2,210
1570'	1,970		3,916		3,570	9,456
1640'				2,700		2,700
1710'	2,685	12,515	12,250	24,000		51,450
1780'		22,000		22,500		44,500
1850'		3,200		13,200		16,400
1950'	11,379		12,365	58,570		82,314
2050'	6,306			18,960		25,266
2170'	8,260		9,275			17,535
2270'					19,530	19,530
TOTAL,	30,600	37,715	38,306	139,930	24,810	271,361

WEST REPUBLIC.

		950				950
GRAND TOTAL,	73,538	38,665	100,926	154,650	59,903	427,682
LESS SHAFT PILLARS & UNAVAIL-ABLE BROKEN ORE,						193,315
NET TOTAL,						234,367

The Ore in Sight has been subdivided into grades as enumerated:-

GRADE	DEVELOPED	PROSPECTIVE	TOTAL
Bessemer,	109,279	21,240	130,519
Basic or Non-Bessemer,	30,983	3,570	34,553
Pascoe or Siliceous,	34,202	35,093	69,295
TOTAL,	174,464	59,903	234,367

Following is a statement showing comparative figures on Ore in Sight, Product, etc., for the last four years:-

	1914	1915	1916	1917
Ore in place, Jan. 1st,	969,700	516,350	383,720	291,980
" on stulls, " "	247,485	250,830	216,884	171,580
Total Ore in Sight,	1217,185	767,180	600,604	463,560
Product,	124,920	185,187	173,096	153,425
Balance,	1092,265	581,993	427,508	310,135
Ore in place, Dec. 31st,	516,350	383,720	291,980	315,479
" Broken, " "	250,830	216,884	171,580	112,203
Total ore in sight,	767,180	600,604	463,560	427,682
Developed during year,	325,085*	18,611	18,732	117,547

*Loss.

The statement, Ore in Sight, includes shaft pillars and unavailable broken ore.

An analysis of the ore in sight shows that although the tonnage developed during the year is much greater than that proven up during the past three years, the broken ore on stulls which constitute our ore reserves are steadily diminishing. To make conditions worse, the amount of unavailable broken ore is the same as three years ago, namely, 38,665 tons, which tonnage becomes an ever increasing percentage of the total amount.

The small ore reserves make it difficult to maintain production because the ore is divided up into many small portions widely distributed over the mine. The ore left is also badly mixed with rock and trammers have a poor chance at getting the ore.

Production is bound to vary greatly during the next few months unless we can open up enough new stopes so that we can break as much or more ore than we are hoisting. We must therefore break about 12,500 tons monthly which we have been unable to do, due to the small size of the ore bodies developed.

The two new levels namely, the 2272' Pascoe and 2232' No. 9 Shaft, must develop more favorably than the levels opened up during 1917 or production will be still further curtailed.

Following is a statement showing the Ore on Stulls on December 31st, 1917.

ORE ON STULLS.

Following is a statement showing the ore on stulls on December 31st, 1917.

NO. 9 SHAFT.

		AVAILABLE			NOT AVAILABLE.		
LEVEL	STOPE	TONS	IRON	PHOS.	TONS	IRON	PHOS.
1665'	#3, N. end,	710	58.00	.062			
"	#5, S. "	28,782	55.00	.062			
1815'	#2,	550	65.40	.024			
1935'	#2, Hanging,	1,513	65.80	.043			
"	#4,	4,710	54.80	.052			
2082'	#1,	2,393	64.70	.060			
"	#2,	3,680	65.10	.050			
"	#3,	600	65.80	.050			
	NO. 9 Total,	42,938					
	PASCOE SHAFT.						
1570'	#1,	1,970	66.30	.069			
1710'	#1,	2,685	66.80	.087			
"	#3,				12,515	65.00	.075
1780'	#3,				18,900	66.00	.066
"	#4,				3,100	64.00	.068
1850'	#3,				3,200	66.00	.087
1950'	#1,	1,555	64.00	.077			
"	#6,	4,220	66.60	.045			
"	#7, Magnetic,	3,154	67.90	.024			
"	#8,	2,450	66.20	.064			
2050'	#1, North,	389	68.18	.082			
"	#2, " S. end,	868	68.11	.050			
"	#2, " N. "	4,124	68.30	.043			
"	#3, "	925	68.40	.092			
2172'	#1, East,	2,040	66.60	.043			
"	#1, West,	5,985	66.50	.036			
"	#2, East,	235	67.10	.023			
	PASCOE TOTAL,	30,600			37,715		
West Rep.860'Level,-#1,					950	64.00	.044
WEST REPUBLIC TOTAL,					950		

SUMMARY.

SHAFT	AVAILABLE	NOT AVAILABLE	TOTAL
No. 9 Shaft,	42,938		42,938
Pascoe "	30,600	37,715	68,315
West Republic,		950	950
TOTAL,	73,538	38,665	112,203

73

REPUBLIC MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR-1917.

GRADE	IRON	PHOS.	
Republic Bessemer,	65.29	.038	
Republic Pascoe,	57.16	.044	
Republic Basic,	63.78	.073	

Above grades went into mixed cargoes.

REPUBLIC MINE.

REPUBLIC MINE

ORE STATEMENT - DECEMBER 31ST, 1917.

	RUN OF MINE			BESS.	BASIC	PASCOE	BESS.	BASIC	PASCOE	BESS.CR.	BASIC CR.		TOTAL
	BESS.	BASIC	PASCOE	LUMP	LUMP	LUMP	CRUSHED	CRUSHED	CRUSHED	P.I.St.P.	P.I.St.P.	TOTAL	LAST YEAR
On Hand Jany. 1st, 1917,	13,184	944	27,769							226	189	42,312	78,275
Output for Year,	101,263	30,682	21,480									153,425	168,498
Stockpile Overrun,													4,598
Transferred between Grades,	104,757	29,861	33,632	31,746	18,358	14,260	59,518	18,634	25,734				
Total,	9,690	1,765	15,617	31,746	18,358	14,260	59,518	18,634	25,734	226	189	195,737	251,371
Shipments,				31,746	18,358	14,260	59,518	18,634	25,734	0	0	168,250	209,059
Balance on Hand,	9,690	1,765	15,617	0	0	0	0	0	0	226	189	27,487	42,312
Decrease in Output-11%												19,671	
Decrease in Ore on Hand,												14,825	

2-8 Hr. Shifts during 1916 & 1917.

REPUBLIC MINE.

REPUBLIC MINE.

REPUBLIC MINE

SHIPMENTS FOR YEAR - 1917.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR	
Republic Bessemer Lump,	13,453	18,293	31,746	25,273	
Republic Basic Lump	12,559	5,799	18,358	21,589	
Republic Pascoe Lump,	5,568	8,692	14,260	17,296	
Republic Bessemer Crushed,	31,764	27,754	59,518	71,988	
Republic Basic Crushed,	14,251	4,383	18,634	25,637	
Republic Pascoe Crushed,	9,191	16,543	25,734	44,794	
Republic Bessemer Crushed (P.I.St.P.),			0	1,300	
Republic Basic Crushed (P.I.St.P.),			0	1,182	
Total,	86,786	81,464	168,250	209,059	
Total last Year,	106,012	103,047	209,059		
Decrease - 19%			40,809		

REPUBLIC MINE.

REPUBLIC MINE.

REPUBLIC MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 7.	1 9 1 6.	INCREASE.	DECREASE.
PRODUCT	153,425	173,096		19,671
General Expense	.136	.117	.019	
Maintenance	.350	.187	.163	
Mining Expense	2.108	1.709	.399	
Cost of Production	2.594	2.013	.581	
Exploratory	.149	.038	.111	
DEPRECIATION.				
Original Purchase	.458	.421	.037	
Plant Account	.100	.100		
Equipment	.014	.021		.007
Total Depreciation	.572	.542	.030	
Taxes	.090	.078	.002	
Central Office	.108	.093	.015	
Miscellaneous		.012	.012	
Sundry Expense	.014	.013	.001	
Cost on Stockpile	3.527	2.765	.762	
Loading & Shipping	.092	.080	.012	
Total Cost on Cars	3.619	2.845	.774	
No.Days Operating	303	302	1	
No.Shifts and Hours	2-8hr	2-8hr		
Avg.DailymProduct	506	573		67
COST OF PRODUCTION				
Labor	1.698	1.405	.293	
Supplies	.896	.608	.188	
Total	2.594	2.013	.581	

REPUBLIC MINE.

REPUBLIC MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 7.	1 9 1 6.	INCREASE.	DECREASE.
PRODUCT	153,425	173,096		19,671
No. Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	68	67	1	
Underground	174	202		28
Total	242	269		27
AVERAGE WAGES PER DAY				
Surface	3.56	2.86	.70-24.5%	
Underground	3.82	3.12	.70-22 %	
, Total	3.75	3.05	.70-23%	
WAGES PER MO. OF 25 DAYS				
Surface	89.00	71.50	17.50	
Underground	95.50	78.00	17.50	
Total	93.75	76.25	17.50	
PRODUCT PER MAN PER DAY				
Surface	7.38	8.45		1.07
Underground	2.93	2.82	.11	
Total	2.10	2.11		.01
LABOR COST PER TON				
Surface	.482	.339	.143	
Underground	1.306	1.105	.201	
Total	1.788	1.444	.344	
AVG. PRODUCT BRK'G & TRM'G	5.64	5.12	.52	
" WAGES CONTRACT MINERS	3.83	3.32	.61	
" " " TRAMMERS	4.53	3.49	1.04	
" " " LABOR	4.08	3.39	.71	
TOTAL NUMBER OF DAYS				
Surface	20,782¾	20,487	295¾	
Underground	52,399¾	61,382		8,982¼
Total	73,182½	81,859		8,676½
AMOUNT FOR LABOR				
Surface	73,994.68	58,667.39	15,327.29	
Underground	200,311.60	191,257.17	09,054.43	
Total	274,306.28	249,924.56	24,381.72	

Proportion Surface to Underground Men:
1917 - 1 to 2.56
1916 - 1 to 3.02
1915 - 1 to 3.
1914 - 1 to 2.34

REPUBLIC MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1917.	AMOUNT 1916.
50% Powder, Red Cross X.	73,215	.1544	11304.86	13334.65
50% " " Gelatine	90,926	.1836	16697.39	209.25
50% " Gelatine				10658.46
Total Powder	164141	.1723	28002.25	24202.36
Fuse	232,750	5.557	1293.32	979.95
Caps	53,188	12.780	679.75	687.47
Cap Crimpers	11	358	3.94	1.35
Tamping Bags	27,569	2.414	66.55	
Total Fuse,Etc.			2043.56	1668.77
Total All Explosives			30045.81	25871.13
Product			153,425	173,096
Pounds Powder per ton Ore			1.07	.0928
Cost per ton for Powder			.1825	.1398
" " Fuse,Caps,Etc.			.0133	.0097
" " All Explosives			.1958	.1495
Avg. Price per lb. for Powder			.1723	.1506

ANNUAL REPORT

OF THE (1917)

IMPERIAL MINE.

Production and Shipments.

The Imperial Mine remained closed throughout the year 1917. No shipments were made and there is no ore in stock.

Estimate of Ore Reserves. Jan. 1, 1918.

Level	Shaft Pillar Tons	Available Ore Tons	Total Tons	Partly Developed Ore Tons	Total Tons
First	12,000	2,000	14,000		14,000
Second	23,000	28,000	51,000		51,000
Third	24,000	178,000	202,000		202,000
Fourth	45,000	200,000	245,000	80,000	325,000
Total	104,000	408,000	512,000	80,000	592,000
Less 10% for loss in Mining		41,000	41,000	8,000	49,000
		367,000	471,000	72,000	543,000

A factor of 13 cu. ft. per ton was used, and incidental rock was deducted on each level.

Surface.

There was no work done at the mine until the month of December. At that time the boilers were removed and shipped to the Maas Mine at Negaunee.

During the heavy rains of the spring two sets at the collar of No. 2 shaft caved, blocking the shaft.

SPIES MINE.

PRODUCTION.

The total ore production for the year 1917 was 74,581 tons, of which 9,753 tons were produced during December. The production by months was as follows:

MONTH.	TONS ROCK.	SPIES TONS-SCREENED.	SPIES TONS-LUMP.	TOTAL TONS.
Jan.	1,956	1,004		1,004
Feb.	916	1,282		1,282
Mar.	1,888	2,068		2,068
Apr.	682	2,374		2,374
May	64	4,538	440	4,978
June	2	6,266	726	6,992
July	52	7,902	1,010	8,912
Aug.	72	8,527	1,535	10,062
Sept.	28	6,955	1,469	8,424
Oct.	14	8,854	1,270	10,124
Nov.		7,129	1,479	8,608
Dec.		9,753		9,753

Of this tonnage the grades were divided as follows:

Spies Lump Ore	7,929 tons
Spies Screened & Crushed . . .	66,652 "
Total production for year . .	74,581 tons

The entire product of Spies Screened and Crushed Ore was put on the stockpile. Of the Lump Ore 6,309 tons were shipped by all rail from the first of May until the middle of October. The balance of the Lump Ore product - 1,620 tons - was put on the stockpile. The Lump Ore ran about 17% of the total product during the months of September, October, and November.

The average analysis of the two grades of Spies Ore dried is:

	LUMP.	CRUSHED.
Iron	56.30	54.90
Phosphorus	.605	.645
Silica	4.45	.560
Alumina	4.24	4.64
Manganese	.22	.19
Lime	.44	.49
Magnesia	.48	.42
Sulphur	.235	.284
Loss by Ignition	7.99	8.23
Moisture	4.51	7.52

OPERATION AND DELAYS.

OPERATION.

This mine was put on an operating basis in May. It was worked on two 8-hour shifts up to September 1st, when it was put on one 8-hour shift. At this time the mine was developed to such a point that enough ore could be broken on one shift for hoisting on two. The maximum number of men employed during any month was 110, while the present force consists of 85 men, 62 men underground and 23 on surface.

DELAYS.

The mine was operated 299¾ days and idle 13¼ days besides Sundays. Of the idle days, 7 were holidays and 6¼ were due to accident to equipment and other causes. There were also many minor delays during the year from various causes. The idle days and causes were as follows:

DATE.	SHIFT.	CAUSE.
Jan. 1	Both	New Year's Day.
Jan. 2	Day	Repairs to Boilers.
Feb. 2	Day)	
Feb. 12	½Night)	Unable to handle the water
Feb. 13	Both)	with equipment of pumps and
Feb. 15	Night)	boilers. Shaft and part of
Feb. 16	Both)	third level drowned out on
Feb. 17	Both)	these dates.
May 16	Day	Repairs to Hoisting Engine.
May 30	Day	Decoration Day.
June 5	Day	Draft Law Registration.
July 4	Both	Independence Day.
Sept. 3	Both	Labor Day.
Sept. 10	Day	Repairs to Boilers.
Oct. 27	Night	Repairs to Hoisting Engine.
Nov. 29	Both	Thanksgiving Day.
Dec. 24	Both	Christmas Holiday.
Dec. 25	Both	Christmas Holiday.

