Before painting, new sills and joist were installed and the posts supporting the houses set on concrete footings. Two of the houses were raised 12", as the old sills were below the ground level. Only two of the houses in the Princeton Location have drop siding; the others have exteriors of ship lap. The two houses with drop siding had been painted ten or twelve years ago; the balance of the houses had not been painted since the company acquired the Princeton property in 1903. Due to the dry and rough condition of the houses sided with ship-lap, the paint was absorbed into the lumber so that two coats failed to make these houses equal in appearance to the houses in the other locations. There has been, however, a big improvement in their appearance.

GARDNER-MACKINAW LOCATION:

The houses in this location, with the exception of those which had been stained, were painted in June. The majority of the houses at this location were given three coats of paint, as two coats did not cover them completely. Very few repairs were necessary here, as the houses had been built relatively only a short time.

DISTRICT OFFICE AND GROUNDS:

The operation of the Central Power Plant in November and December made it possible to clean up the piles of coal left after the burning of the old coal dock. The remains of the old dock uncovered by the removal of the coal were removed; this area must be prepared and planted.

The wood-work of the District Office, Shop building, Central Power Plant and Laboratory were given two coats of paint in the summer. The painting was done by hand, as the only wood-work consisted of the doors, windows and cornice.

GENERAL SURFACE:

GWINN ASSOCIATION:

The Club House continues to be the Community Center for all social and athletic activities of the district. The Club is fortunate in having an exceptionally able manager at the head of its activities. The following report of the years work has been compiled by Mr. Miller, the Secretary:

ATTENDANCE:

Total attendance at building,	74,076
Average monthly attendance,	6,173
Total estimated attendance for all outdoor activities conducted by the Association, including: Ice Skating Rink, Tennis Courts and Playgrounds, Swimming Pool, Baseball Games, Track Meet and Bass Lake Camp, ...	16,120

MEMBERSHIP:

Membership January 1st, 1922,	367
Membership January 1st, 1923,	436
Low membership for year (July)	294
High Membership for year (December)	436
Average monthly membership,	346

No special effort was made to increase the membership during the first part of the year, as many of the persons making use of the Association facilities were still working on a half time basis. In August a membership campaign was started and continued through September and the result was very satisfactory, there being 120 members added to the roll.

GENERAL ACTIVITIES AND ORGANIZATIONS USING BUILDING:

51 - Rehearsals by Association Band and Orchestras.
11 - Engagements by Band.
29 - Rehearsals by Glee Club and Carol Singers.
3 - Concerts by Association Glee Club.
6 - Sales Fancy Work Articles by Churches.
3 - Suppers by Church Organizations.
8 - Social Parties by Young People (No dancing)
4 - Dancing Classes under supervision School.
34 - Dances Held during year - including regular dances and those on special occasions.
5 - Card Parties.
28 - Meetings by Church Organizations, social work, sewing and health lectures; 9 under the State Home Economics Department
46 - Meetings, 15 by Directors and Committees; 3 C.C.I. Power Club; 9 Sportsmen, 5 Legion and 14 by other organizations.
300 - Visitors from other places were shown through the building during the year.

GENERAL SURFACE:

EVENTS OF SPECIAL INTEREST.

Annual New Years Ball by Gwinn Fire Department.
Annual Easter Monday Ball by Basketball Team.
A Series of 3 Community Dances by Association.
Married Folks Dances by the Association.
Carnival by Ladies Guild of Episcopal Church.
Annual Bachelor Club Dance by the Association.
Annual Parent-Teachers Musicale and Reception by School and the Association.
Junior Prom by High School.
Reception and Dance, Baseball and Track Teams-Association.
Masquerade Ball by Seniors of High School.
Hallow'een Party by Girl and Boy Scouts.
Annual Charity Ball by Association.
Card Party by Local Council Girl Scouts.
Farewell Stag Party in honor of A. G. Buchman.
Community Christmas Tree and Treat for Children by entire community.
Initial Concert by Association Glee Club.

MOVING PICTURE THEATRE.

146 - Different Pictures Shown
475 - Shows held during year
32647 - Total Paid Attendance - - Adults - 23417
Children - 9230

SPECIAL FREE SHOWS:

1 - Show, Sportsmen's Association	150
1 - Show, C. C. I. Power Club.....	75
2 - Shows, Charity Ball.....	250
5 - Shows for Children at Christmas.....	652
Grand Total for Year,	33774

LIBRARY AND READING ROOM:

LIBRARY:

Number of books contained in Library,	1345
Number books bought during year,	122
Number books donated during year,	45
Number books withdrawn (bad condition)	70
Number books drawn on cards,	4392
Number books drawn on cards per month,	366

READING ROOM:

The following number of magazines and newspapers are received and placed on the tables in the reading room. This room is open to all and many enjoy the privilege.

Weekly magazines..... 10 Weekly Newspapers..... 4
Monthly magazines..... 21 Daily Newspapers..... 4

GENERAL SURFACE:

EDUCATIONAL DEPARTMENT.

Owing to the fact that the Government demands that the local schools maintain classes in Citizenship, the Association discontinued this branch of service and assisted the school in organizing the different classes which are now being conducted during the winter months.

MUSICAL ORGANIZATIONS.

ASSOCIATION BAND:

The Association Band, organized in 1919 is enjoying the reputation of being the best band of the Upper Peninsula. They are fairly well equipped; having a white uniform for summer and marching work, and a heavy blue uniform for winter and concert work.

The Band at present consists of 24 members, and all are residents of the Gwinn District. During the past year the band held 43 rehearsals and had 11 engagements. During the coming year they will change their present high pitch instruments over to low pitch and no doubt this change will increase their present popularity.

The financial condition of the band at the close of the year showed a balance of..... $36.23

ASSOCIATION GLEE CLUB:

A new organization, but one that is very much appreciated by the entire community. The club was made up of local persons and consisted of 26 members.
Two concerts were given at the High School Auditorium and were praised by all those that attended; the club also assisted at other social activities and they surely fill a much desired position in the entertainment line. During the year the club held 29 rehearsals.

Financial Balance at end of year..... $80.95.

The Association Band and Glee Club are well organized, having their own officers and handling their own funds.

The Association was called upon at different times during the year to assist these organizations, and in doing so expended $265.90. This was used as salary for leader of the Band and to buy music for both organizations.

PHYSICAL AND ATHLETIC DEPARTMENT.

Including all work conducted in the Gymnasium, Swimming Pool and all outdoor activities and recreations; such as, Baseball, Football, Track, Tennis, and Playground Courts, also the Outdoor Swimming Pool.

The interest in this department continued despite the fact that many of the younger members left for other employment. Those using these facilities were benefitted both morally and physically.

Summary of the Activities of the Physical Department:

	Periods:	Attendance:
Boys Gym Classes, including School Basketball Practice,	71	1222
Girls Gym Classes, including Basketball Practice,	27	404
Seniors using Gym for class work, - Basketball, Handball, Volleyball, Indoor Baseball, Boxing, Wrestling and recreative games,	117	1934
Older Girls Gym,	9	64
Boys supervised Swimming,	39	686
Girls supervised swimming,	38	466
Number Baths taken during year,		4875

Basketball games during year - 4 games between local teams, 16 games at home with outside teams and 13 games away from home.

A Volleyball League formed during the winter affords much interest to the men participating. 4 teams completed a 45 game schedule and 43 different men played. Many of the older members of the Association participated and no doubt this will be a yearly affair.

The Association, as in other years, constructed and maintained an Ice Skating Rink in the rear of the club property. The rink is a trifle small but by adhering to a schedule all those interested in this sport find a chance to enjoy same. The rink was in good condition during January, February and the first part of March.
Attendance - 4555

Attendance on playground and Tennis Courts..... 1340

Unfavorable weather interferred with a successful season at the Outdoor Swimming Pool supervised by the Association and located in the East Branch of the Escanaba River:
Attendance - 1100

BASEBALL:

The third season of the Mine Baseball League opened with three teams, but unfortunately one of the teams was compelled to disband on account of losing several of its players near the end of the season.

GENERAL SURFACE:

BASEBALL:

The Francis Mine Team were the winners and have the honor of twice having their name on the Baseball Trophy Cup presented to the Association by Mr. Wm. G. Mather, in 1920.

The Association finances the league and all games are free to the spectators. Many a pleasant evening is spent at the High School Grounds during the summer where all the games are played. As in other years, the ladies take a great interest in the games and the league will be continued the coming year.

The Association Team or City Team is made up from the best players of the Mine League. They enjoyed a successful season, playing 14 games, winning 7 - and losing 7. Games were played with the best teams of the county and also entered the baseball tournament at the Marquette County Fair.
The team in every respect is an amateur organization, all players playing for the love of the game.

Total attendance for all home games..... 6500

FOOTBALL:

Owing to the fact that the men were employed throughout the day and it would be impossible to find time to practice the football team was not organized. The equipment was loaned to the High School and the students made good use of same. Games were played between the different class teams and quite a fine display of class spirit was developed.

TRACK:

The Second Annual Track and Field Meet was held July 24th, and as predicted, the event was more successful than the first.
The prizes offered by the local merchants were even more suitable and the spirit in which they were given was very commendable.
Ideal weather brought out the largest attendance at any one event for the summer and all enjoyed the regular events as well as the novelty races which were arranged for men, women and the children.

Number of events..... 19
Total number entering..... 166

Cash value of prizes..... $150.00

Attendance..... 500

GENERAL SURFACE:

BOWLING:

The Mine Bowling League was again organized, and each team completed its quota of 45 games. Team Number Four won the Championship and the privilege of having its name engraved on the "M. M. Duncan" Bowling Trophy, presented to the Association in 1921.

BASS LAKE CAMP COTTAGE.

Camp opened June 1st: Closed October 15th.

Estimated attendance for season.....2125

Number families using camp at different periods for entire week...	5
Parties using camp week-ends.....	14
All day Picnics.....	16
Families using camp evenings for basket picnics.....	27
Girl Scouts had use of camp (days)..	8
Boy Scouts had use of camp (days)..	6

Receipts for boat hire for season $ 21.40

The Bass fishing was very good and many fine catches were made. The cottage and camp grounds were kept in fine condition during the entire season.

SCOUT ACTIVITIES.

GIRLS:

The girl scout movement organized in 1920 had a fine year and were very active.

Two complete troops are now organized and meet weekly in the Association gymnasium.

Troop number one continues to be the most active and the girls have accomplished much for the good of the community and themselves.

The following summary covers the work of both troops for the entire year. The largest part of the work has been done by troop number one.

SCOUT ACTIVITIES (Continued)

GIRLS:

		Attendance.
Class meetings - - -	68	1589

10 - Parties & Social and those to raise money were held.
7 - Hikes and Outdoor Picnics.

8 - Days spent at Bass Lake Camp
During Christmas week baskets were given out to the needy and flowers to the sick.

Funds collected during year - including amount of Rummage Sale held by Local Council..... $ 128.10

BOYS:

		Attendance.
41 -	Class Meetings - - -	890
7 -	Recreation periods - - -	140

6 - Days at Bass Lake Camp.

During the year a Book Campaign was made and the books collected were given to the Association Library.

Special repairs and new equipment added during the year, expense of which was met by the Association:

EQUIPMENT:

8 - Set Bowling Pins Purchased.
100 - Ft. New Garden Hose.
18 - Chairs purchased for Community Room.
New Lights installed in Gymnasium.
New Lights installed in Theatre and new arrangement on switches to conform to State Law.
New Set Billiard Balls.
New Oil Stove for Club Kitchen.
New Baseball, Tennis, Basketball and other athletic articles purchased.
New cloth for all pool and billiard tables.
The usual stock of office supplies and stationery, including 7 year ledger, also janitor and library supplies purchased.

GENERAL SURFACE:

Special repairs and new equipment added during the year - (continued)

CONSTRUCTION WORK AND REPAIRS:

2 - New boats constructed for Bass Lake Camp.
Repaired one end of swimming pool; necessary to secure new tile.
All storm windows repaired and painted.
Wire fence around tennis court repaired and wire fence on part of club property re-arranged.
Two rooms in living quarters re-calcimined and floors varnished.
Floors throughout entire building oiled.
Roof and tin gutters repaired.
Stairway to basement calcimined and steps varnished.
Bowling Alleys sand-papered and shellaced.
3 Bowling balls repaired.
Gymnasium thoroughly cleaned, walls scrubbed and floors repaired.

