The Cleveland - Cliffs Iron Company

Mining Department

Annual Report of General Manager

For Year ending December 31st. 1928

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THE CLEVELAND-CLIFFS IRON COMPANY

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YEAR 1928

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THE CLEVELAND-CLIFFS IRON COMPANY
MINE DEPARTMENT - MANAGER'S ANNUAL REPORT
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YEAR 1928

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GWINN DISTRICT MINES						
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12. New Construction & Proposed New Construction	-	-	-	234	-	-
13. Equipment & Proposed Equipment	-	-	-	234	-	-
14. Maintenance & Repairs	-	-	-	235	-	-
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11. Accidents & Personal Injury	265	296	-	326-328	-
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17. Mine Location-Condition of Premises	266	299	-	-	-
18. Nationality of Employees	266	299	308	332	-
19. Washing Plant Operations	-	-	-	332-333	-

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Ishpeming, Michigan,
January, 1st, 1929

Mr. Wm. G. Mather, President,
Cleveland, Ohio

Dear Sir:-

I beg to submit the report of the operations of the Mining Department for the year 1928.

The inventories, maps and statements relative to the 1928 report have gone forward to you under separate cover.

The colored portions of the maps show the work for the year. The reports of the different mines of the Company were made by the Superintendents in charge and the reports of the Engineering, Mechanical, Electrical, Geological, Safety and Welfare Departments by the heads of these Departments.

In 1927 the Company was able to dispose of the larger part of the high sulphur ore which was in stock at the Gardner-Mackinaw and it was reported that the furnaces using this ore had no serious trouble with the sulphur. Early in 1928 we started to unwater the property and mine the remaining ore. This is a semi-hard ore, the stopes requiring no timber. The mining cost is therefore low.

In the latter part of the year we secured an option on a large acreage of land in Sections 14,23,24,25 and 26, T. 58N - Range 24 W., Minnesota. Indications of iron ore were found along one of the rivers, it being evident that this material was being washed out by underground water courses. This property is to the north of Marble on the Mesaba Range. Three shallow holes were drilled and as no iron ore formation was encountered, the option was thrown up.

In April, the Company purchased 23/24ths of the fee of the Joan No. 3 property, located on the S½ of the NE¼ of Section 34,47-29, Cuyuna Range. We are now endeavoring to secure the fee of the remaining 1/24th interest.

By decree of Court, dated October 4th, Corbit's Second Addition and the remaining portion of the Maas, Lonstorf & Mitchell Addition, adjacent to the Negaune Mine, were abandoned. This has been one of our most difficult problems and has been hanging fire for a number of years. We are now permitted to continue our mining operations at the Negaunee and Maas Mines and on the Race Course without danger of caving surface improvements which we did not own.

The following statement shows a comparison of all of the Company's mines for the year 1928 as compared with 1927. In figuring the Tons Per Man Per Day, all of the labor under the jurisdiction of the Mining Department has been included. On this basis the Tons Per Man Per Day shows a decrease of .42. Some explanation is necessary and a detailed sheet entitled "Comparison of Total Days Worked and Tons of Ore Mined for Years 1927 and 1928" will be found in the report. You will notice by this that the Tons Per Man Per Day for Underground mines shows an increase in 1928 of .55.

	TONS	TONS PER MAN PER DAY	COST ON CARS	AVERAGE RATE PER DAY	LABOR COST PER TON
1927	3,497,273	5.17	2.181	5.16	.999
1928	3,073,679	4.75	2.145	5.15	1.084
Increase					.085
Decrease	423,594	.42	.36	.01	

Since early in the fall of 1926, a large part of my efforts have been devoted to Safety. What has been accomplished in this line is plainly shown by the following tabulation:

	1926	1927	1928
Total Lost Time Accidents	347	209	117
Percentage of Reduction		40%	66½%

Aside from the humanitarian viewpoint and the peace of our own minds, safety has a direct bearing on effeciency. Facts can be submitted to prove this beyond doubt. During the present year, certain of our mines have established records which have never been even approached by our Company in the past. Up to the date of this letter, February 8th,1929, the Morris Lloyd Mine has worked 277 days without a single lost time accident. The corresponding record for the Maas Mine is 184 days and for the Athens 176 days. By examining the reports of Messrs. Moulton and Conibear, it will be evident that aside from all other reasons, the reduction in cost is a considerable figure.

The only outstanding lease is the Empire Iron Company, covering the SW¼ of Section 19-47-26. This property has been sub-let to the Clement K. Quinn Company who operated it in 1928.

Yours very truly,

SRE:DP

Manager

COMPARISON OF TOTAL DAYS WORKED AND TONS OF ORE MINED FOR YEARS 1927 & 1928

	1927 DAYS	1928 DAYS	1927 DAYS	1928 DAYS
Re-Opening Gardner-Mack.	1,252	3,071		
Stephenson (Production)		863 3/4		
Princeton	1,397 1/4	334 3/4		
Austin (Production)		280 3/4		
Miscel.Payroll	9,249 3/4	11,044 1/2		
Shops & Storehouse	9,294 1/2	13,299 3/4		
Opg. & Eq. Tilden		6,201 1/2		
Francis	15 1/4	25 1/2		
Negaunee - Misc. & Gen.	7,515 3/4	7,625 3/4		
Athens " "	2,971 1/4	3,107		
C.C.I.Co. " "	69,390 1/2	61,042 1/2		
C.P.& L.Co.	11,003 1/2	20,939		
M.C.I.M.Co.	20,502	22,516		
Gwinn	697 3/4			
B. & H.	387 3/4			
	133,677 1/4	150,350 3/4		
Grand Total all Operations	650,093 1/2	584,565 3/4		
Net for Operating Mines	516,416 1/4	434,215	516,416 1/4	434,215
Total Tons Exclusive of Wade Mine	3,358,640	2,775,542		
Less Overruns	15,956			
	3,342,684			
Tons per Man per Day	6.47	6.39		
OPEN PIT PRODUCTION				
Ogden	174,106	116,415	2,008 3/4	1,702
Hill Trumbull	516,385	488,897	19,574 1/2	15,292 1/4
Boeing	316,572		14,004	
	1,007,063	605,312	35,587 1/4	16,994 1/4
Net U.G.Days			480,829	417,220 3/4
Net U.G.Production	2,235,621	2,170,230		
U.G. Tons per Man per Day	4.6495	5.201		
% Open Pit Production to Total Production	30.13	21.81		

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STATEMENT SHOWING COMPARATIVE COST FOR ALL EXPLOSIVES USED AT HARD ORE MINES

	1925	1926	1927	1928
Product - - - - - -	390,915	394,972	466,382	413,994
POWDER				
Lbs. 40%				
" 50% - - - - - -	295,260	326,406	314,961	141,390
" 60% - - - - - -	21,200	46,150	49,550	49,400
" #2-#3-#4 Special -	- -	- -	22,250	133,900
" E.P. 23 - - - -	- -	- -	- -	21,350
Total Lbs.	316,460	372,556	386,761	346,040
Total Cost	46,668.46	53,625.27	54,763.92	47,860.12
Fuse - Feet - - - -	413,600	538,355	600,440	511,350
Caps - Number - - -	93,950	113,406	102,345	116,445
Cap Crimpers - - -	33	44	27	24
Tamping Bags - - -	11,890	22,830	3,370	- -
Ignitors - - - - -	- -	1,200	- -	- -
Elec.Exploders - - -	- -	50	- -	- -
Connecting Wire - - -	- -	26	- -	- -
Leading Wire - - - -	- -	500	- -	- -
Total Cost Fuse, Etc.	3,685.23	4,829.48	4,691.64	4,243.42
Total Cost All Expls.	50,353.69	58,454.75	59,455.56	52,103.54
Avg.Price Per Lb.Powder - -	.1474	.1439	.1416	.1383
Cost Per Ton Powder - - - -	.1194	.1358	.1174	.1156
" " " " Fuse,Caps,Etc -	.0094	.0122	.0100	.0102
" " " All Expls. - -	.1288	.1480	.1274	.1258
Lbs.Powder Per Ton Ore - -	.8095	.9432	.8293	.8358

Open pit mines not included

JAP:EER

STATEMENT SHOWING COMPARATIVE COST FOR ALL EXPLOSIVES USED AT SOFT ORE MINES

	1925	1926	1927	1928
Product - - - - - -	1,825,884	2,052,255	1,835,406	1,756,236
POWDER				
Lbs. 30% - - - - - -	107,370	2,900	- -	- -
40% - - - - - -	178,900	186,445	113,075	158,650
50% - - - - - -	204,700	315,420	339,950	318,950
60% - - - - - -	226,488	251,800	325,350	338,725
80% - - - - - -	300	2,300	- -	- -
35% - - - - - -	- -	76,150	- -	- -
#2,#3,#4 Spec. - - -	- -	- -	3,250	55,600
Total Lbs.	717,758	835,015	781,625	871,925
Total Cost	106,628.94	119,487.81	113,557.94	123,312.40
Fuse (Feet) - - - - -	2,147,200	2,322,700	2,364,900	2,529,868
Caps (No.) - - - - -	441,755	499,476	423,907	425,099
Elec.Explosives - - - -	222	76	15	- -
Connecting Wire - - - -	48#	18#	2#	- -
Leading Wire - - - - -	650'	- -	- -	- -
Tamping Bags - - - - -	112,915	132,230	112,459	118,930
Crimpers - - - - - -	177	140	178	173
Delay Igniters - - - -	- -	- -	- -	- -
Total Cost Fuse, Etc.	19,186.82	22,709.73	19,051.53	20,090.82
Total All Explosives	125,815.76	142,197.54	132,609.47	143,403.22
Avg.Price Per Lb. - Powder	.1486	.1431	.1453	.1414
Cost Per Ton - Powder	.0584	.0582	.0619	.0702
" " " - Fuse,Caps,Etc.	.0105	.0111	.0104	.0114
" " " - All Explosives	.0689	.0693	.0723	.0816
Pounds Powder Per Ton of Ore	.3931	.4068	.4259	.4964

OPEN PIT MINES NOT INCLUDED

JAP:EER

STATEMENT SHOWING COMPARATIVE COST FOR ALL MINE TIMBER USED AT SOFT ORE MINES

	1925	1926	1927	1928
Product - - - - - - - -	1,825,884	2,052,255	1,835,406	1,756,236
TIMBER				
Feet 4 to 6 - - - - - -	4,648	45,294	- -	- -
6 to 8 - - - - - -	572,126	543,275	484,217	515,639
8 to 10 - - - - - -	406,867	471,550	372,289	319,807
10 to 12 - - - - - -	245,548	269,767	268,634	193,780
12 to 14 - - - - - -	83,794	85,282	104,591	93,890
14 to 16 - - - - - -	176	5,939	16,511	108
7 to 9 - - - - - -	133,096	76,442	Treated	14,291
9 to 12 - - - - - -	168,619	146,312	- -	- -
Total Feet	1,614,874	1,643,861	1,246,242	1,137,515
Total Cost	128,792.52	115,102.94	79,754.35	75,578.00
LAGGING				
Feet 5' - - - - - - -	2,008,550	2,348,612	1,553,163	1,202,025
6' - - - - - - -	385,800	747,840	173,500	95,000
7' - - - - - - -	2,374,426	2,869,971	3,434,969	3,220,789
8' - - - - - - -	1,031,632	1,009,672	1,076,343	598,784
Total Feet	5,800,408	6,976,095	6,237,975	5,116,598
Total Cost	44,359.56	52,292.53	45,264.93	37,679.62
Covering Boards-Feet - - - -	734,585	798,527	165,106	163,397
Total Cost	11,319.54	11,960.39	3,049.89	3,230.13
Poles (Feet) - - - - - -	1,970,783	2,493,741	1,544,937	2,053,550
Total Cost	22,891.59	29,585.21	21,748.28	31,760.23
Average Cost Per Foot - Timber - -	.0797	.0700	.0640	.0642
" " " 100 Ft - Lagging -	.7648	.7496	.7288	.7361
" " " 100 Ft - Cover.Bds.-	1.5409	1.5409	1.8472	1.977
" " " 100 Ft - Poles - -	1.1615	1.1615	1.4077	1.547
Feet Timber Per Ton of Ore - - -	.884	.801	.679	.6478
" Lagging " " " " - - -	3.177	3.399	3.398	2.913
" Poles " " " " - - -	1.079	1.215	.842	1.169
Cost Per Ton for Timber - - - -	.0705	.0561	.0434	.0430
" " " " Lagging - - - -	.0243	.0255	.0247	.0214
" " " " Poles - - - -	.0125	.0144	.0118	.0181
" " " " Cover.Brds - - -	.0062	.0058	.0017	.0018
" " " " All	.1135	.1018	.0816	.0843
Total Cost for All Timber	207,363.21	208,941.07	149,817.45	148,247.98

STATEMENT SHOWING TOTAL COST FOR SUPPLIES CHARGED TO "COST OF ORE AT MINES"

SOFT ORE MINES

YEAR	1925		1926		1927		1928	
PRODUCT	1,825,884		2,052,255		1,835,406		1,756,236	
CLASSIFICATION	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON
General	87,283.11	.0478	93,473.76	.0455	85,520.88	.0465	92,928.94	.0529
Iron & Steel	26,849.93	.0147	31,656.04	.0154	28,956.99	.0157	31,679.66	.0180
Machinery Supplies	99,663.91	.0545	126,562.61	.0616	85,936.53	.0468	117,816.27	.0670
Explosives	141,760.34	.0776	166,713.88	.0812	151,669.06	.0826	161,089.99	.0917
Lumber & Timber	231,884.16	.1269	238,095.23	.1160	180,515.49	.0983	182,139.31	.1037
Fuel	42,396.64	.0232	47,348.57	.0230	34,728.59	.0189	30,550.11	.0174
Electric Power	341,884.27	.1872	364,360.25	.1775	361,104.77	.1967	363,365.39	.2068
Miscellaneous	93,175.06	.0510	79,162.37	.0385	56,414.20	.0307	31,071.56	.0177
TOTAL	1,064,897.42	.5832	1,147,372.71	.5590	984,846.51	.5365	1,010,641.13	.575

HARD ORE MINES

YEAR	1925		1926		1927		1928	
PRODUCT	446,670		366,882		467,510		413,994	
CLASSIFICATION	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON
General	35,776.65	.0800	35,756.69	.0974	29,726.59	.0635	41,435.40	.1001
Iron & Steel	14,413.77	.0322	18,051.52	.0492	13,079.36	.0279	16,024.76	.0387
Machinery Supplies	36,875.08	.0825	36,827.06	.1003	32,525.13	.0695	37,849.48	.0914
Explosives	66,808.36	.1495	67,362.55	.1836	74,384.99	.1591	61,290.29	.1480
Lumber & Timber	14,014.51	.0313	12,995.23	.0354	9,431.02	.0201	7,065.76	.0171
Fuel	29,010.78	.0649	21,497.48	.0585	14,371.32	.0307	12,449.56	.0301
Electric Power	64,172.04	.1436	77,042.33	.2099	84,106.40	.1798	80,072.05	.1936
Miscellaneous	7,324.64	.0163	7,461.34	.0203	8,269.92	.0176	7,364.12	.0178
TOTAL	268,395.83	.6008	276,994.20	.7549	266,254.73	.5694	263,551.42	.6368

SOFT ORE MINES

The 1928 unit cost is .0385 increase over 1927. Mostly in General, Machinery and Explosives classifications. More underground scraper equipment is primarily the cause for increase in General and Machinery Classifications. Development of Holmes Mine 5th level also a factor in the increased cost for Machinery Supplies. Increased cost for Explosives due almost entirely to this 5th Level Development.

HARD ORE MINES

The 1928 unit cost is .0674 increase over 1927. Approximately all in General, Iron & Steel and Machinery Classifications. More underground scraper equipment accounts for a large part of these increases. Underground storage battery sets, stator coil for hoist motor, power drills and drill sharpener repairs are other large items.

More detail of these increased supply costs will be found in the Analysis of Cost Sheets for the various mines.

LABOR SUMMARY - ALL COMPANIES

	1925		1926		1927		1928	
TOTAL PRODUCT	3,166,062		3,336,557		3,358,640		2,775,542	
	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT
Surface Cost per ton	222,954½	1,012,074.67 .3197	220,589¾	998,311.45 .2965	208,281¾	945,048.09 .2813	207,047¼	946,889.42 .3441
Underground Cost per ton	404,188	2,057,956.52 .6500	420,686	2,136,173.30 .6345	392,984¼	2,008,260.19 .5979	328,222¾	1,670,341.35 .6017
Supt. & Gen. Roll Cost per ton	56,048¼	434,551.24 .1373	52,694	423,770.23 .1259	48,827½	403,457.86 .1201	49,295¾	391,671.46 .1411
Grand Total Cost per ton	683,190½	3,504,582.43 1.1070	693,969¾	3,558,245.98 1.0569	650,093½	3,356,766.14 .9993	584,565¾	3,008,902.23 1.084
Average Rate Per Day		5.13		5.13		5.16		5.15
Tons Per Man Per Day		4.635		4.85		5.166		4.75

NOTE:-

Above is total of all wages and salaries for all employees of the Mining Department - Including the Cliffs Power & Light Company.

Superintendent and General Roll - Days and Amounts shown is all of the General Payroll, except Mine Clerks and Captains which are included in surface and underground.

Wade Mine not included - Contract mining by the A. Guthrie Company.

Stockpile overruns not included in 1928 Total Product

CLIFFS SHAFT MINE

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1. GENERAL:

Production in 1928 was not quite as large as in 1927, and the stockpile overrun taken up into production was also not as large. There was no over-time hoisting in 1928, and there was more development-work being done, and more advancing work in the stopes. There are in the mine sixty-six contracts and eighty working-places, of which thirteen are in rock. Part of this rock-work has been done to prepare known ore-bodies for mining, and part in search of new ore.