ESTIMATE OF ORE RESERVES.

Main ore body all Non-Bessemer Ore.

NET TONS.	AVAILABLE.	UNAVAILABLE.	PROBABLE.
Ore Above 1st level	103,049		
" " 2nd "	59,630		
" " 3rd "	21,694	2,502	
" Below 3rd "		841	
Total Main orebody	184,373	3,343	

North Lens all Non-Bessemer Ore.

NET TONS.			
Ore Below 2nd level			3,984
" in pillars above 2nd	5,984		
" broken in stope	5,280		
" above stope to sand	52,390		
Total Net Tons North/ Lens	63,654		3,984

NET TONS.			
MAIN ORE BODY	184,373	3,343	
MORTH LENS	63,654		3,984
GRAND TOTAL	248,027	3,343	3,984

SURFACE.

STOCKING GROUND.

The stocking ground was extended to the north and west to the coal dock approach. The stumps were blasted and ground graded, and 160,000' of 3" sollar plank laid. This work was started in July and completed in October by the regular surface crew of 3 men and mine team.

Shipping of Spies Lump Ore was stopped during the latter part of October, and separate stocking of the Lump Ore started. The Lump Ore was stocked on the east side of the screened ore, which was stocked during the summer. This side of the pile was covered with 1½" hardwood hearts to prevent the mixing of the fine with the lumps when loading with the shovel. Lump Ore was only stocked for one month on account of the difficulty of handling.

ENGINE HOUSE & EQUIPMENT.

NEW CONSTRUCTION - E & A NO. 343.

A new Ingersoll Rand Imperial Short Belt drive electric driven Compressor was installed during July and August. The total cost of Compressor, motor, and installation was $6,740.00. The compressor was started on September 14th. This electric compressor gives a more steady air pressure and has a capacity of 900 cu.ft. per minute. With the operation of the electric compressor, there is a saving of almost 50% fuel over the operation of the steam compressor.

HOISTING ENGINE.

Larger cylinders were put on the hoisting engine in September. This enables the better handling of the loaded cage when at the bottom of the shaft, which had heretofore been handled with difficulty.

A new hoisting rope was put on the skip in December and the skip changed.

STORE AND OIL HOUSE.

The store and oil house was completed in February, except for the painting and concrete floor, which was finished in July. This building is used for oil and grease, carbide and general storing of ropes, blocks, and miscellaneous material.

HOSE HOUSE.

A hose house for the housing of the fire hose cart was built just west of the south end of the dry. As the connection in case of fire is made to the boiler feed pump, it is a very convenient place.

COAL DOCK.

A broader and safer passage way was made on the coal dock and guard rails built around it.

During the year 4,400 tons of coal were received at the mine. The balance on hand December 31, 1917, is 1,973 tons.

SHAFT HOUSE.

The enclosure in the shaft house about the crusher and grizzly was completed and steam heating coils installed during January.

On the 21st of March work of making the necessary changes in the shaft house for separating the lump from the fine ore was started. Part of the grizzly chute had to be taken out and a portion of the bell of the crusher removed. The chute was built of wood, lined with steel pipe, and carried the lumps into the shaft house loading pocket. After shipping was stopped and it was found that separating the lump ore was causing too much delay to the hoist, it was decided to discontinue it.

In August a new top tram engine was installed. The old puffer was too slow and could not handle the product. The engine is run by steam.

SPIES MINE.

The ½ inch wire rope winds on an 18" drum, mounted loose on a shaft, to which it is connected by a friction clutch. There is a 4' fly-wheel mounted on the shaft between the engine and drum, which helps to accelerate the engine to a high rate of speed. The engine is at rest except when pulling the car back.

LOCATION.

HOUSES.

All the cottages have been rented since June. One family moved out in April and two others moved in, then in June two more families moved into the location, which filled the ten cottages.

During November the outside doors of all the houses were repaired and rubber weather stripping put around them.

During june the part of the fences that were not stained last year were finished and the barn was given a coat of the same brown stain. In November the stable portion of the barn was covered with a heavy roofing paper in order to keep it warmer than last winter.

WATER SUPPLY.

During the extreme cold of last winter a great deal of trouble was experienced in keeping the location water supply open. This was due to the severe weather of January, February, and March. The location being built on the top of a hill, nearly all of the snow blows away, leaving the ground bare and allowing the frost to penetrate very deep. The pipes were thawed out twice by the local Electric Light Company. During September a shut-off for each house was put in, and the pipes into the supply tank re-arranged to come into the center of the tank. A double walled enclosure

covered with heavy roofing paper was built around them. The boxes enclosing the water pipes under the houses were put into good shape and the bottoms of the houses banked up both inside and out with dirt and cinders.

GARDENING.

The cleared land north of the location was platted out into small lots and given to the men living in the location and others employed at the mine for raising potatoes and other vegetables. About 25 men were taken care of in this way.

FIRE PROTECTION.

Besides a Pyrene Fire Extinguisher in each cottage, two 50' lengths of garden house are kept in a cupboard in the barn. This hose can be attached to the bibbs in the kitchen of the house

FATAL ACCIDENT NO.1.

On Saturday morning, June 16th, at about 9:30, David I. Rayburn, miner, met his death by falling down No. 10 Raise, a distance of about 50'.

Rayburn and his partner had been instructed by the shift boss to work in No. 10 Raise and start cutting out the third sub-level. At the same time he instructed them to cover over the bottom of the raise at the elevation of the second sub-level more securely before starting the work. The Captain arrived shortly afterward and found Rayburn up the raise and inquired if it was all right to come up and was assured by Rayburn that it was. Rayburn had carried the hoses to the top of the raise and tied them and then came down to get the drill machine. He came down as far as the back of the sub-level on sprags placed in hitches cut in the sides of the raise, from here a ladder reached to the floor of the sub. The Captain was

standing on the ladder and Rayburn on the sprag. He called to his partner to hand him the drill when suddenly the sprag gave way and he fell through the covering to the bottom of the raise, a distance of 50'. The raise was covered with three or four poles, but not as well as the shift boss had instructed them to do. Rayburn was an American, and is survived by a widow and four children. There was no time or product lost on account of the accident.

RESCUE AND FIRST AID.

The Government Bureau of Mines Rescue Car No. 7 came into the mine on June 16th for one week. During this week a crew of Rescue men were trained in helmet and rescue work, and eight men given a course in First Aid to the Injured. The helmet and rescue work is particularly valuable in this district where there are frequent fires in the black graphitic slate. This slate carries a high percentage of carbon and sulphur. Although the foot and hanging rock is shown by some of the drill holes to be this black slate, it has not been uncovered as yet, because we find a lean formation as the foot and hanging of the ore.

UNDERGROUND IN GENERAL.

METHOD OF MINING.

The main Spies ore body is egg like in shape with the small end down. The dip of the ore on the foot averages between 50 and 60 degrees. The ore is a tight, self-supporting ore, and can be mined without timber. The method adopted is a modification of the sub-stoping system. It allows the mining of the entire ore body from the 3rd Level.

The ore body was first developed from three main levels: The first

level -200 feet, 805 feet sea elevation; second level, -300 feet, -705 feet sea elevation, and the third level, -400 feet, 605 feet sea elevation.

NOTE: "-" means minus elevation.

The main drifts from the shaft were driven to the southwest to hit the north end of the ore body on the respective levels. On the first and second levels a foot wall drift was driven southeast with cross-cuts to the hanging every 50 feet. On the third level, besides the foot drift, to the southeast, two other drifts parallel to the first at 25' centers were driven.

The foot drifts on the three levels were driven on line and located to parallel one another at a distance so that a 60° raise on the foot would hole into the drift on the level above.

From the third level drifts vertical raises were put up at 25' intervals from the west side of the drifts. In the foot wall drift, besides the vertical raises, incline raises were put up on the foot at 60°. These raises were also located at 25' centers and staggered with respect to the vertical raises on the opposite side of the drift. As the height of these inclined raises increases and the horizontal distance from the incline raise to the next vertical raise west becomes greater than 25 or 30', vertical branch raises are put up from the incline raise. In this way, when the raises are connected by drifts on the different sub-levels by drifting half way from each raise, twelve feet is about the greatest distance necessary, and hence no tramming and very little shoveling is necessary.

The first sub-level was opened up 35' above the floor of the level and then the next two subs 20', making the distance between the

third sub and second level 25'. Above the second level the sub-levels are 20' apart. On these sub-levels drifts are driven connecting the raises, blocking out the ore body in pillars 18 to 20' square by 20' thick. Mining is started from the hanging and worked back to the foot and is done in a vertical face. A slice from a row of pillars in the topmost sub is taken along the hanging, and then this slice is followed down to the lowest sub. Therefore, the higher the stope gets, the greater the working face.

The men work in the drifts and are under solid cover, and drill holes in all directions from this position in the drifts - side holes into the pillars and stope holes in the back and floor.

The mouths of the raises on the bottom sub-level are coned out so as to leave a knife like edge dividing the different raises and providing a large opening to prevent blocking by large chunks. It was found necessary to put up block holing raises between the main raises so as to be able to drill and blast large chunks that block the chutes.

Mining is started by drifting from the row of raises nearest the hanging on the different sub-level elevations toward the hanging and then connecting these drifts along the hanging and finally blasting through from sub to sub, making an opening along the hanging wall. Then stoping is started by working to a vertical face, being careful not to allow the lower sub-levels to get back beyond the sub above and thus have the men working on an overhanging bench of ore. The best condition is to have the stoping on the top sub slightly in advance of the one below. This method is well adapted to the size and character of the ore body.

A secondary ore body on the second level is being mined by the shrinkage stope system. On this level the main drift from the shaft cut

a seam of ore about 20' thick, and this was followed to the northwest and a shrinkage stope started.

The ore body thus far developed is only 15 to 40' wide and the dip of the formation varies from 45 to 70°. Using this system of mining, there should be little danger from falls of ground from the back, as the men work on the broken ore and are in reach of the back at all times and can keep it in a safe condition.

The main tramming drift was driven in the ore and follows the foot wall as closely as possible. As the ore body is developed, raises without cribbing are put up at 15' intervals to a height of 15' above the back of the level, at which elevation the raises are connected and stoping started. The length of one stope is 120'. Chutes were built in all the raises, except the ones at either end of the stope, which are carried up to the level above and connect with the stope at intervals of 20', giving a safe traveling way into the stope, ventilation, and a means of bringing in the air lines. This method is particularly adapted to a narrow, steep pitching deposit and allows a 100% extraction. 8,000 tons have been taken from this stope, with an estimate of 5,280 tons of broken ore remaining in the stope.

ELECTRIC LIGHTING AND SIGNALS SYSTEM.

During the month of June a ten conductor cable was put down the shaft for the underground lighting and signal system. Lights were installed on the plats of the three levels and throughout the main third level drift.

Electric bell signals were installed on each level for signalling the cage and skip. The cage signal is a repeat system, and

insures the cage rider who gives the signal that the engineer has received the correct signal, or if not, it can be repeated back and forth until it has been correctly received.

The signals are operated by an alternating current. A small transformer located in the Engine House takes 220 volt current from the lighting system and reduces it to 16 volts. Different tone bells are used for the cage and skip. Besides this system of signals, there is also a pull bell to surface.

PUMPS, PIPING, ETC.

A great deal of trouble was experienced during the months of January and February in handling the water. The temporary equipment at this time consisted of a No. 10 Cameron Pump on the first level, a No. 10 Knowles on the third level, and a No. 7 Cameron Pump located 13' above the bottom of the shaft. The two No. 10 pumps discharged into the same 4" pipe.

The first level pump took care of the first level and shaft water. The shaft water was relayed to this level by the No. 7 Cameron. The third level pump took care of the second and third level water. It was necessary to keep the pumps running at full speed to keep control of the water, which meant maintaining a boiler pressure of 110 pounds. At this same time the boilers were badly in need of repair and at times it was impossible to keep steam for running the pumps.

A 6" discharge pipe was put in the shaft during the last week of January, and the first level pump connected to it, which relieved the situation somewhat.

The installation of a 300 gallon Dean Electric Pump, which came

from one of the mines of the North Lake District, was completed on February 13th and put into immediate operation. This pump was connected into the new 6" discharge line.

The electric shaft cable installed at this time was only a temporary one obtained from the Athens Mine. The permanent armored cable was installed upon arrival in August.

Besides the electric pump, a Worthington Duplex Steam Pump with a Prescott Jet Condenser was installed at the same time as a spare pump, either pump being able to handle the present amount of water. It is only necessary to run the electric pump about eleven hours in every twenty-four hours.

LOCATION WATER SUPPLY.

Early in March the water caught at ledge for the water supply began to decrease and made it necessary to move the pumping station to the first level. Here the water caught in a concrete gutter about 30' above the level is drained into a wooden tank 4'x5'x7' placed just north of the shaft. The water is pumped from here by a Dean Duplex Feed Pump. The amount of water is not sufficient for both location supply and boilers; however, as much as is available is turned into the boiler/tanks.

PUMP ROOM AND SUMP.

A permanent pump room was cut on the third level 30' north of the shaft in the foot wall, black slate. It is a room 16' wide, 36' long and 11' high, and is timbered. The cutting of the pump room was started and completed during the month of January.

The timber was fire proofed by first covering with a heavy building paper, then metal lath and plastered with concrete plaster. The work of plastering the pump room was done during the month of July. A light concrete floor was also put around the pumps. Besides making the pump room fire proof, it gives it a very clean, solid appearance.

A sump was cut to the south of the pump room by driving a drift to the east 7' below its floor, 8' wide and 45' long. At the present flow of water the capacity of the sump will hold for 2½ hours. With this sump capacity and the present amount of water it is only necessary to run the pump intermittently amounting to a total of about 11 hours in 24.

POWDER HOUSE.

A powder house was cut on the second level, during April. It is located 230' southwest of the shaft, and was cut in from the east side of the drift. It is a room 8'x12'. The shift boss has charge of the powder, and gives to each gang or contract the proper number of sticks for the holes to be blasted.

DEVELOPMENT WORK.

FIRST LEVEL.

The development of the first level was completed during the first four months of the year by contract No. 1. It extended the drift to the southeast 158'. Except for a distance of about 25' of first-class ore, this drift cut only second-class and lean ore. The last 10' was lean formation. It struck seams of black slate in the upper left hand

corner of the breast and was stopped. Diamond Drill Hole No. 17 was found on the left side of this foot wall drift, and the formation cut checks very well with that shown by the drill hole.