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It is recommended that cement walks be built in the Club House grounds, as it is impossible to keep the building clean in the spring and fall, with the present soft limestone walks.

It is earnestly hoped that the present motion picture room will be enlarged in 1923. The present room is very small and is usually crowded, the ventilation is very poor and it is also hard on the eyes, as the seats extend within ten feet of the screen.

REPUBLIC MINE.

Operations at the Republic Mine were resumed on full time basis on June 5th, 1922. For the balance of the year, we operated three single shifts a week. In 1921 the mine worked full time only from January 1st to February 12th. From February 12th to June 1st, the schedule was five days a week, and from June 1st, 1921, to June 5th, 1922, only three single shifts a week were worked.

PRODUCTION:-

The tonnage hoisted for the year 1922 was as follows:-

Basic Lump ore,	51,020 tons,
Basic Crushed ore,	47,254 "
Pascoe Crushed ore,	314 "
Total,	98,588 "

This exceeds last year's total of 73,014 tons considerably.

New ore developed comes within a few tons of exceeding production. We hope to prove up considerable new tonnage next year. The following table shows the ore produced and new ore developed since 1915:-

YEAR	ORE PRODUCED	NEW ORE DEVELOPED
1915	185,187	18,611
1916	173,096	18,732
1917	153,425	117,541
1918	142,476	155,939
1919	155,315	189,447
1920	153,951	100,046
1921	73,014	159,510
1922	98,588	88,569
Total for five year period:1918-1922, inclusive,	623,344	693,511

You will note that previous to 1918 the ore reserves were practically exhausted, but since 1918 the total of the five years shows a gain of 70,167 tons.

ESTIMATE OF ORE IN MINE, DECEMBER 31, 1922.				
NO. 9 SHAFT.				
LEVEL	DEVELOPED ORE		PROSPECTIVE ORE	TOTAL
	AVAILABLE ORE	SHAFT PILLARS		
911-1153		14,720		14,720
2172'	25,040			25,040
2270'	16,400			16,400
2370'	6,784			6,784
Total,	48,224	14,720		62,944
PASCOE SHAFT.				
1640'		2,700		2,700
1710'	8,960	31,700		40,660
1780'		42,940		42,940
1850'		13,200		13,200
1950'	26,596	58,570		85,166
2050'	610	18,960		19,570
2470'	18,080			18,080
2570'	51,975			51,975
2670'	53,838		106,776	160,614
Total,	160,059	168,070	106,776	434,905
Grand Total,	208,283	182,790	106,776	497,849

The ore reserves exclusive of shaft pillars subdivided into grades are as follows:-

GRADE	DEVELOPED TONS.	PROSPECTIVE TONS	TOTAL TONS
Bessemer Ore,	151,099	106,776	257,875
Basic "	8,960		8,960
Pascoe "	48,224		48,224
Total,	208,283	106,776	315,059

The following statement shows the ore produced, the reserves and new ore developed each year since 1919:-

	1919	1920	1921	1922
Ore in sight January 1st,	398,450	410,582	381,712	398,608
Prospective Ore, " "	42,695	64,595	39,660	109,260
Total,	441,145	475,277	421,372	507,868
Product,	155,315	153,751	73,014	98,588
Balance,	285,830	321,326	348,358	409,280
Ore in sight, Dec. 31st,	410,582	381,712	398,608	391,073
Prospective Ore," "	64,595	39,660	109,260	106,776
Total,	475,277	421,372	507,868	497,849
Developed during year,	189,447	100,046	159,510	88,569

REMARKS:-

Although the new tonnage developed in 1922 apparently is less than the year's production, we have not included the broken ore in the 1950', 2370' or 2470' Level Stopes, as we have no way of determining these tonnages accurately. There are probably 25,000 tons of ore that will be secured from these stopes before they are exhausted.

When the stopes are being mined, we keep a bi-monthly record of the cross-sectional area and calculate the tonnage broken. We have a record of the cars of ore trammed from these stopes. As soon as mining ceases and the broken ore is trammed, the foot and hanging break off in large masses and mix with the ore. Most of this rock is picked out of the ore on the Picking Belt on surface. As the cars trammed from the stopes contain mixed material, the car tally from each stope exceeds the number of cars of ore calculated from each stope and so as the stopes are cleaned up we naturally get an over-run.

There are probably still 25,000 tons of ore in the three stopes mentioned previously, so that we actually proved up about 15,000 tons more ore than we hoisted in the year 1922.

SHIPMENTS.

The 1922 shipping season showed a vast improvement over 1921, but was still far from normal due to no shipments of Crushed ore. We shipped all the Lump ore in stock and continued shipments from the pockets until November 12th. We held over in cars from 1920 about 900 tons of Pascoe Crushed ore. In order to move that, we loaded up approximately 775 tons of Pascoe run - of - mine ore from the No. 9 Shaft pile and crushed it. At the very close of the season, we had an inquiry for 2,500 tons of Crushed Pascoe ore but due to the lateness of the season, the order was deferred until next season.

The cargoes for the season follow together with the mine analysis and results from Lower Lake chemists:-

BOAT	GRADE	MINE ANALYSIS			LOWER LAKE ANALYSIS		
		IRON	PHOS.	SILICA	IRON	PHOS.	SILICA
Ishpeming,	Pascoe Crushed	56.92	.045	15.54	56.32		
Ishpeming,	Basic Lump,	65.03	.037	4.90	65.32		5.40
Sheadle,	"	65.18	.031	4.85	64.50		6.31
Angeline,	"	65.63	.031	4.05	64.80		6.30
Central West,	"	64.42	.043	5.75	64.60		
Marquette,	"	65.02	.044	4.75	64.00		7.10
Angeline,	"	66.06	.035	3.65	64.40		
Cadillac,	"	66.16	.039	3.50	64.95		
Sheadle,	"	64.94	.043	4.81	65.90		
Marquette,	"	65.01	.042	4.45	64.25		
Ishpeming,	"	64.32	.039	5.04			
Mather,	"	64.14	.040	5.74	62.70		
Sheadle,	"	63.44	.041	6.76	62.10		
Ishpeming,	"	65.13	.038	4.88	62.90		
Michigan,	"	65.53	.038	4.79	65.32		
Cadillac,	"	63.69	.041	6.80	63.55		
Negaunee,	"	63.44	.055	7.55	63.20		
Grand Island,	"	63.54	.045	7.35	63.70		
Rogers,	"	65.22	.038	5.55	66.10		
Munising,	"	63.87	.042	6.47	64.95		
Mather,	"	64.71	.038	5.91	64.40		
Cadillac,	"	63.91	.044	6.55	65.20		
Munising,	"	65.67	.036	4.40	65.40		
Fitzgerald,	"	64.65	.034	6.02	65.50		
Angeline,	"	65.53	.040	4.96	67.10		
Fitxgerald,	"	65.89	.043	4.95	66.75		
Negaunee,	"	66.24	.037	3.50	66.00		

The average of the above cargoes for the entire season is as follows:-

	MINE ANALYSIS			LOWER LAKE ANALYSIS		
	IRON	PHOS.	SILICA	IRON	PHOS.	SILICA
Basic Lump Grade,	64.73	.040	5.41	64.52		

You will note that the averages check very closely and that our cargoes ran considerably higher than the guarantee which was 64.00.

There was some complaint relative to Silica in two or three cargoes early in the shipping season. We sent for the powders which were a portion of the samples taken by the chemists at Lake Erie ports, and found as I suspected, that their Silica determinations were too high.

Following are comparisons for only three cargoes that we received powders from:-

		SILICA (SAME POWDER)		
		LOWER LAKE CHEMISTS	REPUBLIC MINE CHEMIST	FRED BAKER DETERMINATION
Sheadle,	May 30,	6.31	6.15	6.23
Angeline,	June 9,	6.30	6.00	5.96
Marquette,	June 19,	7.10	6.56	6.61

It has been my experience the lower lake chemists do not take enough care in their analytical work when determining Silica on Republic Mine ores.

ESTIMATED PRODUCTION FOR 1923.

Production for 1923 is based on 500 tons a day out-put. There are times when it is possible to increase the estimated production but as a general rule if we produce over an average of 500 tons a day, we are producing ore faster than the conditions warrant. If one averages the annual tonnage of new ore developed each year since 1918, you will find it runs very close to the annual production estimated for 1923. You can not operate the Republic Mine economically without having from 200,000 to 250,000 tons of ore in sight available for mining. A year ago we were tramming ore from our stopes to the extent that we were interferring with mining operations. The shrinkage stopes were drawn down so low that it was difficult for the miners to reach all the ore in the back to drill and blast properly. We had no alternative, however, if the out-put was to be kept up to some where near normal.

At present, conditions are fair in this respect but to really operate properly, we should have another level opened up at this time. In reality it will be six or seven months more before we are mining ore on the 2670' Level.

DELAYS.		
DATE	DURATION	CAUSE
Apr. 11,	4 hours,	Electric Transmission line broken,
Jun. 15,	1½ "	" " " trouble,
Jul. 31,	8 "	" " " "
Sep. 5,	4 "	" " " "
Sep. 6,	8 "	" " " "
Sep. 7,	4 "	" " " "
Sep. 8,	8 "	" " " "
Nov. 1,	8 "	Adjusting hoisting rope,
Dec. 14,	4 "	Pascoe Shaft skip off track.

The most serious delays were those of July 31st and September 5th to 8th inclusive. On the latter dates we had a series of serious electrical storms and lightning struck the line twice both times in the evening and repairs in each case were not finished until the following afternoon.

LABOR & WAGES.

We were not seriously inconvenienced by shortage of men. There were times when we were short of trammers for a few days, and in November, due to hunting season and sickness, we were short handed.

The scale of wages was changed twice during the year. On June 1st wages were reduced from an average of $4.18 per day for underground and surface labor to $3.81 per day. On September 1st, wages were restored to an average of $4.27.

COSTS.

It is difficult to compare costs for the last few years due to variations in wage scale and to the wide fluctuations in the costs of supplies

Since June 1st, 1922, the costs at the Republic Mine have been on a par with the lowest secured in 1915 when cheap costs were obtained by shutting down development work and not operating the Diamond Drill.

Previous to June, 1922, for over a year, mine operations were curtailed and naturally no cheap costs can be secured operating at only one-third capacity.

The following table shows the 1915 costs compared with 1922 after the mine resumed full time operations:-

YEAR	COST OF PRODUCTION	AVERAGE RATE OF WAGES
1915,	1.621	2.58
Jun., 1922,	3.00	3.82
Jul., "	2.494	3.80
Aug., "	2.246	3.80
Sep., "	2.521	4.26
Oct., "	2.411	4.28
Nov., "	2.528	4.26
Dec., "	2.80 Apprx.	4.31

In order to make the actual comparison the following table shows the costs for 1922 as they would have been had the 1915 wage scale been paid. Furthermore, the cost of coal and explosives, the two heaviest items on our cost sheet, has been corrected to bring it in line with 1915 cost for fuel and powder. Furthermore, previous to January, 1920, the cost of operating the Diamond Drill was not charged to operating expense. The following table of 1922 costs, therefore, is corrected to correspond to the 1915 wage scale, explosives and fuel cost; and Diamond Drill expense has been deducted.

YEAR	COST OF PRODUCTION
1915	1.621
Jun., 1922,	2.048 Corrected.
Jul., "	1.660 "
Aug., "	1.544 "
Sep., "	1.577 "
Oct., "	1.530 "
Nov., "	1.621 "
Dec., "	1.697 "

To illustrate how above costs are figured, take October, 1922, for example. The actual cost of production was $2.411. Of this amount, $1.712 was Labor and $.699 was supplies and $.073 was Diamond Drill expense.