The development campaign has been more successful in "A" shaft than in "B" shaft, where the areas having possibilities of new ore are very limited. The diamond-drill has been used entirely in "A" shaft, and new ore has been found by drilling, drifting and raising in the North Vein in both Bancroft and Cliffs Shaft territory and in the South-East Deposit.

In "B" shaft promising results have continued to be found on the first level in both the Main Vein and South Lens, and on lower levels to a lesser extent in the North Vein. The limits of the ore in the Main Vein on the lower levels have apparently been reached, but there are still a few possibilities of finding ore further west.

This program of intensive development must be continued, if the ore-reserves are to be maintained. The greatest opportunity seems to be to the north and northeast, and work will be concentrated in this area in the coming year.

The mine continued on a single shift basis, working six days a week.

The Bancroft Lump stockpile was the only pile cleaned up, and an overrun of 876 tons was found here. By measurement and calculation substantial overruns were found in both the Lump and Crushed ore piles.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Grade	Product Tons	Overrun Tons	Total Tons
Cliffs Shaft Lump	249,593		249,593
Cliffs Shaft Crushed	106,663		106,663
Total Cliffs Shaft	356,256		356,256
Bancroft Lump	24,549	876	25,425
Bancroft Crushed	10,181		10,181
Total Bancroft	34,730	876	35,606
Total Ore	390,986	876	391,862
Rock			27,278

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

Dividing the ore by shipping grades, production was as follows:-

Lump Ore	275,018 Tons	70.2%
Crushed Ore	116,844 "	29.8%
Total	391,862 "	100.0%

This is a decrease of 1.5% in the proportion of lump, and is due in large part to the change in the method of handling the ore on surface. Since the early part of 1928 the whole product has been put through the No. 8 gyratory crusher, which is set at nine inches, and the product from the crusher is screened. In this way the very large lumps are eliminated at much less expense than would be the case if they were broken underground. The ore was screened over 2½ inch holes.

All rock was dumped underground.

Comparison of product for 1928 and 1927.

	1928 Tons	1927 Tons	Decrease Tons
Production	390,986	399,716	8,730
Stockpile Overrun	876	2,816	1,940
Total	391,862	402,532	10,670
Percentage of Lump	70.2%	71.7%	1.5%
Percentage of Bancroft	8.9%	9.6%	.7%

In 1927 the mine worked 291 days, and the average daily product was 1383 tons. In 1928 the mine worked 300 days, and the average daily product was 1306 tons. There was no overtime hoisting in 1928.

b. Shipments:

Grade	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year Tons
Cliffs Shaft Lump	156,898	110,393	267,291	240,781
Cliffs Shaft Crushed	47,764	45,314	93,078	98,849
Total Cliffs Shaft	204,662	155,707	360,369	339,629
Bancroft Lump	10,320	9,729	20,049	22,051
Bancroft Crushed	3,572	4,743	8,315	4,639
Total Bancroft	13,892	14,472	28,364	26,690
Total Ore	218,554	170,179	388,733	366,319
Total Last Year	238,285	128,034	366,319	
Increase in Shipments			22,414	

Shipments to the dock began on April 18th and ended on November 22nd.

All-rail shipments were in small quantities throughout the year.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

c. Stockpile Inventories:

Grade	Tons
Cliffs Shaft Lump	36,491
Bancroft Lump	3,182
Total Lump	39,673
Cliffs Shaft Crushed	29,072
Bancroft Crushed	7,891
Total Crushed	36,963
Total Ore	76,636

On Dec. 31st, 1927 there was in stock 73,507 tons, 3,129 tons less than in 1928. There is ample room for stocking ore.

d. Division of Product by Levels:

Level	"A" Shaft Tons	"B" Shaft Tons	Total Tons
First	7,394	37,673	45,067
Second	26,864	4,528	31,392
Third	1,253	483	1,736
Fourth	6,399	8,995	15,394
Fifth	25,082		25,082
Sixth	30,149	10,339	40,488
Seventh	32,474	14,131	46,605
Eighth	26,370	11,471	37,841
Ninth	14,994	8,487	23,481
Tenth	33,095	7,951	41,046
Eleventh	15,933		15,933
Twelfth		26,098	26,098
Thirteenth		22,895	22,895
Fourteenth		17,490	17,490
Fifteenth		438	438
Total	220,007	170,979	390,986
Rock	21,200	6,078	27,278

e. Production by Months:

Month	Days	C.S. Lump	C.S. Crushed	Banc. Lump	Banc. Crushed	Total Ore	Rock
January	25	21,283	8,228	1,613	626	31,750	1,848
February	24	19,648	8,841	1,427	646	30,562	1,834
March	27	21,791	9,080	2,053	880	33,804	2,442
April	23	19,965	8,630	1,556	499	30,650	2,228
May	26	22,982	10,576	1,866	707	36,131	2,488
June	25	22,683	9,632	1,901	805	35,021	2,518
July	25	22,646	9,986	1,481	502	34,615	2,494
August	27	22,901	10,028	3,188	1,244	37,361	2,160
September	23	20,178	8,544	1,404	827	30,953	1,946
October	27	23,274	9,623	1,346	647	34,890	2,488
November	24	16,787	6,949	3,616	1,490	28,842	2,200
December	24	15,455	6,546	3,098	1,308	26,407	2,632
Year	300	249,593	106,663	24,549	10,181	390,986	27,278
Stockpile Overrun				876		876	
Total	300	249,593	106,663	25,425	10,181	391,862	27,278

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

f. Ore Statement:

	C.S. Lump	C.S. Crushed	Ban. Lump	Ban. Crushed	Total Tons	Total Last Year
On Hand Jan. 1, 1928.	46,926	15,103	5,069	6,409	73,507	37,294
Output for Year	249,593	106,663	24,549	10,181	390,986	399,716
Stockpile Overrun			876		876	2,816
Transfers	7,263	384	7,263	384		
Total	303,782	122,150	23,231	16,206	465,369	439,826
Shipments	267,291	93,078	20,049	8,315	388,733	366,319
Balance on Hand	36,491	29,072	3,182	7,891	76,636	73,507
Decrease in Output					8,730	
Increase in Ore on Hand					3,129	

g. Delays:

Date	Hours	Tons Lost	Cause	Cost
Jan. 24	2	300	No current. Low voltage.	
Jan. 25	3	400	Testing out new crushing plant.	
Jan. 26	2½	300	" " " " "	
Feb. 1	1	125	"A" shaft pocket blocked.	
Feb. 8	2	300	Casting broke in crusher bldg.	$ 12.50
Feb. 14	1	125	Repairing lump pocket " "	11.03
Feb. 14	½	75	Tip loose on crusher motor.	4.75
Feb. 29	4	300	Stator burnt out on "A" shaft hoist motor.	734.90
May 9	1	125	Lump stockpile car off track.	
July 26	1	125	"A" shaft top-tram car off track.	
Aug. 8	1¼	150	No current. Low voltage.	
Nov. 2	2	250	Bearing on big crusher motor running hot.	6.10
Nov. 14	1½	150	Large chunk caught between rock chute on 2nd level "A" and skip.	
Nov. 24	2	250	"A" shaft pocket blocked.	
Nov. 27	4	600	Waino Tarkka's funeral.	
Dec. 3	1½	200	Stringer broke on lump trestle.	24.89
Dec. 4	1	150	Lump stockpile car off track.	
Dec. 8	½	75	"A" shaft top-tram car off track.	
Dec. 8	1	125	Chute blocked - crusher bldg.	
Dec. 19	4	600	Mr. M.M. Duncan's funeral.	
Dec. 22	1½	200	Top tram controller.	7.50
Year	38¼	4925		$ 801.67

h. Delays Due to Lack of Current:

Date	Hours	Tons Lost	Cause
Jan. 24	2	300	No current. Low voltage.
Aug. 8	1¼	150	" " " "
Year	3¼	450	

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3. ANALYSIS:

a. Average Mine Analysis on Output:

Grade	Iron	Phos.	Silica
Cliffs Shaft Lump	59.25	.104	6.88
Cliffs Shaft Crushed	57.02	.108	9.09
Bancroft Lump	61.14	.097	4.96
Bancroft Crushed	58.80	.101	7.09

b. Average Analysis on Straight Cargoes:

	Mine		Lake Erie	
Grade	Iron	Phos.	Iron	Moisture
Cliffs Shaft Lump	59.47	.096	58.99	.79
Cliffs Shaft Crushed	(All Mixed)			
Bancroft Lump	"	"		
Bancroft Crushed	"	"		

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore - Cliffs Shaft Grade:

	"A" Shaft Tons	"B" Shaft Tons	Total Tons
Pillars	1,450,000	720,000	2,170,000
Floors	1,717,000	793,000	2,510,000
Partly Developed	22,000	18,000	40,000
Total	3,189,000	1,531,000	4,720,000
To Support Surface	1,910,000	1,195,000	3,105,000
Available Ore	1,279,000	336,000	1,615,000
Less 10% Rock and 10% Loss in Mining	256,000	67,000	323,000
Net Total	1,023,000	269,000	1,292,000

RECAPITULATION

	Developed Tons	Prospective Tons	Total Tons
Available Ore	1,575,000	40,000	1,615,000
Less 10% Rock and 10% Loss in Mining	315,000	8,000	323,000
Net Available Ore	1,260,000	32,000	1,292,000

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4. ESTIMATE OF ORE RESERVES: (Continued)

a. Developed Ore - Bancroft Grade:

	"A" Shaft Tons
Pillars	86,000
Floors	37,000
Partly Developed	21,000
Total	144,000
To Support Surface	62,000
Available Ore	82,000
Less 10% Rock and 10% Loss in Mining	16,000
Net Total	66,000

RECAPITULATION

	Developed Tons	Prospective Tons	Total Tons
Available Ore	61,000	21,000	82,000
Less 10% Rock and 10% Loss in Mining	12,000	4,000	16,000
Net Available Ore	49,000	17,000	66,000

Assumptions:- 8, 9 and 10 cu. ft. equals one ton.
10% deduction for rock.
10% deduction for loss in mining.
Percentage of Bessemer is 0.

c. Estimated Analysis:

	Iron	Phos.	Sil.	Alum.	Mang.	Lime	Mag.	Sul.	Igni.	Moist.
Dried 212°	58.30	.100	6.71	2.45	.593	1.69	1.33	.010	2.66	
Natural	57.02	.098	6.56	2.40	.580	1.65	1.30	.010	2.60	2.20

5. LABOR AND WAGES:

a. Comments:

(1) Labor:

There was no shortage of labor during the year, but at times an unusually large number of men were temporarily absent from work on account of illness or were working on their farms. This condition was most acute during the second half of November and the first half of December, first on account of the deer-hunting season and then on account of the epidemic of influenza.

There was no change in the wage scale during the year.

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5. LABOR AND WAGES:
(Continued)

b. Comparative Statement of Wages and Product:

	1928	1927	Increase	Decrease
PRODUCT	391,862	399,716		7,854
No. of Shifts & Hours	1-8	1-8		
No. of Days	300	291	9	
AVG. NO. OF MEN WORKING:				
Surface	61	57	4	
Underground	224	220	4	
Total	285	277	8	
AVG. WAGES PER DAY:				
Surface	4.40	4.39	.01	
Underground	5.00	5.04		.04
Total	4.86	4.91		.05
WAGES PER MO. OF 25 DAYS:				
Surface	110.00	109.75	.25	
Underground	125.00	126.00		1.00
Total	121.50	122.75		1.25
PRODUCT PER MAN PER DAY:				
Surface	20.53	22.00		1.47
Underground	5.80	6.19		.39
Total	4.52	4.85		.33
LABOR COST PER TON:				
Surface	.214	.200	.014	
Underground	.861	.814	.047	
Total	1.075	1.014	.061	
AVG. PRODUCT BRK'G & TRAM'G	10.61	11.14		.53
AVG. WAGES CONTRACT MINERS	5.41	5.57		.16
AVG. WAGES CONTRACT LABOR	5.40	5.45		.05
TOTAL NO. OF DAYS:				
Surface	19,076¼	18,169¼	907	
Underground	67,526½	64,611¼	2915¼	
Total	86602¾	82,780½	3822¼	
AMOUNT FOR LABOR:				
Surface	84,025.77	79,735.77	4,290.00	
Underground	337,263.24	325,547.61	11,715.63	
Total	421,289.01	405,283.38	16,005.63	

Proportion of Surface to Underground Men:

1928 - 1 to 3.67
1927 - 1 to 3.86
1926 - 1 to 3.89
1925 - 1 to 3.41
1924 - 1 to 3.19

1924 - 1-8 Hr. Shift 5 days per week from July 30th.
1925 - 1-8 Hr. Shift 5 days per week.
1926 - 1-8 Hr. Shift 5 days per week Jan. 1st to Oct. 1st. 1-8 Hr. Shift 6 days per week Oct. 1st to Dec. 1st. 1-8 Hr. Shift 5 days per week from Dec. 1st.
1927 - 1-8 Hr. Shift 5 days per week Jan. 1st to Apr. 30th. 1-8 Hr. Shift 6 days per week from April 30th.
1928 - 1-8 Hr. Shift 6 days per week.

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6. SURFACE:

a. Buildings and Repairs:

Hoist:

On February 29th the stator on "A" shaft hoist motor burned out, and was replaced by the new stator purchased late in 1927. The old stator has been rewound.

In March a new hoisting rope was put on for "A" shaft skip and on April 1st a new rope was put on for "B" shaft skip.

Engine-House:

The interior of the engine-house has been painted, and is much improved in appearance.

Dry:

The drying-hoods in the south room were replaced by hooks and chains in February. Later in the year the interior of the dry was painted and calcimined.

Office:

The office was calcimined late in the fall.

Shops:

Both the drill-shop and the old shops were calcimined inside and the wood-work painted.

New oil-burners were put on the drill-forges, and Maxim silencers on the sharpeners in order to reduce the noise.

Coal-Dock:

The coal-dock roof at the upper end has been repaired for a length of 150 feet. Further repairs will be necessary in 1929.

Roads, Walks and Fences:

The path between the office and the shops was regraded, and hand-rails and concrete perrones were built.

The road between the mine and the General Office grounds was repaired and new fences were built, leaving more space for the road.

Storage-Yard:

Much of the scrap in the storage-yard was sorted over and two carloads of steel were sold. Some of the remaining scrap was moved to the old ore-dock south of the coal-dock, where the new storage-yard is to be placed.

Gravel Pit:

The L.S. & I. Ry. knocked down the trestle leading from the gravel-pit to the coal-dock, and the trestle was rebuilt and equipped with a scraper and hoist to load gravel for the Tilden Mine.

Crusher:

On May 29th the spider of the No. 8 crusher broke and was replaced by one taken from the South Jackson Mine. This also broke, but has been continued in service. The old one was repaired and is ready for service.

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6. SURFACE:
(Continued)

a. Building and Repairs: (Continued)

Teaming:

The only remaining horses were sold in November.

b. Stockpiles:

Some changes had to be made in the stockpile trestles on account of the new loading track at the pocket, and a new trestle was built south of and parallel with the old one, in order to stock the winter's production.

The Bancroft Lump stockpile was cleaned up. Measurements taken in November indicate substantial overruns in all piles.

7. UNDERGROUND:

b. Development:

Development at the Cliffs Shaft Mine is divided into two classes:-

1. Opening new ore.
2. Preparing known ore for mining.

New ore is opened by drifts, raises and breast-stopes. In this work breast-stopes and large raises are used mostly, because of greater economy in breaking ore. Drifts and raises are used for preparing known ore for mining.

As a breast-stope proves up approximately as much additional ore as is mined with it, the ore reserves can be maintained without much decrease, if half the working-places in ore are developing new ground, or as it is often put, if they are advancing. Mining floors, pillars and backs is called retreating.

The average classification of contracts for the past year is given as follows:-

	"A" Shaft	"B" Shaft	Total
Stopes	14	6	20
Floors	13	13	26
Backs	1	1	2
Drifts and Raises in Ore	4	3	7
Rock	9	1	10
Total	41	24	65
Developing New Ore	17	8	25
Mining Known Reserves	15	15	30
Rock	9	1	10
Total	41	24	65

Fifteen of the contracts have two machines and two working-places, and the total number of active working places is eighty.

"A" Shaft: Bancroft Ore:

This ore is on Lot 2 of Section 3, and is leased from the Oliver Iron Mining Co.

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7. UNDERGROUND:
(Continued)

b. Development: (Continued)
"A" Shaft: Bancroft Ore:

Second Level:

A cross-cut was driven north 95 feet, following Drill-Hole No. 372, 540 feet northeast of "A" shaft, and a raise was put up in ore to the first level. The ore in Drill-Hole No. 373, 30 feet further east, was then followed to the north.

Third Level:

A raise was put up from the fifth level, and a cross-cut stope opened up in the ore found in Diamond-Drill Hole No. 374, 620 feet northeast of "A" shaft. At the same time a raise was put up from the north drift on the fifth level, and a cross-cut is being driven south in the second run of ore found in Diamond-Drill Hole No. 374, 1050 feet northeast of "A" shaft.

Fifth Level:

The east drift along the boundary was continued for 180 feet, and crossed only a very narrow vein of ore before passing into the hanging-wall. A raise was put up in this ore, but it was too small to mine. A cross-cut was also driven to the south for ventilation and outlet, and three raises were put up to the third and fourth levels.

A branch drift was driven northeast for 330 feet in rock from the boundary-line, 530 feet north of the shaft, and a raise was put up to the ore on the third level.

Sixth Level:

1580 feet northeast of the shaft a stope was opened on the foot-wall, and the ore was followed east and west a short distance.

Seventh Level:

On a sub-level 1130 feet northeast of the shaft one contract is opening up new ore in a breast stope, and 200 feet further west another contract is opening a small stope at the top of a raise put up from the eighth level.