Five cross-cuts were then driven from this foot wall drift toward the hanging. No. 1 cross-cut was started 104' northwest of the breast of the foot wall drift. Nos. 2, 3, and 4 - 50', 100', and 150', respectively, northwest of No. 1, and No. 5 was started 50' southeast of No. 1. These cross-cuts were extended 113', 58', 83', 26', and 48', respectively. No. 1 cross-cut cut 40' of ore; No.2 cross-cut 35'; No. 3 cross-cut 70', and No. 4 cross-cut 16', and then passed into a mixed lean formation. No. 5 cross-cut first cut 26' of second-class ore and then 22' of first-class ore. The breast of this cross-cut was in good ore when it was stopped.

During the month of November a gang working in No. 100 raise from the second level extended it to the first level elevation and then drifted southwest off the top of the raise 38', holing into the main cross-cut 315' from the shaft. Although this raise was in ore, the drift was in lean formation. The formation is pitching toward the southeast and there is evidence that the ore extends above the first level. There was no work done on the first level during December.

SECOND LEVEL.

The main ore body on the second level was developed by No. 2 contract during the first four months of the year. The development of the north lens was started in March by No. 6 contract, and in May No. 7 contract was added to assist No. 6 in this territory.

No. 2 contract extended the drift to the southeast along the foot 192', through 25' of lean formation; then passed into ore for 55'; then again into a mixed lean and second-class ore formation. It found Diamond Drill Hole No. 20 to the right of the center of the drift where it started the first cross-cut to the hanging. The formation in the drift checks with the drill records at this elevation in the hole. It then drove three cross-cuts from the foot wall drift toward the hanging. This foot wall drift parallels the drift on the first level, moved to the southwest a horizontal distance of a 60° raise in a 100' difference of elevation. The cross-cuts were driven, of course, vertically under those on the first level.

Cross-cut No. 1 was extended 137', cutting a 110' of ore; No. 2, 119', cutting 75' of ore, and No. 4, 127', cutting 55' of second-class ore; then 15' of lean ore; then into 47' of good ore.

No. 6 contract was added during the first week of March, and started off the main drift 355' southwest of the shaft. A seam of 20' of first-class ore was cut at this point. It followed this ore northwesterly for 125', putting a test drift to the hanging and foot between Nos. 103 and 104 chutes - showing a width of 30' of ore.

No. 7 contract was added in May, and started to follow this seam southeast, but found it too lean, and then with No. 6 contract started Nos. 100, 101, 102, 103, 104, and 105 raises. These raises were spaced 15 foot centers, developing this ore for mining by the shrinkage stope system. The raises were put up 14' above the back of the level, at which elevation they were connected and stoping started.

THIRD LEVEL.

The third level was developed by Nos. 3, 4, and 5 contracts. No. 3, during January, extended the main drift southwest 104', making the breast 553' from the shaft. Then 478' from the shaft it started a drift to the southeast to parallel the drift on the second level, moved to the southwest on an angle of 60° at a difference of 100' in elevation. It extended this drift to the southeast 148' during January, and February, and March entirely through lean formation. In February it started a second drift parallel to the first 25' southwest, and extended it during February and March 154', the last 50' being in first-class ore.

No. 4 contract, after completing the sump in February, started a third drift to the southeast parallel to those driven by No. 3 contract and 25' southwest of No. 2 drift. It extended this drift during February and March 137', cutting only 30' of first-class ore at the southeast portion of the drift.

No. 5 contract was added during March, and put up No. 30 raise 91' from drift No. 1. It passed into ore 25' above the floor of the level. This raise is a 60° incline raise on the foot.

During April nearly all the development work was concentrated on this level, Nos. 3, 4, and 5 contracts worked here the entire month and Nos. 1 and 2 during the last half. These contracts put up raises and cut out the first sub-level 35' above the floor of the level. The following tabulation gives the location and numbers of the raises:

Cross-cut No. 3 Vertical	Cross-cut No. 2 Vertical	Cross-cut No.1 Vertical	Cross-cut No.1 Incline
			30
	10	20	40
2	12	22	50
4	14	24	60
6	16	26	

No. 5 extended No. 30 raise 21', holing into the second level. This raise is used as a traveling way between the second and third levels. As the other raises reached the height of the first sub-level, they were connected by drifts, blocking out the ore in pillars 18' square.

MINING.

FIRST LEVEL.

No mining was done on the first level or above.

SECOND LEVEL NORTH LENS.

Mining in this territory was begun in June, when No. 6 contract started from 100 raise and No. 7 from 106 raise and drifted toward each other, connecting the tops of the raises and stoping started.

No. 8 contract was added the first of July and extended the main level drift to the north for 17', and then put up Nos. 107, 108, and 109 raises 20' each to the elevation of the starting of the shrinkage stope; then moved to the top of 106 raise and drifted northerly, connecting up the tops of the raises 106 to 109, extending the length of the stope about 50'.

No. 9 was added the latter part of July and extended 100 raise 20', cutting into the stope for a new traveling way. Contracts Nos. 6, 7, and 8 continued to work in this stope for the balance of the year and opened it up to a height of 76' above the level for a 110' long and an average width of 20'.

No. 9 contract during these months put up No.100 raise to the first level elevation and No.109 raise 91' above the second level. It would put up raises in the pillar at the ends of the stope and cut into these main raises, keeping a traveling way open into the stope. 8,000 tons of ore have been taken from this stope with about 5,280 tons of broken ore left.

During December Nos. 6, 7, and 8 worked in this stope extending it to a height of 76' and above the level. 840 tons of ore were taken from this stope during the month. Estimate of broken ore in the stope about 5,280 tons.

MAIN STOPE.

Mining was started in this stope in May and has continued until the stope has reached a height of the 744' sub-level, the second sub-level above the second level. This gives a working face of 114'. The ore body is not very large, being only 100' long at the second level elevation. It is cut by lean seams of Jasper and Limonite, and it is hard to mine the ore clean and keep the ore up to grade.

THIRD LEVEL.

During May small block holing raises were put in by No. 5 contract between Nos. 4 and 6 and Nos. 1 and 2. In June No. 2 contract put up No.22 raise to the 642' sub-level and then moved to this sub. No. 1 contract in July put up No. 24 raise to the first sub above the level and started No.26 raise, which it put up 60' to the second sub-level in August. It also put up No. 60 raise to the second sub-level, completing it in October. There was no work done on the third level during December.

642' SUB-LEVEL.

Mining of the main ore body was started on this sub-level in May by contracts 1, 2, 3, and 4. The tops of Nos. 2, 4, and 6 raises were coned and drifts driven from these raises toward the hanging. No. 41, a vertical 25' northeast of raise No. 20, was put up from this sub-level, branching from the incline raise No. 40. Stoping on this sub-level was continued from time to time during the year, coning each line of raises as the face of the stope was moved toward the foot.

In December contract No. 13 continued to stope back from raises Nos. 20, 22, 24, and 26 and coned them. It also cut into the rock northwest of No. 20 raise for a distance of 15'. The face of the stope on this sub has been brought back 10' northeast of the line of raises 20-26.

662' SUB-LEVEL.

The development of this sub-level was started in May by contracts Nos. 1, 3, 4, and 5. Raises Nos. 2, 4, and 6 reached lean formation a short distance over the back of this sub-level and were discontinued. Stoping on this sub-level was continued from time to time, the stope having advanced back to the line of raises 20-26. There was no work done on this elevation during December.

682' SUB-LEVEL.

This sub-level was developed during the month of June by contracts 1, 3, and 4, by drifting off 10, 12, 14, and 16 raises to the hanging, a distance of 18 to 20', when stoping was started. These raises were then put to the second level elevation, No. 16 cutting very lean formation. Stoping was then continued from time to time, the

face of the stope having moved back to the line of raises 20-26.

Contracts Nos. 11 and 12 worked on this sub during the greater part of December. One gang stoped northwest from No. 20 raise and the other one extended the drift to No. 60 raise, then stoped to the southeast from No. 24 raise for 30'.

SECOND LEVEL.

The second level was developed before mining was started. The stope from the third level reached this elevation about the middle of July. It is being cut off on the south at No. 14 raise; the strike of the formation is almost due east and west at this point. The stope has been brought back to within 50' of the drift along the foot. Incline raises Nos. 30, 40, and 60 have holed into this drift, and vertical branch raises Nos. 42 and 62 started from Nos. 40 and 60 raises.

During December contracts Nos. 5 and 9 worked on this level part of the month, stoping between cross-cuts Nos. 1 and 4, stoping back to within 10' of No. 41 raise; then moved to No. 42 raise; No. 9 to the 724' sub-level and No. 5 to the 744' sub-level.

No. 1 contract extended No. 40 raise 15' toward the first level and No. 62 raise 30', which was started off No. 60 raise from the second level elevation. No. 2 contract extended No. 60 raise from the first sub-level below the level and 20' above the level toward the first level.

724' SUB-LEVEL.

This sub-level was opened up during July. Raises Nos. 10, 12, and 14 passed into the hanging at the back of this sub and were stopped.

Stoping was started on this elevation in August, and has continued from time to time, and the face of the stope is not back to within 10' of No. 41 raise.

During December No. 10 contract worked on this sub-level during the entire month, and took a slice for about 8' along the entire face of the stope. No. 9 moved to this elevation about the middle of the month and drifted off No. 42 raise 22' to the southeast.

744' SUB-LEVEL.

Raises Nos. 20, 22, and 24 were extended to this sub-level during August, and drifting started. No. 24 raise is in the hanging at this elevation; No. 22 has hanging 10' above, and No. 20, 20' above this sub-level. No. 41 raise is also in lean formation at this elevation; in fact, the line 20-41 seems to be the limit of the ore to the northwest. Stoping has been continued on this sub-level and has advanced to a point within 10' of No. 41 raise.

In December No. 4 contract stoped back about 8' between the drift off No. 41 raise and 24 A raise, a raise put up to test out the hanging. No. 3 contract extended the stope to the southeast for 27' along the face of the stope.

No. 5 contract moved to this elevation about the middle of the month and cut out No. 42 raise, drifting 10' southeast.

SPIES MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR-1917.

GRADE	IRON	PHOS.	SILICA
Spies,	55.45	.474	
Spies Lump,	56.91	.481	4.26

ORE STATEMENT AND SHIPMENTS FOR 1917.

	SPIES	SPIES LUMP	TOTAL	TOTAL LAST YEAR
On Hand Jany. 1st, 1917,	314		314	
Output for Year,	66,601	7,929	74,530	314
Total,	66,915	7,929	74,844	314
Shipments,	0	6,309	6,309	0
Balance on Hand,	66,915	1,620	68,535	314

1917 - 2-8 Hr. Shifts - Began operating May 1st.

SPIES MINE.

SPIES MINE.

MINING COSTS FOR 8 MONTHS, 1917.

	1917.
PRODUCT	74,530
General Expense	.149
Maintenance	.127
Mining Expense	1.290
Cost of Production	1.566
Ore Produced in Development	.132
DEPRECIATION.	
Original Purchase	.085
Equipment	.001
Construction	.400
Total Depreciation	.486
Taxes	.042
Central Office	.051
Sundry Expense	.020
Cost on Stockpile	2.297
Loading & Shipping	.018
Total Cost on Cars	2.315
Nol Days Operating	205
No. Shifts and Hours	2-8hr
Avg. Daily Product	364
PRODUCTION.	
Labor	.933
Supplies	.633
Total	1.566

SPIES MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.
PRODUCT	74,530
No. Shifts and Hours	1-8hr
AVERAGE NUMBER MEN WORKING	
Surface	14
Underground	45
Total	59
AVERAGE WAGES PER DAY	
Surface	3.36
Underground	3.87
Total	3.74
WAGES PER MO. OF 25 DAYS	
Surface	84.00
Underground	96.75
Total	93.50
PRODUCT PER MAN PER DAY	
Surface	16.65
Underground	5.41
Total	4.09
LABOR COST PER TON	
Surface	.202
Underground	.715
Total	.917
AVG. PRODUCT BRK'G & TRM'G	6.74
" WAGES CONTRACT TRAMMERS	3.68
" " " LABOR	3.68
TOTAL NUMBER OF DAYS	
Surface	4,477¼
Underground	13,766¾
Total	18,244
AMOUNT FOR LABOR	
Surface	15,046.43
Underground	53,260.74
Total	63,307.17

Proportion Surface to Underground Men:

1917 - 1 to 3.2

SPIES MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1917.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1 9 1 7.
6" to 8" Timber	18	.03	.54
8" to 10"	581	.07	40.67
Total 1917	599	.068	41.21
	LINEAL FEET.	PER 100'.	
5' Lagging	1,334	.65	8.67
7' "	11,171	.762	85.18
Total Lagging	12,505	.75	93.85
Poles	820	1.25	10.26
Total 1917	13,325	.781	104.11

Product	67,853
Feet Timber per ton of ore	.00088
Feet Lagging	.0018
Feet Lagging per foot of Timber	2.09
Cost per ton for Timber	.006
" Lagging	.0138
" Poles	.0002
" Timber, Lagging & Poles	.020
Equivalent of stull timber to Bd. Measure	0

Mine started on operating basis Maylst, 1917.
Mine operated two-8hr shifts from May 1st to Aug. 31, 1917.
Mine operated one-8hr shift from Sept. 1st to Dec. 31st, 1917.
Very little timber used in mine; most of it for raises and chutes.

SPIES MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 7.
25% Powder	28,750	.15034	4322.32
40% "	36,250	.17216	6240.98
50% "	7,300	.16117	1176.61
80% " Giant	0		
Total Powder	72,300	.16237	11739.91
Fuse	185,200	6.316	1169.83
Caps	25,150	15.325	385.45
Cap Crimpers	1		.56
Tamping Bags	15,000	.002	30.04
Total Fuse,Etc.			1585.88
Total Explosives			13325.79
Product			67,853
Pounds Powder per ton Ore			1.06
Cost per ton for Powder			.1730
" " Fuse, Caps, Etc.			.023
" " All Explosives			.196
Avg.Price per lb. for Powder			.162

Mine started on operating basis May 1, 1917.
Mine operated 2-8hr shifts from May 1st to Aug.31,1917.
Mine operated 1-8hr shift from Sept. 1st to Dec. 31st,1917.

CROSBY MINE

ANNUAL REPORT FOR 1917.

The production of wash ore from the Crosby Mine during the past year amounted to 290,795 tons, 90,061 tons coming from underground operations and 200,734 tons from the open pits. The washing plant was operated from May 1st. to November 1st. It handled 296,168 tons of crude ore and turned out 187,938 tons of concentrates. The stockpile on hand May 1st. amounted to 41,404 tons and on Jan. 1st. 1918, 36,031 tons, the difference, or 5,373 tons, representing the variance between the tonnage produced for 1917 and that treated in the mill.