In October, 1922, the average rate of wages paid for surface and underground labor was $4.28; in the year, 1915, this rate was $2.58: therefore, to bring the October, 1922, Labor cost in line with the 1915 Labor cost, one must reduce it approximately 40%. That brings the October, 1922, Labor cost from $1.712 down to $0.99. Then the October, 1922, supply cost was .699. Of this amount, explosives was .228 and fuel .051. In 1915, explosives were charged out at .114 per lb. and coal at $3.20. In October, 1922, explosives were .157 per lb. and fuel $6.00. Therefore, correcting the 1922 costs to bring them in line with 1915 reduces the supply cost for October, 1922, by .086. This makes the cost of production for October, 1922, $1.603. Deducting .073 Diamond Drill expense which was not included in operating expense in 1915, makes the corrected 1922 cost stand at $1.530, or less than 1915 cost. In fact, the average for the six months period, 1922, compares very favorably with 1915 cost, being $1.604 or a little less than the previous record of low costs in 1915 when the average for the year stood at $1.621.

Another way of comparing costs is to take the months when we have approximately corresponding wage scales in the last six years. Take the period from October, 1917, to April, 1918, and compare it with September, October, November and December, 1922, as shown in the following table:-

MONTH	COST OF PRODUCTION	RATE OF WAGES U.G.& SURFACE	AMOUNT OF DECREASED COST COMPARED WITH OCT.'17 TO APR.'18.
Oct., 1917,	$3.142	4.11	
Nov., "	3.382	4.10	
Dec., "	3.185	4.13	
Jan., 1918,	2.855	4.13	
Feb., "	2.972	4.16	
Mar., "	3.234	4.19	
Average,	3.116	4.14	
Sep., 1922,	2.521*	4.26	.595
Oct., "	2.411*	4.28	.705
Nov., "	2.528*	4.26	.588
Dec., "	2.80 *Apprx.	4.31	.316

*Includes Diamond Drill expense whereas 1917 & 1918 costs do not; also, 1922 wage scale is slightly higher.

It is apparent from the above that we are securing better results even with a slight increased wage scale.

LABOR STATEMENT.

We are now operating the Republic Mine with considerably less men than ever before in the history of this property.

Take November, 1922, for example and compare with previous Novembers:-

	MEN EMPLOYED			
	SURFACE	UNDERGROUND	TOTAL	PRODUCT
Nov., 1922,	56	153	209	12,619
Nov., 1920,	72	185	257	10,578
Nov., 1919,	72	181	253	11,019
Nov., 1918,	62	166	228	10,268
Nov., 1917,	65	157	222	9,846
Nov., 1916,	66	182	248	12,661
Nov., 1915,	71	204	275	16,229
Nov., 1914,	72	180	252	10,011

The average number of men employed surface and underground since going back to full time in 1922 will actually average only 200 or even less than November shown above.

EXPLORING.

The Diamond Drill operated one shift throughout the year. The cost per foot would naturally be higher than in previous years when the drill worked both day and night shifts because of the overhead expense.

The following holes were drilled during the year.

NO. OF HOLE	LOCATION	DEPTH	FOOTAGE OF ORE
489	2370' Level	145	15'
490	" "	156	No ore
491	" "	49	2'
492	" "	54	No ore
493,	" "	111	No ore
494	1710' "	83	13'
495	" "	112	No ore
496	" "	80	32'
497	2070' "	175	No ore
498	1850' "	170	" "
499	" "	171	24'
500	2470' "	104	No ore
501	1950' "	37	" "
502	" "	2	" "
503	2570' "	71	46'
504	" "	68	45'
505	" "	70	41'
506	" "	36	No ore
507	1950' "	34	" "
508	1570' "	238	27'
509	" "	154	13'
510	2470' "		

The total footage drilled was 2367 feet at a total cost of $8,450.44 or $3.57 per foot.

TABLE OF DIAMOND DRILL COSTS.		
YEAR	FEET DRILLED	COST PER FT.
1920	3,621	$4.963
1921	2,531	4.11
1922	2,367	3.57

SHAFT SINKING.

The Pascoe Shaft was sunk 13 feet to the 2570' Level and the plat cut and pockets installed on this level. Then sinking was resumed and by the end of the year was down 115 feet below the 2570' Level.

The shaft was sunk in ore until a point about 100 feet below the 2570' Level was reached. Here the Jasper began to come in at the North-East corner and the ore dropped back gradually into the foot. It appears that there is a vein of ore at least 20 feet thick back of the foot of the shaft as we cut out a sump and pump house in the foot of the shaft just below the 2470' Level and no rock was encountered.

Progress in this shaft is slow. It takes from five to six days to drill, blast and muck a complete cut of 6 feet. We have four men on a shift and work two eight hour shifts. Due to the low air pressure between shifts when the blowers are open in the stopes, we can not work three eight hour shifts. The shaft is 7 feet wide and 20 feet long and is sunk at an angle of 45°. The ground whether Jasper or ore is tough and must be drilled with mounted machines, perferably Ingersoll-Rand 248's. We find it impossible to use more than four men at the bottom of the shaft. These four men can drill about twelve holes in a shift and the round takes from forty-eight to fifty-four holes, or approximately four shifts drilling. We drill and blast the cut of sixteen holes first and then drill the balance of the holes after the cut is mucked. The relievers are blasted next and after this dirt is mucked the squaring up holes are blasted. It takes an average of thirty-four hours to muck the material from the cut.

ROCK DRIFTING.

We did less rock drifting in 1922 than for many years past.

On the 1710' Level, a drift 50 feet long was driven through Jasper to reach ore discovered in Diamond Drill Holes, Nos.: 494 & 496.

On the 1950' Level a rock drift in Jasper 135 feet long was driven along Diamond Drill Hole #428 to reach the ore found in Diamond Drill Holes, Nos.: 428 & 469.

On the 2470' Level a drift was driven parallel and 25 feet back of the foot of the main stope and cross-cuts in rock were turned off approximately 20 feet apart to tap the broken ore on the foot side of the stope. All of this drifting was in Soaprock or sheared Quartzite.

On the 2570' Level the main drift East of the shaft was run from the plat to the ore body 40 feet away, the opening being in Jasper all the way.

ORE DRIFTING & RAISING.

Two raises were put up in ore from the back of the #1 stope on the 1950' Level to the floor of #4 stope on the 1850' Level.

Another raise was started on the footwall at the South end of the main stope on the 2570' Level, and by the end of the year was up within 15 feet of the 2470' Level.

We did not drive any drifts in ore strictly speaking but when a new stope is opened up, all of the ore mined on the sill floor and 8 feet high is considered as ore development. After mining begins in the back, the labor & supplies are charged to stoping.

STOPES.

Ore was mined in six stopes during the past year.

On the 1710' Level, two stopes were worked. The first one at the end of the long drift leading South from the shaft was opened on the ore found in Diamond Drill Hole #496. This ore body was a disappointment as the ore only went up a few feet above the level. The second or inside stope was carried up an additional 100 feet in height. In January the breast was about 25 feet long but by the end of the year, this stope had increased in size until six miners were employed on each shift along a face approximately 100 feet long.

On the 1950' Level, a nice stope of high grade Bessemer ore was opened up, a detailed description of which appears later in this report.

The stope on the 2270' Level was exhausted about 50 feet above the level.

The main ore body was stoped on both the 2470' and 2570' levels; the ore at the former elevation being nearly all worked out by the close of the year. On the 2570' Level, the stoping operations were just started.

TIMBERING.

Very little timber is now used in the Republic Mine. If the ore bodies are long and narrow, we still build the old style stull, but in the larger ore bodies instead of trying to carry the weight of the broken ore in the stope on timber, we only timber along the hanging by building square cribs and filling them with broken ore. The ore on the foot side is taken out through cross-cuts leading through the rock to the main foot wall drift.

TRAMMING.

The trammers at the Republic Mine although still earning very good wages have had their earnings reduced considerably more than any other class of labor. Their average wages per day up to December 1st were $5.13 compared with $4.21 for contract miners. In 1920, when wages were at the peak, the trammers averaged $11.11 per day for the year, while the contract miners were paid an average of $6.42 per day. In the two year period, the wages of the trammers were cut 54% and the miners were only reduced 34.4%

The following table shows the cars filled per trammer per day:-

YEAR	CARS PER TRAMMER PER DAY
1916	12.3
1917	13.1
1918	15.1
1919	18.2
1920	20.5
1921	21.8
1922	16.7

You will note a considerable reduction in the cars trammed per day compared with previous years. That is due to employing more trammers making it unnecessary to crowd each gang so hard to keep the out-put up as we did in 1920. Trammers were fairly plentiful and so as a result of the decreased cars per day their average daily wages naturally dropped as they are paid by the car.

PUMPING.

The unit cost of handling water was above normal as it was last year due to mine operating only three days a week for the first five months in the year. When the mine is idle, it is customary to send a helper with the pumpman, as they are the only men underground on those days. Our pumpmen have to do considerable climbing as two of the pumps are located in the Pascoe Shaft and we don't believe it safe to leave one man underground alone.

COMPRESSORS & AIR PIPES.

The cost of operating our compressors in 1922 is the least in the history of the mine for two reasons. We had an abundance of water due to frequent showers all through the summer and when the mine was idle four days a week in January, February and March, which are the months the stage of water is lowest in the river, the water had a chance to accumulate over the week end. When we are operating full time, about 120 tons of coal is burned monthly to operate the steam driven air compressors.

UNDERGROUND SUPERVISION.

In addition to Captain Pascoe we have two bosses in the Pascoe Shaft territory, John Perry and Fred Upperstrom. We also have a timber boss who is held responsible for conditions underground in case the Captain is sick or away on a vacation.

COMPRESSORS & POWER DRILLS.

No new drilling machines were purchased in 1922 and as a result, the maintenance charged to this account is only 5% of the amount expended from 1916 to 1921.

TRAMMING EQUIPMENT.

We expended only the usual amount keeping the underground tracks and cars in shape and laying tracks into the new workings. One trackman and helper are kept busy day shift only on this work.

A new storage battery was purchased for the underground locomotives. The locomotives came equipped with 13 plate cells with 48 cells, 6 trays, 8 to a tray. The new battery contains the same number of cells but has 15 plates in each cell, increasing its capacity 18%. By having the larger battery the cost of maintenance will be decreased due to its longer life.

I have made comparisons with other mines to find out how the cost per ton for handling ore with the storage battery locomotives compared with costs in the Negaunee and Ishpeming Districts where trolley locomotives are used. Our costs are amongst the lowest being almost exactly the same as at the Negaunee Mine.

PUMPS.

The cost of maintaining the pumping equipment was about half that of 1921 and only about one-third the 1920 and 1919 expense. We experienced absolutely no trouble except with the 2470' Level electrical pump in the Pascoe Shaft. The water end on this pump gave so much trouble with the gaskets that we finally built an entirely new one. A new belt was put on the 1153' Level pump in No. 9 Shaft.

HOISTS & EQUIPMENT.

There was only one change made in the hoisting equipment. The Pascoe Shaft underground hoist on the motor haulage level was speeded up 50% by putting on a larger pinion. This hoist handles all the ore hoisted from the lower levels in the Pascoe Shaft and the rope speed originally designed for 500 feet was too slow. The new 2570' Level is 750 feet below the dump and so we speeded up the hoist 50%, the old 100 H.P. motor being powerful enough to take care of the increased speed. In fact, I think we can still speed up the hoist another 25% without over-loading the motor.

A new double deck cage was built and put in the No. 9 Shaft. The old cage was pretty well worn out and much too short to ride smoothly. The new cage was also weighted down with a 1500 lb. casting under the floor to offset the weight of the skip. This gives a more equal load on the main hoist motors.

STOCKPILE GROUNDS.

Quite extensive work was done on both the Lump and Fine ore stocking areas. The former located North-West of, the shaft was in very bad shape. Before the Cleveland-Cliffs Iron Company acquired the mine in 1914, the former operators had laid plank on a very rough bottom. The steam shovel finally damaged this plank so badly that repairs were impossible. Furthermore, the old stocking area had settled in spots due to the settling of the filling in the old excavated foundation areas where former dwellings stood. Due to high price of plank previous to 1921, I did not recommend re-planking and leveling off this area.

We had great difficulty loading the Lump ore stocked with the steam shovel because a great many of the chunks were imbedded in the sand. In September after the pile was pretty well cleaned up, we levelled off an area about 400 feet long and 120 feet wide, using ashes from the Boiler Plant.

We purchased 85,000 feet of 3" Hemlock and laid about 50,000 feet before December 1st, but the balance did not come forward until December 15th and had to be laid on frozen ground at greatly increased cost. The latest delivery date of this plank was specified to be October 15th, but due to car shortage the last of it did not show up until two months later despite our repeated efforts to get it here on time.