A narrow vein of ore found by Drill-Hole No. 378 was followed east and west for 130 feet, 800 feet northeast of "A" shaft.

Eighth Level:

Two cross-cuts have been driven north into Bancroft ore, and another is following Drill-Hole No. 396, 1750 feet northeast of the shaft. 900 feet northeast of the shaft the drift was turned to the north, and cut more than 30 feet of ore beyond the contact. A raise was put up here to the seventh level, passing through 20 feet of rock and 30 feet of ore. 300 feet further east another contract is following the ore found in Drill-Hole No. 381.

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7. UNDERGROUND:
(Continued)

b. Development: (Continued)

"A" Shaft: Bancroft Ore:

Tenth Level:

A cross-cut has been started to the north in rock 1400 feet northeast of "A" shaft, which is expected to reach the Bancroft Vein in about 400 feet.

"A" Shaft: Cliffs Shaft Ore:

First Level: North Vein:

One contract stoped east for 120 feet just south of the boundary, 550 feet northwest of "A" shaft, and drove two short cross-cuts to the Bancroft ore.

Second Level: North Vein:

The stope under Lake Bancroft, 600 feet northwest of "A" shaft, was driven west 60 feet and two raises were put up to the first level.

550 feet northeast of "A" shaft a stope was driven east along the boundary in ore found in Drill-Hole No. 373, until it holed to an old stope.

Fifth Level: North Vein:

450 feet northwest of "A" shaft a cross-cut was driven northwest for 40 feet in rock, and cut a small vein of ore. Forty feet further another vein was cut, and a stope is being driven northwest in this ore.

At the east end of the vein, just beyond the Bancroft Lease one contract has opened a fine stope of ore 180 feet long, and is now following the ore north along the Bancroft boundary.

Fifth Level: South-East Deposit:

The ore in the east stope, 2000 feet southeast of the shaft, was followed east for a short distance, but pinched out. Two cross-cuts were driven south at 1800 and 1900 feet southeast of the shaft, and both found ore, which is being followed east and west by two contracts. A raise was also put up to the fourth level in ore and a stope started 1930 feet southeast of the shaft.

Sixth Level: North Vein:

At the east end of the vein two contracts are driving stopes to the east in good ore 2190 and 2370 feet northeast of the shaft. The eastern contract is about 350 feet from the workings of No. 3 Mine.

Sixth Level: Main Vein:

One contract opened a stope in good ore 2250 feet east of "A" shaft in December. They have been stoping in this vicinity most of the year, and drove stopes in two places for 180 feet.

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7. UNDERGROUND:
(Continued)

b. Development: (Continued)

"A" Shaft: Cliffs Shaft Ore:

Sixth Level: South-East Deposit:

One contract has been stoping most of the year from 1900 to 1990 feet southeast of the shaft, but the ore was cut off in November, and they are now cross-cutting south 180 feet further west.

Seventh Level: North Vein:

One gang is drifting west in jasper, 800 feet northeast of the shaft, to get under a floor left in a stope on the sixth level. They have drifted 90 feet.

1800 feet northeast of the shaft a raise is being put up in jasper and mixed ore to the sixth level. 120 feet further east early in the year a cross-cut was driven southeast 75 feet to the hanging without finding ore.

Seventh Level: South-East Deposit:

In the stope at the east end of the vein the ore was cut off early in the year, and a drift was driven 80 feet east along the hanging-wall, and two cross-cuts, 70 and 85 feet long respectively, were driven to the south without finding ore.

Eighth Level: North Vein:

One contract continued a stope east for 100 feet from a point 2000 feet east of the shaft, but came to the end of the ore, and are now raising to the north near the breast.

Eighth Level: South-East Deposit:

One gang is driving a breast-stope to the southeast in good ore, 1850 feet southeast of the shaft.

Another contract drifted west 100 feet in jasper from a raise 1620 feet southeast of the shaft, and now have good ore in the breast.

A third contract has been drifting northeast most of the year, starting at a point 2060 feet southeast of the shaft, and have followed the hanging-wall for 400 feet without finding ore in commercial quantity. This is the extension of the Incline Mine vein, and the results of the exploration have been very disappointing.

Ninth Level: North Vein:

The ore is being followed to the east, 1860 feet east of the shaft, by one contract. It is not wide, but has been improving in quality. A cross-cut was also driven south from this same ore-body 50 feet in rock, and a raise was put up to the eighth level. There was 10 feet of ore in the floor of the eighth level.

Ninth Level: Main Vein:

A raise put up from the tenth level was continued to the eighth level, 1940 feet east of the shaft.

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7. UNDERGROUND:
(Continued)

b. Development: (Continued)

"A" Shaft: Cliffs Shaft Ore:

Tenth Level: South Lens:

A raise was put up to the ninth level, 960 feet east of the shaft. This was in rock for ten feet.

Eleventh Level: Main Vein:

One contract cross-cut south through the pillar 1440 feet east of the shaft, but found little ore. They are now cross-cutting north on Drill-Hole No. 328, 1460 feet east of the shaft, and have ore in the breast.

Another contract working two machines, drove a stope east along the north foot-wall for 100 feet to the end of the ore 1860 feet east of the shaft. They also cross-cut south 70 feet to the south foot-wall, 1660 feet east of the shaft, and stoped west for another 70 feet. They are now raising in the back 1680 feet east of the shaft.

Twelfth Level: Main Vein:

A raise was put up to the eleventh level 1460 feet east of the shaft.

Fifteenth Level:

A raise was put up to the twelfth level 1420 feet east of the shaft. The last 60 feet was in ore.

"B" Shaft: Cliffs Shaft Ore:

First Level: Main Vein:

A drift 270 feet long was driven west from an old stope 600 feet southeast of "B" shaft, and a raise was put up to the 1165 foot sub-level. In this drift 60 feet of ore was found and a stope was driven in this ore to the northwest, holing to an old sub-level 520 feet southeast of "B" shaft. From this stope a raise was put up to the 1190 foot sub-level.

First Level: South Lens:

The ore found last year 1040 feet southeast of the shaft has been followed east for 140 feet, but has been cut off by a dike. Three gangs are working here, two raising and one stoping.

First Level: North Vein:

A stope 110 feet long has been driven northeast and southwest 330 feet north of "B" shaft and a cross-cut driven north into the hanging-wall.

Fourth Level:

An irregular vein of ore has been followed east for 130 feet and west for 50 feet, 350 feet north of the shaft.

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7. UNDERGROUND:
(Continued)

b. Development: (Continued)

"B" Shaft: Cliffs Shaft Ore:

Fifth Level: Main Vein:

The plat has been enlarged and the cross-cut north of the shaft and the drift to "A" shaft straightened and enlarged for motor-haulage.

Sixth Level: North Vein:

Drifting and raising has been done to the west and north on a sub-level 750 feet northwest of "B" shaft, and new ore was found at the end of the year. Its extent is unknown.

Working from a raise 350 feet northeast of "B" shaft new ore was opened in a stope 65 feet long. This ore will probably go down to the seventh level.

Seventh Level: North Vein:

The known limits of the ore have been extended in a stope 470 feet north of the shaft.

Eighth Level: North Vein:

The northeast drift was extended 160 feet in rock, and struck ore 100 feet northeast of the section corner. This has been followed east for 160 feet and a raise put up to the seventh level. Apparently the end of the ore has been reached.

Thirteenth Level: Main Vein:

At the west end of the vein on a sub-level 1500 to 1640 feet west of "B" shaft stopes have been driven, which are in the aggregate 285 feet long. The ore is good, but the back is treacherous, and apparently the limits of the ore have been reached. Three gangs are working here.

1330 feet west of the shaft on a sub-level 15 feet below the twelfth level a cross-cut has been driven to the north in ore, and a stope is being opened.

On the main level a drift is being driven southwest in very hard jasper to reach the ore found in Drill-Hole No. 317.

Fourteenth Level: Main Vein:

The ore in the stope in the hanging-wall pinched out 1640 feet northwest of the shaft.

Fifteenth Level: Main Vein:

A drift is being driven northeast, following a narrow vein of ore, 1930 feet northwest of "B" shaft.

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7. UNDERGROUND:
(Continued)

c. Stoping:

Development stoping has been described under Development. Under the heading of stoping will be described all retreating work, i.e. the mining of known ore-bodies.

"A" Shaft:

First Level: North Vein:

One contract has mined the floor of a stope 600 feet northwest of "A" shaft.

First Level: Main Vein:

One contract has mined the floor of the level for a length of 200 feet, starting at a point 220 feet north of the shaft and working towards the northeast.

Another contract mined the floor of a sub-level and of the first level 360 feet northeast of "B" shaft, and are now mining the floor of the second level.

Second Level: Main Vein:

One contract is mining the floor 370 feet northeast of "B" shaft.

Third Level: South Lens:

One contract mined some ore on a sub-level 350 feet south of "A" shaft early in the year.

Fourth Level: South-East Deposit:

Two contracts have been stoping and mining floors near the boundary from 1460 to 1580 feet southeast of the shaft.

Sixth Level: North Vein:

One contract has been mining floors between the sixth and seventh levels throughout the year, 1200 feet northeast of the shaft.

Seventh Level: North Vein:

Two contracts have been mining floors all year from 1250 to 1500 feet northeast of the shaft.

Another contract has mined the ore in the back of the stope from 1660 to 1880 feet east of the shaft.

Eighth Level: Main Vein:

One gang has mined the floor of a stope 1420 to 1540 feet east of the shaft.

Eighth Level: South Lens:

One contract has mined the floor of the level close to the hanging-wall, 900 feet southeast of the shaft.

Ninth Level: Main Vein:

One contract has been mining floors from 1100 to 1300 feet east of the shaft, and another, further north, from 1240 to 1400 feet east of the shaft.

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7. UNDERGROUND:
(Continued)

c. Stoping: (Continued)

"A" Shaft:

Ninth Level: Main Vein:

Another contract, further south, has mined the floor westward from 1080 to 970 feet east of the shaft.

Ninth Level: South Lens:

One gang has been mining floors 1200 feet southeast of the shaft all year.

Tenth Level: Main Vein:

One contract stoped up to the ninth level, 1100 feet southeast of the shaft, and another has been stoping most of the year in a raise, 1860 feet east of the shaft.

"B" Shaft:

First Level: Main Vein:

One contract with two machines has been stoping in good ore on the foot-wall and mining floors of the sub-levels from 320 feet south to 500 feet southwest of "B" shaft.

Two more contracts have been mining the floor of the 1190 foot sub-level most of the year 500 feet south of the shaft and from 520 to 620 feet southeast of the shaft.

Another gang opened a stope on the 1160 foot sub-level, 900 feet southeast of the shaft, and followed the ore east till it was cut off by the hanging-wall.

Fifth Level: North Vein:

During the first half of the year one contract was mining floors 400 to 500 feet northeast of the shaft.

Sixth Level:

One contract has been mining floors all year 300 to 380 feet northwest of the shaft.

Seventh Level:

One contract has been mining floors throughout the year from 580 to 680 feet northwest of the shaft.

Eighth Level: Main Vein:

One contract is mining floors 1320 feet southwest of the shaft.

Eighth Level: Fault Vein:

One contract has been mining floors from 1440 to 1360 feet southwest of the shaft, and have found some unexpected ore.

Ninth Level: Main Vein:

One contract has been mining floors most of the year between the eighth and tenth levels from 1400 to 1520 feet southwest of "B" shaft.

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7. UNDERGROUND:
(Continued)

c. Stoping: (Continued)

"B" Shaft:

Ninth Level: Fault Vein:

One gang is mining floors 900 feet southwest of "B" shaft.

Eleventh Level: Main Vein:

One contract has been mining floors 1000 feet west of "B" shaft all year, and still has some ore to take out.

Eleventh Level: Fault Vein:

One gang has mined floors nearly all year from 1250 to 1320 feet west of "B" shaft.

Twelfth Level: Fault Vein:

One contract has mined floors throughout the year 1300 to 1400 feet west of the shaft.

Thirteenth Level: Main Vein:

Two contracts have been mining floors all year from 1300 to 1420 feet west of the shaft, and from 1350 to 1460 feet northwest of the shaft.

e. Drifting and Raising:

The drifting and raising done in 1928 has been described under "Development."

Year	Rock Drifting	Ore Drifting	Rock Raising	Ore Raising
1927	3784 Ft.	868 Ft.	1090 Ft.	1626 Ft.
1928	3595 Ft.	695 Ft.	1167 Ft.	1153 Ft.

f. Explosives, Drilling and Blasting:

In 1927 six new drills were purchased and in 1928 eleven.

In the last three months of 1927 and in all of 1928 part of the powder used, in 1928 nearly half, was a new bulk powder, called "Hercomite," of which the cost per stick is less than that of standard dynamites. This powder makes a good deal of smoke, and does not shatter the ore so well, so that the cost for secondary blasting is excessive. For these reasons it was decided to discontinue its use.

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)

Statement of Explosives Used:

Kind	Quantity	Average Price	Amount 1928	Amount 1927
50% L.F. Powder	114,550	.1362	15,604.00	31,962.00
60% " "	49,400	.1457	7,196.50	7,432.50
Hercomite No. 3	133,900	.1369	18,328.75	3,115.00
E.P. 23	21,350	.1350	2,882.25	
Total Powder	319,200	.1379	44,011.50	42,509.50
Fuse	459,800	5.775	2,655.38	2,529.30
Caps	107,400	10.993	1,180.68	987.13
Crimpers	23	.667	15.35	13.99
Total Fuse, Etc.			3,851.41	3,530.42
TOTAL EXPLOSIVES			47,862.91	46,039.92
Product			391,862	402,532
Pounds Powder per Ton of Ore			.8146	.7455
Cost per Ton for Powder			.1123	.1056
Cost per Ton for Fuse, Etc.			.0098	.0088
Cost per Ton for All Explosives			.1221	.1144
Rock Development:				
50% L.F. Powder	6,500		892.25	5,789.00
60% " "	18,300		2,724.00	7,402.50
Hercomite No. 3	33,250		4,538.25	546.00
E.P. 23	1,400		189.00	
Fuse	133,700		772.13	882.42
Caps	14,100		153.38	276.89
Crimpers	6		3.98	4.67
TOTAL EXPLOSIVES - ROCK DEVELOPMENT			9,272.99	14,901.48
TOTAL EXPLOSIVES USED IN MINE			57,135.90	60,941.40
Average Price per Pound for Powder			.1383	.1417

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8. COST OF OPERATING:

a. Comparative Mining Costs:

	1928	1927	Increase	Decrease
PRODUCT	391,862	402,532		10,670
Underground Costs	1.451	1.333	.118	
Surface Costs	.201	.170	.031	
General Mine Accounts	.083	.074	.009	
Cost of Production	1.735	1.577	.158	
Depreciation				
Plant and Equipment	.051	.051		
Movable Equipment	.003	.012		.009
Taxes	.276	.277		.001
Central Office	.116	.093	.023	
Welfare, Safety, Hospital, Etc.	.042		.042	
Cost Adjustment		.019		.019
Contingent Expense		.050		.050
Cost on Stockpile	2.223	2.079	.144	
Loading & Shipping	.035	.034	.001	
Total Cost on Cars	2.258	2.113	.145	
No. of Days Operating	300	291	9	
No. of Shifts & Hours	1-8	1-8		
Average Daily Product	1,306	1,383		77
COST OF PRODUCTION:				
Labor	1.085	1.048	.037	
Supplies	.650	.529	.121	
Total	1.735	1.577	.158	

b. Detailed Cost Comparison:

The mine worked single shift six days a week in 1928, a total of 300 days. In 1927 the mine worked six days a week after April 30th, a total of 291 days; but hoisting was done for 1/4 shift overtime at frequent intervals. In 1928 there was no overtime hoisting.

There was no change in the wage scale in either year.

UNDERGROUND COSTS:

Exploring in Mine:

1927	$ 4681.23	$ .012
1928	9066.20	.023
Increase	$ 4384.97	$ .011

The diamond-drill was loaned to the Holmes Mine for 5 months in 1927, and 1½ months in 1928. In 1927 1509 feet cost $ 3.10 per foot. In 1928 3174 feet cost $ 2.82 per foot.

Development in Rock:

1927	$ 54868.90	$ .136
1928	55480.97	.141
Increase	$ 612.07	$ .005

In 1927 4874 feet cost $ 11.26 per foot. In 1928 4762 feet cost $ 11.65 a foot.

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8. COST OF OPERATING: (Continued)

UNDERGROUND COSTS: (Continued)

Development in Ore:		
1927	$ 25420.00	$ .063
1928	17774.58	.046
Decrease	$ 7645.42	$ .017

In 1927 2494 feet cost $ 10.19 per foot. In 1928 1848 feet cost $ 9.62 a foot.

Stoping:		
1927	$ 157651.93	$ .392
1928	165333.21	.422
Increase	$ 7681.28	$ .030

In 1928 more breast stopes were worked and more narrow places. Stoping conditions in general were not as good as in 1927. Explosives cost increased $ .008 in 1928. Drill steel was also higher.

Timbering:		
1927	$ 10510.06	$ .026
1928	9787.43	.025
Decrease	$ 722.63	$ .001

In 1928 lumber and timber decreased $ 265 and plates and chute-fingers decreased $ 457.

Tramming:		
1927	$ 143376.36	$ .356
1928	149519.12	.382
Increase	$ 6142.76	$ .026

In 1927 291 days cost $ 492 per day. In 1928 300 days cost $ 498 per day. There was not so much ore handled in 1928.

Ventilation:		
1927	$ 61.22	$ .000
1928	29.48	.000
Decrease	$ 31.74	$ .000

Pumping:		
1927	$ 29709.52	$ .074
1928	30732.56	.078
Increase	$ 1023.04	$ .004

Power charges increased $ 1027 on account of the heavier rainfall.