The general labor situation in the Nashwauk district showed some improvement over that for 1916, however, the class of men was not at all satisfactory and operations were handicapped as a result. The question of inefficient labor was especially noticeable during the periods that underground operations were carried on, namely, from January 1st. to May 1st. and November 1st. to December 31st. The labor prospects for 1918 are no brighter, in fact there may be a decided shortage. Fortunately, we should be able to carry on our summer's operations with less men than were employed last year during the corresponding period, as we will have one additional shovel in the pits and practically no hand milling will be undertaken.

Our stockpile, as of May 1st. 1918, should be as large as that accummulated on May 1st. 1917, namely 97,205 tons. The

overrun will bring the total to at least 100,000 tons and 65,000 tons of concentrates should be realized from a treatment thereof. We should then be required to produce 180,000 tons of wash ore during the six months from May 1st. to November 1st. in order to turn out a total of 180,000 tons of concentrates during the coming season. The estimated production from the Crosby operations for 1918 has been figured at 180,000 tons of concentrated ore.

ORE ESTIMATE OF JANUARY 1st., 1918.

MERCHANTABLE ORE.

As no merchantable ore was developed or mined from the property during the past year, the estimate will be the same as reported for January 1st. 1917. It is not considered likely that any additional merchantable ore will be developed at the Crosby Mine, in fact it is quite probable that a part of the above tonnage will be treated in the washing plant, as the silica content is high.

In sight January 1, 1918.

East forty	86,000 tons.
West Forty	122,000 tons.
Total.....	208,000 tons.

This ore, the bulk of which is tied up in the track and shaft pillar, averages 56 per cent iron, .040 phosphorus and 14 per cent silica. It may also be advisable from a mining standpoint to extract a part of the above tonnage with the wash material and send it through the mill.

"WASH ORE."

	Est.Jan.1st.'17	Mined 1917.	Est.Jan.1st.'18
Stripped & Above Main Level	650,000 tons	200,734 tons	450,000 tons
" Below " "	435,000 "	-------	435,000 "
From Underground Operations	765,000 "	90,061 "	675,000 "
Total	1,850,000 "	290,795 "	1,560,000 "

No exploratory or development work was undertaken during the past year and in the process of mining no factors, tending to alter the estimate assumptions, were encountered. The estimate of January 1st. 1918 is therefore 290,000 tons, the yearly production, less than that for the previous year.

The 1,850,000 tons, estimated in sight on January 1st. 1917, was based on an average of 47 per cent iron and .045 phosphorus. The output for 1917 averaged 49.44 per cent iron and .038 phosphorus. As the product mined during 1917 was above the average 2.44 per cent in iron content and below the average .07 in phosphorus, the average analysis of the tonnage is sight January 1st. 1918 is based on a 46.50 per cent iron and .046 phosphorus. It is apparent that we will not be able to turn out a large tonnage of Bessemer concentrates in the future. In fact it is doubtful whether we can make any Bessemer grade after the coming season. While raising the iron content of our ore 14 per cent in our concentrating plant, the phosphorus is raised from .005 to .006. Subsequent to the year 1918 our operations will be largely confined to the deposit below our present main level. This ore is almost entirely non-Bessemer and the mining conditions are such that it will be very inadvisable to attempt to make a Bessmer grade. It is very unfortunate that we could not have mined more of our high phosphorus ore during 1916 and 1917, as we were considerably below our guarantee in phosphorus and received no benefit therefrom. Our second level has not been developed to a sufficient extent to enable us to attack the high phosphorus underground ore tributary thereto and the open pit deposit necessarily had to be mined according to our past two years' program. As it was, the height of the steam shovel cuts taken was almost prohibitive. We would be obliged to suspend mining operations for several months in order to strip the shaft, construct pockets and push out

our tramming drifts on the second level. We now plan on starting this work at the close of navigation next fall and should make sufficient progress prior to the opening of the 1919 shipping season to enable us to maintain our present yearly shipments. While there would not be a large tonnage in stock May 1st., the shovels would be able to mill extensively from the east pit, the tram would be short and the ore comparatively free from rock. All waste material is being cleaned from the east pit as the shovel cuts are taken. The ore below the present pit bottom is comparatively clean.

We do not anticipate attempting any exploratory or development work during 1918, which might result in increasing our ore reserves.

GENERAL SURFACE.

It was necessary to keep a force of from 2 to 4 men on the surface drainage ditch during the severe weather of January and February, in order to keep a channel open for the seepage from the storage basin. About 100 gallons per minute seeped from the dam, and as this amount of flow is not sufficient to keep a channel open, it was necessary to chop and shovel out a shell of ice at frequent intervals. To minimize this work, dams were constructed at several points along the ditch to the north and west of the Crosby pit. These dams would be blasted out when a sufficient head of water had accummulated to insure an appreciable flow for a day. When the flow decreased to about 100 gallons per minute the water was again dammed.

As the Hawkins Mine is to strip the northwest corner of their property, it was necessary to change the course of our drainage ditch and to run our mine water into this ditch at a point

north of our west pit. The mine water has always been drained along the Hawkins line, on their land. We have run a pipe line from the collar of our pump raise to within 400 feet of the drainage ditch and excavated a drain to handle the water from the end of the pipe. This work was done during the month of November. The new ditch will be approximately one half a mile in length and the average depth of cut 9 feet. The Hawkins, York and Crosby Mines will each pay one third the cost of this ditch. Most of the work, which was started in November, will be done with the York Mine dragline.

Some work was done on the shop buildings and boiler house, the boiler and steam lines covered and all leaks in water and steam lines repaired. In order to economize on heating fuel, the inside of the boiler house and shops were cased.

Some new stringers were placed on the coal dock and necessary repairs made here and to the coal chutes.

A force of eight men was employed during the last week of April, constructing and lining a pocket and chute to handle the rock sorted on the head frame, changing the dumping plates to accomodate the new 4 ton skips and placing grizzly bars across the shaft pocket. The grizzly bars were spaced 2½ inches apart. While it was frequently necessary to delay hoisting operations in order to clear away rock and frozen chunks, the material sent to the mill was much cleaner and the rates of concentration improved. The openings in the rail grizzly, used during 1916, were four inches and considerable rock and partly decomposed material found its way to the washing plant and had to be sorted on the picking belt. By increasing the capacity of the skips one ton, we were able to hoist 135 tons per hour. The longer skips cleared themselves to better advantage in the dumps and practically no trouble was experienced with chunks falling back into the shaft.

The top tram cars were thoroughly overhauled, some minor repairs made on the six railway cars and considerable patching done on the 7 yard side dump cars used for handling the rock. These 10 rock cars are practically worn out and many replacements will be necessary for 1917 operations. It may, be advisable to send over five or six of the Helmer cars and make five good cars from the ten at the Crosby, in order to have 10 cars in service this summer.

The steam shovels and locomotive were thoroughly overhauled during March and April. The locomotive was sent to the Hawkins shops. The shovels were furnished with new cabs and the machinery was carefully repaired. It will be necessary to repeat all this work next spring and in addition replace numerous worn parts on the steam shovels.

A fire proof oil house was constructed in the open space between the dry and power houses. Metal lath and concrete plaster was placed on the frame shell both inside and out. Five 100 gallon iron tanks were set down in the concrete floor and one 100 gallon tank for gasoline was set in the ground, so that the top was 3 feet below the surface.

The Mine locomotive while returning light from the mill on July 20th. struck a Ford automobile owned and driven by Dyrck Englebert. He was the only occupant of the car. The Township road crossing, which is located a little better than one quarter of a mile north of the Mine is in a cut and while the brush had been cleared on either side of the track, it was possible to approach within about 30 feet of the crossing without sighting a train coming from the mill. The Ford car was wrecked and Mr. Englebert severely bruised. A settlement of $800.00 was made with Mr. Englebert. The brush has now been cut back some distance on either side of the track and the Township has removed some material from the sides of the cut. The engine crews were in-

structed to slow down for the crossing and to whistle 300 feet from it. The bell is always rung.

The Mine team and single driver were worked steadily during the past year, carting away rock from the stockpile grounds, spreading ashes over the property roads, hauling timber to the several raises and shaft, delivering freight from the depot and coal to the locomotive dock and steam shovel chutes.

MINING OPERATIONS.

Mining activities were confined to underground operations during the months of January, February, March and April and the output was placed in stock. This work will be considered first.

Two company account gangs were engaged during January and February in stoping out the 47 per cent ore to the east of Nos. 109 and 128 chutes. These workings were driven under the stripping bank and were exposed to such an extent that ventilating doors were placed at the mouths of the pit entrances. The rock seams in the ore were so numerous, and the tonnage per man so small, that operations here were suspended.

A force of 4 men spent the months of January and February slicing out pillars of 50 per cent ore under the old 1500 Foot Sub to the north of No. 183 chute. The severe weather was somewhat of a handicap here. The ore was exhausted and the men transferred to the East Forty workings early in March.

No. 1 followed out several seams of 50 per cent ore from No. 204 raise at an elevation of 1490 feet. The gang was engaged here when open pit work was started May 1st.

No. 11 spent several months on development work to the east of No. 119 raise. These drifts and crosscuts were extended on the 1490 Foot Sub with the intention of demonstrating the

advisability of further stripping to the east of the open pit. It looked for a time as though sufficient ore might be developed here to warrant extending the stripping limits, but the large percentage of rock and the extremely lean character of the ore, caused us to abandon the proposition.

A force of from 2 to 6 gangs were engaged during the first four months of the year in developing and scramming on the 1500, 1490 and 1475 Foot Subs to the north and west of raises Nos. 48, 68 and 69. This ore was rather low in iron content, averaging under 45 per cent, but the phosphorus was below .030. The 1500 and 1490 Foot Subs were cleaned up by April and operations in April consisted in extending the development work on the 1475 Foot Sub. There was a question here of stripping back from the open pit limits, but several test raises from the 1475 Foot Sub showed a capping of partially decomposed taconite and the removal of the overburden was not considered feasible. The underground deposit on the 1475 Foot Sub had a width of 130 feet, was 270 feet in length and the height of ore varied from 8 to 16 feet.

No. 14, a double contract, continued their drifts to the north and south of their raise, holing to the open pit just east of No. 40 raise and the old workings on the south side. A square set room was then mined out along the north drift and the ore gouged out from the back and along the sides of the south seam. This ore averaged 54 per cent iron and .025 phosphorus.

Nos. 4, 5, 6 and 15 were engaged in scramming along the sides of the northeast main haulage way between Nos. 48 and 73 raises from January 1st. to May 1st. The tonnage and grade of ore obtained here was very satisfactory. The iron content was well above 50 per cent and the phosphorus below .030.

Nos. 2, 12 and 19 spent the months of March and April scramming through the old workings to the east of Nos. 28, 30 and 32 chutes. This product averaged 52 per cent iron and .035 phosphorus.

Two company account gangs were employed in following out seams of high grade wash ore to the north and south of No. 16 crosscut, gouging out the sides and caving back.

Prior to the inauguration of open pit operations, May 1st., considerable rock was moved so as to allow the shovels free access to the ore banks and the motor tracks were put in good shape. This entailed considerable work in the west pit, a force of 10 men being engaged here for the greater part of one week.

The No. 2 shovel was operated in the west pit during the entire shipping season and spent several weeks subsequent thereto in preparation for the season of 1918. The ore bank attacked varied in height from 30 to 40 feet and it was necessary to gopher hole it from the bottom, blast and then put in a second series of horizontal holes about halfway from the top. The men worked on the pile of broken material in preparing the latter holes. There was a capping of decomposed taconite in places and it was necessary to blast vertical holes from the top, as well as the customary gopher holes. The presence of considerable frost in the banks and surrounding the old underground workings caused much inconvenience, as the large chunks had to be cast back of the shovel and blasted when the shovel had advanced to a safe distance. The handling of frozen chunks also delayed operations on the headframe, as they had to be broken down to 2½ inches in order to pass the grizzles. Two underground locomotives were used to handle the product from the No. 2 shovel and as they had been equipped with take-up reels and cable, the tramming problem was much simplified compared with the 1916 arrangement. The rock was cast, for the most part, over the motor tracks and in consequence comparatively little of the waste material sorted on the head frame came from the west pit.

The shovel cut the ore bank back to the stripping limits from No. 145 raise to the north tramway. The length of the cut

was 350 feet and the average depth 125 feet. Upon the completion of this work in October the shovel was moved to the north ore bank and spent two months casting back rock and digging into the ore face sufficiently to prepare for extensive operations with the opening of navigation in 1918. It was considered advisable to complete preliminary operations along the north bank before the frost had gotten into the ore. The initial cut in May 1918 might otherwise have been extremely difficult with a vertical ore face to attack.

A force of from 4 to 8 men were engaged in hand milling at the northeast corner of the west pit during the months of June, July and August. The product gained here was milled into chutes Nos. 117, 118 and 119.

The seasons product from the west pit workings averaged above 50 per cent iron, about .045 phosphorus and constituted approximately 60 per cent of the mine's output from May 1st. to November 1st.

From 5 to 12 men were engaged in milling operations to the west of Nos. 63, 64, 65, and 66 chutes. The face of ore was mined back to the stripping limits and considerable wash material gouged out between seams of taconite. More or less rock was mixed with the ore and had to be sorted out and piled along the tramways. The material gained here ran below 45 per cent iron and .030 phosphorus.

The No. 1 shovel dug back the bank to the east of Nos. 59, 60, 61, 62, 63, and 64 chutes, operations being very similar to those described in connection with the west pit. There was this difference, however, while the west pit ore was cleaned down to the bottom rock, the east pit cuts were taken 20 feet above this bottom rock and all waste material had to be removed in order to clean the bottom 20 feet of ore for future second level mining operation.

operations. But one underground locomotive could be used to spot cars for this shovel, as the proportion of rock was so great that the men on the head frame grizzles could not handle a larger amount. The locomotive and cars were run out from the main level drift just north of No. 59 raise.

The swinging pinion on the No. 2 shovel was stripped September 14th. and as better than 60 per cent of our product was derived from west pit operations, it was deemed advisable to replace the broken parts from the No. 1 shovel and tie up that machine until a new pinion could be obtained from the Marion Company. Although we wired for the new parts, asking that they be shipped by express, we did not receive them until October. Approximately an 8,000 tons loss in product resulted from this tie up.

The ore bank, at the close of the Season's activities, had been cut back to the east of the center main haulage drift and had been extended northward to a point east of No. 65 chute. The bottom of the cut is 300 feet long and averages 100 feet in width. The large quantity of rock will continue to be a serious handicap as regards extensive shovel operations in this pit, although the banks are now lower and the shovel can work to better advantage.