The fine ore stocking area was enlarged by filling in along the lake shore on the West side. We provided room for about 25,000 tons additional.

A cut was taken parallel to the track leading to this stocking area with the steam shovel, stripping cars borrowed from the Athens Mine being used to transport the material. It is planned to use this cut for a roadway eventually when the stocking area becomes so filled that the present roadway will be blocked.

SCREENING ORE.

The second pair of segments on the revolving screen installed in the No. 9 Shaft House in 1920 wore out. The original sections were 3/8" thick. We ordered ½" the second time and we now have 5/8" plates installed. These latter are as thick as we can install as no rolls in the county will bend heavier plate. In an effort to make all the Lump ore possible we have cut down the number of perforations in these plates. The old screen in the old Crushing Plant used until 1920 had 4½" perforations. The new screen installed in 1920 had only 3½" perforations, spaced 2" apart. The new sections have 3½" holes spaced about 4" apart.

TOP TRAM EQUIPMENT.

The top trams installed in 1920 have given us no trouble. About once in eight months new rubber liners must be placed in the grooves of the six foot driving sheaves.

The principal expense maintaining the top trams is 5/8" rope and I think by enlarging some of the turn sheaves that we will increase the life of these ropes.

DWELLINGS.

A force of five carpenters was kept busy from June 1st to November 1st repairing the Company's dwellings. Three of these men repaired the sidings, windows, doors and porches and the other two were kept on the roofs.

Then all the dwellings were painted by the spray system, the D. E. Hoffman Company doing the work. There were painted a total of 12,898 yards. The cost for material and supplies was $1198.00 or .09288 per yard for two coats. To this must be added the labor cost of 11¢ per yard.

From my observation of the spray system, I believe that the results secured depend on the skill of the operator running the nozzle. Some of our houses look pretty well and the work on others does not look good. Mr. Hoffman had two good men but the rest of his crew were picked up locally and when he did not watch them closely, their work was poor. The weather was against him on the Republic job. It was late in the Fall and we had a great many cold rainy days and I don't believe we can judge the results of the spray painting done at Republic as a sample of a fair job.

NEW DRILL SHARPENING SHOP.

E. & A. #417 covers cost of building and equipping new shop for sharpening drills located near No. 9 Shaft.

The new shop is a duplicate of the one erected at the Cliffs Shaft Mine. It is equipped with an Ingersoll Oil Heating Furnace and a Sullivan Oil Tempering Furnace. The heating furnace supplies drills to two Sullivan Sharpeners.

We have also rigged up a furnace to heat shanks and there is installed a shanking device constructed of an old drilling machine. In the centre of the shop we have an air driven grinder.

The method of handling steel is as follows:-

The drills are loaded onto a truck that runs onto the cage. A track runs from the shaft to and into the shop. The steel from the truck is unloaded onto a sorting table and the men operating the drill sharpeners take the steel from this table. After the drills are sharpened they are placed on racks. The temperer takes the drills from the racks and after heating them in the tempering furnace tests each one with a magnet before cooling.

At this point we have introduced something new which I don't believe is done in any other shop. The steel from the tempering furnace is placed in a 2½" vertical pipe, one foot long, and a jet of cold water cools the steel. The idea is to get a quick cooling action and to have the steel immersed in a stream of flowing water. In the ordinary tank method of cooling the water around the bit becomes heated and the cooling of the bit is irregular, the centre of the bit cooling very slowly.

The drills are taken from the tempering tank and placed on the truck ready to go underground.

The cost of this shop and equipment will be approximately $6,000.00.

SUPPLIES.

The unit cost for supplies for 1922 shows a considerable decrease compared with 1921. The unit cost for 1922 was .788 compared with 1.111 for 1921; 1.133 for 1920; 1.019 for 1919; 1.038 for 1918; .978 for 1917 and .619 for 1916. The decrease comes by the saving in the use of General Supplies, Machinery Supplies, Explosives and Fuel.

GENERAL SUPPLIES.

The total for 1922 amounts to $10,741.70 or $.108 per ton compared with .152 per ton in 1921.

The main items under this heading are:-

Diamond Drill Carbon,	$2,632.83
Wire Rope,	929.49
Coke & Coal for Blacksmith Shop,	1,353.85
Feed for Horses,	872.70
	$5,788.87

IRON & STEEL.

The consumption of Iron and Steel was practically the same as last year but the unit cost for 1922 was slightly less.

OILS & GREASE.

We expended $1215.87 for Oils & Grease in 1922 compared with $1276.00 in 1921; $1898.34 in 1920; $1765.96 in 1919 and $1913.76 in 1918. We are showing a gradual reduction.

We are now using graphite grease to lubricate drilling machines instead of Castor Drill oil. There is far less waste using grease and the machines have better lubrication. In 1922 we bought 1076 lbs. of graphite grease at a total cost of $149.20. The last year we used Castor Drill oil we spent $368.80 for lubrication.

MACHINERY SUPPLIES.

In 1922 we purchased $12,239.26 worth of these supplies compared with $15,227.07 in 1921. The principal item under this heading is repairs for drilling machines.

EXPLOSIVES.

The unit cost or cost per ton for explosives shows a large decrease for 1922, being .232 compared with .324 in 1921. A portion of this decrease comes from the fact that the price of explosives dropped from an average of .1964 in 1921 to .1653 in 1922.

LUMBER & TIMBER.

We continue to use less timber underground, but the laying of 85,000 feet of 3" plank at the No. 9 Lump stockpile area increased the amount of plank used in 1922 considerably above the average of the last few years.

FUEL.

The coal burned at the Republic Mine shows a steady decrease. For sake of comparison, the following table shows the figures for the last few years:-

1914 - 8948	tons,
1915 - 7158	"
1916 - 8435	"
1917 - 8567	"
1918 - 6617	"
1919 - 5446	"
1920 - 3748	"
1921 - 1265	"
1922 - 1115	"

In the meantime the electric power expense has increased from nothing to $12,562.00 or the equivalent of 2093 tons of coal at the 1922 price. In terms of coal therefore we are operating our pumping, hoisting and compressor plants at only one-third of the 1914 cost, exclusive of the saving in fireman, coal handlers, etc.

NATIONALITY OF EMPLOYEES.

The following table shows the percentage of Finns, Scandinavians, English, etc., employed at the Republic Mine at the end of the year:-

	NO.MEN	P.C.
Finns,	103	47.8%
Scandinavians,	36	16.4%
English,	29	13.6%
French,	23	10.4%
Irish,	15	7.3%
Belgium,	6	2.7%
German,	4	1.8%
Total,	216	100.0%

UNDERGROUND WORKINGS.

1710' LEVEL:-

The stope opened up in 1921 continued to enlarge and at the end of 1922, we had reached a point approximately 100 feet vertical above the sill floor, and whereas, at the beginning of the year the breast was approximately 25 feet wide, at the end of the year this had increased to a length of approximately 120 feet. We drilled for the upward extension of this ore body on the 1570' Level but we did not find it, so that we presume that the back of this stope had pinched out just below the 1570' Level.

At the North-West corner of the stope, however, indications are that the ore will run further East, so that we hope to find considerable additional tonnage along the East side of this stope.

At the South end of the first stope nearest the shaft on the 2200 North Meridan and about 175 West, we drilled two holes and encountered considerable ore. We presumed that the ore between these holes was continuous and started a rock drift mid-way between them and found that a large horse of Jasper separated these two ore bodies. We stoped out the ore found in the drill holes but were very much disappointed that the ore in these drill holes did not develop into a good size stope.

In view of the ore found above the 1710' Level, we were planning at the close of the year to test this ground further with a Diamond Drill hole.

1850' LEVEL:-

There was no work done at this elevation except at the very close of the year when a contract was put to work cleaning out the drift and winze at the North end of old #4 Stope at approximately 2360 North and 210 West.

This winze leads down into a drift which connects with a raise leading to the stope on the 1950' Level, and we are opening this up to provide a new travelling road into the top of the stope.

1950' LEVEL:-

The rock drift driven along hole #428 was finished and a good size stope opened up on the ore found in drill holes Nos.: 428 and 469. There isn't any question but what this ore will go all the way up to the 1850' Level. At the end of the year, we had six miners employed here on each shift. So far, we have not been able to find this ore body on the 2050' Level.

2270' LEVEL:-

The stope West of the shaft was abandoned by the middle of the year. This ore body was not very large at the start but increased in area a short distance above the level. At a point about 40 feet above the level it began to pinch out and it was no longer profitable to mine this ore.

2470' LEVEL:-

To date, we have only found one ore body at this elevation; that being the main stope just East of the shaft. At the North end of this stope, the miners advanced to a short distance North along the hanging before they encountered the main Jasper back of the stope. On the footwall side a drift was driven in Soaprock and numerous cross-cuts driven from this drift to connect with the foot side of the stope. The bulk of the ore mined in the stope is drawn off through these footwall cross-cuts. On the hanging side of the stope just North of the main drift leading to the shaft, we built a stull and mined the ore out along the hanging and along the North side of the Jasper pillar.

Shortly after the middle of the year when mining in the back had reached a point about 20 feet below the 2370' Level, we took all the miners out of the stope. We thought it advisable to leave this pillar of ore to prevent the rock from the upper levels mixing with the ore left on the floor of this stope. By the end of the year we had trammed out all except about 10,000 tons of this broken ore and we were debating as to whether to try to break down more of this pillar of ore or not. Inasmuch as this particular ore body comes up under the main haulage drift between the Pascoe and No. 9 Shafts, I thought it adviaable not to disturb the filling of broken rock which extends from the 2370' Level up to within about 30 feet of the 2050' Level. I fear that after we blast the back of the stope below the 2370' Level, that the sudden rush of rock and ore down to the 2470' Level, might endanger the main drift between our two main shafts.

2570' LEVEL:-

Drifting at this elevation towards the new ore body was started early in the year 1922. By the end of the year we had opened up an ore body a little larger than the one on the 2470' Level, but unfortunately, at least a quarter of the ore lies under the Pascoe Shaft and can not be mined.

We have seven miners employed breaking ore in the stope and all of them are working on the hanging side. Timber cribs have been built about 10 feet out from the hanging and the cribs filled with ore and spaced about 10 feet apart, so that trammers can reach the broken ore. On the footwall side, a contract had started to drift and cut cross-cuts similar to the work done on the 2470' level.

At the close of the year we were also preparing to start a drift North along the hanging to explore the ground between the main stope and territory formerly served by the No. 9 winze.

This ground has not been explored below the 2270' Level at all and has not been thoroughly explored below the 2050' Level.

PASCOE SHAFT SINKING:-

At the close of the year, the shaft was down within 30 feet of the 2670' Level. Practically all of the lift between the 2570' and 2670' Levels is in high grade Bessemer ore. About 50 feet above the 2670', a little Jasper bagan coming in at the North-East corner of the shaft but 90% of the cross-section of the shaft at the end of December was in ore. We have been making pretty fair progress sinking about 25 feet a month. We have only room for four men on a shift and work two - eight hour shifts.

RESUME.

The general underground conditions at the Republic Mine were changed but little the past year as shown previously in this report; we have mined approximately the same tonnage as we have developed. Although this is true, I am not altogether satisfied with the speed with which we are opening up new ore bodies and for that reason at the close of the year, we have decided on an extensive development campaign for 1923. The principal development will be the proposed drift North along the hanging on the bottom level in Pascoe Shaft. We also plan on doing considerable Diamond Drilling from the 1710' Level down to the 2050' Level in the Pascoe Shaft.

ORE HOISTED FROM LEVELS, RESPECTIVELY, DURING 1922		
1710' Level,	Pascoe Shaft,	17,070
1780' "	" "	2,148
1950' "	" "	9,515
2272' "	" "	1,368
2372' "	" "	915
2472' "	" "	48,248
2572' "	" "	16,598
Shaft,	" "	2,394
2070' "	No. 9 "	332
Total,		98,588

REPUBLIC MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1922.

GRADE	IRON	PHOS.
Republic Bessemer Lump,	65.40	.027
Republic Basic Lump,	65.04	.040
Republic Basic Crushed,	64.39	.038
Republic Pascoe Lump,	55.98	.050
Republic Pascoe Crushed,	57.23	.044

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1922.