Compressors and Air Pipes:		
1927	$ 35199.88	$ .087
1928	36304.23	.093
Increase	$ 1104.35	$ .006

The increase is due to nine more work-days in 1928.

Back Filling:		
1927	$ 11206.95	$ .028
1928	11911.00	.030
Increase	$ 704.05	$ .002

The increase is due to nine more work-days in 1928.

Underground Superintendence:		
1927	$ 15913.49	$ .040
1928	17833.14	.046
Increase	$ 1919.65	$ .006

There was a second assistant captain in 1928 and the mine worked nine more days.

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8. COST OF OPERATING: (Continued)

UNDERGROUND COSTS: (Continued)

Maintenance Accounts:

Compressors and Power Drills:		
1927	$ 2755.88	$ .007
1928	4072.86	.010
Increase	$ 1316.98	$ .003

In 1928 eleven drills were purchased and in 1927 six, an increase of $ 1800.

Hand Tramming Equipment:		
1927	$ 26010.53	$ .065
1928	35104.55	.090
Increase	$ 9094.02	$ .025

In 1928 there were the following increases:-

Labor on Scrapers increased	$ 951
Transformers	383
Magnetic Switches	1666
Floodlights	676
Motor Repairs	421
Scraper-Hoists (5 New 1928)	1027
Cables, Etc.	1270
Wire-Rope	700
Scrapers, Slides & Sheaves	2000
Total	$ 9094

Electric Tram Equipment:		
1927	$ 17394.16	$ .043
1928	24906.02	.063
Increase	$ 7511.86	$ .020

In 1928 there were the following increases:-

40 lb. Rail	$ 193
2 Locomotives from Republic	1824
1 Charging Set " "	350
2 New Batteries	1393
Hard Ore Labor Rep. Generator	830
Reprs. to Wheels & Armatures	938
Wiring & Motor Repairs	1983
Total	$ 7511

Pumping Machinery:		
1927	$ 1842.90	$ .004
1928	894.73	.002
Decrease	$ 948.17	$ .002

The sump was cleaned out early in 1927.

SURFACE COSTS:

Hoisting:		
1927	$ 19008.94	$ .047
1928	19128.88	.049
Increase	$ 119.94	$ .002

There were nine more work-days in 1928.

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8. COST OF OPERATING: (Continued)

SURFACE COSTS: (Continued)

Stocking Ore:			
1927	$	9356.66	$ .023
1928		9934.47	.025
Increase	$	577.81	$ .002

The increase is in labor charges handling snow and picking rock. There were two men on the lump pile in 1928 and one in 1927.

Screening-Crushing at Mine:			
1927	$	10906.49	$ .027
1928		15222.67	.039
Increase	$	4316.18	$ .012

In 1928 the screening and crushing arrangement went into operation in February. This requires more power and one more man.

Dry-House:			
1927	$	7529.49	$ .019
1928		8801.85	.022
Increase	$	1272.36	$ .003

Heating expense increased $ 1374 in 1928.

General Surface Expense:			
1927	$	8276.92	$ .021
1928		9677.04	.025
Increase	$	1400.12	$ .004

The path to the shops was improved in 1928 and a new fence was built along the road on the north side of the mine. Much of the scrap from the storage-yard was moved, and the mine worked nine more days. The bill for rebuilding the road by the laboratory, work done in 1927, was paid in 1928.

Maintenance Accounts:

Hoisting Equipment:			
1927	$	4251.30	$ .011
1928		8374.40	.021
Increase	$	4123.10	$ .010

In 1928 a new stator for the hoist-motor cost $ 1476 and other repairs to the hoist-motor cost $ 691. Three new hoisting ropes cost $ 1796 in 1928; nothing in 1927. An 8 ft. bicycle sheave cost $ 385. Total $ 4348.

Shaft:			
1927	$	1220.50	$ .003
1928		1283.92	.003
Increase	$	62.42	$ .000

Top Tram Equipment:			
1927	$	2100.72	$ .005
1928		1021.45	.002
Decrease	$	1079.27	$ .003

In 1927 $ 820 was a direct charge for making top-tram cars.

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8. COST OF OPERATING: (Continued)

SURFACE COSTS: (Continued)

Docks, Trestles and Pockets:			
1927	$	1114.44	$ .003
1928		1372.47	.004
Increase	$	258.03	$ .001

The increase is in pocket repairs and plates.

Mine Buildings:			
1927	$	4766.07	$ .012
1928		3899.55	.010
Decrease	$	866.52	$ .002

In 1927 direct charges on E and A. 495, heating plant, amounted to $ 178 per month. In 1928 the engine-house, shops and dry were painted and the coal-dock repaired.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

GENERAL MINE ACCOUNTS:

Insurance:			
1927	$	3253.27	$ .008
1928		133.80	.000
Decrease	$	3119.47	$ .008

In 1927 a large amount of back insurance was charged out to operations.

Engineering:			
1927	$	2416.87	$ .006
1928		2518.09	.007
Increase	$	101.22	$ .001

This is a Central Office charge.

Analysis:			
1927	$	2675.89	$ .007
1928		3275.06	.009
Increase	$	599.17	$ .002

Central laboratory charges increased $ 487. Balance is labor sampling.

Personal Injury Expense:			
1927	$	5018.38	$ .013
1928		8710.57	.022
Increase	$	3692.19	$ .009

In 1927 charges were actual payments. In 1928 2% of the pay-roll was charged to this account.

Safety Department Expense:			
1927	$	132.23	$ .000
1928		151.11	.000
Increase	$	18.88	$ .000

Telephones and Safety Devices:			
1927	$	2396.15	$ .006
1928		3549.17	.009
Increase	$	1153.02	$ .003

In 1928 loss on hard hats and goggles cost $ 415; bells, safety-lights, etc. increased $ 220. Fire-hose cost $ 118; and underground labor increased $ 400.

Local General Welfare:			
1927	$	1192.80	$ .003
1928		1126.18	.003
Decrease	$	66.62	$ .000

This is a Central Office charge.

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8. COST OF OPERATING: (Continued)

GENERAL MINE ACCOUNTS: (Continued)

Mine Office:

1927	$ 12665.69	$ .032
1928	12983.92	.033
Increase	$ 318.23	$ .001

In 1928 the overhead of the General Storehouse was charged to this account to the amount of $ 1348; but this was partly offset by a decrease of $ 220 in superintendent's choreman and no charge for superintendent in February and March.

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Underground Diamond Drilling:

On hole was finished and nineteen others were drilled in 1928, a total of 3174 feet. Twelve holes found ore in quantity sufficient to mine, an average of thirty-eight feet in each hole. All of the holes were drilled in "A" shaft and all were horizontal. A detailed description of this drilling will be given in the Geologist's report. A general resume' follows:-

Hole No. 379 was in 404 feet at the first of the year, and was continued for 163 feet in quartzite and slate till stopped. It was drilled northeast from a Bancroft stope on the seventh level 900 feet northeast of "A" shaft. This hole tried to cross the Bancroft syncline, but was unsuccessful.

Hole No. 380 was drilled due north on the eighth level, starting at a point 940 feet northeast of "A" shaft, and was stopped in the hanging-wall at a depth of 129 feet. It cut three small veins of ore.

Hole No. 381 was drilled due north on the eighth level, starting at a point 950 feet northeast of "A" shaft. It cut three runs of ore, and was stopped at a depth of 116 feet.

Hole No. 382 was drilled due north on the sixth level in the North Vein, starting at a point 1060 feet northeast of the shaft. The first 43 feet of this hole were ore, and it was continued in rock to a depth of 93 feet.

Hole No. 383 was drilled due north on a sub-level above the seventh level, 920 feet northeast of "A" shaft, and was continued in rock to a depth of 85 feet.

Hole No. 384 was drilled due north on the seventh level 1000 feet northeast of "A" shaft, and was continued to a depth of 193 feet. It cut two minable veins of ore, and two narrow veins, 93 feet in all.

Hole No. 385 was drilled due north on the eighth level 1230 feet northeast of "A" shaft, and was continued to a depth of 98 feet. It was stopped in the hanging-wall, after crossing one vein of ore 20 feet wide.

Hole No. 386 was also drilled due north on the eighth level, starting at a point 1390 feet northeast of "A" shaft, and cut one run of good ore, 33 feet wide. It was stopped at a depth of 110 feet.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS: (Continued)

Hole No. 387 was drilled due north from a stope on the sixth level near the Bancroft boundary 1740 feet northeast of "A" shaft, and cut two veins of ore aggregating 93 feet. It was stopped in the hanging-wall at a depth of 182 feet.

Hole No. 388 was drilled to the north in jasper on the sixth level 230 feet east of Hole No. 387, and was stopped in slate at a depth of 105 feet.

Hole No. 389 was drilled to the south into the hanging-wall of the Main Vein on the sixth level 1980 feet east of "A" shaft. It found no merchantable ore and was stopped at a depth of 110 feet.

Hole No. 390 was drilled due south on the fifth level in the South-East Deposit 1780 feet southeast of the shaft, and found one vein of ore 17 feet wide. It was stopped at the boundary at a depth of 120 feet.

11. ACCIDENTS AND PERSONAL INJURY:

Hole No. 391 was drilled due north from the same location as No. 390, and went directly into the hanging-wall. It was stopped at a depth of 71 feet.

Hole No. 392 was drilled due south for 490 feet from a point 220 feet east of Hole No. 390 on the fifth level, and cut 63 feet of material that averaged as merchantable ore. Much of it, however, is sideritic, and its value is doubtful. This hole is on Moro Mine ground, and passed through the anticline between the two mines, and cut the north limb of the Moro syncline. There was no merchantable ore at this point.

Hole No. 393 was drilled to the southeast, from the same stope on the fifth level as No. 392, but 50 feet further east, and was in foot-wall material for 112 feet.

Hole No. 394 was drilled due north for 160 feet from the sixth level 1490 feet northeast of "A" shaft. It went into the hanging-wall right away, and was stopped in slate.

12. NEW CONSTRUCTION AND PROPOSED CONSTRUCTION:

Hole No. 395, 170 feet west of No. 394 on the same level, was drilled to the north also. It had 23 feet of ore at the start, and then went into the hanging-wall. It was stopped at a depth of 136 feet.

Hole No. 396 was drilled due north from the end of the northeast drift on the eighth level, 1740 feet northeast of "A" shaft. It cut 17 feet of ore at a depth of 86 feet, and was stopped at 195 feet.

Hole No. 397 was drilled due north on the fourth level at the boundary 700 feet northeast of the shaft, and cut three small veins of ore. There was some pyrite in this hole. It was continued to a depth of 356 feet.

Hole No. 398 was drilled N. 70° E. on the seventh level, 2180 feet northeast of the shaft, in jasper, siderite and dike, and was stopped at a depth of 150 feet at the end of the year.

The best chance for future explorations is in this territory to the north and east, especially in the Bancroft syncline.

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10. TAXES:

Taxes were slightly lower in 1928, but the cost per ton remained almost unchanged.

Comparative Statement of Taxes for Years 1928 & 1927:

	1928		1927	
	Valuation	Taxes	Valuation	Taxes
Realty placed by Tax Comm.	2,580,000	85,289.92	2,747,250	90,737.21
Personal	573,000	18,942.26	510,000	16,843.87
Lot 2, Sec. 3, 47-27 60-A. Minerals	90,000	2,975.22	90,000	2,972.62
Lot 174, Nelson Addition	100	3.31	100	3.30
South 35.91 Ft. of Lot 179	50	1.65	50	1.65
Total	3,243,150	107,212.36	3,347,400	110,558.65
Collection Fees		1,072.12		1,105.58
Total		108,284.48		111,664.23

11. ACCIDENTS AND PERSONAL INJURY:

One fatal accident marred the record for 1928.

At 9:50 P.M. Saturday, November 24th, Waino Tarkka was instantly killed by falling down "A" shaft from the tenth level. Tarkka, who was acting as cage-rider, Fred Paju, and Matt Renowden, shift-boss, came up in the cage from the fifteenth level, and, when the cage reached the tenth level, it almost stopped, and Tarkka, who had just opened the door, started to step out on the plat. The cage did not stop, however, until it had gone about seven feet higher. Tarkka was thrown off, and fell down the shaft.

Tarkka was a single man, American born of Finnish parentage, and was 27 years old. He had worked at the Cliffs Shaft Mine for three years.

12. NEW CONSTRUCTION AND PROPOSED CONSTRUCTION:

E and A. No. 508:

Certain changes in the crusher-building, started in 1927 in order to crush all large lumps of ore, were completed in January, but when tried out gave some trouble, and needed adjustment. A change in plan was allowed, whereby all the ore was put through the crusher, and the plant went into operation in February.

The last statement of this E and A. was as follows:-

Acct. No.		Estimate	Expenditures To Date	Unexpended Balance
1	Crusher Changes	$ 1,500.00	$ 1,326.34	$ 173.66
2	Rotary Grizzlies & Drives	1,500.00	828.02	671.98
3	Trestle Changes & Stockpile Pockets	2,500.00	1,824.41	675.59
4	Chutes & Linings & Building Changes	2,500.00	5,327.44	2,827.44
5	Railroad Pocket	2,000.00	1,793.54	206.46
6	6 Ft. Revolving Screen	8,000.00	158.82	7,841.18
7	Contingencies	2,000.00		2,000.00
	Total	$ 20,000.00	$ 11,258.57	$ 8,741.43

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12. NEW CONSTRUCTION AND PROPOSED CONSTRUCTION: (Continued)

E and A. No. 508:
The entire cost was charged out in 1928.

13. NEW EQUIPMENT AND PROPOSED NEW EQUIPMENT:

d. Tugger Hoists and Scrapers:

Two new 10 H.P. single drum air-hoists were bought for spotting cars at the pocket.

Five new scraper-hoists were bought during the year and several others were rebuilt.

A new, large scraper-slide was built and sent underground, and it is planned to build several portable scraper-slides during the coming year.

A second-hand trolley locomotive was purchased from the Stephenson Mine in November and put in service. Two two-ton storage-battery locomotives were bought from the Republic Mine during the summer.

In the drill-shop one of the drill-sharpeners was rebuilt, and Maxim silencers were put on both sharpeners to reduce the noise. New burners were also purchased for the drill-forges.

Eleven new rock-drills were purchased during the year.

14. MAINTENANCE AND REPAIRS:

The spare skip was almost entirely rebuilt, and so was one top-tram car. This car had trammed 220,000 tons.

On February 29th the stator on "A" shaft hoist-motor burned out, and was replaced by a new stator, purchased last year. The old stator was then rewound.

The spider of the No. 8 Crusher split in the head on May 29th, and was replaced by one from the South Jackson Mine. The old one was repaired, and is ready to go into service. The spider from the South Jackson Mine is also cracked, but has been continued in service.

18. NATIONALITY OF EMPLOYEES:

Americans	20
English	45
Irish	9
French	20
Finnish	100
Scandanavians	74
Germans	4
Italians	13
Total	285

This statement shows the nationality of the father at birth, and not the man's nationality at birth. Nearly all are U.S. citizens.

HOLMES MINE

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1. GENERAL:

The Holmes Mine continued to work five days a week on single shift for producing ore, but worked night shift as well on development. Shaft-sinking was started in November 1927, and was continued until February 1928, the shaft being sunk 130 feet to the fifth level. Development work was continued on both shifts throughout the year, and the fifth level was nearly all opened.

One diamond-drill-hole was put down near the boundary north of the shaft to test some iron formation cut by the shaft, but no ore was discovered.

There was no change in the wage-scale and no shortage of labor in 1928.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Grade	Yearly Product Tons	Product Stockpile Overrun Tons	Total Tons
Holmes Bessemer	2,446	6,629	9,075
Holmes Lump	24,281		24,281
Holmes Crushed	33,220		33,220
Junction Bessemer	35,416	5,962	41,378
Junction	75,833		75,833
Total	171,196	12,591	183,787
Rock	36,140		36,140
Total	207,336	12,591	219,927

Excluding stockpile overruns the product was 5,298 tons less than in 1927, but the combined ore and rock was 20,886 tons more in 1928 than in 1927. All hard ore was screened in 1928, and the Holmes Crushed and Holmes Bessemer were separated during the shipping season only.

The mine worked 262 days in 1928, and produced an average of 653 tons per day, exclusive of stockpile overruns. In 1927 the mine worked 262 days and produced 674 tons per day.

b. Shipments:

Grade	Pocket Tons	Stockpile Tons	Total Tons	Last Year Total Tons
Holmes Bessemer	2,796	17,015	19,811	26,173
Holmes Lump	10,986	7,937	18,923	17,580
Holmes Crushed	14,788	22,649	37,437	25,836
Junction Bessemer	18,704	25,256	43,960	47,666
Junction	19,086	42,070	61,156	51,269
Total	66,360	114,927	181,287	168,524
Total Last Year	58,105	110,419	168,524	
Increase in Shipments	8,255	4,508	12,763	

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

Shipments were slightly less than production including stockpile overrun, but more than net product, so that the actual balance on hand is less than a year ago.

There is ample stocking room for all grades of ore this winter.