The product from the east pit constituted less than 40 per cent of the Mine's output. The ore averaged little better than 40 per cent iron, but ran low in phosphorus and in consequence held the higher phosphorus ore from the west pit will below our guarantee figures.

Underground operations were resumed at the close of the shipping season November 1st. and a discussion of the work will now be taken up.

The ore in stock January 1st. 1918 and the average analysis of same follows:

Tons.	Iron.	Phosphorus.	Silica.
36,031	49.10	.043	23.24

The phosphorus content of the ore to be placed in stock from January 1st. to the opening of navigation will be well under .040 and should bring the average for the entire pile to about .040 per cent.

Should washing operations be inaugurated May 1st., we will have close to 100,000 tons of ore in stock, including our probable overrun. This tonnage will fill our stocking accommodations to capacity.

During the months of November and December a gang of 4 men was engaged in scramming through the old workings adjacent to No. 189 raise.

Contracts Nos. 1 and 2 robbed back and scrammed along the seam of ore developed during the previous winter by No. 1. One gang dumps into No. 202 raise, and the second into No. 204. There is sufficient 50 per cent ore here to provide work for Nos. 1 and 2 during the next several months.

No. 3 has cut out and drifted to the east and west from No. 188 raise at an elevation of 1470 feet. This ore is badly mixed with taconite, but should afford a fair scram until spring.

Five gangs, Nos. 10, 11, 12, 13 and 16 have been engaged in slicing and robbing pillars blocked out the previous winter on the 1475 Foot Level. This product was trammed into Nos. 68 and 69 raises. The ore deposit varies in width from 16 feet at the west end to 8 feet near the raises and is mined with props, which are placed at frequent intervals between the foot rock and the capping. The material runs 45 per cent iron,.038 phosphorus and there is sufficient of it to keep this force occupied until open pit operations are resumed.

Nos. 8 and 14 continue stoping out the ore and caving back along the seam developed to the north and south of their raise during the early months of the year.

Nos. 6, 7 and 15 have been engaged in slicing, scramming and robbing along the northeast haulage drift. This ore runs

close to 50 per cent iron, .030 phosphorus and the tonnage realized is very satisfactory.

Tributary to No. 16 crosscut, Nos. 4, 5 and 9 spent the last two months of the year scramming through the old caves just above and to the north of the main level. This is fair wash ore, but considerable care has to be exercised in order to keep it free from sand and boulders from the old caves.

A small area 50 by 70 feet was stripped with teams during November and a force of five men have been engaged in milling the ore down to No. 16 crosscut. The stripped area lies along the open pit, the ore having been exposed when a mass of taconite slabbed from the vertical bank. Approximately 3,000 tons of 55 per cent ore will be milled here.

WASHING OPERATIONS.

While the washing plant was started May 1st., it was not until the middle of the month that operations assumed normal proportions. The Model "36" Shovel for stockpile loading was not received and placed in commission until May 16th. and the May feed to the mill was much below the average.

Numerous minor repairs were made from time to time during the season, such as relinning the loading and rock pockets, replacing worn plates in the launders, paddles on the log and turbo, straightening bent cleats on the apron feeder and renewing the worn picking belt and pulleys.

The Great Northern Power Company's voltage was somewhat erratic and upon numerous occasions the switches would open and the machinery stop. We were often obliged to clean out the log before starting up, especially when this machine was carrying a heavy load. There was no loss in production, however, as the mill was always able to catch up on the feed, its capacity being decidedly

in excess of the mine's production and transportation facilities.

The shortage of Great Northern Cars was a serious item, especially during the last two months of the season. We were frequently without cars for six hours at a stretch and after filling our railway bin, six cars and shaft pockets, we would be obliged to put our force on rock work at the mine as well as the mill.

The new sorting grizzles in the head-frame were responsible for there being a decided decrease in the amount of rock sorted on the mill picking belt. Whereas as high as 75 tons were handled here during 1916, from 25 to 30 tons was the maximum in 1917. The fact that the rock and ore chunks had to be broken to 2½ inch mesh was also a great benefit so far as mill practice was concerned. We had very little trouble with the feeder blocking and the wear on the conveyor belt was reduced.

While we have ordered a new converyor belt and unquestionably it will be palced in service by July 1918, the old belt is far from being worn out and may carry us pretty well through the season. We do not believe at this time that it will be necessary to purchase another belt for 1919 operations.

New trammel screen sections were placed in commission August 1st. They were perforated with 1½ inch openings instead of 2 inch and this proved to be a desirable alteration. Two men were still able to sort the material on the picking belt to advantage and a considerable load was taken from the log. In one ten hour shift 2,944 tons of ore were run through the mill and the log motor did not heat appreciably. We were obliged to shut down the mill in order to cool the log motor several times during the months of June and July. The wear on the screens is very great and new sections have been ordered for 1918.

An average crew of 14 men per shift was employed at the mill during the past season.

Following is the tonnage washed during 1917, the concentrates produced and the analysis of same as obtained from mine and Lake Erie sampling:

	Tons	Fe.	Phos	Sil.	Mois.	Fe. Natural.
Crude Ore	296,168	48.51	.034	25.32		
Concentrates) Mine Sampling)	187,938	60.73	.040	7.78		
Concentrates) Lake Erie) Sampling)	185,763	61.30	.038	7.95	6.95	57.04

The ratio of concentration for the season of 1917 was 63.43 per cent, which compares with 61.2 per cent for the previous year. The improved method of sorting rock on the head-frame grizzles was largely responsible for the improved ratio during 1917.

The recovery of iron units for 1917 was 79.41 per cent, against 79.04 per cent for 1916.

The approximate percentage of product obtained from the several machines was as follows:- screen or picking belt 16.3, log 62.3, turbo 17.1 and tables 4.3 per cent. This compares with 15 per cent for the screen, log 65, turbo 15 and tables 5, during the season of 1916.

The average analysis of the product from the machines for the past two seasons was as follows:-

	Fe. 1917	Fe. 1916	Phos. 1917	Phos. 1916	Sil. 1917	Sil. 1916
Screen,	53.73	56.43	.042	.049	16.14	12.23
Log,	61.16	60.33	.038	.044	7.34	8.03
Turbo,	60.62	59.63	.029	.033	9.49	9.22
Tables,	65.47	64.13	.019	.022	4.45	7.84
Tailings	24.60	22.70				

Following are the cargoes of Crosby concentrates shipped during the 1917 season and the analysis of same as obtained at the Mine and by the Lower Lake Chemists:

J. H. REPLOGLE - - - - - - - - 3,682 Tons.

	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.06	.036	9.72		
Textor	61.40	.041		6.56	57.372

SHENANGO - - - - - - - - 7,214 Tons.

	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.07	.036	8.23		
(Crowell & (Murray	61.48	.036		6.75	57.33
Emmerton	61.00	.031		6.80	56.85

NEGAUNEE - - - - - - - - 6,715 Tons.

	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.50	.037	8.57		
(Rattle & (Son	61.30	.032		7.81	56.512
Cremer & Case	61.00	.032		7.58	56.469

Slick - - - - - - - - 3,931 Tons.

	Fe	Phos	Sil	Mois	Fe.Nat.
Mine	60.74	.035	8.47		
Crowell & Murray	61.24	.036		6.60	57.20

H. W. SMITH - - - - - - - - 7,068 Tons.

	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.72	.037	8.83		
Textor	61.20	.034		6.31	57.338
Emmerton	60.90	.031		6.58	56.893

UHRIG - - - - - - - -10,251 Tons.

	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.42	.040	8.03		
(Crowell & (Murray	61.99	.035		6.83	57.76
Cremer & Case	61.00	.034		6.94	56.767

SNYDER JR. - - - - - - - -12,717 Tons.

	Fe	Phos	Sil	Mois	Fe.Nat.
Mine	60.35	.041	6.14		
Textor	61.60	.038		6.79	57.417
(Rattle & (Son	61.00	.038		7.20	56.608

CHAS. S. HEBARD- - - - - - - - 9,772 Tons.

	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.65	.039	7.46		
(Cremer & (Case	60.60	.036		6.73	56.52
Emmerton	61.18	.036		6.80	57.02

SHENANGO	- - - - - - - - - 7,155 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.94	.038	7.71		
(Crowell &					
(Murray	61.03	.038		6.80	56.88
Textor	61.63	.037		6.52	57.61

FRENCH	- - - - - - - - - 1,693 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.19	.034	8.64		
(Crowell &					
(Murray	61.40	.031		6.45	57.44

GLENSHEE	- - - - - - - - - 9,344 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.24	.038	8.89		
Textor	61.08	.033		6.65	57.018
(Crowell &					
(Murray	61.50	.035		6.40	57.56

SCHNEIDER	- - - - - - - - - 6,149 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.52	.036	8.93		
Cremer &					
Case	61.20	.030		6.23	57.387
(Rattle &					
(Son	60.70	.029		7.20	56.330

SCHOONMAKER	- - - - - - - - - 8,660 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.94	.036	7.94		
(Crowell &					
(Murray	61.53	.036		6.48	57.54

SCHNEIDER	- - - - - - - - - 6,152 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	61.00	.039	7.34		
(Textor &					
(Son	61.70	.037		7.24	57.233
Emmerton	61.08	.036		7.04	56.780

SHENANGO	- - - - - - - - - 12,261 Tons.				
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.73	.042	7.96		
Cremer &					
Case	61.60	.036		7.25	57.134
(Rattle &					
(Son	61.00	.035		7.50	56.425

VIKING	- - - - - - - - - 1,734 Tons.				
Mine	61.18	.044	6.93		
Textor	61.70	.037		6.46	57.714

SHENANGO	- - - - - - - - - 12,476 Tons.				
	Fe.	Phos.	Sil	Mois	Fe.Nat.
Mine	60.92	.043	7.54		
Emmerton	60.80	.038		7.24	56.398
(Cremer &					
(Case	61.30	.037		7.41	56.758

CROSBY MINE.

SHENANGO - - - - - - - - - 8,092 Tons.					
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.55	.044	7.98		
Textor	60.83	.040		7.43	56.310
Crowell & Murray	61.03	.039		6.99	56.76

SNYDER - - - - - - - - - 11,196 Tons.					
	Fe.	Phos.	Sil	Mois	Fe.Nat.
Mine	60.88	.041	7.58		
Textor	61.58	.038		7.13	57.189
Emmerton	61.25	.036		6.95	56.993

SHENANGO - - - - - - - - - 12,452 Tons.					
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.80	.040	7.76		
Crowell & Murray	61.30	.040		6.62	57.242
Rattle & Son	61.00	.035		7.00	56.730

SNYDER JR.- - - - - - - - - 13,780 Tons.					
	Fe.	Phos	Sil	Mois	Fe. Nat.
Mine	60.41	.043	8.22		
Crowell & Murray	61.54	.037		7.42	56.97
Textor	60.58	.042		7.26	56.182

PETER WHITE - - - - - - - - -6,416 Tons.					
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.67	.045	7.60		
Rattle & Son	60.90	.042		7.50	56.33
Cremer & Case	61.40	.041		7.15	57.01

RICHARDSON - - - - - - - - - 2,155 Tons.					
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	60.79	.044	7.05		
Textor	60.70	.044		7.59	56.093
Emmerton	60.53	.045		7.56	55.954

LUZON - - - - - - - - - 4,948 Tons.					
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	61.14	.045	6.42		
TEXTOR	61.10	.044		7.44	56.554
Crowell & Murray	61.73	.044		7.13	57.33

RICHARDSON - - - - - - - - - 1,895 Tons.					
	Fe.	Phos	Sil	Mois	Fe.Nat.
Mine	61.28	.046	6.23		
Crowell & Murray	61.90	.042		7.47	57.276
Textor	61.60	.045		7.54	56.955

CROSBY MINE.

ACCIDENTS

Following is a list of the accidents, which occured at the Crosby Mine during the past year and were of a nature serious enough to be reported:

DATE	NAME	OCCUPATION	NATIONALITY	REMARKS.
1/9	J. Lavola	Carpenter	Finnish	Levola was laying a rail on stock pile. He stepped on a piece of ore and turned on ankle. Sprained right ankle. Lost 3 days.
1/12	P. Stanich	Miner	Monte.	Party was lagging back of drift and using axe. Fell from staging and cut hand. Received $23.92 compensation. Lost 27 days.
1/15	L. Contess	Top Lander	Greek.	Man was cleaning skip and dump. Skip moved and caught Contess between it and timber. Lost 6 days.
1/17	S. Andler	Miner	Austrian	When dumping a car of dirt Andler's arm was squeezed between box of car and a timber. Lost 9 days.
1/24	M. Zarich	Miner	Austrian	Zarich and partner were loading a car of dirt. When swinging a shovel, partner struck Zarich on hand with shovel. Lost 3 days.
2/2	A. Ohlcren	Chuteman	Finnish	Party had loaded a car at the chute. When moving car to make room for another, he struck his head against the mouth of the chute. Lost 2½ days.
4/17	J. Papin	Motor Brakeman	American	Papin had signaled the motorman that a coupling was to be made. When making coupling he was squeezed between the platform under the chute and a car. Time lost not known as party never returned to work.

DATE	NAME	OCCUPATION	NATIONALITY	REMARKS.
4/3	J. Ruoha	Miner	Finnish	Ruoha was on staging. A rock fell from the back of the drift striking the staging, breaking plank. Party lost 20 days. Received $12. 68 compensation.
4/18	J. Martire	Miner	Italian	Martire was loading a car of dirt when some small particles fell into his eye. Lost 3½ days.
5/5	P. Legarter	Brakeman	Serbian	When alighting from the train, motor caught his foot. Lost 52½ days. Rec'd $77.00 compensation.
7/31	P. Raskovich	Trackman	Monte.	Man was coupling cars and was caught between them. Lost 15 days. Received 19.95 compensation.
7/31	A. Soch	Miner	Monte.	Man was breaking a piece of rock with a sledge and particle struck him on the leg. Lost 6 days.
8/3	F. Pellezzi	Brakeman	Italian	When riding the motor to the shaft, it left the track and squezed Pellezzi against a timber. Lost 11 days.
8/10	M. Wukovich	Chuteman	Monte.	While loading a car at the chute, a piece of taconite struck his hand. Lost 21½ days. Received $32.55 compensation.
8/14	J. Stanovich	Pitman	Austrian	Was standing near the steam shovel while it was moving ahead, rock rolled from the bank onto his foot. Lost 76 days. Received $144.62 compensation.