GRADE	Mine IRON	Mine PHOS.	Mine SILICA	Lake Erie IRON	Lake Erie MOIST.
Republic Bessemer Lump,	(All Mixed)				
Republic Basic Lump,	64.79	.040	4.98	64.60	.29
Republic Basic Crushed,	(All Mixed)				
Republic Pascoe Lump,	(All Mixed)				
Republic Pascoe Crushed,	56.92	.045	15.54	56.32	1.62

REPUBLIC MINE

ORE STATEMENT - DECEMBER 31ST, 1922.

	RUN-OF-MINE BESS.	BASIC	PASCOE	BESS. LUMP	BASIC LUMP	PASCOE LUMP	BESS. CRUSHED	BASIC CRUSHED	PASCOE CRUSHED	BESSEMER CRUSHED P.I.ST.P.	BASIC CRUSHED P.I.ST.P.	TOTAL	TOTAL LAST YEAR
On hand Jan.1,1922,	25,877	11,018	11,999	-	46,502	1,765	7,214	30,374	3,669	226	189	138,833	71,273
Output for Year,	-	-	-	-	51,020	-	-	47,254	314	-	-	98,588	73,014
Transferred,	-	-	1,759	180	10,588	91	-	10,401	1,675	-	-	-	-
Stockpile Shortage,	-	-	-	-	-	-	-	-	-	226	189	415	-
Total,	25,877	11,018	10,240	180	86,934	1,856	7,214	88,029	5,658	-	-	237,006	144,287
Shipments,	-	-	-	180	77,072	1,094	-	-	1,675	-	-	80,021	5,932
Balance on Hand,	25,877	11,018	10,240	-	9,862	762	7,214	88,029	3,983	-	-	156,985	138,355
Increase in Output,												25,159	
Increase in Ore on Hand,												18,630	

1922 -- 1-8 Hour Shift, 3 days per week, Jan. 1st to June 4th, 1922.
2-8 Hour Shifts, 6 days per week, June 5th to Dec. 31st, 1922.

1921 -- 2-8 Hour Shifts, 6 days per week, Jan. 1st to Feb. 8th, 1921.
2-8 Hour Shifts, 5 days per week, Feb. 8th to June 1st, 1921.
1-8 Hour Shift, 3 days per week, June 1st to Dec. 31st, 1921.

REPUBLIC MINE

SHIPMENTS FOR YEAR 1922.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Republic Bessemer Lump,	-	180	180	195
Republic Basic Lump,	25,884	51,188	77,072	3,092
Republic Pascoe Lump,	-	1,094	1,094	46
Republic Bessemer Crushed,	-	-	-	2,072
Republic Basic Crushed,	-	-	-	49
Republic Pascoe Crushed,	-	1,675	1,675	478
Total,	25,884	54,137	80,021	5,932
Total Last Year,	-	5,932	5,932	
Increase,	25,884	48,205	74,089	

REPUBLIC MINE

COMPARATIVE MINING COST FOR YEAR

	1922	1921	INCREASE	DECREASE
PRODUCT	98,173	73,014	25,159	
Underground Costs	1.986	2.948		.962
Surface Costs	.563	.880		.317
General Mine Accounts	.235	.344		.109
Cost of Production	2.784	4.172		1.388
Plant Account	.120	.136		.016
Equipment	.010	.017		.007
Taxes	.289	.416		.127
Central Office	.159	.238		.079
Contingent Expense	.123	.188		.065
Cost Adjustment	.029	.092		.063
Cost on Stockpile	3.514	5.259		1.745
Loading & Shipping	.037	.021	.016	
Total Cost on Cars	3.551	5.280		1.729
No.Days Operating	239	200	39	
No.Shifts & Hours	1-8-65 2-8-174	2-8 1-8		
Avg.Daily Product	411	365	46	
COST OF PRODUCTION				
Labor	1.968	3.017		1.049
Supplies	.816	1.155		.339
Total	2.784	4.172		1.388

REPUBLIC MINE

COMPARATIVE WAGES AND PRODUCT

	1 9 2 2	1 9 2 1	INCREASE	DECREASE
PRODUCT	98,173	73,014	25,159	
No.Shifts & Hours	1-8;2-8	2-8;1-8		
AVG.NO.MEN WORKING				
Surface	54	53	1	
Underground	124	133		9
Total	178	186		8
AVG.WAGES PER DAY				
Surface	4.04	5.02		.98-19.5%
Underground	4.14	5.29		1.15-21.7%
Total	4.11	5.21		1.10-21.1%
WAGES PER MO. OF 25 DAYS				
Surface	101.00	125.50		24.50
Underground	103.50	132.25		29.75
Total	102.75	130.25		27.50
PRODUCT PER MAN PER DAY				
Surface	6.91	5.95	.96	
Underground	3.10	2.54	.56	
Total	2.14	1.78	.36	
LABOR COST PER TON				
Surface	.584	.844		.260
Underground	1.336	2.087		.751
Total	1.920	2.931		1.011
AVG.PRODUCT BRK'G & TRM'G	7.25	5.91	1.34	
" WAGES CONTRACT MINERS	4.25	5.37		1.12
" " " TRAMMERS	5.16	7.39		2.23
" " CONTRACT	4.46	5.83		1.42
TOTAL NO. OF DAYS				
Surface	14,206¼	12,278	1,928¼	
Underground	31,679¼	28,772¼	2.907	
Total	45,885½	41,050¼	4,835¼	
AMOUNT FOR LABOR				
Surface	57359.55	61630.11		4,270.56
Underground	131177.71	152381.24		21,203.53
Total	188537.26	214011.35		25,474.09

Proportion Surface to Underground Men:

1922- 1 to 2.30
1921- 1 to 2.51
1920- 1 to 2.67
1919- 1 to 2.81
1918- 1 to 2.58

1921

2-8hr 6 days a week Jan.1 to Mar.5th;
2-8hr 5 " Mar.5 to June 1st;
1-8hr 3 " June 1 to Dec.31;

1922

2-8hr full time June 5,1922.

REPUBLIC MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY	AVERAGE PRICE.	AMOUNT 1922.	AMOUNT 1921.
50% Powder	108,250	.1653	17,896.20	13,196.52
Total Powder	108,250	.1653	17,896.20	13,196.52
Fuse	147,750	6.792	1,003.48	639.42
Caps	26,000	11.683	303.76	267.03
Tamping Bags	23,690	2.229	52.81	21.69
Cap Crimpers	7	.787	5.50	2.31
Battery Caps				3.24
Fuse, Igniters,				14.97
Total Fuse,Etc.			1,365.55	948.66
Total All Explosives			19,261.75	14,145.18
Product			98,588	73,014
Pounds Powder per ton of ore			1.09	.92
Cost per ton for Powder			.1815	.1808
" " Fuse, Caps, Etc.			.0138	.0129
" " All Explosives			.1953	.1937
Avg.Price per lb. for Powder			.1653	.1964

Republic Mine on 3 shifts (single) basis on June 1,1921.
" " 6 double shifts " " 1922.

REPUBLIC MINE.

SPIES - VIRGIL MINES.

The following is a report covering Shaft Sinking operations at the Spies Mine for the year 1922.

PRELIMINARY WORK.

In August it was decided to sink the Spies Mine shaft 800 feet deeper in order to reach the ore discovered by Diamond Drilling on the Virgil Lease.

E. & A. #429 covers the proposed cost of this work which includes not only the sinking of the shaft but also drifting on two levels and installation of new pumps and motor haulage. The erection of a new Engine House and its equipment was also authorized.

SINKING EQUIPMENT.

We are using the sinking equipment formerly designed for the Athens Mine shaft which includes cage, cars and revolving tipple for dumping cars.

The cage had been used at the Frances Mine while the cars and tipple were still at the Athens.

We also secured pumps from the Barnes-Hecker shaft.

All this equipment was loaded on one flat-car and arrived at the Spies property early in September.

Before the cage could be installed all the runners in the shaft were moved because the old cage-compartment had to be subdivided to provide for a new ladder-way, the old ladder-way becoming a new skip-compartment providing for two skips in balance. The sinking cage was then installed with the cross-heads spaced 40 feet apart.

The revolving tipple was placed about 10 feet above the elevation of the rock track and the rock from the shaft is handled by the old top tram equipment. We have enclosed the tipple with a temporary building.

The electric hoist at the mine was only designed to handle 600 feet of rope. As the shaft is to be sunk to a depth of 1250 feet and as it is necessary to use the skip as a counter-balance to hoist the cage, it was necessary to put throw-over devices in the centre and at both ends of the drum. We put three layers of rope on the drum. In order to use the skip as a counter-balance, we placed on the bale of the skip a 3½ foot sheave and the hoisting rope runs around this sheave, one end being securely fastened to the top of the shaft house so that the skip has only half its normal travel.

A pull bell was installed and so arranged as to ring direct to the engine house.

A safety gate was placed at the end of the rock track. This gate slides on guides and is always closed until the cage is hoisted when it is lifted by a projection on the roof of the cage, the gate again dropping back into place as the cage is lowered.

The bottom of the shaft was cleaned up and two new sets of timber placed.

SHAFT SINKING.

Sinking was actually started on October 2nd. The first two cuts were shallow as only light charges could be blasted so as not to damage the timber.

After sinking 12 feet the regular cut was drilled and blasted.

The shaft was sunk 224.5 feet in 1922 reaching a total depth of 678.5 feet.

DRILLING.

The regular round consists of thirty-six holes, six rows are drilled, six holes in each row. The cut of twelve holes is drilled 7' to 8' deep depending on the ground and the other twenty-four holes from 6' to 7'.

We started the shaft by using three B.C.R.430 Ingersoll-Rand Jackhammers, two Cleveland 44's and one Sullivan D.P. 33. The latter was soon discarded. The Cleveland Sinkers gave good satisfaction, being fast drillers, until about November 20th when harder ground was encountered. We then tried out the new Ingersoll-Rand D.C.R. #23 and found the latter to be far superior to any other machine in the shaft. On December 20th, we put six D.C.R. #23 into service. The following table shows the time consumed drilling the complete rounds:-

MONTH	CUT NO.	AVERAGE HOURS DRILLING PER CUT	MACHINES USED
October,	1 to 17	8.08	I.R.230; C-44; D.P. 33.
Nov. 1 - 10,	18 to 27	7.40	I.R.230 & Cleveland 44.
Nov.10 - 30,	28 to 35	11.15*	" "
Dec. 1 - 18,	36 to 44	13.10	" "
Dec.18 - 19,	45	17.00	" "
Dec.20 - 31,	46 to 49	10.87	D.C.R. #23.

* Encountered hard ground on 28th cut.

You will note that on December 18 - 19 it took seventeen hours to drill the thirty-six holes. The new machines were put into use on the next cut and reduced the time of drilling over one-third. On December 27th, twenty-six holes were drilled in four hours with the new machines, so that we expect to drill the complete round in six hours or less.

BLASTING.

The first three cuts in the shaft gave us trouble due to missed holes. We discovered that the caps were not impervious to water and so we dipped them in capseal compound following this up by wrapping the caps and the delay action fuses with electrician's

tape and again dipping the wrapped fuse in seal compound. No further trouble with missed holes followed until November 17th, 21st and 24th when we had three sets of holes that failed to explode. I decided then that the leading wire was too small from surface down to the 3rd level, as we were using the regular lighting circuit for blasting, there being eight or ten lamps on a #14 wire. We then connected our blasting wires onto a separate #12 duplex wire from surface to the bottom of the shaft. The leading wire is wound on a reel and kept in the Engine House to keep it from getting damp.

We tried several ways of blasting the holes. We found when blasting all the holes in one operatinn using delay fuzes to make the cut holes go first that the ground did not break nearly as well or the cuts break as deep as when blasting the twelve holes first, mucking the cut and then blasting the balance of the holes.

We also secured the best results connecting the holes in parallel. We are using instantaneous fuzes and the first four delays. The blasting circuit carries alternating current at 220 volts.

MUCKING.

During the first three or four weeks all the rock was mucked by shoveling same into the car on the cage. This was a slow operation and with a full crew of six men and a boss the best mucking done the first month was twenty-four cars per shifts of eight hours, the average for the entire month being 2.46 cars per hour or approximately 19½ cars per shift.