Shipments to the dock began early in May and continued intermittently to November 16th.

c. Stockpile Inventories:

Grade	Tons
Holmes Lump	15,584
Holmes Crushed	15,339
Junction Bessemer	5,452
Junction	109,288
Total	145,663

d. Division of Product by Levels:

Third Level	93,339	Tons
Fourth Level	77,217	"
Fifth Level	640	"
Total	171,196	"

e. Production by Months:

Month	Days	Holmes Bessemer Tons	Holmes Lump Tons	Holmes Crushed Tons	Junction Bessemer Tons	Junction Tons	Total Tons	Rock Tons
Jan.	22		2,196	3,188	2,692	6,156	14,232	2,512
Feb.	21		2,405	3,553	588	7,763	14,309	1,496
Mar.	22		2,507	3,771	1,776	5,940	13,994	3,460
April	21		2,368	3,891	2,544	4,882	13,685	2,952
May	23	1,235	2,209	2,562	3,468	5,392	14,866	2,928
June	21	649	1,332	1,514	4,510	6,198	14,203	3,396
July	22	570	1,319	1,223	5,548	5,946	14,606	3,912
August	23	967	1,974	2,290	2,193	8,326	15,750	3,360
Sept.	20	613	1,980	2,081	2,913	5,592	13,179	3,172
Oct.	23	800	2,148	2,067	4,055	5,865	14,935	3,508
Nov.	22		1,969	2,580	3,300	5,952	13,801	3,444
Dec.	22		1,874	2,112	3,320	6,330	13,636	2,000
Total	262	4,834	24,281	30,832	36,907	74,342	171,196	36,140
Transfers		2,388		+2,388	1,491	+1,491		
Total		2,446	24,281	33,220	35,416	75,833	171,196	36,140
Stockpile Overrun		6,629			5,962		12,591	
Year	262	9,075	24,281	33,220	41,378	75,833	183,787	36,140

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

f. Ore Statement:

	Holmes Bessemer Tons	Holmes Lump Tons	Holmes Crushed Tons	Junction Bessemer Tons	Junction Tons	Total 1928 Tons	Total 1927 Tons
On Hand Jan. 1, 1928.	10,736	10,226	19,556	8,034	94,611	143,163	135,193
Output for Year	4,834	24,281	30,832	36,907	74,342	171,196	176,494
Transferred	2,388		2,388	1,491	1,491		
Stockpile Overrun	6,629			5,962		12,591	
Total	19,811	34,507	52,776	49,412	170,444	326,950	311,687
Shipments	19,811	18,923	37,437	43,960	61,156	181,287	168,524
Balance on Hand	0	15,584	15,339	5,452	109,288	145,663	143,163
Decrease in Output						5,298	
Increase in Balance on Hand						2,500	

1928 - 1-8 Hour Shift 5 Days per Week, Jan. 1st - Dec. 31st.
1927 - 1-8 " " 5 " " " " " - " "
1926 - 1-8 " " 5 " " " " " - " "

g. Delays:

Date	Hours	Tons Lost	Cause
Aug. 8	2	175	No current. Main line trouble.

h. Delays from Lack of Current:

Date	Hours	Tons Lost	Cause
Aug. 8	2	175	No current. Main line trouble.

3. ANALYSIS:

a. Average Mine Analysis on Output for Year:

Grade	Iron	Phos.	Silica
Holmes Bessemer	60.56	.045	6.59
Holmes Lump	61.42	.058	7.85
Holmes Crushed	62.09	.063	5.55
Junction Bessemer	62.42	.040	5.07
Junction	58.52	.078	7.53

b. Average Analysis on Straight Cargoes:

Grade	Mine		Lake Erie	
	Iron	Phos.	Iron	Moisture
Holmes Bessemer	All Mixed			
Holmes Lump	All Mixed			
Holmes Crushed	63.52	.052	63.05	4.73
Junction Bessemer	All Mixed			
Junction	All Mixed			

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4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Level	Holmes Bessemer Tons	Holmes Tons	Junction Bessemer Tons	Junction Tons	Total Tons
Third	10,000	6,000	6,000	70,000	92,000
Fourth	50,000	46,000	80,000	505,000	681,000
Total	60,000	52,000	86,000	575,000	773,000

b. Prospective Ore:

Fourth	8,000	12,000			20,000
Fifth			32,000	160,000	192,000
Total	8,000	12,000	32,000	160,000	212,000
Total Ore	68,000	64,000	118,000	735,000	985,000

Assumptions:- Hard Ore - 9 cu. ft. per ton.
Soft Ore - 12 cu. ft. per ton.

Deductions of 10% for loss in mining and 10% for rock were made in calculating tonnage.

c. Estimated Analysis:

	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Igni.	Moist.
Holmes Bessemer										
Dried at 212°	61.98	.039	6.56	.179	.267	.410	.179	.007	1.09	
Natural	59.50	.037	6.30	.172	.256	.402	.172	.007	1.05	4.00
Holmes										
Dried at 212°	59.40	.100	8.13	.110	.244	.300	.220	.021	1.41	
Natural	57.08	.096	7.80	.106	.234	.288	.211	.020	1.35	3.90
Junction Bessemer										
Dried at 212°	60.50	.045	7.55	.228	.178	.145	.166	.023	1.52	
Natural	52.94	.039	6.61	.200	.156	.127	.145	.020	1.33	12.50
Junction										
Dried at 212°	56.67	.100	8.50	.244	.283	.141	.161	.029	5.09	
Natural	51.00	.090	7.65	.220	.255	.127	.145	.026	4.58	10.00

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5. LABOR AND WAGES:

a. Comments:

1. Labor:

Labor conditions at the mine were satisfactory during the year. There are a great many old men in the organization, inherited from the Lake and Salisbury Mines, who have passed their greatest usefulness and are approaching pension age. Three of the older employees died during the year.

The tons per man were low and the cost per ton high during the year on account of sinking the shaft and opening the fifth level. All of this development work was charged against operations.

There were no changes in the wage scale during the year.

b. Comparative Statement of Wages and Product:

	1928	1927	Increase	Decrease
*PRODUCTION	171,196	176,494		5,298
No. of Shifts and Hours	1-8	1-8		
AVG. NO. MEN WORKING:				
Surface	46	45	1	
Underground	120	112	8	
Total	166	157	9	
AVG. WAGES PER DAY:				
Surface	4.40	4.37	.03	
Underground	5.39	5.39	.00	
Total	5.10	5.09	.01	
WAGES PER MO. OF 25 DAYS:				
Surface	110.00	109.25	.75	
Underground	134.75	134.75	.00	
Total	127.50	127.25	.25	
PRODUCT PER MAN PER DAY:				
Surface	13.07	14.06		.99
Underground	5.36	5.99		.63
Total	3.80	4.20		.40
LABOR COST PER TON:				
Surface	.336	.311	.025	
Underground	1.007	.900	.107	
Total	1.343	1.211	.132	
AVG. PRODUCT BREAK'G & TRAM'G	9.21	8.72	.49	
AVG. WAGES CONTRACT MINERS	5.60	5.66		.06
AVG. WAGES CONTRACT LABOR	5.60	5.66		.06
TOTAL NO. OF DAYS:				
Surface	13,090½	12,549	541½	
Underground	31,934	29,464	2,470	
Total	45,024½	42,013	3,011½	

*Based on production without stockpile overrun.
**Mine works 22 days per month.

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5. LABOR AND WAGES: (Continued)

b. Comparative Statement of Wages and Product: (Continued)

	1928	1927	Increase	Decrease
AMOUNT FOR LABOR:				
Surface	57,593.79	54,900.42	2,693.37	
Underground	172,405.49	158,958.64	13,446.85	
Total	229,999.28	213,859.06	16,140.22	

Proportion Surface to Underground Men:

1928	1 to 2.60	1928 -	1-8 Hr. Shift 5 Days per Week
1927	1 to 2.49	1927 -	1-8 Hr. Shift 5 Days per Week
1926	1 to 2.36	1926 -	1-8 Hr. Shift 5 Days per Week
1925	1 to 2.30	1925 -	1-8 Hr. Shift 5 Days per Week
1924	1 to 2.23	1924 -	1-8 Hr. Shift from Jan. 7th.
			1-8 Hr. Shift 4 Days per Week
			7-30 to 12-1.
			1-8 Hr. Shift 5 Days per Week
			from 12-1.

6. SURFACE:

a. Buildings and Repairs:

3. Buildings:

The interior of the office was calcimined in December. Piping was repaired in the dry.

4. Skip-Hoist:

On August 29th the key in the drum of the skip-hoist became loose, and a new key was fitted. This also worked loose, and a new key was again fitted on Sept. 15th and 16th and the gear shrunk on.

b. Stockpiles:

The Holmes Bessemer and Junction Bessemer stockpiles were cleaned up, yielding overruns of 6629 and 5962 tons respectively.

A cut was finished along the west side of the Junction pile in ore that has been in stock for ten years. 150 feet of new trestle was built for this stockpile in November.

d. Subsidence:

No new cracks have appeared on the Holmes Mine property, but a new one opened up about half-way between the Chicago and North-Western Ry. and the Duluth, South Shore and Atlantic Ry. main line tracks north of the drainage ditch on the land of the Oliver Iron Mining Co.'s Section 16 Mine.

The caved area in the limits of the old cracks has gone down appreciably during the year, and the principal flow of water from the hanging-wall has moved east 400 feet from Raise 367 on the third level to Raise 361, showing that cracks in the eastern part have opened up again as the result of ground movement.

It would be well to move the main-line tracks during 1929.

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7. UNDERGROUND:

a. Shaft-Sinking:

Shaft-sinking was continued in January and February, and the shaft was sunk 46 feet, completing the skip-pit below the fifth level. The pocket was completed in March, and the tail-drift in April. A small pump-house and a large sump were cut on the west side of the plat, and two pumps were installed, throwing water to the main pump-room on the fourth level.

b. Development:

Third Level:

Raise 312 was put up to the 310 foot sub-level 50 feet west of Raise 312. Between the two raises a cross-cut was driven south through the dike 50 feet, and then crossed the Hard Ore vein, which is 20 feet wide at this point.

A cross-cut was also driven from the foot-wall drift just west of Raise 322 to the hanging-wall drift half-way between Raises 365 and 367, a distance of 155 feet. The last 70 feet was in rock.

Fourth Level:

Raises 421, 423 and 481 have been put up to the third level, and Raise 466 to the 240 foot sub-level.

Fifth Level:

The fifth level has been nearly completed. A cross-cut was driven 880 feet south from the shaft, and drifts driven east and west. The east drift was advanced 460 feet, all in diorite. The west drift struck ore in November and was in ore during the remainder of the year. This drift is in 230 feet, 170 feet in rock and 60 feet in ore.

c. Stoping:

The number of contracts averaged one more than in 1927, the increase being on the fifth level. At one time there were two more contracts than last year. The number and classification for the year is as follows:-

Stoping	20	Contracts
Drifting and Raising in Ore	14	"
Drifting and Raising in Rock	3	"
Total	37	"
Hard Ore Vein	14	"
Soft Ore Vein	20	"

Much rock-drifting was done by contracts classified as on ore, because it was incidental to their work. For this reason the production of rock from the mine is much larger than the classification would indicate. The number of contracts on rock amounted to 3 out of 37, or 8%, whereas the production of rock was 36,140 out of 207,336, or over 17%.

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7. UNDERGROUND:
(Continued) c. Stoping: (Continued)

Hard Ore Vein:

An average of fourteen contracts was distributed over nine sub-levels from the 330 foot sub-level on the west at the beginning of the year to the 250 foot sub-level on the east. The 330 foot sub-level was finished in April.

330 Foot Sub-Level:

Three gangs finished the ore west of Raise 368 from No. 8 cross-cut on the third level west to No. 10 cross-cut, a distance of 200 feet. The average width of the ore was 30 feet.

320 Foot Sub-Level:

Four gangs finished the ore from Raise 317 west to No. 10 cross-cut, and a narrow pillar east of Raise 317, a total distance of 280 feet.

310 Foot Sub-Level:

Three contracts are stoping south of Raises 311 and 312, and another is drifting west from Raise 317. This territory was all opened in 1928.

There was some ore left between Raises 360 and 368 at the beginning of the year, and this has all been mined. As many as six contracts worked here during part of the year.

300 Foot Sub-Level:

The ore between Raises 361 and 368 that was so wide on the two sub-levels above the 300, pinched out on this sub-level, and was mined in two narrow veins. One gang is still mining 30 feet east of Raise 363. The ore around Raise 361 was mined from the third level.

Third Level:

The ore around Raise 361 was mined as far west as the main cross-cut, and has just been finished. Another gang is stoping in a small vein in the hanging-wall between Raises 367 and 368.

280 Foot Sub-Level:

The hard ore was mined for a distance of 70 feet northwest from a point 20 feet east of Raise 467, and one contract is still working here.

270 Foot Sub-Level:

At the beginning of the year the vein had been mined as far west as Raise 463, and some development had been done west of this. The vein has now been mined west and northwest of this point for 160 feet, and there are three gangs working near Raise 467.

260 Foot Sub-Level:

At the beginning of the year most of the ore east of Raise 463 had been mined. Most of the vein has now been mined for eighty feet further west, and there are four contracts working near Raises 463, 465 and 466.

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7. UNDERGROUND:
(Continued)

c. Stoping: Hard Ore Vein: (Continued)

250 Foot Sub-Level:

A small amount of hard ore has been mined on this sub-level between Raises 462 and 463.

Soft Ore Vein:

The average number of contracts working in the Soft Ore Vein has been twenty. They have been distributed over eleven sub-levels from the 330 foot sub-level on the north and west to the 230 foot sub-level on the south and east.

330 Foot Sub-Level:

A piece of ore sixty feet long and fifty feet wide was mined out east of Raise 321.

320 Foot Sub-Level:

East of Raise 321 an irregular ore-body 120 feet long and 20 feet wide has been opened up and partly mined. West of the same raise ore was followed along the foot-wall for 180 feet, and one contract is now stoping 60 feet west of the raise. The vein near the hanging-wall has been mined for 200 feet west of a point 20 feet north of Raise 323, and one gang is now mining east of Raise 316.

310 Foot Sub-Level:

Some ore has been mined near the dike south and west of Raise 325, and south of the dike south of Raise 326. Ore has also been mined along the contact with the Hard Ore Vein from Raise 425 west nearly to Raise 317, a distance of 330 feet.

300 Foot Sub-Level:

Three gangs have worked on this sub-level in the last ore mentioned above, and have mined nearly all of it.

Three more contracts mined the ore north of Raises 328, 333, 430, 450 and 336.

Third Level:

During the year the ore north of the dike, that lies between the Hard Ore and Soft Ore Veins, was mined from Raises 346 and 452 west for 200 feet to No. 5 Cross-Cut, except a small pillar west of Raise 333 and 430. There are two gangs stoping here.

280 Foot Sub-Level:

East and north of Raises 456 and 452 the ore has been mined on the foot-wall over a length of 120 feet and a maximum width of 80 feet. Next to the hard ore contact ore has also been mined around Raises 451, 488 and 490. Three gangs are now working on this sub-level.

270 Foot Sub-Level:

Ore on the foot-wall north and east of Raises 452, 453, 454 and 464 has been mined during the year, and there are now two gangs working in Raise 452.

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7. UNDERGROUND:
(Continued)

c. Stoping: Soft Ore Vein: (Continued)

260 Foot Sub-Level:

Between the foot-wall and the Hard Ore Vein an area 180 feet long and 90 feet wide has been finished during the year, extending from a point 50 feet west of Raise 454 east to the foot-wall and as far north as Raise 453. One contract is now working in Raise 453.

250 Foot Sub-Level:

In 1927 a small amount of ore was mined on the foot-wall close to the south boundary near Raise 460. In 1928 the ore was mined along the boundary as far west as Raise 462 and on the foot-wall east and north of Raise 464. Four contracts are now working in Raises 445, 455 and 464.

240 Foot Sub-Level:

The northwest part of this sub-level has been re-timbered.

Except for connections to raises and retimbering the second outlet no other work has been done on this sub-level, except north of Raise 461, where one contract has started stoping on the foot-wall.

230 Foot Sub-Level:

One contract mined a small area south of Raise 461 along the south boundary early in the year.

d. Timbering:

The cost for timbering was $ 5544 higher in 1928 than in 1927, the increase being in labor repairing and retimbering underground. The cost for timber (supplies alone) was slightly lower in 1928.

Treated timber is being used on the fifth level.

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7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

Statement of Timber Used:

Kind	Linear Feet	Avg. Price Per Foot	Amount 1928	Amount 1927
6" - 8" Timber	44,145	.0414	1,827.92	2,639.68
8" - 10" "	46,669	.0658	3,072.94	3,943.47
10" - 12" "	33,328	.0874	2,914.51	2,629.78
12" - 14" "	18,519	.0986	1,826.72	1,489.95
10" Treated Timber	814	.3712	302.14	
12" " "	568	.2775	157.64	
Total Timber 1928	144,043	.0706	10,101.87	10,702.88
" " 1927	182,361	.0586		
		Per C. Ft.		
5 Ft. Lagging - 785 Cds.	667,250	.7622	5,084.70	5,648.88
1 In. Covering Boards	33,913	2.4534	832.01	346.06
Total Lagging, Etc.	701,163	.8438	5,916.71	5,994.94
Tamarack Poles	239,412	1.668	3,994.66	2,412.79
Total Lagging, Poles, Etc. 1928	940,575	1.062	9,911.37	8,407.73
Total - 1927	961,766	.8742		

PRODUCT	171,196	176,494
Ft. Timber per Ton of Ore	.841	.962
Ft. Lagging per Ton of Ore	3.897	4.424
Ft. Lagging per Ft. of Timber	4.663	4.221
Cost per Ton for Timber	.0590	.0606
Cost per Ton for Lagging	.0297	.0339
Cost per Ton for Poles	.0233	.0137
Cost per Ton for All Timber	.1120	.10822
Ft. Brd. Measure per Ton of Ore	1.674	1.870

Cost for Timber Year 1928 - $ 20,013.24
" " " " 1927 - 19,113.78
Ft. Brd. Measure - 286,618

e. Drifting and Raising:

In 1928 the fifth level was opened, largely in rock, and two cross-cuts were driven on the third level.

Year	Rock Drifting Feet	Ore Drifting Feet	Rock Raising Feet	Ore Raising Feet
1928	2816	324	37	468
1927	585	175	137	731

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting:

All hollow steel, except that used in the shaft, was sharpened at the Cliffs Shaft Mine. During the past year there has been a notable increase in hardness of the ore throughout the mine.