DATE	NAME	OCCUPATION	NATIONALITY	REMARKS
8/29	J. Persons	Pocketman	Swede	When loading rock from the pocket with a bar, a piece struck the bar causing it to strike and fracture Pearson's jaw. Lost 33 days. Received $60.72 compensation.
10/24	A. Ohlcren	Top Lander	Finnish	When dumping a car of dirt he strained his back. Lost 3 days.
11/15	V. Kostich	Miner	Monte.	Kostich was charging a gopher hole in the pit. A rock rolled from the bank and struck him on the back. Lost 23½ days. Compensation $35.00.
11/22	A. Wukovich	Miner	Monte.	Wukovich was working in front of the steam shovel. When moving a section of track, he struck his head against the shovel. Lost 4 days.
10/24	M. Salo	Top Lander	Finnish	Salo was dumping a car of ore from the trestle. After lifting the box part way to dump same, it fell back and caught his leg. Lost 57 days. Compensation $102.00
12/12	R. Petrovich	Miner	Monte.	While at work in his drift a small amount of ore fell from the back and struck Petrovich on the head. Lost 16 days. Received $20.00 Compensation.
12/14	V. Kostich	Miner	Monte.	Kostich was on staging to fire some holes. His lamp went out after spitting the fuse and the charge exploded before a safe distance was reached. Lost 6 days.

DATE	NAME	OCCUPATION	NATIONALITY	REMARKS
12/14	R. Raskovich	Miner	Monte.	Partner's lamp had gone out and Raskovich handed partner his lamp. Explosion occured before either man could get to a safe place. Lost 6 days.
12/17	M. Rokich	Miner	Austrian	Rokich was putting in a piece of timber when some loose dirt fell from the back of the drift and struck him on the head and shoulder. Lost 11 days.
12/17	M. Sakovich	Miner	Monte.	When moving some cars with motorman Sakovich's foot was squezed between rail and wheel of car. Lost 3 days.

ANALYSIS OF COST SHEET.

Mining operations were conducted continuously during 1917, January, February, March, April, November and December being confined to underground activities and May, June, July, August, September and October to work in the open pits, whereas in 1916 there were but three months, October, November and December, of underground work and five months from April 25 th to October 1st. when open pit operations were conducted.

The tonnage produced from the mine and a table showing the character of operations for the two years follows:

	Tonnage	Open Pit Work	Underground Work.
1916	290,795	303 Shifts	115 Shifts
1917	222,277	322 Shifts	300 Shifts

The cost sheets furnished were based on a production of 290,795 tons of wash ore during the year 1917, but the 1916 output considered was 41,404 tons of wash ore stocked and 110,653 tons of concentrates turned out by the mill. In other words the 1916 production of crude ore should have been used, as was done in 1917, and the basis for cost analysis should have been 222,277 tons instead of 152,057. In order to make a comprehensive comparative analysis of the cost sheets between the years 1916 and 1917, we have used 222,277 as a basis for 1916 costs.

	1917	1916
General Expense	$.045	.038
Maintenance	.069	.039
Mining Expense	.594	.435
Cost of Production	$.708	$.512

The advance in wages and supplies during 1917, as compared with 1916, and the fact that the mine operated almost three times as many shifts, underground, were responsible for

the 1917 increases noted above. These factors effect materially all items under "Mining Expense" and to a more or less extent "Mine Office" and the "Maintenance" items.

GENERAL EXPENSE.

The items "Insurance","Engineering", "Analysis" and "Personal Injury" were all low and the cost per ton practically the same for the two years 1916 and 1917. The increase in wages for 1917 was offset by the larger output realized.

"Mine Office" was $.005 per ton higher for 1917, due to increased wages and the fact that an extra man was employed in the office during the summer months.

MAINTENANCE.

The increase of $.003 in "Tracks and Yards" was due to the extensive work in connection with cleaning the mine premises and repairing roads during the spring of 1917.

"Docks, Trestles and Pockets" costs were high for 1917, being $.009 per ton over the 1916 figure. The expense of the new headframe grizzles and construction of the rock pocket explains the increase. The steel in the rock pocket and grizzles cost over $1,000.

The item "Buildings" shows an increase of $.003 per ton for 1917. The erection of the new concrete oil house and extensive repairs to the boiler house were responsible for this.

The large expense incurred in keeping the surface drainage ditches open and the cost of fireproofing the electric pump house explains the increase of $.006 per ton in the 1917 "Pumping Machinery."

The rebuilding of our three skips during the spring of 1917 and repairs to the guides caused an increase of $.002 per ton to "Skips and Skip Roads."

The item "Electric Tram Plant" was $.006 per ton higher for 1917, due to cost of installing the take up reels and cables on our underground locomotives and the expense incurred in putting the motor tracks in good shape for electric haulage. The old motors were also thoroughly overhauled during 1917.

MINING EXPENSE.

There was a decided decrease in the 1917 cost for "Pumping", as compared with the figure for the previous year. The decrease in the cost per ton amounted to $.013 and was due to the fact that operations were conducted electrically in 1917 and with steam during the greater part of 1916.

A rock drift was extended from the bottom of the auxiliary pit to tap and drain the west boundary main level workings and a winze was sunk in rock to the south of our operating shaft from the first to the second level. This work was responsible for an increase of $.01 per ton in "Rock Drifting."

"Breaking Ore" cost $.101 per ton more in 1917 than it did in 1916, due to the increase in wages and supplies.

The "Tramming" increase of $.02 per ton was caused by the larger wages paid during 1917.

The item "Timbering" was $.003 per ton higher for 1917. This was the result of there having been approximately three times as much work done underground during that year.

With the exception of the Captain, but one boss was employed during the summer of 1916, whereas two shift bosses were carried during the entire past year. This and the higher rate of wages was responsible for an increase of $.009 per ton in the 1917 item "Captain and Bosses."

The relatively high wages paid in 1917 explains an increase of $.005 per ton in "Top Landing and Tramming."

The stripping of a pocket of ore above No. 16 crosscut resulted in a charge of $.003 per ton against "Stripping." There was no charge under this heading for 1916.

CROSBY MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR-1917.

GRADE	IRON	PHOS.	SILICA
Crude on Stockpile	50.16	.033	22.69
Washed Ore,	60.57	.040	8.01

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1917.

	Mine			Lake Erie		
GRADE	IRON	PHOS.	SILICA	IRON	PHOS.	MOIST.
Crosby,	60.62	.040	7.85	61.26	.037	7.00

ORE STATEMENT AND SHIPMENTS FOR YEAR-1917.

	CRUDE ORE	CONCENTRATES	SHIPMENTS	PERCENTAGE OF RECOVERY
On Hand Jany. 1st, 1917,	41,404	0		
Output for Year,	288,889	187,938	187,938	63
Stockpile Overrun,	1,906			
Total,	332,199	187,938	187,938	
Crude Ore Treated,	296,168			
Balamce on Hand,	36,031	0	0	
Output last Year,	222,277	110,653	110,653	61%
Crude Ore Treated last Year,	180,873			
Balance on Hand,	41,404	0		
Increase in Output,	68,518	77,285		
Decrease in Ore on Hand,	5,373			

1917 - 2-10 Hr. Shifts Jan. 1st to Dec. 11th
2- 8 Hr. Shifts Dec. 11th to Dec. 31st
Washing Plant operated from May 1st to Oct. 30th
1916 - Idle Jan 1st to April 25th
2-10 Hr. Shifts April 25th to Oct. 2nd
2-8 Hr. Shifts Oct. 2nd to Dec. 31st
Washing Plant operated May 1st to Oct.2nd.

CROSBY MINE.

CROSBY MINE.

COMPARATIVE MINING COST FOR YEAR.

Based on Crude Ore Production.

	1 9 1 7.	1 9 1 6.	INCREASE.	DECREASE.
PRODUCT	290,795	152,057	138,738	
General Expense	.045	.056		.011
Maintenance	.069	.082		.013
Mining Expense	.594	.797		.203
Cost of Production	.708	.935		.227
DEPRECIATION.				
Original Purchase	.026	.038		.012
Plant Account	.042	.001	.041	
Equipment	.007	.008		.001
Construction	.003	.143		.140
Total Depreciation	.078	.190		.112
Taxes	.037	.047		.010
Central Office	.033	.036		.003
Miscellaneous		.003	.003	
Sundry Expense	.011	.012		.001
Cost on Stockpile	.867	1.217		.350
Loading & Shipping	.025	.009	.016	
Total Cost on Cars	.892	1.226		.334
No. Days Operating	311	209	102	
No. Shifts and Hours	2-8hr	2-8hr		
Avg. Daily Product	935	727	208	
COST OF PRODUCTION.				
Labor	.542	.692		.150
Supplies	.166	.243		.077
Total	.708	.935		.227

CROSBY MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.	1916.	INCREASE.	DECREASE.
PRODUCT	290,795	152,057	138,738	
No. Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	37	36	1	
Underground	87	77	10	
Total	124	113	11	
AVERAGE WAGES PER DAY				
Surface	3.98	3.14	.84-26.75%	
Underground	4.06	3.19	.87-27.27%	
Total	4.04	3.18	.86-27.05%	
WAGES PER MONTH OF 25 DAYS				
Surface	99.50	78.50	21.00	
Underground	101.50	79.75	21.75	
Total	101.00	79.50	21.50	
PRODUCT PER MAN PER DAY				
Surface	24.03	20.61	3.42	
Underground	10.50	7.90	2.60	
Total	7.31	5.71	1.60	
LABOR COST PER TON				
Surface	.166	.152	.014	
Underground	.387	.404		.017
Total	.553	.556		.003
AVG. PRODUCT BRK'G ORE, BASED ON CRUDE ORE	17.65	16.08	.57	
TOTAL NUMBER OF DAYS				
Surface	12,108¾	7,378	4,730¾	
Underground	27,690¼	19,247	18,443¼	
Total	39,799	26,625	13,174	
AMOUNT FOR LABOR				
Surface	48,152.21	23,176.91	24,975.30	
Underground	112,507.99	61,381.79	51,126.20	
Total	160,660.20	84,558.70	76,101.50	

Proportion Surface to Underground Men;
1917 - 1 to 2.35
1916 - 1 to 2.14

CROSBY MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1917.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1917.	AMOUNT 1916.
6" to 8" Timber	12,841	.05095	654.24	261.36
8" to 10"	11,236	.05095	572.46	256.53
10" to 12"	4,815	.05095	245.34	135.80
12" to 14"	2,568	.05095	130.85	173.61
14" to 16"	642	.05095	32.71	33.60
Total 1917	32,102	.05095	1635.60	[illegible]
Total 1916	16,490	.0528		870.90
	LINEAL FEET.	PER 100'.		
6' Lagging	83,300	.5819	484.75	557.75
10' "	4,250	.8823	37.50	
Total Lagging(1)	87,550	.5965	522.25	557.75
Poles				64.00
Total 1917	87,550	.5965	522.25	
Total 1916	109,450	.312		621.75

Product	290,795	222,277
Feet Timber per ton of ore	.11039	.00741
Feet Lagging " " (1)	.30107	.04780
Feet Lagging per foot of Timber	2.7272	6.4432
Cost per ton for Timber	.0056	.0039
" Lagging	.0018	.0025
" Poles		.0003
" Timber, Lagging & Poles	.0074	.0067
Equivalent of stull timber to Bd.Measure	64,074	42,666
Feet Board Measure per ton of ore	.22034	.192

Total Cost for Timber, Lagging & Poles	1917	2157.85
"	1916	1492.65
"	1915	4068.66
"	1914	1318.84
"	1913	3550.21
"	1910	5090.20
"	1909	5034.18
"	1908	4848.19

The tonnage of ore mined by underground methods was relatively small during 1916 as compared with 1917. This explains increase in 1917 figures. Considerable lagging was used in 1916 in repairing and blocking the back of main level drifts.

CROSBY MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.
(Factors based on Crude Ore).

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 7.	AMOUNT 1 9 1 6.
30% Powder	44,100	.1425	6285.36	2381.73
40% "	23,272	.1366	3178.81	4420.13
XXXX " (Black)	42,275	.0726	3069.99	1516.10
Total Powder	109,647	.1143	12534.16	8317.96
Blasting Machine	1		25.00	
Fuse	83,700	.633	529.62	284.67
Caps	26,146	1. 285	336.09	236.70
Cap Crimpers	5	.538	2.69	8.23
Electric Exploders	5,504	.0835	459.59	225.05
Connecting Wire (Lbs)	9	.5111	4.60	3.91
Total Fuse,Etc.			1357.59	773.56
Total All Explosives			13891.75	9091.52
Product			290,795	222,277
Pounds Powder per ton Ore			.377	.36
Cost per ton for Powder			.0431	.0374
" " Fuse,Caps,Etc.			.0047	.0035
" " All Explosives			.0478	.0409
Avg.Price per lb. for Powder (1)			.1143	.1039

(1) Includes Black Powder.
Increases in costs per ton of ore due to advanced prices for powder during 1917.

MEADOW AND FOWLER MINES.

ANNUAL REPORT FOR 1917.

While there was no serious labor trouble in the Aurora District during the past year and the Meadow and Fowler Mines were operated without interruption, the shortage of men was a serious handicap during the summer months especially and even by carrying extra hands, we were never sure of a full crew. In fact upon numerous occasions from 20 to 30 per cent of our men would not report for work. This was generally the case following holidays, paydays and Sundays. The men did not complain about wages and few of them quit work on this account. Of course the wet working places and the fact that the Mines are over a mile from the Village were items. The building up of the Stein-O'Rourke Addition, immediately south of the Meadow Shaft, has benefited us somewhat and as the mine workings are carried to lower levels, the water question is handled to better advantage and the flow confined instead of seeping through the deposit. With the same number of men available in the Aurora District during 1918, we should fare somewhat better. St. Louis County will enter the dry column March 1st. and no doubt this will prove a benefit from a labor standpoint as has been the case in Itasca County.

The production from the Meadow-Fowler Mines for the past year amounted to 106,382 tons, 93,087 tons having been shipped and 13,295 tons placed in stock subsequent to the closing of navigation. This tonnage is divided between the Meadow and Fowler Mines as follows:

	Produced.	Shipped	Stock Jan. 1st 1918
Meadow Mine	95,095 Tons	84,675 Tons	10,420 Tons
Fowler Mine	11,287 "	8,412 "	2,875 "
Total	106,382 "	93,087 "	13,295 "

The estimate of production for the calender year 1919 is placed at 78,000 tons for the Meadow and 30,000 tons for the Fowler Mine.

Meadow Mine Ore Estimate January 1st. 1918.

Following is an estimate of the ore in sight at the Meadow Mine on January 1st. 1918-the tonnage reported January 1st. 1917 and the amount mined during the past year:

A factor of 13 cubic feet per ton was used in this estimate and a 10 per cent deduction made to cover mining loss.