In November we introduced shoveling boxes, the idea being that during the four minutes the cage was travelling up and down the shaft the men ordinarily idle, would muck dirt into the boxes which would be dumped into the car when the cage returned to the bottom of the shaft.

We first built three wooden boxes 3' x 3' x 1' high. These boxes had two sides and the back nailed on, the front being left open. Chains were fastened to each corner, the two chains on each side being connected at the upper end with a ring. A Tugger hoist was placed on the wall plates 50 feet above the bottom of the shaft. The Tugger was controlled by one of the crew at the bottom of the shaft by running a clothes line from that point to the lever that operated the machine. We placed a large hook in the end of the cable leading from the Tugger hoist and the boxes were quickly lifted by the rings and dumped by the boss standing in the car on the cage.

These boxes worked out so well that steel boxes were constructed of 1/8" steel plate, 3' x 3' x 1½'. These boxes with the load of rock weighed approximately one-half ton. Four of these boxes filled the car and it is obvious that by having two of these boxes ready to dump when the cage reached the bottom of the shaft that considerable time would be saved. As proof of this we find that as high as 36 cars have been filled a shift compared with 24 by the old method.

How the mucking speed has increased is apparent from the following table:-

MONTH	CARS LOADED	HOURS MUCKED	CARS PER HOUR
Oct.,	796	323	2.46
Nov.,	973	297	3.28
Dec.,	818	219.5	3.73

December shows an improved mucking speed of a little over 50%.

TIMBERING.

Thirty-six sets of timber and two sets of bearers were placed in the shaft. The bearers are put in every 100 feet vertically. The regular timber sets are placed six foot centres. The outer walls of the shaft are lined with 2" Tamarack and split Cedar lagging is used for blocking.

DELAYS.

We experienced a number of delays, the most serious occurring the last week in December when the hoist motor burned out.

On October 5th two coils burned out on the stator of the hoist motor causing five hours delay.

On October 23rd operations were delayed one hour due to trouble with air compressor.

The chains on the safety dogs on the cage broke on November 1st, and it took one and one-half hours to repair same.

On November 11th trouble with the hoist motor delayed us two hours.

On December 5th the skip froze fast to the guides and sinking was delayed two hours.

On December 28th at noon several coils on the rotor of the hoist motor burned out and although several electricians worked on this day and night, we did not resume sinking until 11:00 P.M. on December 30th.

In previous annual reports will be found accounts of numerous delays on account of the hoist motor. This motor was purchased from the Allis-Chalmers Company for the Chase Mine in the North Lake District. This motor gave trouble there. After being removed to the Spies Mine and being used a year, the motor was completely re-wound because it had been giving us so much trouble. For the last two months, it has lived up to its previous reputation as a trouble maker.

LABOR & WAGES.

We had great difficulty in keeping our shaft gangs intact. It took us over a week at the very beginning to get six miners for each of the three shifts and then we were constantly hiring new men. One day the Captain hired eight men or 45% of the total crew.

Shaft sinking is the most unpleasant kind of work around the mine and as all the mines in the Iron River District were short of miners, the mines paying the highest wages naturally drew the men away from the other mines. We realized that the only way to keep men at all would be to pay a sliding scale of wages, depending on the footage sunk. The Company account rate is $4.75 per day and the bonus starts after 70 feet. The following table shows the wages the men earn depending on the footage. I have only shown a few of the rates to illustrate the schedule:-

FEET SUNK	RATE PER DAY	RATE OF INCREASE PER FOOT	ESTIMATED COST PER FOOT OF SHAFT
70	4.75		$103.40
84	5.31	.04	93.14
85	5.35¼	.04¼	92.55
99	5.94¾	.04¼	85.58
100	5.99¼	.04½	85.17
114	6.62¼	.04½	80.21
115	6.67	.04¾	79.91
129	7.33¼	.04¾	76.25
130	7.38¼	.05	76.04
144	8.08¼	.05	73.32
145	8.13½	.05½	73.16
150	8.41	.05½	72.42

In October the men earned only Company account wages but in November they averaged $5.61 per day. The first half of December they made $5.07 and only Company account the last half, due to hoist motor going out of commission.

In order to show what great difficulty we have trying to make footage with only the shaft gangs partially filled, I have tabulated the various shifts showing those on which we worked full crews of men and those on which we were short:-

		TOTAL NO. OF DAYS.
Shifts worked with full crew	105	630
" " " 5 Miners,	97	485
" " " 4 "	38	152
" " " 3 "	9	27
" " " 2 "	4	8
" " " 1 "	2	2
Total,	255	1304

If we had been full handed right along the miners would have worked a total of 1530 days, so that progress in the shaft was curtailed about 18% due to labor shortage.

TIME SCHEDULE.

The following table shows the time consumed drilling the holes, mucking, timbering, piping, etc.:-

	NO. OF HOURS	PERCENTAGE OF TOTAL TIME
Drilling,	503.25	23.98%
Blasting,	163.10	7.79%
Mucking,	1003.00	47.87%
Timbering,	277.10	13.25%
Miscellaneous,	109.05	5.21%
Delays,	39.50	1.90%
Total,	2095.00	100.00%

MISCELLANEOUS DATA.

EFFICIENCY OF CREWS.

BOSS.	DRILLING HOLES PER MAN HOUR.				MUCKING CARS PER MAN HOUR			
	OCT.	NOV.	DEC.	AVER.	OCT.	NOV.	DEC.	AVER.
Carbines,	.76	.68	.64	.69	.46	.51	.59	.52
Johnson,	.71	.65	.51	.62	.41	.50	.59	.50
Pelkinen,	.61	.71	.48	.60	.41	.51	.52	.48

You will note that the crew headed by John Carbines is getting the best results both in drilling and mucking. You will also note that the reduction in the holes drilled per hour in December is due to hard ground in the shaft. Also the introduction of the mucking boxes increased the average cars filled per hour considerably in December.

POWDER CONSUMPTION.

MONTH	STICKS OF POWDER	STICKS PER FOOT OF SHAFT	POUNDS PER FOOT OF SHAFT
Oct.,	3342	50	27.1
Nov.,	5014	55	30.1
Dec.,	4360	65	35.3

DIAMOND DRILLING.

I have made no mention of the holes drilled on the Virgil Lease as this ground will be covered by E. L. Derby in his report. He will also give the ore estimate figures.

SPIES MINE.

The foregoing report also covers all the work done on the Spies Mine Lease.

No mining was done in the Spies Mine proper since June, 1921, and there will be no change in the ore estimate as shown in the 1921 Annual Report.

SPIES MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1922.

GRADE	IRON	PHOS.	SILICA
Spies,	(No Production)		
Virgil,	(No Production)		

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1922.

	Mine			Lake Erie	
GRADE	IRON	PHOS.	SILICA	IRON	MOIST.
Spies,	(All Mixed)				
Virgil,	(No Shipments)				

ORE STATEMENT - DECEMBER 31ST, 1922.

	VIRGIL	SPIES	TOTAL	TOTAL LAST YEAR
On hand January 1, 1922,	835	29,925	30,760	14,713
Output for Year,	-	-	-	44,514
Stockpile Overrun,	-	7,500	7,500	-
Total,	835	37,425	38,260	59,227
Shipments,	-	35,123	35,123	28,467
Balance on Hand,	835	2,302	3,137	30,760
Decrease in Output,			37,014	
Decrease in Ore on Hand,			27,623	

1922 -- Mine Idle Jan. 1st to Oct. 1st, 1922.
3-8 Hour Shifts, 6 days per week, Oct. 1st to Dec. 31st, 1922.

1921 -- 2-8 Hour Shifts, 6 days per week, Jan. 1st to April 18th, 1921.
1-8 Hour Shift, 6 days per week, April 18th to June 1st, 1921.
Mine closed May 31st, 1921.

SPIES MINE

SHIPMENTS FOR YEAR 1922.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Spies,	-	35,123	35,123	28,467
Virgil,	-	-	-	-
Total,	-	35,123	35,123	28,467
Total Last Year,	-	28,467	28,467	
Increase,	-	6,656	6,656	

SPIES MINE

COMPARATIVE MINING COST FOR YEAR

	1922	1921	INCREASE	DECREASE
PRODUCT	7,500	44,514		
Underground Costs		1.561		
Surface Costs		.237		
General Mine Accounts		.082		
Cost of Production		1.880		
Taxes		.375		
Central Office		.063		
Contingent Expense		.007		
Idle Expense		.382		
Cost Adjustment		.060		
Cost on Stockpile		2.868		
Loading and Shipping		.015		
Total Cost on Cars		2.883		
No.Days Operating		126		
No.Shifts & Hours		2-8-89 1-8-37		
Avg.Daily Product		353		
COST OF PRODUCTION				
Labor		1.300		
Supplies		.580		
Total		1.880		

Mine closed May 31, 1921. Not operated during 1922.
7,500 tons is Stockpile Overrun.

SPIES MINE

COMPARATIVE WAGES AND PRODUCT

	1 9 2 2	1 9 2 1	INCREASE	DECREASE
PRODUCT	7,500	44,514		37,014
No.Hours & Shifts	2-8;1-8			
AVG. NO. MEN WORKING				
Surface	1	10		9
Underground	3	28		25
Total	4	38		34
AVG.WAGES PER DAY				
Surface	3.02	4.76		1.74-36%
Underground	3.99	5.64		1.65-29%
Total	3.69	5.42		1.73-32%
WAGES PER MO. OF 25 DAYS				
Surface	75.00	119.00		44.00
Underground	99.75	141.00		41.25
Total	92.50	135.50		43.00
PRODUCT PER MAN PER DAY				
Surface		15.49		
Underground		5.32		
Total		3.96		
LABOR COST PER TON				
Surface		.307		
Underground		1.060		
Total		1.367		
AVG. PRODUCT BRK'G & TRM'G		8.01		
" WAGES CONTRACT MINERS				
" " " TRAMMERS		6.61		
" " "		6.61		
TOTAL NO. OF DAYS				
Surface	431½	2874¼		2442-3/4
Underground	977	8361-3/4		7384-2/3
Total	1409½	11236		9727-½
AMOUNT FOR LABOR				
Surface	1303.96	13691.34		12387.38
Underground	3894.47	47177.95		43283.48
Total	5198.43	60869.29		55670.86

Proportion Surface to Underground Men:

1922 - 1 to 3.
1921 - 1 to 2.8
1920 - 1 to 3.1
1919 - 1 to 2.91
1918 - 1 to 2.86

Operated 2-8hr shifts 6 days a week Jan to Apr.17,'19.
" 1-8hr " 6 " April 18 to May 31;
Mine closed May 31, 1921.
Not operating during 1922. Product shown is stockpile overrun.

CROSBY MINE

ANNUAL REPORT FOR 1922.

No mining activities were undertaken at the Crosby Mine during the year 1922. Underground work was discontinued May, 1921, and was never resumed.

There is approximately 60,000 tons of high grade wash ore remaining in the track and shaft pillar. Aside from this, there is some scattered wash ore on and below the main haulage level. This material for the most part is quite low grade and the cost of extraction is relatively high.

Estimates were made on the cost of removing the track and shaft pillar and the necessary alterations to do this. According to the terms of our lease and the requirements of the Fee Owner's Agent, this ore could not be profitably handled and the other tonnage underground would not justify a continuation of operations by itself.

After considering the matter carefully, a report was made and it was decided to throw up the lease. A formal notice of surrender of the lease was sent to the Fee Owners on October 31st. Under the terms of the lease, this gave us until December 31st. to remove our property from the Crosby ground, but the Fee Owner's Agent extended this time until next spring. The lease on the washing plant and other auxiliary lands continues for a period of 25 years after the cancellation of the Crosby Mine lease.

During the first months of the year only two men, a day and night policeman, were employed at the Crosby property. Daily trips of inspection were made to the washing plant and storage dam and the regular policing of the mine premises was carried on.

A small force of men was employed in March and April in cleaning the surface drainage ditches of snow and debris, so that the spring flood water would be taken care of. The ground under the storage dam spillway had heaved and cracked the concrete in places. It was necessary to do some repair work here in the spring to hold back the water.

The Great Northern section crew spent some time during April in repairing the Crosby Mine tracks and laying a track for stockpile loading.