Statement of Explosives Used for the Year 1928:

Developing Ore and Stoping:

Kind		Quantity	Average Price	Amount
50% Powder L.F. Standard		22,400	13.56	3036.75
60% " " "		58,950	14.67	8648.50
60% " Amm. Gelatin		4,300	15.22	654.50
Total Powder		85,650	14.41	12339.75
Eagle Brand Fuse	Per M.	257,800	.572	1475.24
No. 6 Blasting Caps	" M.	67,900	10.95	743.33
Tamping Bags	" M.	10,000	2.10	21.00
Crimpers	Each	11	.805	8.85
Total Fuse, Caps, Etc.				2248.42
TOTAL EXPLOSIVES				14588.17
PRODUCT				171,196
Pounds Powder per Ton of Ore				.500
Cost per Ton for Powder				.072
Cost per Ton for Fuse, Caps, Etc.				.013
Cost per Ton for Explosives				.085

Sinking Shaft:

60% Powder Amm. Gelatin		1,850	15.42	285.25
80% " " "		3,950	19.50	770.50
Total Powder		5,800	18.20	1055.75
Fuse		7,500	.571	42.82
No. 6 Blasting Caps		1,400	10.65	14.91
Electric Blasting Caps No. 8	Per C.	900	11.45	103.04
Connecting Wire (Spools)		8	.77	6.18
Crimpers		1		.50
Total Fuse, Caps, Etc.				167.45
TOTAL EXPLOSIVES				1223.20

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)

Statement of Explosives Used for the Year 1928: (Continued)

Developing in Rock:

Kind	Quantity	Average Price	Amount
50% Powder L.F. Standard	600	13.66	82.00
60% " " "	5,100	14.52	740.25
60% " Amm. Gelatin	12,250	14.79	1812.00
80% " " "	12,400	19.00	2355.50
Total Powder	30,350	16.44	4989.75
Fuse	52,900	.559	295.74
Caps	11,900	10.89	129.64
Crimpers	1		.75
Total Fuse, Caps, Etc.			426.13
TOTAL EXPLOSIVES			5415.88

Cutting Out Pump-House and Sump - 5th Level:

60% Amm. Gelatin Powder	1,700	14.82	252.00
80% " " "	4,150	19.04	790.25
Total Powder	5,850	17.81	1042.25
Fuse	9,600	5.73	55.09
Caps	1,800	1.07	19.31
Total Fuse and Caps			74.40
TOTAL EXPLOSIVES			1116.65

Cutting Out Car Barn - 5th Level:

80% Amm. Gelatin Powder	50	19.50	9.75
Fuse	100	.57	.57
Caps	100	1.06	1.06
TOTAL EXPLOSIVES			11.38

Blasting Stockpile:

50% L.F. Standard Powder	250	13.10	32.75
Fuse	300	.58	1.76
Caps	100	1.06	1.06
Crimpers	1		.50
TOTAL EXPLOSIVES			36.07

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7. UNDERGROUND:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)

Recapitulation of All Explosives Used at the Holmes Mine for Year 1928:

	Quantity	Average Price	Amount
50% L.F. Standard Powder	23,250	13.55	3151.50
60% " " "	64,050	14.66	9388.75
60% Amm. Gelatin "	20,100	14.94	3003.75
80% " " "	20,550	19.10	3926.00
Grand Total Powder	127,950	15.22	19470.00
Fuse (Eagle Brand)	328,200	.571C	1871.22
Caps No. 6 Hercules	83,200	10.92M	909.31
Caps No. 8 Electric	900	11.45C	103.04
Tamping Bags	10,000	2.10M	21.00
Connecting Wire	8	.77½	6.18
Cap Crimpers	14	.757	10.60
Total Blasting Supplies			2921.35
TOTAL EXPLOSIVES AS PER COST SHEET			22391.35

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8. COST OF OPERATING:

a. Comparative Mining Costs:

	1928	1927	Increase	Decrease
PRODUCT	171,196	176,494		5,298
Underground Costs	1.737	1.455	.282	
Surface Costs	.293	.271	.022	
General Mine Accounts	.139	.123	.016	
Cost of Production	2.169	1.849	.320	
Movable Equipment	.002		.002	
Plant & Equipment	.120	.120		
Development	.079	.079		
Taxes	.263	.321		.058
Central Office	.148	.113	.035	
Welfare, Hospital, Etc.	.054		.054	
Cost Adjustment		.018		.018
Contingent Expense		.061		.061
Cost on Stockpile	2.835	2.561	.274	
Loading & Shipping	.067	.064	.003	
Cost on Cars	2.902	2.625	.277	
No. of Days Operating	262	262		
No. of Shifts and Hours	1-8	1-8		
Average Daily Product	653	674		21
COST OF PRODUCTION:				
Labor	1.336	1.207	.129	
Supplies	.833	.642	.191	
Total	2.169	1.849	.320	

Costs per ton for both years are based on product exclusive of stockpile overrun.

b. Detailed Cost Comparison:

The mine worked one more contract than in 1927, but two more contracts were in rock. In 1927 5.3% of the gross product was rock and in 1928 17.4%. Correcting costs per ton by this factor we have $ 1.76 for 1927 and $ 1.85 for 1928 as cost per ton of ore and rock combined.

The number of days worked was the same in both years, but in 1928 both rock-work and hoisting were carried on at night, and there was delay in hoisting from excessive rock and from wet ore clogging the crushers.

UNDERGROUND COSTS:

Exploring in Mine:

1927	$ 2508.76	$ .014
1928	884.18	.005
Decrease	$ 1624.58	$ .009

In 1927 1370 feet of diamond-drilling cost $ 1.83 per foot. In 1928 424 feet cost $ 2.09 per foot.

Sinking in Shaft:

1927	$ 11628.56	$ .066
1928	18088.90	.106
Increase	$ 6460.34	$ .040

In 1927 80 feet cost $ 145.71 per foot. In 1928 46 feet cost $ 393.24 per foot. Included in this cost is all the steel sets, cutting the pocket, cutting and concreting the plat and 294 feet of drift.

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8. COST OF OPERATING: (Continued)

UNDERGROUND COSTS: (Continued)

Development in Rock:			In 1927 722 feet cost $ 7.76 a foot. In 1928 2853 feet cost $ 7.82 per foot.
1927	$ 5600.50	$ .032	
1928	22230.75	.130	
Increase	$ 16630.25	$ .098	
Development in Ore:			In 1927 906 feet cost $ 8.85 per foot. In 1928 792 feet cost $ 7.49 per foot.
1927	$ 8022.36	$ .045	
1928	5931.31	.035	
Decrease	$ 2091.05	$ .010	
Stoping:			There was a decrease of 5,298 tons in 1928, and more scrapers were used.
1927	$ 123648.77	$ .700	
1928	112056.93	.655	
Decrease	$ 11591.84	$ .045	
Timbering:			Timber used decreased $ 601, but lagging and poles increased $ 1503, a net increase of $ 902. The balance is in labor repairing.
1927	$ 46209.30	$ .262	
1928	51753.49	.303	
Increase	$ 5544.19	$ .041	
Tramming:			
1927	$ 14795.79	$ .085	
1928	14824.79	.086	
Increase	$ 29.00	$ .001	
Ventilation:			In 1928 new doors were built and pipe and tubing bought for auxiliary fans.
1927	$ 245.92	$ .001	
1928	421.26	.002	
Increase	$ 175.34	$ .001	
Pumping:			There was more rain in 1928 and some relay-pumping from the fifth level.
1927	$ 8448.27	$ .048	
1928	8571.20	.051	
Increase	$ 122.93	$ .003	
Compressors and Air Pipes:			In 1927 the compressor ran on day shift only for ten months. In 1928 it ran on both shifts all year. In 1928 the fifth level air-line was installed.
1927	$ 14564.29	$ .082	
1928	20562.52	.120	
Increase	$ 5998.23	$ .038	
Back Filling:			
1927	$ 210.00	$ .001	
1928	184.00	.001	
Decrease	$ 26.00	$ .000	
Underground Superintendence:			In 1928 there were two bosses on the fifth level during part of the year. None in 1927.
1927	$ 7154.43	$ .041	
1928	8393.23	.055	
Increase	$ 1238.80	$ .014	

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8. COST OF OPERATING: (Continued)

UNDERGROUND COSTS: (Continued)

Cave-In:		
1927	$	$
1928	8.47	.000
Increase	$ 8.47	$ .000

Maintenance Accounts:

Compressors and Power Drills:		
1927	$ 987.71	$ .006
1928	2256.42	.013
Increase	$ 1268.71	$ .007

In 1927 four drills cost $ 680. In 1928 eight drills cost $ 1908, an increase of $ 1228.

Hand Tramming Equipment:		
1927	$ 4029.30	$ .023
1928	10873.11	.063
Increase	$ 6843.81	$ .040

	1928	1927
Cars	$ 533	$ 1520
Scrapers	10159	2080
Tracks	181	429
Total	$ 10873	$ 4029

There were nine scrapers built in 1928 and seven in 1927. Six new scraper-hoists cost $ 3426, and six 15 H.P. motors cost $ 2098.

Electric Tram Equipment:		
1927	$ 7046.21	$ .040
1928	10289.84	.060
Increase	$ 3243.63	$ .020

Charges were as follows:-

	1928	1927	Increase
Generator	$ 37	$ 21	$ 16
Locomotive	1329	1031	298
Wiring	966	585	381
Tracks	3937	1911	2026
Cars	4020	3498	522
	$ 10289	$ 7046	$ 3243

Wiring and tracks increased on account of opening the fifth level, and cars on account of purchases from Stephenson Mine.

Pumping Machinery:		
1927	$ 1623.11	$ .009
1928	8973.95	.052
Increase	$ 7350.84	$ .043

In 1927 the centrifugal pump was overhauled and new bearings were put on the Aldrich pump. In 1928 a pump-house and sump were built on the fifth level and two pumps installed there.

SURFACE COSTS:

Hoisting:		
1927	$ 12548.00	$ .072
1928	14543.71	.085
Increase	$ 1995.71	$ .013

In 1927 there was no hoisting at night until November. In 1928 rock was hoisted at night throughout the year.

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8. COST OF OPERATING: (Continued)

SURFACE COSTS: (Continued)

Stocking Ore:			
1927	$	9948.67	$ .056
1928		13339.29	.079
Increase	$	3390.62	$ .023

In 1928 13 more bents were erected in the trestles, increasing charges $ 837; operating charges increased $ 2805, on account of night shift hoisting; but rock-picking decreased $ 252.

Screening-Crushing at Mine:			
1927	$	3237.10	$ .018
1928		3436.01	.020
Increase	$	198.91	$ .002

The No. 6 crusher for soft ore was re-babbited in 1928, and an extra man was employed for a short time on account of wet dirt.

Dry House:			
1927	$	5889.37	$ .033
1928		5531.69	.032
Decrease	$	357.68	$ .001

The decrease is in water bills and heating expense.

General Surface Expense:			
1927	$	6827.09	$ .039
1928		6374.54	.037
Decrease	$	452.55	$ .002

There was less teaming expense, and less road repairs in 1928.

Maintenance Accounts:

Hoisting Equipment:			
1927	$	4979.39	$ .028
1928		3334.52	.019
Decrease	$	1644.87	$ .009

In 1927 a new cage-rope and counterweight rope cost $ 734, and a new motor was added to the hoist and three pinions were bought.

In 1928 two new skip-ropes cost $ 946 and repairs to the hoist $ 1169.

Shaft:			
1927	$	205.84	$ .001
1928		703.66	.004
Increase	$	497.82	$ .003

The increase is in cost of plates and labor installing in pockets underground. A new pocket was built on the fifth level.

Top Tram Equipment:			
1927	$	1015.85	$ .006
1928		1392.84	.008
Increase	$	376.99	$ .002

	1927	1928
Engines & Motors	$ 122	$ 270
Tracks & Cars	659	637
Wire-Rope	208	362
Sheaves, Etc.	27	124
Total	$ 1016	$ 1393

Docks, Trestles and Pockets:			
1927	$	1729.30	$ .010
1928		644.24	.004
Decrease	$	1085.06	$ .006

In 1927 new floors were put on permanent trestles and the rock-trestle was extended. In 1928 a new floor was put on one trestle.

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8. COST OF OPERATING: (Continued)

SURFACE COSTS: (Continued)

Mine Buildings:			In 1927 all the roofs were painted and the dry and shops were painted and calcimined inside.
1927	$ 1434.24	$ .008	
1928	777.91	.005	
Decrease	$ 656.33	$ .003	

GENERAL MINE ACCOUNTS:

Insurance:			In 1927 a large amount of accumulated insurance from past years was distributed and charged to operating mines regardless of its source.
1927	$ 2223.00	$ .013	
1928	87.30	.001	
Decrease	$ 2135.70	$ .012	
Engineering:			Central Office charge.
1927	$ 1725.32	$ .010	
1928	1698.74	.010	
Decrease	$ 26.58	$ .000	
Analysis:			Central laboratory charges increased $ 870.45.
1927	$ 6096.92	$ .035	
1928	6979.65	.041	
Increase	$ 882.73	$ .006	

10. TAXES:

Personal Injury Expense:			In 1927 charges were actual payments. In 1928 they were 2% of the pay-roll.
1927	$ 2217.98	$ .013	
1928	4800.63	.028	
Increase	$ 2582.65	$ .015	
Safety Department Expense:			
1927	$ 238.94	$ .001	
1928	291.74	.002	
Increase	$ 52.80	$ .001	
Telephones and Safety Devices:			Underground lights increased $ 470.
1927	$ 214.05	$ .001	
1928	607.00	.003	
Increase	$ 392.95	$ .002	

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a.

Local General Welfare:			
1927	$ 623.38	$ .003	
1928	631.28	.003	
Increase	$ 7.90	$ .000	
Mine Office:			In 1928 $ 556.42 was charged to this account for General Storehouse overhead. None in 1927.
1927	$ 8318.37	$ .047	
1928	8736.30	.051	
Increase	$ 417.93	$ .004	

b.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

In order to test the iron formation found in the shaft below the fifth level and to determine the elevation of the basal contact of the main diorite sheet a vertical diamond-drill hole, No. 29, was put down during the summer from the cross-cut north of the shaft on the fifth level. This hole passed through the following formations:-

Diorite ---------	23	Feet
Jasper ----------	102	"
Diorite ---------	269	"
Jasper ----------	30	"
Total Depth --	424	"

Diamond-drilling in future should be tried again in two places:-

1. Vertically from the end of No. 6 Cross-Cut on the fourth level, when it has been extended 160 feet farther. This will test for the extension of the Castleford Vein, found in the Section 16 Mine.

2. Vertically from the east end of the fourth level and horizontally from the east end of the fifth level to see if the main ore-body of the Section 16 Mine pitches west under our foot-wall dike.

10. TAXES:

Total valuation was decreased $ 350,000, realty being increased $ 246,000 and personal property decreased $ 596,000.

	1928		1927	
	Valuation	Taxes	Valuation	Taxes
Realty, SW¼ SE¼ Sec. 9-47-27	$ 854,000	$ 28,231.53	$ 608,000	$ 20,082.69
Personal	496,000	16,396.77	1,092,000	36,067.78
Total	$ 1,350,000	$ 44,628.30	$ 1,700,000	$ 56,150.47
Collection Fees		446.28		561.50
Total Tax		$ 45,074.58		$ 56,711.97

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. Tugger Hoists and Scrapers:

Five 15 H.P. electric scraper-hoists were purchased during the year, and a scraper-slide was borrowed from the Cliffs Shaft Mine and equipped with a 15 H.P. D.C. motor, and was used for loading ore and rock on the fifth level. These 15 H.P. electric hoists are much superior to the smaller air-hoists, but are not as easy to move and erect.

b. Cars:

Three rocker-dump cars were sold to the Cliffs Shaft Mine. All of the remaining wooden sub-level cars have been replaced by steel cars.

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18. NATIONALITY OF EMPLOYEES:

English	66
Swedish	25
French Canadian	17
Irish	2
Norwegian	5
German	1
Finnish	42
Italian	2
Total	160

This classification is based on the father's nationality at birth and not on the man's nationality at birth. Practically all employees are United States citizens, and all speak English. A large percentage are American born, many of mixed parentage.

MORRIS-LLOYD MINE

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1. **GENERAL:**

The Morris-Lloyd Mine continued to show improvement in 1928. Production and tons per man are the best we have ever shown with a consequent reduction in costs.

Our development work continued to add to our reserves so that the production for 1928 is more than offset by new tonnage developed.

Shipments were fairly satisfactory, a total of 393,184 tons being forwarded in 1928.