Ore in sight January 1st. 1917 (Above tramming level.)	211,000 Tons
Ore in sight January 1st. 1917 (Below tramming level.)	142,000 "
TOTAL	353,000 "
Ore mined during 1917 (Above tramming level.)	95,095 "
Balance from these figures	257,905 "
Ore in Sight January 1st. 1918 (Above tramming level.)	96,000 Tons
Ore in sight January 1st. 1918 (Below tramming level.)	142,000 "
TOTAL----------	238,000 "
Decrease in ore estimated in sight January 1st. 1918 as compared with the figure for January 1st. 1917 and diducting the tonnage mined during 1917----------	19,905 Tons

This decrease is due to the fact that it was deemed advisable to exclude a part of the north deposit, between the 1345 and 1365 Foot Levels, from the estimate, owing to the low iron content of the ore. Development work during the past year demonstrated the existance of lean material between the levels mentioned above in the neighborhood of No. 204 raise.

The Meadow tonnage is based on a 57 per cent iron, .075 per cent phosphorus, 2 per cent manganese and 10 per cent silica. The probabilites of developing an additional tonnage are remote and it is impossible to make any estimate theron.

Fowler Mine Ore Estimate January 1st. 1918.

Following is an estimate of the ore in sight at the Fowler Mine on January 1st. 1918, the tonnage reported January 1st. 1917 and the amount mined during the past year.

A factor of 13 cubic feet per ton was used in this estimate and a 10 per cent deduction made to cover mining loss.

Ore in sight January 1st. 1917 (Exclusive of the Fowler Shaft pillar) ----------	35,000	Tons
Fowler Shaft Pillar----------	3,000	"
TOTAL---------	38,000	"
Ore mined during 1917----------	11,287	"
Balance from these figures	26,713	
Ore in sight January 1st. 1918 (Exclusive of Pillar)	78,000	"
Fowler Shaft Pillar----------	3,000	"
TOTAL----------	81,000	"

Increase in ore estimated in sight January 1st. 1918 as compared with the figure for January 1st. 1917, and deducting the tonnage mined during 1917-------- 54,287 Tons

The above increase in the estimate is the result of development work done during the past year on the 1345 and 1365 Foot Levels. We should show up some additional tonnage during the present year, although the amount will be decidedly less than that for 1917.

The Fowler tonnage, developed and prospective, is based on a 58.50 per cent iron, .060 phosphorus, .80 manganese and 10.50 per cent silica. There is a probability of developing 25,000 tons of ore during the present year.

STOCKPILES.

Following is the tonnage of Meadow ore reported in stock May 1st. 1917, that loaded out and the average analyis of the ore, as obtained in making and loading the pile:

	Tons	Fe.	Phos	Mn	Sil
Skip tally . . .	43,271	56.29	.069	1.98	10.45
Loaded out . . .	46,454	55.59	.070	2.09	11.27

This gave an overrun of 3,183 tons, or 7.3 per cent, on the Meadow pile.

Following is the tonnage of Fowler ore reported in stock May 1st. 1917, that loaded out and the average analyis in each case:

	Tons	Fe.	Phos	Mn	Sil
Skip tally ....1...	4,139	57.44	.046	1.14	9.69
Loaded out	5,121	57.32	.045	1.69	10.94

An overrun of 982 tons, or 23.7 per cent was realized on this small pile.

The tonnage and average analysis of the Meadow and Fowler stockpiles, as of January 1st. 1918, follows:

	Tons	Fe	Phos	Mn	Sil.
Meadow 1.....	10,420	55.97	.079	2.51	9.96
Fowler	2,875	56.27	.069	1.90	10.58
Total & Averages	13,295	56.03	.077	2.38	10.09

The grade of ore in stock is not entirely satisfactory, especially as regards the iron content. In the development of the Fowler 1365 Foot Level some rather lean ore was encountered. Slicing operations should be inaugurated on the Fowler side by the end of February and the grade of ore will then show a dicided improvement. It is expected that the Meadow ore in stock at the opening of navigation will average 56 per cent iron and 2.5 per cent managanese, while the Fowler pile should run 58 per cent iron and 1.3 per cent manganese. By May 1st. we should have approximatley 50,000 tons in the two piles.

SHIPMENTS.

Following are the cargoes of Meadow-Fowler ore shipped during the past year and the analysis of same as obtained at the Mine and by the Lower Lake Chemists:

	Fe	Phos	Mn	Sil	Mois	Fe.Nat.	Tons.
Steel King							6,680
Mine	56.36	.065	1.93	10.80			
Crowell & Murray	56.60				12.73	49.395	
Negaunee							4,645
Mine	56.01	.067	1.97	11.03			
Rattle	56.10				12.30	49.20	
Panay							5,826
Mine	56.25	.065	2.00	10.99			
Crowell & Murray	56.33				12.96	49.03	
Panay							6,034
Mine	56.24	.070	2.21	10.81			
Textor	56.45				12.69	49.25	
Paisley							5,963
Mine	56.00	.068	2.24	10.73			
Rattle	56.80				12.30	49.81	
French							6,070
Mine	56.07	.069	2.21	10.15			
Textor	55.75				12.56	48.748	
Smith							6,674
Mine	55.85	.070	2.31	11.07			
Emmerton	55.05				12.69	48.06	
Michigan							4,755
Mine	55.91	.069	2.43	10.54			
Cremer & Case	56.70				12.94	49.363	
Panay							6,305
Mine	55.73	.072	2.16	10.38			
Textor	55.75				12.89	48.56	
Nottingham							6,845
Mine	55.81	.070	2.08	11.30			
Cremer & Case	56.40				12.55	49.322	
America							3,523
Mine	55.86	.069	1.98	11.05			
Crowell & Murray	55.58				12.65	48.55	
Negaunee							6,927
Mine	55.57	.070	.198	11.19			
Textor	55.65				13.37	48.210	

	Fe	Phos	Mn	Sil	Mois	Fe.Nat.	Tons
Brazil ...	...	...	...	...	...	... ...	3,186
Mine	56.38	.063	1.93	10.32			
Textor	55.28				12.16	48.558	
Paisley ...	...	...	...	...	...	... ...	6,024
Mine	55.50	.064	1.95	11.37			
Rattle	55.10				12.22	48.37	
Negaunee ...	...	...	...	...	...	....	3,196
Mine	55.82	.068	1.92	11.50			
Crowell & Murray	55.30				12.54	48.37	
Marquette ...	...	...	...	...	...	... ...	7,919
Mine	55.70	.063	1.91	11.12			
Cremer & Case	55.70				12.24	48.882	
Paisley ...	...	...	...	...	...	... ...	3,580
Mine	56.40	.072	2.09	10.66			
Emmerton	56.55				13.10	49.142	
Marquette ...	...	...	...	...	...	... ...	6,262
Mine	55.24	.078	2.22	11.15			
Crowell & Murray	55.88				13.10	48.56	
Munising ...	...	...	...	...	...	... ...	3,179
Mine	55.73	.087	2.34	10.70			
Crowell & Murray							

The complete analysis of the cargoes showed the following results:

Fe.	Phos	Mn.	Sil.	Al.	Lime	Mag.	Sul.	Loss by ignition
55.95	.075	2.00	10.80	1.59	.31	.22	.008	4.70

The analysis of the shipments as sampled at the mine follow:

	Tons	Fe.	Phos	Mn.	Silica
Meadow	96,191	55.77	.072	2.19	10.87
Fowler	11,137	56.22	.046	1.27	11.48
Total & Averages	107,328	55.81	.069	2.10	10.93

PUMPING.

The underground flow of water January 1st. 1917 amounted to approximately 800 gallons per minute. When the concrete dam on the 1270 Foot Level was completed, and the flow of water from the South workings shut off March 15th, the mine pump slowed down

appreciably and the volumn of water handled was reduced to 450 gallons per minute.

The pumphouse was made fire proof and the triple expansion Prescott pump from the Negaunee Mine installed, during March. With this equipment installed, we were able to shut down and thoroughly overhaul the Compound Worthington Pump, which was purchased from the Jones and Laughlin Company and had been run continuously for an appreciable period.

About 60 per cent of the fuel consumed during 1916 was charged to pumping, whereas less than 50 per cent was so charged in 1917.

GENERAL SURFACE.

The caving of the 1410, 1395, 1385 and 1365 Foot Levels caused a settlement of the surface over a considerable area. Where the surface breaks were abrupt, it was deemed advisable to erect fences to keep children and cattle from falling into the openings. The railway spur leading to the Fowler shaft was taken up by the Iron Range Company from a point just to the north of the Meadow timber shaft. While the ground has settled very little here, the old tack pillar has been mined extensively and a considerable cave may occur at any time.

The surface mule team was kept busy hauling timber and lagging to the timber shafts, carting freight and supplies from Aurora and hauling ashes onto the mine roads. While stocking operations are in progress, the team is engaged in the removal of snow and rock from the stockpile grounds.

More or less difficulty was experienced in maintaining top tram operations during the severe weather of January and February. The temperature was frequently down to 30 degrees below zero. A force of 3 men per shift was engaged on this work, one man on tracks and two tramming.

Some repairs were made on the boilers, stack breeching and hoist. No. 1 boiler was out of commission for nearly two weeks while undergoing repairs. The smoke stack was scraped and painted.

The ten company houses were painted and hard wood floors layed in the down stairs rooms of seven. Some fence repairs were made and the yards cleaned.

A force of men was employed for one week clearing inflamable material from the immediate vicinity of the powder magazine and fighting brush fires in the neighborhood of the timber yard. No damage was done by the fires, but we had several narrow escapes.

DRILLING.

A contract to drill the West Meadow Forty was given to the Cole and MacDonald Company. Two drills were placed in operation November 23rd. Holes Nos. 300, 301 and 302 were completed and Nos. 303 and 304 were drilling at the end of the year. With the exception of Hole No. 300 no ore was encountered. The intention is to drill the ground between our North Meadow deposit and our West boundary, a distance of approximately 2000 feet and also to put down 3 or 4 holes to test the formation along the Westerly Fowler workings at depth.

The results of the drilling to January 1st. 1918 were as follows:

Drill Hole No.	Feet.	Material.
300	35	Gravel & Boulders.
	25	Mixed Taconite & ore.
	25	Taconite.
	5	Mixed Taconite & ore.
	18	Taconite.
	40	Quartzite.

Drill Hole No.	Feet.	Material.
301	25	Gravel & Boulders
	7	Taconite.
	65	Casing old hole.
	15	Mixed Taconite & Paintrock.
	43	Quartzite.
302	19	Gravel & Boulders.
	10	Taconite.
	95	Chert & Seams of magnetite.
	20	Quartzite & Slate Seams.
303	30	Gravel & Boulders.
	9	Taconite.
	59	Chert & Seams of Magnetite.
		Drilling Jan. 1st.
304	25	Gravel & Boulders.
	2	Taconite
	41	Cherty Taconite with Seams of Magnetite.
		Drilling Jan. 1st.

UNDERGROUND.

The force of 11 contracts, engaged in the Meadow workings January 1st. 1917, has been gradually reduced during the year, owing to the fact that the deposit narrows considerably as the workings are carried down to the main tramming level, and it is now possible to employ but 6 gangs to advantage on ore. We were very short handed during the summer months and seldom had a full crew even for our limited number of working places.

The Meadow deposit was worked out and caved on the 1395 and 1385 Foot Subs, with the exception of a few small pillars near No. 201 raise, the 1365 Foot Level was robbed back to No. 204 raise and the work of blocking out the deposit on the main level inaugurated. The bottom level, 1260 Foot, which is 85 feet

below the Main Level, will be pushed out under the southerly portion of the Main Level deposit and raises run up at intervals of 50 feet. This work should be completed during the first half of 1918. The force of miners on the Meadow side can then be increased, provided men are available.

The 1345 Foot (Main Level) drift, leading out under the Fowler deposit, was repaired and the bottom cut down to afford a desirable grade for mule tramming. The drift was then extended to the north for 450 feet and three raises run up to the McInnis Slope Level (1387 Foot Sub). The ore body has been developed from these raises at an elevation of 1365 feet and a sub started 10 feet below the slope level. A deposit of 59 per cent ore, 500 feet long and having an average width of 70 feet, has been blocked out on the 1365 Foot Sub. Crosscuts will now be driven to the east and west on the 1345 Foot Level to demonstrate the width of the ore body at this elevation. Preparations are now being made for attacking the old Fowler Shaft pillars, which were left by Mr. McInnis and are estimated to contain 3,000 tons of high grade ore.

MEADOW SIDE

1410 FOOT SUB-LEVEL.

Contract No. 6 spent the fore part of January scramming out the small pillars standing adjacent to No. 18 raise. The gang was then transferred to the 1395 Foot Sub.

1395 FOOT SUB-LEVEL.

Nos. 5, 6, 10, and 11 were engaged on this sub until the middle of April slicing out pillars, scramming and caving back in the vicinity of Nos. 15, 16, 17, 18 and 19 raises. The ore mined

between Nos. 18 and 19 raises was rather low in iron content, but the manganese averaged better than 3 per cent. Owing to the fact that the 1385 Foot Sub had been badly cut up before we took the property over, it was impossible to mine the deposit as extensively on the 1395 Foot Sub as we would have wished and several blocks of ore had to be taken with top sets from the 1385 Foot Sub.

1385 FOOT SUB-LEVEL.

At the beginning of the year 4 contracts were employed at this elevation, No. 2 gouging out the ore along the east side of their old room, Nos. 3 and 4 developing the ground to the west and south of the timber shaft and No. 1 slicing along their square set room to the west of No. 204 raise. No. 1 completed operations here in February and was placed on repair work in the main level workings, No. 2 was transferred to No. 3's place and No. 3 was discontinued. As the 1410 and 1395 Foot Subs were exhausted the gangs operating there were moved down in their raises and in April Nos. 6,7,8, 10 and 11 were engaged in slicing out pillars adjacent to Nos. 204, 207, 208 and 209 raises, while Nos. 2 and 4 continued developing and stoping out the ground near No. 202 raise. Nos. 2 and 4 continued developing and stoping out the ground near No. 202 raise. Nos. 2 and 4 conducted operations from two parallel drifts and mined out the 25 foot pillar of manganese ore between without the use of timber. The material slabbed off from the taconite capping, which varied in height from 15 to 25 feet.

The operating force was gradually reduced here as the pillars were exhausted and the workable ground became so limited in extent that it was not safe to attack it vigorously. During July but 4 gangs were employed and these were transferred to the

1365 Foot Sub or Fowler side until by October only No. 6 remained. No. 6 spent the remainder of the year and will operate for several months in 1918 slicing out the pillars between Nos. 14 and 17 raises.

Approximately one half of the Meadow product for 1917 came from the 1385 Foot Sub workings. The grade of ore was quite satisfactory, averaging above 57 per cent iron and 2.5 manganese. There is a lean layer of ore between the 1385 Foot Sub and the Main Level and the 1365 Foot Sub workings, which encounter this material, especially to the north, have made it rather difficult to maintain a desirable grade during the latter months of the year. The iron content of the ore on the Main Level and below is better again.