It was found necessary to secure additional pumping equipment in connection with the open pit operations at the Boeing and the Crosby underground centrifugal pump was brought to surface and shipped to Hibbing.

We received word to start washing our stockpile on June 22nd and a small crew was hired to put the plant and equipment in shape for this work.

A force of from six to 10 men were engaged from the latter part of June until early in September in removing rails, trolley equipment, the Model "28" shovels, pipe, motors cars and other mining equipment. This work progressed very satisfactorily, although we had to do some cleaning and repairing of drifts in order to remove all of the rail and sub-level cars.

Two cars of 40-lb. rail were loaded and shipped to Michigan. This rail was in first class condition.

One care of machinery was forwarded to Gwinn on October 12th. This consisted of the hoist, with motor and electrical equipment, two sets of dump plates from the shaft house, the Sullivan compressor with a 50 HP motor and the motor generator set, with the electrical equipment. Included in this car were also the four 4-ton skips.

The two Model "28" shovels, Nos. 12 and 13, were loaded on flat cars and shipped to the Hill-Trumbull Mine on October 23rd. These machines will be stored here until they are required at some other property. The shovels can be repaired at the Hill-Trumbull to good advantage whenever the occasion demands.

Two of the 6-ton underground locomotives were overhauled and shipped with the Helmer Mine boiler to the Spies Mine at Iron River. All the repair parts for these locomotives were shipped with them, as our other motors in this district are of different design. The other two underground locomotives at the Crosby Mine, which were purchased in 1915, were sent to the Hill-Trumbull Mine. They will be overhauled there and sent to one of our other operations when desired. These locomotives are of a much later design and better machines than the two sent to the Spies.

A considerable amount of old scrap plates and rail were sold to the Hill-Trumbull Mine for repair work in connection with the washing plant. Arrangements were made to dispose of the rest of the Crosby scrap to the West End Scrap Iron & Metal Company of Duluth. The loading of this scrap was started the latter part of December and should be completed early in January.

The Marion Model "60" shovel, which was used for stockpile loading, the six standard railway cars, the 45-ton railway locomotive and the six 7-yd. dump cars, were sent to the Hill-Trumbull Mine for storage during October. This equipment can be repaired to good advantage at the Hill-Trumbull and will be held there until there is some use for it at some of our other properties. It is quite likely that we will be able to use most of this equipment to advantage in our Mesaba Range properties this year.

All of the mine supplies were transferred from the warehouse to the machine shop and will be held there until shipped to some of our other properties.

The two cottages, four dwelling houses, office-warehouse, and barn, were sold to Mr. P. H. Tweed of Nashwauk the forepart of November, for a consideration of $2,500.00.

WASHING PLANT

Washing plant operations were started July 5th and the stockpile was loaded out by September 29th.

We aimed to turn out 1,000 tons of concentrates per 10-hour shift, operating days only, but due to the fact that there was considerable frost in the pile and the Great Northern car service was poor, we fell somewhat short of this figure. There was considerable frost at the bottom of the pile and it was necessary to break these chunks down before they could be handled to advantage at the mill. This slowed up our operations appreciably. The Great Northern car supply was rather poor at times and we frequently suffered losses of from two to three hours duration. On account of the dock situation, we were forced to close down entirely from July 19th to the 22nd, inclusive.

We operated the Crosby washing plant during the past season with a force of 13 men, including the foreman. The mill operated very satisfactorily, and with the exception of several shut downs to repair the conveyor belt, there were no serious interruptions. The old conveyor belt was in poor shape to start with, but by repeatedly patching it, we were able to get through the season. The belt was worthless when it was taken off.

The mill was given a thorough overhauling during the winter of 1920-1921 and as the service last year was lighter than usual, the repairs to put it in first class shape should not be heavy.

The following is the tonnage and analysis of the crude ore treated and the concentrates secured during 1922:

	Tons	Fe.	Phos	Sil.
Crude Ore Treated During 1922----------	95,510	44.68	.043	29.46
Bessemer Concentrates Produced During 1922------	18,814	58.83	.045	8.95
Non-Bessemer " " " 1922------	39,339	58.67	.051	8.98
TOTAL CONCENTRATES PRODUCED DURING 1922---------	58,153	58.72	.049	8.97

According to our skip tally, we had 89,754 tons of crude ore in stock. We loaded out 95,510 tons, thus securing an overrun of 5,756 tons on the crude ore.

We estimated our ratio of concentration at 60%, figuring the Bessemer concentrates at 18,000 tons and the Non-Bessemer at 36,000 tons. Our actual gross recovery was 60.9%, giving us an overrun of 4,154 tons in the concentrates, 851 tons in the Bessemer and 3,303 tons in the Non-Bessemer.

Our recovery of iron units amounted to 80.02%, which compares with 80.91% for the season of 1920.

The final clean-up cut with the stockpile shovel entailed considerable work, as we scraped all the ore and sorted out considerable rock.

The average analysis of the product from the machines for the past season was as follows:

	Fe.	Phos	Sil.
Screen----------	55.01	.050	12.92
Logs----------	58.51	.051	8.93
Turbo----------	58.89	.037	10.48
Tables----------	63.56	.022	6.79
Tailings----------	31.80	---	--

At the conclusion of washing operations, all of the piping at the mill was disconnected and drained. The machines were carefully oiled and greased and everything put in shape for an indefinite shutdown. The old conveyor belt was taken off.

As the mill is to be leased to the M. A. Hanna Company, no repairs were attempted. It was considered advisable for the M. A. Hanna Company to make such repairs as they deemed advisable, and thus in case anything went wrong, it would be entirely their lookout. As stated before, the repairs should not be extensive, as the machinery was in relatively good shape at the end of the season.

When the lease to the M. A. Hanna Company has been executed, we will go over the mill carefully with the M. A. Hanna Company's representatives, so as to determine just what shape the machinery is in. It is the understanding that the mill will be turned back to us in the same shape as it was when leased, ordinary wear and tear excepted.

SHIPMENTS

Following are the cargoes of Crosby concentrates shipped during the 1922 season and the analysis of same as obtained at the Mine and by the Lower Lake Chemists:

BESSEMER ORE

	Fe.	Phos	Sil.	Mois.	Fe.Nat.
PIONEER - 7/20/22 - 2,999 Tons.					
Mine	59.37	.045	8.73	----	-----
Crowell & Murray	58.45	.045	----	7.53	54.05
ISHPEMING - 8/10/22 - 2,706 Tons.					
Mine	58.67	.045	8.98	----	-----
Hughes-Guentzler	58.10	.048	----	7.34	53.84
Oscar Textor	58.00	.047	----	7.04	53.92
J. H. SHEADLE - 8/20/22 - 2,170 Tons.					
Mine	59.29	.045	8.60	----	-----
Oscar Textor	60.10	.045	----	7.45	55.62
Hughes-Guentzler	59.50	.044	----	7.39	55.47
PONTIAC - 8/27/22 - 2,356 Tons.					
Mine	58.84	.046	8.59	----	-----
Oscar Textor	58.45	.045	----	7.82	53.88
Cremer & Case	58.80	.045	----	7.26	54.53
PANAY - 9/16/22 - 3,870 Tons.					
Mine	58.81	.045	9.00	----	-----
Cremer & Case	58.50	.045	----	7.39	54.18
MICHIGAN - 10/17/22 - 4,713 Tons.					
Mine	58.80	.045	11.67	----	-----
Hughes-Guentzler	57.95	.047	-----	6.59	54.13
Oscar Textor	58.10	.044	-----	6.41	54.38

NON-BESSEMER ORE

	Fe.	Phos	Sil.	Mois.	Fe.Nat.
PONTIAC - 7/13/22 - 2,106 Tons.					
Mine	57.88	.052	9.86	----	-----
Oscar Textor	58.40	---	----	7.36	54.10
HARRY YATES - 8/4/22 - 9,517 Tons.					
Mine	58.66	.052	8.95	----	-----
Cremer & Case	59.00	----	----	7.04	54.85
J. T. KOPP - 8/21/22 - 8,561 Tons.					
Mine	58.72	.051	8.97	----	-----
Oscar Textor	59.10	---	----	7.57	54.63

C. F. MOLL- - - - - - - - - - - - - - - -9/6/22- - - - - - - - - - - - -8,400 Tons.

	Fe.	Phos	Sil.	Mois.	Fe.Nat.
Mine----------	58.69	.051	8.89	----	-----
Cremer & Case---------	59.00	---	----	7.83	54.38

C. F. MOLL- - - - - - - - - - - - - - - -9/24/22- - - - - - - - - - - - - 8,474 Tons.

Mine----------	58.81	.050	8.67	----	-----
Crowell & Murray------	58.75	---	----	7.38	54.41

M. A. REEB- - - - - - - - - - - - - - - -11/6/22- - - - - - - - - - - - - 5,621 Tons.

Mine----------	58.99	.055	7.59	----	-----
Oscar Textor----------	58.00	---	----	6.13	54.45

The Bessemer Concentrates were shipped in six cargoes, which averaged as follows:

	Tons	Fe.	Phos	Sil.	Mois.	Fe.Nat.
Mine Analysis----------	18,814	58.94	.045	9.54	----	-----
Lower Lake Analysis-----	18,814	58.43	.046	----	7.15	54.27

The Non-Bessemer Concentrates were shipped in six cargoes, averaging as follows:

	Tons	Fe.	Phos	Sil.	Mois.	Fe.Nat.
Mine Analysis----------	39,339	58.71	.052	8.75	----	-----
Lower Lake Analysis-----	39,339	58.81	---	----	7.26	54.54

The composite samples of the season's shipments shows the following results:

	Tons	Fe.	Phos	Sil.	Mn.	Alum	Lime	Mag.	Sul.	Loss
Bessemer-----	18,814	58.68	.045	8.89	1.49	1.11	.18	.13	.012	3.54
Non-Bessemer-	39,339	58.63	.050	8.94	1.58	1.08	.20	.15	.013	3.52

CROSBY MINE

AVERAGE MINE ANALYSIS ON CRUDE ORE FOR YEAR 1922.

GRADE	IRON	PHOS.	SILICA
Crosby Crude,	(No Production)		

AVERAGE MINE ANALYSIS ON CONCENTRATES FOR YEAR 1922.

GRADE	IRON	PHOS.	SILICA
Crosby Bessemer Concts.,	58.83	.045	8.95
Crosby Non-Bess. Concts.,	58.64	.050	9.02

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1922.

GRADE	Mine IRON	Mine PHOS.	Mine SILICA	Lake Erie IRON	Lake Erie MOIST.
Crosby Bessemer,	(All Mixed)				
Crosby,	58.67	.051	8.93	58.93	7.44

ORE STATEMENT AND SHIPMENTS FOR YEAR 1922.

	CRUDE ORE	CONCENTRATES	SHIPMENTS	PERCENTAGE OF RECOVERY	TOTAL LAST YEAR
On hand January 1, 1922,	89,754	-	-		30,621
Output for Year,	-	58,153	58,153	61 %	59,133
Stockpile Overrun,	5,756	-	-		-
Total,	95,510	58,153	58,153		89,754
Crude Ore Treated,	95,510				
Balance on Hand,	-	-			89,754
Decrease in Output,	53,377				
Decrease in Ore on Hand,	89,754				

1922 -- Mine idle during Year.
Washing Plant operated from July 5th to Sept. 30th, 1922.

1921 -- 2-8 Hour Shifts, Jan. 1st to May 8th, 1921.
Mine closed May 7th, 1921.

CROSBY MINE

COMPARATIVE MINING COST FOR YEAR

	1922	1921	INCREASE	DECREASE
PRODUCT (Crude)	5,756	59,133		
Underground Costs		1.462		
Surface Costs		.194		
General Mine Accounts		.088		
Cost of Production		1.744		
Original Cost		.026		
Plant Account		.044		
Taxes		.169		
Central Office		.071		
Contingent Expense		.008		
Idle Expense		.425		
Cost Adjustment		.038		
Winter Expense		.006		
Cost on Stockpile		2.531		
Loading and Shipping				
Total Cost on Cars		2.531		
No.Days Operating		108		
No.Shifts & Hours		2-8hr		
Avg.Daily Product		548		
COST OF PRODUCTION				
Labor		1.329		
Supplies		.415		
Total		1.744		

Mine closed May 7,1921. 5756 tons is Stockpile Overrun.