2. **PRODUCTION, SHIPMENTS & STOCKPILE BALANCES:**

a. **Production by Grades:**

The production each year since 1920 shown by table that follows:-

Year	Morris	Manganese	Silica	Lloyd	Lloyddale	Total
1920	45,572		63,873	105,327	45,000	261,772
1921	68,593		45,529	84,741	171	209,034
1922	109,227		22,850	89,902		221,979
1923	132,413		25,147	101,145	1,630	260,335
1924	76,038		69,253	88,672	12,393	246,356
1925	100,568		59,945	105,316		265,829
1926	110,863	3,436	53,088	49,678	73,097	290,162
1927	173,118	1,357	33,871	58,251	60,217	326,814
1928	134,455	33,347	49,754	32,161	106,447	356,164

The following table shows each grade produced in 1928:-

Grade	Tons
Morris	134,455
Morris Manganese	33,347
Morrisville	34,879
Lloyd	32,161
Lloyddale	106,447
Lloyd Silica	14,875
Total for 1928	356,164

b. **Shipments:**

The ores shipped show a marked increase in tonnage over any previous year as will be noted from the following tables:-

Shipments by Grades:

Grades	1923	1924	1925	1926	1927	1928
Morris	45,394	27,084	122,435	86,413	148,118	193,093
Morris Manganese				3,259	86	22,849
Morrisville	39,773	80,975	28,673	12,372	15,790	2,391
Lloyd	80,267	104,115	67,953	33,948	58,615	66,440
Lloyddale	20,390	25,171		67,119	53,641	83,736
Lloyd Silica	24,868	31,883	21,084	21,664	21,038	24,675
Total	210,692	269,228	240,145	224,775	297,288	393,184

MORRIS-LLOYD MINE
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2. PRODUCTION, SHIPMENTS & STOCKPILE BALANCES: (Continued)

b. Shipments: Continued-

Shipments as forwarded from pockets and stockpiles were as follows:

Grade	Pocket	Stockpile	Total
Morris	82,748	110,345	193,093
Morris Manganese	22,849		22,849
Morrisville	1,726	665	2,391
Lloyd	15,514	50,926	66,440
Lloyddale	46,039	37,697	83,736
Lloyd Silica	24,675		24,675
Total	193,551	199,633	393,184

The ores shipped in 1928 were consigned to the docks and charcoal furnaces as shown:-

Destination	Total Tons
L. S. & I. Dock	288,421
C. & N. W. "	8,687
Antrim Iron Co.	15,688
Newberry Furnace	20,355
Pioneer #2 "	36,556
Wells "	20,685
Cadillac "	1,747
East Jordan "	1,045
Total	393,184

c. Stockpile Balances:

The following are various grades stocked at mine on Dec. 31st each year:

Year	Morris	Morris Mang.	Morrisville	Lloyd	Lloyddale	Lloyd Silica	Total
1920	26,917		52,514	33,840	73,821	39,077	226,169
1921	87,371		74,849	90,270	73,992	42,871	369,353
1922	65,658		59,651	96,674	31,250	44,184	297,417
1923	137,758		31,985	132,977	12,417	31,923	347,060
1924	186,709		5,568	117,373		14,538	324,188
1925	164,842		15,759	154,733	0	14,538	349,872
1926	194,820		34,783	164,763	6,354	14,538	415,259
1927	219,820	1,271	31,786	164,399	12,930	14,579	444,785
1928	167,324	10,656	53,282	124,884	35,939	15,680	407,765

MORRIS-LLOYD MINE
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2. PRODUCTION, SHIPMENTS & STOCKPILE BALANCES: (Continued)

e. Production from Chase Leases by Months:

Leases	No. 9	No. 24	No. 25	No. 26	Nos. 27 & 28	Total
Minimum Yearly Tonnages Required	10,000	15,000	15,000	15,000	22,500	77,500
January	9,748	3,230	0	0	0	12,978
February	9,414	3,238	0	0	0	12,652
March	8,237	3,402	0	0	0	11,639
April	8,059	4,005	0	0	0	12,064
May	8,879	2,705	0	0	0	11,584
June	10,462	2,662	0	0	0	13,124
July	10,050	2,215	0	0	0	12,265
August	11,048	986	0	0	0	12,034
September	9,106	1,071	0	0	0	10,177
October	9,739	1,403	0	0	0	11,142
November	10,569	1,904	0	0	0	12,473
December	11,774	1,719	0	0	0	13,493
Totals	117,085	28,540	0	0	0	145,625
Over-run	2,030	550	0	0	0	2,580
Grand Total	119,115	29,090	0	0	0	148,205

Production from Leases by Years:

The following table shows production from each lease from 1920 to date. Since the year 1921, production has exceeded the minimum requirements.

Lease No.	9	24	25	26	27	28	Totals
Minimums	10,000	15,000	15,000	15,000	15,000	7,500	77,500
Year							
1920	33,411	19,073	1,527	1,320	0	0	55,331
1921	56,794	12,075	4,843	2,075	0	0	75,963
1922	97,082	6,980	2,057	0	0	0	106,119
1923	104,522	9,148	7,109	1,831	0	0	122,610
1924	97,123	13,047	699	137	2	0	111,008
1925	77,244	29,526	10,367	2,425	0	0	119,562
1926	53,102	47,876	14,604	303	0	0	115,885
1927	88,956	48,931	10,040	952	0	0	148,879
1928	119,115	29,090	0	0	0	0	148,205

Total Royalties Accrued and Production from Leases:

No. of Lease	Accrued To Dec.31, 1928	Mined To Dec.31,1928	Balance
9	202,283	1,007,382	805,099
24	286,088	223,148	62,940
25	286,088	51,246	234,842
26	276,713	9,043	267,670
27	254,213	178	254,035
28	127,107	0	127,107
Totals	1,432,492	1,290,997	141,495

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2. PRODUCTION, SHIPMENTS & STOCKPILE BALANCES: (Continued)

e. Table Showing Balances Due on Accrued Royalties For Leases Nos. 9 to 28 Inclusive since 1920:

Year	Tons Accrued	Tons Mined	Balance
1920	812,492	342,766	469,726
1921	889,992	418,729	471,263
1922	967,492	524,848	442,644
1923	1,044,992	647,458	397,534
1924	1,122,492	758,466	364,026
1925	1,199,992	878,028	321,964
1926	1,277,492	993,913	283,579
1927	1,354,992	1,142,792	212,200
1928	1,432,492	1,290,997	141,495

f. Ore Statement:

	Morris	Morris Mang.	Morris ville	Lloyd	Lloyd-dale	Lloyd Silica	Total
On Hand Jan.1,1928	219,820	1,271	31,786	164,399	12,930	14,579	444,785
Production in 1928	134,455	33,347	34,879	32,161	106,447	14,875	356,164
Total	354,275	34,618	66,665	196,560	119,377	29,454	800,949
Transfers	6,142	1,113	10,992	5,236	298	10,901	
Net Total	360,417	33,505	55,673	191,324	119,675	40,355	800,949
Shipments	193,093	22,849	2,391	66,440	83,736	24,675	393,184
Balance	167,324	10,656	53,282	124,884	35,939	15,680	407,765
Increase in Output							29,350
Dec. in Ore on Hand							37,020

g. Delays:

Date	Cause of Delay	Loss of Production
Aug. 8th,	9½ Hours Delay. No Power	800 Tons

3. ANALYSIS:

Average Mine Analysis on Output For Year 1928:

Grade	Lloyd Mine Iron	Phos	Silica
Lloyd	59.32	.097	6.29
Lloyddale	58.37	.156	7.05
Lloyd Silica	51.65	.086	17.46
	Morris Mine		
Morris	59.24	.080	7.38
Morrisville	52.26	.072	16.39
Morris Manganese	60.47	.060	6.49

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3. **ANALYSIS:**
(Continued)

Average Analysis on Straight Cargoes For Year 1928:
Ore Shipped:

Grade	Mine		Lake Erie	
	Iron	Phos	Iron	Phos
Morris	59.08	.094	58.82	10.60

Average Mine Analysis for Year 1928:
Ores Stocked:

Grade		Iron	Phos	Silica	Moisture
Morris	Dried	58.40	.090	8.21	10.75
	Natural	52.12	.080	7.33	
Morris Manganese	Dried	60.70	.056	6.30	10.50
	Natural	54.30	.050	5.64	
Morrisville	Dried	52.80	.076	16.02	10.50
	Natural	47.25	.068	14.32	
Lloyd	Dried	59.40	.096	6.18	11.25
	Natural	52.72	.085	5.48	
Lloyddale	Dried	58.40	.158	6.54	11.25
	Natural	51.83	.140	5.80	

Ores Shipped:

Grade		Iron	Phos	Silica	Moisture
Morris	Dried	59.10	.086	7.04	10.75
	Natural	52.76	.077	6.28	
Morris Manganese	Dried	60.70	.065	6.74	10.50
	Natural	54.32	.058	6.02	
Lloyd	Dried	58.80	.110	5.93	11.25
	Natural	52.20	.100	5.26	
Lloyddale	Dried	58.00	.167	6.90	11.25
	Natural	51.48	.148	6.10	
Lloyd Silica	Dried	51.80	.091	17.14	11.00
	Natural	46.10	.081	15.25	

4. **ESTIMATE OF ORE RESERVES:**

Assumption:-

12 cu. ft. equals one ton
10% deduction for rock
10% " " loss in mining

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4. ESTIMATE OF ORE RESERVES:
(Continued)

Ore in Sight as of December 31st, 1928:

MORRIS MINE

Location of Ore	Bessemer	Morris	Total Tons
Above 6th Level, C.C.I.Co. Lands		12,700	12,700
" " " Chase Lease No. 9,		1,350	1,350
" 7th " C.C.I.Co. Lands,	49,065	242,152	291,217
" " " Chase Lease No. 9,	49,934	422,590	472,524
" " " " " No.24,		21,620	21,620
" " " " " No.25,		22,937	22,937
" " " " " No.26,		9,687	9,687
Below " " C.C.I.Co. Lands,	18,208	54,622	72,830
" " " Chase Lease No. 9,	29,138	110,662	139,800
" " " " " No.24,		18,394	18,394
" " " " " No.25,		10,336	10,336
" " " " " No.26,		16,453	16,453
Total Ore in Morris Mine	146,345	943,503	1,089,848

LLOYD MINE

Location of Ore	Lloyd	Lloyddale	Total Tons
Above 3rd Level,	57,922		57,922
Below " "	6,185		6,185
Total Ore in Lloyd Mine	64,107		64,107

LLOYD MINE EAST

Location of Ore	Lloyd	Lloyddale	Total Tons
Above 3rd Main Sub,	15,517	72,700	88,217
" 4th " "	15,533	107,023	122,556
" 3rd " Level	8,901	98,971	107,872
" and Below 4th Main Level	228,729	633,774	862,503
Total Ore in Lloyd Mine East	268,680	912,468	1,181,148

SUMMARY OF TOTAL ORE

Mine	Bessemer	Morris	Lloyd	Lloyddale	Total Tons
Morris	146,345	943,503			1,089,848
Lloyd			64,107		64,107
Lloyd East			268,680	912,468	1,181,148
Total	146,345	943,503	332,787	912,468	2,335,103

Total Ore on Chase Lease No. 9, -	613,674 Tons
" " " " " No.24, -	40,014 "
" " " " " No.25, -	33,273 "
" " " " " No.26, -	26,140 "
Total Ore on All Leases,	713,101 "
Total Ore on C.C.I.Co. Lands,	1,622,002 "
Total Ore in Morris-Lloyd Mine,	2,335,103 Tons

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4. ESTIMATE OF ORE RESERVES:

Estimated tonnage of ore underground as reported to the State Tax Commission. All tonnages reported this year as developed ores.

Bessemer Grades	Morris Shaft	Lloyd & Lloyd East	Total
Morris Bessemer	146,345		146,345
Non-Bessemer Grades			
Morris	943,503		943,503
Lloyd		332,787	332,787
Lloyddale		912,468	912,468
Total	1,089,848	1,245,255	2,335,103

Ore Reserves:

The following table shows ore in sight January 1st; product for year; balance in sight and new ore developed during year.

Estimated Ore	1924	1925	1926	1927	1928
Ore in Mine Jan. 1st.	3,306,270	3,309,075	3,325,341	2,891,893	2,612,722
Production	246,356	265,829	290,162	326,814	356,164
Balance	3,059,914	3,043,246	3,035,179	2,565,079	2,256,558
Ore in Mine Dec. 31st.	3,309,075	3,325,341	2,891,893	2,612,722	2,335,103
New Ore Developed	249,161	282,095	143,286	47,643	78,545

5. LABOR AND WAGES:

a. General:

Labor conditions were most satisfactory during the year. The labor turn over was practically nil and the force worked steadily with few exceptions.

b. Comparative Statements:

Product - Shifts - Hours:

	1928	1927	Increase
Product	356,164	326,814	29,350
No. of Shifts & Hours	1-8 Hr.	1-8 Hr.	

Average Number of Men Working:

Year	Surface	Underground	Total
1921	46	203	249
1922	48	162	210
1923	44	156	200
1924	44	144	188
1925	45	145	190
1926	45	149	194
1927	50	178	228
1928	52	173	225
Decrease for 1928 - 3 Men			

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5. LABOR AND WAGES:

b. Comparative Statements:
Product - Shifts - Hours:
(Continued)

Average Wages Per Day:

Year	Surface	Underground	Total
1922	3.72	4.19	4.08
1923	4.12	4.65	4.53
1924	4.29	4.94	4.78
1925	4.34	5.02	4.86
1926	4.32	5.02	4.85
1927	4.33	5.14	4.94
1928	4.34	5.09	4.90

Surface rate increased .01 in 1928, while underground average rate decreased .05 and the average rate for both surface and underground was reduced .04 per day.

Wages Per Month of 25 Days:

	1928	1927	Increase	Decrease
Surface	108.50	108.25	0.25	
Underground	107.25	128.50		1.25
Total	122.50	123.50		1.00

Product Per Man Per Day:

Year	Surface	Underground	Total
1920	17.67	4.33	3.48
1921	18.78	4.22	3.44
1922	17.40	5.33	4.08
1923	18.47	5.58	4.28
1924	19.08	6.42	4.80
1925	20.45	6.85	5.13
1926	21.42	6.97	5.26
1927	20.93	6.61	5.02
1928	23.09	7.59	5.71

	1928	1927	Increase
Surface	23.09	20.93	2.16
Underground	7.59	6.61	.98
Total	5.71	5.02	.69

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5. LABOR AND WAGES:

b. Comparative Statements:

Product - Shifts - Hours:
(Continued)

Labor Cost Per Ton:

Year	Surface	Underground	Total
1920	.307	1.482	1.791
1921	.242	1.248	1.490
1922	.214	.786	1.000
1923	.223	.834	1.057
1924	.225	.770	.995
1925	.212	.733	.945
1926	.201	.721	.922
1927	.207	.777	.984
1928	.188	.671	.859

	1928	1927	Decrease
Surface	.188	.207	.019
Underground	.671	.777	.106
Total	.859	.984	.125

	1928	1927	Increase	Decrease
Average Product Stoping & Tramming	13.64	12.04	1.60	
" Wages Contract Miners	5.69	5.80		0.11

Total Number of Days:

	1928	1927	Increase	Decrease
Surface	15,425	15,618		193
Underground	46,948½	49,479½		2,531
Total	62,373½	65,097½		2,724

Amount For Labor:

	1928	1927	Increase	Decrease
Surface	66,965.09	67,551.48		586.39
Underground	238,962.49	254,175.60		15,213.11
Total	305,927.58	321,727.08		15,799.50

Proportion Surface to Underground Men:

1924	1 to 3.27
1925	1 to 3.22
1926	1 to 3.31
1927	1 to 3.56
1928	1 to 3.33

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6. SURFACE:

a. Buildings:

The mine office roof was covered with Asbestos roofing. The roof on the dry, engine house and shops was given a coating of "Save All" roofing paint.

The laboratory, dry and office were painted.

b. Stockpiles:

The Lloyddale stocking area was increased by grading South-west of the Lloyd shaft, leaving just enough room for a new road adjacent to the old cave.

c. Tracks, Roads, Etc.:

A new track was laid by the L. S. & I. Ry. through the centre of the Morris timber yard. This will be used for unloading poles and lagging.

A cross-over track was also put in between the two pocket tracks East of the Morris shaft, making it possible to spot two separate strings of empties above the crusher pocket.

d. Miscellaneous:

A new steam line was laid from the dry to the laboratory and crusher building. The old line laid underground, gave us constant trouble and we replaced it by putting one overhead.

A new heating boiler was put into service at the Lloyd shaft crusher plant, replacing an old up-right diamond drill boiler.

The main water line between the Lloyd shaft and the storage tank back of the location, was repaired where it crosses the main line of the L. S. & I. Ry. A small lake existed for years near the tracks and we had been suspicious for some time that there was a leak in the water line near by. The lake was pumped out and a new line laid under the old lake bed.

A new dry was constructed for the surface men near the carpenter shop by cleaning out the old store-house and putting in heating coils, lockers, wash basins and benches.

7. UNDERGROUND:

a. Shaft Sinking:

The Morris shaft was bottomed 80 feet below the 8th level. By the end of the year, we had put in a large concrete storage pocket and finished cutting the plat. A part of the pump-house was also cut out. All of the rock excavated was scraped into the storage pocket.

b. Development:

There were driven 307 feet of main level drifts in rock. Besides this, there was a considerable footage driven in ore on the main levels, but by far the greatest amount of ore drifting was confined to the sub-levels. The following figures give the comparison for the last three years.

Year	Ore Drifting	Ore Raising
1926	2249	1703
1927	2210	2232
1928	3211	2778

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7. UNDERGROUND:

b. Development:
(Continued)

It will be noted that the footage of ore drifts increased by 50%, while there was approximately a 25% increase in the amount of raising. In 1926, we were getting 8.90 tons per man in our development work. This was increased to 11.24 tons per man in 1928.

The new ore tonnage developed was confined largely to the Morris shaft area. On the 180 foot sub, on Chase Lease No. 9 between the 6th and 7th levels, a new ore area was discovered 350 feet in length, at least 110 feet high and from 40 to 50 feet in width.

On the 180 foot sub, on Chase Lease No. 9, half way between the 6th and 7th levels, we found the main ore deposit and No. 21 deposit joined together, adding a considerable tonnage to the reserves.

c. Stoping:

For 1928, we show a notable increase in the tons per man secured from stoping operations. The unit cost was cut from .460 to .417 per ton.