1365 FOOT SUB-LEVEL.

The south half of this sub was developed during 1916, but it was not until the Main Level raises, Nos. 207, 208 and 209, had been pushed up and the 1385 Foot Sub pillars exhausted, that the north half of the ore body could be blocked out. From June to the end of the year the bulk of the Meadow product was obtained from the northerly 1365 Foot Sub-Level workings. Nos. 2, 5, 7, 8, and 11 were employed here in June and Nos. 1, 5, 7 and 11 in December, the average force being 4½ gangs during this period.

The ore to the north of No. 204 raise had been practically exhausted by the end of the year and the pillars between Nos. 201, 202, 203 and 204 raises will now be attacked. It should take the present force from 4 to 5 months to clean up the deposit at this elevation.

As mentioned before, the north ore was not especially desirable as regards the iron content, but the manganese ran above 3 per cent and it will require some high manganese material to mix with the Fowler product, if we are to maintain a 2 per cent grade in

our 1918 shipments. As it was, we did not take all of the north ore on this sub with the result the there has been a shrinkage of approximately 20,000 tons in the Meadow ore estimate of January 1st. 1918 as compared with that of the previous year.

MAIN LEVEL.

No. 9 spent the first three months of 1917, pushing out a drift to the north and raising to the 1385 Foot Sub. Three raises were put through, Nos. 207, 208 and 209. The northerly 120 feet of No. 9's drift was in decomposed quartzite.

No. 1 spent two months repairing between Nos. 13 and 204 raises. The ore above these drifts settled some what on account of the work done on the 1365 Foot Sub. There was also some side weight noticable whereever seams of paintrock had been cut by the workings.

Contract No. 8 has started to block out the easterly limits of the deposit at this elevation, starting their work from a point near No. 201 raise.

1260 FOOT LEVEL.

A company account gang was engaged during the month of December, cleaning up the north drift of this level and laying track between the shaft and breast. As noted before, the drift is to be extended out under the south part of the main level and raises put up to tap this deposit. The entire extension will be in quartzite.

FOWLER SIDE.

1365 FOOT SUB-LEVEL.

Contract No. 3 was engaged from June until the end of the year, developing the deposit at this elevation from Nos. 1 F,

2 F and 3 F raises. No. 2 was transferred here from the Meadow side in August and No. 4 in November and assisted No. 3 in the blocking out of the ore body. A lense of 58 per cent ore, 500 feet in width has been developed.

Arrangements are now being made to mine the 3,000 tons of ore, which were left as a shaft support by Mr. McInnis. This ore is 20 feet above the new sub, and will have to be trammed on the 1365 Foot Level to No. 3 F raise.

There will be one sub between the old Fowler workings and the 1365 Foot Level.

MAIN LEVEL.

No. 12 has worked off and on the entire year, repairing the old Fowler drift, cutting down the bottom of same to provide a suitable grade and extending this drift to the north for 450 feet. These two compartment raises are spaced 100 feet apart.

The northerly 125 feet of the tramway is in ore, which averages 58 per cent in iron content. Crosscuts will now be driven to the east and west and the drift pushed north as far as the ore extends. Should the deposit show any appreciable width on the main level, the estimated tonnage in sight would be materially increased. It may also be advisable to put down winzes to demonstrate the depth of the ore body, the number depending on the width of the deposit at this elevation.

ACCIDENTS.

Following is a list of accidents, where the injured parties lost time, which have occured at the Meadow Mine during the past year.

DATE	NAME	OCCUPATION	NATIONALITY	REMARKS
2/1	J. Mosich	Surface Hand	Austrian	Unloading coal from railway car. Prying bar struck foot, lacerating toes. Lost 25 days.
4/23	J. Cuderman	Mule Driver	Austrian	Walking behind loaded car-chute knocked chunk from car against hand. Laceration and loss of finger nail. Lost 5 days.
8/3	John Pod	Miner	Austrian	While pushing out tram car, the car tipped to one side and jammed hand against post. Laceration palm of left hand. Lost 6 days.

Mike Rodoman, a chuteman, was killed on the morning of Saturday, May 26th. He had worked 25 shifts at the Meadow Mine, the last 16 being employed as chuteman.

The mule driver, car rider and Rodoman had loaded two cars from No. 14 chute and the cars were being hauled to the shaft when Rodoman attempted to get aboard. He ran along the south side of the drift and although the car rider, who was standing on the rear drawhead, told him to stop, continued in his attempt. The drift is from 8 to 9 feet in width, but at a point 50 feet south of No. 14 chute, where the fatality occured, the track runs close to the south side and there is but a few inches clearance between the car and two drift legs.

Rodoman was crushed between the car and one of these posts and died almost immediately without regaining consciousness. His chest was crushed and he also suffered abdominal injuries.

There was fully 4 feet clearance between the cars and the north side of the drift at the place Rodoman was caught and aside from the two posts mentioned above, there was room for a man to pass between the drift timbers and cars on the south side.

Rodoman was 21 years of age and without dependents. He came from Montenegro in 1913.

The loss in product, due to this accident, is figured at 150 tons. The day shift did not return to work in the afternoon, but 8 out of 10 gangs reported for the short shift Saturday night.

ANALYIS OF COST SHEET

Mining activities were continuous during 1917, whereas in 1916 operations were largely in the nature of development work during the early months of the year and were interrupted in June and July by the general Mesaba Range strike. The shortage of labor was a serious item during both years in question, although they were better on the whole in 1917. The increase of wages and cost of supplies in 1917 more than offset any improvement in labor conditions, however.

The production from the Meadow-Fowler Mines in 1917 and from the Meadow Mine during 1916 and an analyis of the cost sheets follows:

	MEADOW*FOWLER MINES 1917.	MEADOW MINE 1916.
Production-	106,382	62,279 Tons
General Expense	$.096	$.112
Maintenance	.072	.197
Mining expense	1.102	1.125
Cost of Production	$1.270	$1.434

- - - - - -

GENERAL EXPENSE

The charges under this heading were all slightly lower during 1917, excepting "Personal Injury Expense," which showed an increase of $.009 per ton. This was due to the settlement of the Gogola case and expenses incurred in connection with the burial of Mike Rodoman. The decreases of $.003 per ton in "Insurance", $.007 in "Engineering", $.004 in "Analysis" and $.011 in "Mine Office" were due to the larger 1918 output.

MAINTENANCE

There was a decrease of $.125 per ton under this caption for 1917, as compared with the previous year. The larger 1917 output and the necessity of making rather extensive repairs on some of the equipment, which we took over from the Jones and Laughlin Company, during the early months of 1916, explains the above decrease.

In 1916 the office was repaired, painted and hardwood floors were layed. There was a decrease of $.026 per ton under "Buildings." The reduction of $.056 per ton in the item "Pumping Machinery" was due to the fact that 1916 charges were excessive. The pumps were thoroughly overhauled in 1916, whereas during 1917 the repairs were nominal. "Underground Tracks and Cars" shows a decrease of $.016 for the year 1917. The repair charges in 1916 were rather heavy on account of the former operating company having allowed this equipment to run down.

MINING EXPENSE.

There was a decrease of only $.023 per ton in 1917 "Mining Expense", as compared with the previous year. About one half of the items under the caption showed an increase, due entirely to the advance in wages and cost of supplies. In the other cases the increased production of 1917 more than offset such advances and a reduction in the cost per ton was realized.

Compared with the output, less air pipes were installed during 1917 and this item showed a decrease of $.005 per ton.

"Compressors" and "Hoisting" were each $.006 per ton higher for 1917 on account of the increase in the price of fuel. The wage increase affected them very slightly.

The item "Pumping" was $.044 per ton less for 1917. While the fuel cost was greatly increased in 1917, the volumn of water handled was little more than half and the production was increased by 67 per cent. The strike was also a big factor in the 1916 cost.

Considerable more rock drifting was undertaken during 1917 and the cost per foot was higher. "Rock Drifting" for 1917 showed an increase of $.006 per ton.

There was a slight decrease in "Breaking Ore" and "Tramming" for 1917, in spite of the fact that wages and supplies were so much higher. The bulk of the output came from development work in 1916, while during 1917 slicing, scramming and robbing operations were carried on quite extensively. The abandoning of the transfer hand tram on the 1385 Foot Level was more than sufficient to offset the advance in labor and supplies under "Tramming."

The 1917 increase of $.039 per ton for "Timbering" was due to the higher price paid for material and the extensive repairs that were made on the 1365 Foot Sub and Main Level.

The increase of $.002 and $.006 per ton for "Dry House" and "Top Landing and Tramming" was the result of advanced wages during 1917.

"Stocking Ore" and "Sorting Ore" were $.002 and $.001 per ton lower for 1917. This decrease was due to the larger tonnage extracted from the mine.

MEADOW MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR-1917.

GRADE	IRON	PHOS.	SILICA	MANG.
Meadow,	56.04	.072	10.41	2.20

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1917.

	Mine				Lake Erie	
GRADE	IRON	PHOS.	SILICA	MANG.	IRON	MOIST.
Meadow,	55.97	.069	10.76	2.11	56.17	12.71

ORE STATEMENT AND SHIPMENTS FOR YEAR-1917.

	MEADOW	TOTAL LAST YEAR	
On Hand Jany. 1st, 1917,	11,516		
Output for Year,	91,912	62,279	
Stockpile Overrun,	3,183		
Total,	106,611	62,279	
Shipments,	96,191	50,763	
Balance on Hand,	10,420	11,516	
Increase in Output-53%	32,816		
Decrease in Ore on Hand,	1,096		

1917 - 2-8 Hr. Shifts during year

1916 - 2-8 Hr. Shifts Jan. 28th to June 5th.
Idle June 5th to July 31st account strike
1-8 Hr. Shift Aug. 1st to Sept. 30th
2-8 Hr. Shifts Oct. 1st to Dec. 31st

MEADOW MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 7.	1 9 1 6.	INCREASE.	DECREASE.
PRODUCT	103,987	62,279	41,708	
General Expense	.096	.112		.016
Maintenance	.072	.197		.125
Mining Expense	1.102	1.125		.023
Cost of Production	1.270	1.434		.264
Extraordinary Drifting & Exploring	.053	.005	.048	
DEPRECIATION.				
Plant	.050	.050		
Equipment	.018	.024		.006
Total Depreciation	.068	.074		.006
Taxes	.064	.116		.052
Central Office	.058	.054	.004	
Idle Expense		.048		.048
Sundry Expense	.016	.013	.003	
Cost on Stockpile	1.529	1.744		.215
Loading & Shipping	.041	.021	.020	
Total Cost on Cars	1.570	1.765		.195
No. Days Operating	309	260	49	
No. Shifts and Hours	2-8hr	2-8hr		
Avg. Daily Product	337	239	98	
COST OF PRODUCTION.				
Labor	.901	.931		.030
Supplies	.369	.503		.134
Total	1.270	1.434		.164

MEADOW MINE.

COMPARATIVE WAGES AND PRODUCT.

	1917.	1916.	INCREASE.	DECREASE.
PRODUCT	103,987	62,279	41,708	
No. Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	21	15	6	
Underground	58	45	13	
Total	79	60	19	
AVERAGE WAGES PER DAY				
Surface	3.60	2.94	.66-22.5%	
Underground	4.42	3.19	1.23-38.4	
Total	4.03	3.12	.91-28.6%	
WAGES PER MO. OF 25 DAYS				
Surface	90.00	73.50	16.50	
Underground	110.50	79.75	30.75	
Total	100.75	78.00	22.75	
PRODUCT PER MAN PER DAY				
Surface	15.95	13.13	2.82	
Underground	5.76	4.51	1.25	
Total	4.23	3.35	.88	
LABOR COST PER TON				
Surface	.226	.224	.002	
Underground	.727	.707	.020	
Total	.953	.931	.022	
AVG. PRODUCT BRK'G & TRM'G	8.56	6.12	2.44	
" WAGES CONTRACT MINERS	4.52	3.38	1.14	
" " " TRAMMERS	0	0		
" " " LABOR	4.52	3.38	1.14	
TOTAL NUMBER OF DAYS				
Surface	6,518½	4,745¼	1,773¼	
Underground	18,040¼	13,816¾	4,223½	
Total	24558 ¾	18,562	5,996¼	
AMOUNT FOR LABOR				
Surface	23,453.21	13,967.51	9,485.70	
Underground	75,586.41	44,019.64	31,566.87	
Total	99,039.62	57,987.05	41,052.57	

Proportion Surface to Underground Men:
1917 - 1 to 2.8
1916 - 1 to 3.

MEADOW MINE.

MEADOW MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1917.

KIND.	LINEAL FEET.	AVG. PRICE PER FOOT.	AMOUNT 1917.	AMOUNT 1916.
4" to 6" Timber	13,353	.02	267.06	55.98
6" to 8"	18,003	.049	878.69	449.26
8" to 10"	53,408	.059	3136.04	725.36
10" to 12"	12,528	.105	1312.56	270.00
Total 1917	97,292	.0575	5594.35	
Total 1916	48,673	.031		1500.60
	LINEAL FEET.	PER 100'.		
6' Lagging	348,840	.427	1491.00	472.80
7' "				472.80
Total Lagging(1)	348,840	.427	1491.00	
Poles				510.30
Total 1917	348,840	.427	1491.00	
Total 1916	237,960	.413		983.10

		1917	1916
Product		106,382	62,278
Feet Timber per ton of Ore		.914	.781
Feet Lagging " " (1)		3.279	3.243
Feet Lagging per foot of Timber		3.584	4.15
Cost per ton for Timber		.052	.024
" Lagging		.015	.007
" Poles		0	0
" Timber & Lagging		.067	.039
Equivalent of stull timber to Board Measure		144,892	77,910
Feet Board Measure per ton of Ore		1.36	1.25
Total Cost for Timber, Lagging & Poles	1917		7085.35
"	1916		2482.70

Timber cost higher in 1917, due to increased price paid for same and large amount of underground repair work.

MEADOW MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 7.	AMOUNT 1 9 1 6.
30% Powder	462	.105	48.21	845.72
40% "	27,350	.1537	4204.07	2579.37
Total Powder	27,812	.1529	4252.28	3425.09
Fuse	64,200	.628	403.44	328.36
Caps	24,100	1.29	312.48	299.26
Cap Crimpers	1		.25	3.25
Electric Exploders				5.64
Connecting Wire				1.80
Total Fuse,Etc.			716.17	638.31
Total All Explosives			4968.45	4063.40
Product			106,382	62,278
Pounds Powder per ton Ore			.262	.462
Cost per ton for Powder			.040	.055
" " Fuse, Caps, Etc.			.007	.01
" " All Explosives			.047	.065
Avg. Price per lb. for Powder			.1529	.1191

Reason for using above amount of 30% powder in 1916 due to fact that we took over same with Fowler Mine.