Stoping Tons Per Man:

Year	Tons Per Man
1919	8.75
1920	9.27
1921	10.20
1922	13.82
1923	15.54
1924	15.67
1925	17.10
1926	17.33
1927	17.46
1928	20.26

The Averages by Months for the Year 1928 follow:

Month	Tons Per Man
Jan.	18.99
Feb.	19.84
Mar.	19.51
Apr.	21.01
May	20.08
June	19.63
July	21.54
Aug.	21.68
Sep.	19.63
Oct.	20.30
Nov.	20.37
Dec.	20.67

In order to increase the efficiency of the stoping gangs, we have provided most of them with two drilling machines. There are normally 35 contracts on ore and we have 51 No. 230 Ingersoll-Rand auger drills, 8 No. 10 auger machines and 7 No. 12 or a total of 65 machines.

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7. UNDERGROUND:

c. Stoping:
(Continued)

All stoping contracts are provided with scraper outfits and some gangs have two scraper hoists. At the end of the year, we had the following hoists available for use.

Sullivan Air Hoists	12	In Number
" Electric Hoists	14	" "
Ingersoll-Rand Air Hoists	5	" "
Waugh Air Hoists	2	" "
" Electric Hoists	7	" "
Total	40	

d. Timbering:

The unit cost for timbering shows a decrease for 1928. This is partially due to less repairing in the Section Six raises and also because some of the production came from No. 8 shrinkage stope and No. 20 sub stope where little timber was required.

Timber Statement:

The following statement shows the various quantities of timber used during 1928.

	Lineal Feet	Avg. Price Per Foot	Amount 1928	Amount 1927
6" to 8" Timber	87,513	.043	3,682.43	3,620.51
8" to 10" "	62,622	.063	3,923.49	4,140.53
10" to 12" "	31,166	.099	3,071.29	5,005.14
12" to 14" "	13,509	.115	1,555.21	487.76
Treated Timber	990	.35	346.40	1,697.02
Total Timber 1928	195,800	.064	12,578.82	14,950.96
" " 1927	215,792	.0693	14,950.96	
		Per 100'		
5' Lagging - 626½ Cords	532,525	.759	4,042.14	3,260.42
8' "	598,784	.753	4,509.84	4,394.54
Total Lagging	1,131,309	.756	8,551.98	7,654.96
3" Poles	450,056	1.46	6,560.14	5,149.42
Total Lagging & Poles 1928	1,581,365	.956	15,112.12	12,804.38
" " " 1927	1,405,339	.911	12,804.38	

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7. UNDERGROUND:

d. Timbering:
(Continued)
Timber Statement:
(Continued)

	Amount 1928	Amount 1927
Product	356,164	326,814
Feet of Timber Per Ton of Ore	.550	.66
" " Lagging " " " "	3.18	3.07
" " " " Ft. " Timber	5.78	4.65
Cost Per Ton for Timber	.0353	.0457
" " " " Lagging	.0240	.0234
" " " " Poles	.0184	.0158
" " " " All Timber	.0777	.0857
Equivalent of Stull Timber to Board Measure	333,836	364,741
Feet of Board Measure Per Ton of Ore	.937	1.12
Cost of Timber, Lagging, Poles Etc. - 1928	27,690.94	
" " " " " " " - 1927	27,993.33	
" " " " " " " - 1926	21,787.65	
" " " " " " " - 1925	17,701.50	
" " " " " " " - 1924	16,664.69	
" " " " " " " - 1923	15,207.16	
" " " " " " " - 1922	11,735.86	

e. Drifting and Raising:

It will be noted from the table that follows that we did more development work in 1928 than had been done for years past. This is partially accounted for by the fact that all the dirt from development drifts is mechanically handled, either by the Armstrong loader or by scrapers. As a result, most of the gangs driving these drifts in new ore lenses, get just as much footage and cars per month as the gangs doing regular stoping operations.

Following is the comparison for the past five years.

Year	Total Footage	Ore Drifting	Ore Raising	Rock Drifting	Rock Raising
1924	3,107 Ft.	1,945 Ft.	803 Ft.		359 Ft.
1925	4,896 Ft.	2,794 Ft.	1,288 Ft.	390 Ft.	424 Ft.
1926	5,350 Ft.	2,249 Ft.	1,703 Ft.	868 Ft.	530 Ft.
1927	4,845 Ft.	2,210 Ft.	2,232 Ft.	9 Ft.	394 Ft.
1928	6,296 Ft.	3,211 Ft.	2,778 Ft.	237 Ft.	70 Ft.

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7. UNDERGROUND:

f. Explosives, Drilling and Blasting:

During the year, we made another change in the kind of powder used at the mine. For some years past, the practice was to use 1½" x 8" - 40% Low Freezing Ammonia and 1¼" x 8" - 60% Gelatine. Then we changed to the new bulk powders, using #4 so-called. The fumes were objectionable and we finally standardized on 1¼" x 8" Gelatine for all our powder. If a stick of 1¼" x 8" - 60% Gelatine is substituted for one stick of 1½" x 8" - 40% Low Freezing Ammonia Extra, the cost is less because at the current cost of explosives, the former costs .078 per stick compared with .083 for the latter. As the former has more strength than the latter, you naturally cut the cost per ton for explosives. The following table shows that very clearly.

Statement of Explosives Used:
Ore Development and Stoping:

Kind	Quantity	Average Price	Amount 1928	Amount 1927
40% Powder "Extra"				4,244.50
60% Gelatine	168,475	15.14	25,518.75	19,611.25
No. 2 Extra "Bulk"				147.00
No. 4 " "				308.00
Total Powder	168,475	15.14	25,518.75	24,310.75
Fuse	591,168	5.77	3,412.89	3,570.76
Caps	95,499	11.29	1,078.72	1,104.12
Tamping Bags	50,000	2.03	101.50	75.75
Hand Crimpers	14	.41	5.75	12.79
Bench Crimpers	3	22.00	66.00	
Cap Seal, Cans	5	.46	2.30	
Total Caps, Fuse Etc.			4,667.16	4,763.42
" Explosives			30,185.91	29,074.17
Product			356,164	326,814
Pounds Powder Per Ton of Ore			.473	.50
Cost Per Ton For Powder			.0716	.0744
" " " " Fuse, Caps Etc.			.0131	.0146
" " " " All Explosives			.0847	.089

Rock Development, Sinking Etc.:

40% Powder "Extra"				97.50
60% Gelatine	12,925	15.13	1,955.66	1,752.56
Total Powder	12,925	15.13	1,955.66	1,850.06
Fuse	22,132	5.77	127.92	115.42
Caps	4,310	11.29	48.01	51.14
Crimpers	2		.89	.84
Elec. Delay Fuses & Caps	1,200	7.85	94.18	291.00
Connecting Wire	24	.387	9.28	18.56
Sealing Compound - Can	1		.25	.25
Total Caps, Fuse Etc.			2,236.19	2,327.27
Grand Total Explosives as per Cost Sheet			32,422.10	31,401.44
Average Price Per Lb. for Powder			.1513	.1487

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7. UNDERGROUND:

f. Explosives, Drilling and Blasting:

Ore Development and Stoping:
(Continued)

The following table shows comparisons for four years back:-

	1928	1927	1926	1925
Pounds Powder Per Ton of Ore	.473	.50	.514	.518
Cost Per Ton for Powder	.0716	.0744	.0739	.0764
" " " " Fuse Etc.	.0131	.0146	.0145	.0132
" " " " Breaking Ore	.0847	.089	.0884	.0896
Average Price Per Lb. for Powder	.1513	.1487	.1438	.1474

It will be noted that despite the increase in the average price per pound for powder in 1928, that we show a saving in every item in the fore-going table.

The most radical change in the handling of powder at any of the company's mines was put into effect in the North Lake District this past year.

Most of the contracts had powder delivered to them by the stick instead of by the box. All the contracts were provided with Jute bags and only the daily requirements were given to the men.

The fuse and caps were made up in specially constructed cap houses and given to the men in sealed containers. That practice removed caps from all our working places and the job of crimping caps was delegated to one man. All fuses were cut in standard lengths.

The whole idea was to eliminate nearly all the hazards in connection with the transportation, storage and use of explosives and to do away with wasting valuable supplies.

8. COST OF OPERATING:

Cost of Production for the Past Nine Years:

Year	Production	Daily Product	Cost of Production Labor	Supplies	Total
1920	261,772	873	1.751	.734	2.485
1921	209,034	723	1.482	.870	2.352
1922	221,979	737	1.019	.649	1.718
1923	260,335	882	1.083	.682	1.765
1924	246,356	940	1.026	.658	1.684
1925	265,829	1,022	.978	.595	1.573
1926	290,162	1,120	.949	.531	1.480
1927	326,814	1,224	1.018	.624	1.642
1928	356,164	1,362	.877	.589	1.466

The cost of production for 1928 is the lowest the mine has ever shown, being a reduction from last year of .18 per ton.

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8. COST OF OPERATING:

	1928	1927	Increase	Decrease
Product	356,164	326,814	29,350	
Underground Costs	1.154	1.288		.134
Surface Costs	.181	.222		.041
General Mine Accounts	.131	.132		.001
Cost of Production	1.466	1.642		.176
Depreciation	.234	.225	.009	
Taxes	.153	.178		.022
Central Office	.096	.093	.003	
Welfare,Safety,Hospital Etc.	.036	.050		.014
Cost Adjustment		.018		.018
Cost on Stockpile	1.985	2.206		.221
Loading and Shipping	.044	.063		.019
Total Cost on Cars	2.029	2.269		.240
Royalty	.104	.114		.010
Rail Freight	.640	.640		
Lake "	.760	.760		
Cargo, Insurance and Analysis	.010	.010		
Shrinkage	.028	.030		.002
Total Cost Lower Lake Ports	3.571	3.823		.252
No. of Days Operating	261½	267		5½
No. of Shifts and Hours	1-8	1-8		
Average Daily Product	1362	1224	138	
Cost of Production				
Labor	.877	1.018		.141
Supplies	.585	.624		.039
Total	1.462	1.642		.180

9. EXPLORATION:

No diamond drilling was done for the year. Some new ore was found by raising and drifting in leaders and ore lenses that were followed up from sub-level to sub-level.

We have had very little luck in finding ore lenses proved up by old drill holes.

In two or three instances in the Morris shaft territory, drifts and raises were driven looking for ore shown in the drill holes. In every case, we failed to find anything but narrow ore lenses.

In the Section Six territory, we spent considerable effort trying to prove up the ore shown in Diamond Drill Hole No. 60. This hole, located South-west of the 3rd and 4th level workings, proved up 140 feet of high grade ore close to the main dike. Geologically, the ore was located where one would expect to find a large ore body.

We raised up to the 795 foot sub, cross-cutted and raised to the 890 foot sub, driving development drifts both North and South and East and West and found nothing but narrow stringers of ore

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10. TAXES:

The following tables show tax data for Ely and Ishpeming Townships and the valuations and taxes paid by our company in these two townships.

	1928		1927	
Lloyd Mine	Valuation	Amount	Valuation	Amount
Realty	336,450	12,794.05	396,450	14,886.24
Personal	433,000	16,464.61	421,000	15,807.74
Total Lloyd & Sec. 6	769,450	29,258.66	817,450	30,693.98
Morris Mine				
Realty	172,600	6,134.01	355,600	11,348.62
Personal	533,000	18,942.22	500,000	15,959.01
Total Morris	705,600	25,076.23	855,600	27,307.63
Grand Total	1,475,050	54,334.89	1,673,050	58,001.61
Product- Tons		356,164		326,814
Taxes Per Ton Produced		.1525		.1778
Shipments- Tons		393,184		297,288
Taxes Per Ton Shipped		.1382		.1953

Taxes Raised Ishpeming Township:

Tax	1928	1927	1926
State	3,259.46	4,141.88	3,221.41
County	6,422.87	6,315.58	6,760.15
County Road	3,245.90	2,914.20	3,281.91
Township Contingent	2,500.00	1,010.35	1,000.00
Highway Improvement	5,000.00	6,996.79	6,600.00
Road Repair	4,000.00	4,497.38	5,000.00
School	18,820.00	18,486.98	16,750.00
One Mill	1,180.16	1,227.00	1,253.00
Rejected	2.54		1.11
Total Tax	44,430.93	45,590.16	43,867.58
Tax Paid By C.C.I.Co.	33,698.97	35,073.20	34,026.34
Percentage of Tax Paid by C.C.I.Co.	75.84	77.05	77.65
Assessed Valuation	1,180,160.00	1,227,000.00	1,253,000.00
Tax Rate	3.764	3.717	3.502

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10. TAXES:
(Continued)

Taxes Raised Ely Township:

Tax	1928	1927	1926
State	4,524.57	6,132.88	4,512.02
County	8,915.79	9,359.17	9,468.52
County Road	4,505.74	4,314.26	4,596.76
Highway Improvement	5,000.00	5,000.93	4,000.00
Road Repair	6,000.00	5,999.91	4,500.00
School	13,000.00	12,999.95	13,000.00
One Mill	1,638.22	1,816.60	1,755.00
Bridge	3,000.00	2,999.06	2,000.00
School Building	8,000.00	4,251.18	
Township Contingent	3,000.00	3,500.35	2,500.00
Total Tax	57,636.55	57,407.90	46,372.87
Tax Paid by C.C.I.Co.	26,818.13	34,222.89	31,546.14
Percentage of Tax Paid By C.C.I.Co.	46.53	59.80	68.15
Assessed Valuation	1,638,220.00	1,816,600.00	1,755,000.00
Tax Rate	3.519	3.160	2.657

11. ACCIDENTS AND PERSONAL INJURIES:

We are very pleased to report a marked reduction in the number of accidents. We had a total of 9, but all of them occurred before May 3rd. In the last 8 months of the year, we were extremely fortunate in not having a lost time accident.

The following table shows the days worked and the number and frequency of accidents for the past few years.

Year	Man Days For Year	Number Of Accidents	Accident Frequency Rate
1922	55,822	49	.880
1923	62,628	43	.687
1924	54,032	47	.868
1925	53,986	45	.835
1926	58,526	39	.666
1927	68,323	26	.366
1928	64,242	9	.140

The accidents that occurred the first four months of the year 1928 were classified as follows:

Falls of Ground	6
Unloading Timber	1
Making Up Primers	1
Shaft	1
Total	9

I believe the reduction in accidents is due to three reasons:- First; Standardization of proper methods of doing each piece of work; Second; Discipline; and Third; Cooperation of men and bosses.

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11. ACCIDENTS AND PERSONAL INJURIES: (Continued)

First, standards were adopted for the erection, maintenance and operation of all haulage equipment and transportation of ore, rock and supplies. Second, we fixed the proper routine and handling of all explosives, how they should be stored, transported etc. We also adopted certain fixed methods for the operation of scrapers and hoists.

Discipline was enforced by laying off men that failed to follow the standards of operation. For their first offence, each man was laid off for three days.

We had fine cooperation between the bosses and workmen. Everybody was very anxious to extend the record of no-time lost due to accidents to the end of the year at least. Now that we have entered a new year, we are going to try our best to carry the no-time lost period to May 3rd, 1929.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

We did no new construction during the year 1928 and there is nothing of any importance planned for 1929 around the mine surface.

Underground, we expect to open up the 8th level and install pumps removed from other mines.

In the mine location, we should put in a sewer system and paint the houses.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

b. Stockpile Trestles:

There was no change from last years lay-out except at the Lloyd shaft where additional stocking area was graded and new trestles built South-west of the shaft house to make room for Lloyddale ore.

d. Tugger Hoists and Scrapers:

We added a few hoists to our equipment in order to have spares to take care of break-downs. By the end of the year, we had a total of 40 hoists. We made no changes in ropes, blocks, guards or scrapers used last year.

f. Electric Haulage Equipment:

A new 4/0 haulage cable was placed in the Morris shaft doubling our capacity. We found that with the new electric scraper hoists drawing power from the trolley wire system, that the voltage drop was excessive. In some sections of the Lloyd East Mine, when the haulage locomotives were pulling loads, the voltage was reduced to less than of normal. This voltage drop caused motor failures.

Since the duplicate cable has been in operation, we have burned out no armatures.

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14. MAINTENANCE AND REPAIRS:

a. Shafts:

All three shafts are in excellent condition. During the past year, we installed 11,376 feet of new runners in the skip and cage roads. We also placed steel plates on top the dividers and end plates in the skip roads in both hoisting shafts in order to stop the wearing away of the timber by chunks dropping down the shaft compartments.

In the lift between the 7th and 8th levels Morris shaft, the casing planks, dividing the skip and cage compartments, were placed flush with the skip road side of the dividers.

We have been three years getting the shafts back into first class condition.

b. Electric Tram Equipment:

The electric haulage system gave us very little trouble during the year. The installation of the duplicate power cable, kept the voltage so satisfactory that no armature burn-outs resulted. In 1927, we repaired or replaced 15 armatures and in 1926, 12 were sent in for repairs.

Tracks were kept clean and haulage-ways clear of all rubbish and supplies. New ties and rails were installed in various sections of the mine. Planks were laid down between the rails to provide better walking.

c. Hoisting Equipment:

The life of the hoisting ropes has been doubled by making a few changes. In the shaft-house, we have installed the new type steel lined head-sheaves, discarding the old cast iron sheaves. The hoisting ropes are oiled daily and as a result, we put into service 3450 feet of new hoisting rope in 1928 compared with 7350 feet in 1927.

16. WATER SUPPLY:

Twice during the year, the regular underground water supply, because contaminated by Ferruginous slate slabbing off the old rock drift leading to the sump, discoloring the water so badly we could not pump it into the water supply tank. As the drift between the sump and the point where the water flows into the pipe is caved down, we can't timber up the caving ground.

When the regular supply fails us, the pump at the Morris shaft shop is utilized. This draws water from the drainage ditch connecting the Carp River with the old North Lake Basin. This source of water also became unfit for use a few times last year, when beavers dammed up the Barnes-Hecker Mine drainage ditch, causing it to overflow into the old North Lake.

The Department of Conservation was notified and the beavers were trapped and removed.