CROSBY MINE

COMPARATIVE WAGES AND PRODUCT

	1922	1921		
PRODUCT	5,756	59,133		
No. Shifts & Hours		2-8hr		
AVG. NO. MEN WORKING				
Surface	5	9		
Underground	2	36		
Total	7	45		
AVG. WAGES PER DAY				
Surface	4.68	5.33		
Underground	4.66	5.98		
Total	4.68	5.85		
WAGES PER MO. OF 25 DAYS				
Surface		133.25		
Underground		149.50		
Total		146.25		
PRODUCT PER MAN PER DAY				
Surface		20.81		
Underground		5.53		
Total		4.37		
LABOR COST PER TON				
Surface		.256		
Underground		1.082		
Total		1.338		
AVG. PRODUCT BRK'G & TRM'G BASED ON CRUDE ORE		7.05		
TOTAL NO. OF DAYS				
Surface	1468-3/4	2,841		
Underground	637-$\frac{1}{4}$	10,693$\frac{1}{4}$		
Total	2106	13,534$\frac{1}{4}$		
AMOUNT FOR LABOR				
Surface	6,879.04	15141.99		
Underground	2,967.58	63961.97		
Total	9,846.62	79103.96		

Mine closed May 7, 1921.
Lease surrendered Dec.31, 1922. 5756 tons stockpile overrun.

MEADOW AND FOWLER MINES

ANNUAL REPORT FOR 1922.

The mine and location premises have been policed throughout the year, the watchman being the only one steadily employed here. These properties were closed down on June 3rd., 1921, and the leases given up.

At the time of closing down, all mining timber, drills, small tools and pipe fittings were transferred to the Boeing Mine, together with all supplies that could be used at our other Mesaba properties. Only repair parts and material for the boilers, hoist, compressor, pumps and gasoline locomotives were left in the Meadow warehouse.

In November, we sold to Mr. David Silk of Duluth, the scrap at the Meadow-Fowler Mines. This included the boilers, underground cars and several old pumps, besides the miscellaneous material that had accumulated for several years. Mr. Silk started loading out the scrap about the middle of the month and had forwarded the last of eleven cars by December 6th.

An effort was made to sell the hoist and compressor, but no market was found and it was decided to store this equipment at the Wade Mine. A crew of six men, including Captain Wivell, started to dismantle the hoist and compressor on November 27th. This equipment, together with pipe, rail, three gasoline locomotives, four Cameron pumps, blacksmith and underground tools, the remaining warehouse supplies and lockers from the dry house, were sent to the Wade Mine for storage. Four cars were loaded out.

The sheet iron warehouse was torn down and the material shipped to the Wade. A part of this lumber and sheet iron will be used to provide a building for storing the material from the Meadow. This work was completed December 8th.

Everything of any value belonging to the Cleveland-Cliffs Iron Co. has now been removed from the Meadow-Fowler Mines, with the exception of the mine buildings and ten dwelling houses. We will try and dispose of these as soon as possible. The watchman will be released January 1st., 1923.

STOCKPILES

The original lease of the Meadow Mine states that all property, including stockpiles, must be removed within 90 days after cancellation. According to a supplementary agreement reached with the Fee Owners of the Meadow Mine, we were granted permission to allow our stockpiles to remain on their land after the ninety day period had expired, provided that 20,000 tons be shipped by September 1st., 1921, and the balance prior to September 15th, 1922.

The tonnage and average analyses of the Meadow-Fowler stockpiles as of January 1st., 1922, follows:

	Tons	Fe.	Phos	Mn.	Sil.
Meadow Stockpile----------	29,532	56.89	.072	1.95	9.61
Fowler " ----------	16,316	56.62	.059	1.66	10.92
TOTAL AND AVERAGES---------	45,848	56.79	.067	1.85	10.08

Preliminary work for stockpile loading at the Meadow Mine was started on April 11th. Four cars of coal were received and unloaded on the stockpile ground, rather than from the coal dock. From this location the coal was supplied to the shovel in wheelbarrows instead of teaming. A No. 8 Cameron pump was installed in the shaft to supply water for the shovel and a steam and water line laid from the shovel to the pump.

The Wade Mine 70-ton Bucyrus shovel which was used for loading out part of the stockpile last season, was laid up here during the winter, and after a few minor repairs, was ready for this year's service.

Actual loading operations began on April 19th, but progressed very slowly, due to bad frost conditions in the pile. Approximately 9,000 tons had been loaded out by May 1st., when word was received to discontinue.

The "A" frame on the shovel failed on the afternoon of May 1st., just previous to receiving word to stop loading operations. This accident allowed the boom to drop and considerable damage was done to the swinging circle and various front braces. The broken parts were loaded onto a flat car and shipped to the Hill-Trumbull Mine for repairs. The repairs were made at once, and the shovel was put in shape for loading by the 23rd of May.

In the meantime a boat was due at Two Harbors for a cargo of Meadow ore, with only a part tonnage in dock. We were able to secure a shovel from the Miller Mine at Aurora. This shovel was used on May 15th, 16th and 17th, loading out approximately 3,000 tons needed to make the cargo.

Stockpile loading was resumed again on June 19th and continued to July 20th, when both the Meadow and Fowler piles were loaded out. It was necessary to do a considerable amount of hand cleaning over the bottom of the stocking ground, on account of the frozen condition of the ore, during the early part of the season. Three to five men followed behind the shovel cuts. Quite a tonnage was recovered from this work.

Upon completion of loading operations here the shovel was shipped to the Boeing Mine for stockpile work.

The shipments from the Meadow Mine for the season of 1922 amounted to 60,098 tons, made up of 39,538 tons of Meadow ore and 20,560 tons of Fowler ore.

The tonnage and average analysis of the season's shipments follows:

	Tons	Fe.	Phos	Mn.	Sil.
Meadow----------	39,538	56.72	.073	2.01	9.68
Fowler----------	20,560	56.35	.052	1.10	11.79
TOTAL & AVERAGES--	60,098	56.59	.066	1.70	10.40

According to our skip tally records, we show an overrun of 10,006 tons of Meadow and 4,244 tons of Fowler ore. This is a much larger tonnage than we had anticipated, as compared with our estimate of 5,000 tons of Meadow ore. We were quite sure the Meadow pile would develop an overrun, but we were not positive with regard to the Fowler, as it had never shown one in the past. The large overruns were partly due to the fact that the piles had not been cleaned up in several years.

The analysis of the seven cargoes shipped during the season checked very closely with the stockpiles in making.

Following are the cargoes of Meadow-Fowler ore shipped during the season of 1922 and the analyses, as obtained from the Mine and by Lower Lake Chemists' sampling:

"A.S.UPSON"- - - - - - - - - - - - - - 5/10/22- - - - - - - - - - - - - - 6,279 Tons.

	Fe.	Phos	Mn.	Sil.	Mois.	Fe.Nat.
Mine----------	56.77	.065	1.51	11.33	-----	-----
Cremer & Case---------	56.50	---	---	---	12.53	49.42

"A.S.UPSON"- - - - - - - - - - - - - - - - -5/18/22- - - - - - - - - - - - 6,339 Tons.

	Fe.	Phos	Mn.	Sil.	Mois.	Fe.Nat.
Mine----------	56.62	.067	1.70	10.89	-----	-----
Crowell & Murray-----	56.00	---	----	-----	11.59	49.51

"W. G. MATHER"- - - - - - - - - - - - - - -6/26/22- - - - - - - - - - - - -10,506 Tons.

Mine----------	55.56	.059	1.47	12.20	-----	-----
Oscar Textor---------	55.55	---	----	-----	11.54	49.14

"PONTIAC"- - - - - - - - - - - - - - - - - -7/5/22- - - - - - - - - - - - - -11,805 Tons.

Mine----------	58.10	.066	1.51	8.31	-----	-----
Cremer & Case--------	56.90	---	----	----	11.16	50.55

"SHEADLE"- - - - - - - - - - - - - - - - - -7/10/22- - - - - - - - - - - -10,147 Tons.

Mine----------	56.52	.055	1.75	10.18	-----	-----
Crowell & Murray-----	56.45	---	----	-----	11.14	50.16

"MICHIGAN"- - - - - - - - - - - - - - - - -7/17/22- - - - - - - - - - - - 10,037 Tons.

Mine----------	56.56	.068	1.97	9.99	-----	-----
Oscar Textor---------	56.00	---	----	----	10.35	50.20

"WOLF"- - - - - - - - - - - - - - - - - - -7/22/22- - - - - - - - - - - - 4,984 Tons.

Mine----------	56.03	.070	2.20	9.99	-----	-----
Oscar Textor---------	55.05	---	----	----	9.74	49.69

MEADOW-FOWLER MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1922.

GRADE	IRON	PHOS.	SILICA	MANG.
Meadow,	(No Production)			
Fowler,	(No Production)			

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1922.

GRADE	IRON	Mine PHOS.	SILICA	MANG.
Meadow,	(All Mixed)			
Fowler,	(All Mixed)			

ORE STATEMENT - DECEMBER 31ST, 1922.

	MEADOW	FOWLER	TOTAL	TOTAL LAST YEAR
On hand January 1, 1922,	29,532	16,316	45,848	31,405
Output for Year,	-	-	-	34,671
Stockpile Overrun,	10,006	4,244	14,250	-
Total,	39,538	20,560	60,098	66,076
Shipments,	39,538	20,560	60,098	20,228
Balance on Hand,	-	-	-	45,848
Decrease in Output,			20,421	
Decrease in Ore on Hand,			45,848	

1922 -- Mine Idle during Year.

1921 -- 2-8 Hour Shifts, Jan. 1st to June 4th, 1921.
Mine closed June 3rd, 1921.

MEADOW-FOWLER MINE

SHIPMENTS FOR YEAR 1922.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Meadow,	-	39,538	39,538	9,573
Fowler,	-	20,560	20,560	10,655
Total,	-	60,098	60,098	20,228
Total Last Year,	-	20,228	20,228	
Increase,		39,870	39,870	

MEADOW MINE

COMPARATIVE MINING COST FOR YEAR

	1922	1921	INCREASE	DECREASE
PRODUCT	14,250	34,671		
Underground Costs		1.967		
Surface Costs		.273		
General Mine Accounts		.156		
Cost of Production		2.396		
Taxes		.144		
Central Office		.077		
Contingent Expense		.009		
Idle Expense		.461		
Cost Adjustment		.060		
Cost on Stockpile		3.147		
Loading & Shipping		.055		
Total Cost on Cars		3.202		
No.Days Operating		130		
No.Shifts & Hours		2-8hr		
Avg.Daily Product		267		
COST OF PRODUCTION				
Labor		1.617		
Supplies		.779		
Total		2.396		

NOTE: Mine abandoned May 31,1921.
Not operated 1922; Lease surrendered 1921.
14,250 tons is Stockpile OverRun.

MEADOW MINE

COMPARATIVE WAGES AND PRODUCT

	1922	1921
Product	14,250	34,671
No.Shifts & Hours		2-8hr
AVG.NO.MEN WORKING		
Surface	3	10
Underground		22
Total	3	32
AVG.WAGES PER DAY		
Surface	4.20	5.07
Underground		6.21
Total	4.20	5.84
WAGES PER MO. OF 25 DAYS		
Surface		126.75
Underground		155.25
Total		146.00
PRODUCT PER MAN PER DAY		
Surface		10.70
Underground		5.10
Total		3.46
LABOR COST PER TON		
Surface		.473
Underground		1.216
Total		1.689
AVG.PRODUCT BRK'G & TRM'G		7.63
" WAGES CONTRACT MINERS		6.69
" " " TRAMMERS		6.69
" " "		6.69
TOTAL NO. OF DAYS		
Surface	1056¼	3239-3/4
Underground		6792
Total	1056¼	10031-3/4
AMOUNT FOR LABOR		
Surface	4434.22	16409.81
Underground		42150.74
Total	4434.22	58560.55

PROPORTION SURFACE TO UNDERGROUND MEN:

1921 - 1 to 2.2
1920 - 1 to 2.3
1919 - 1 to 1.84
1918 - 1 to 2.31

Mine abandoned May 31,1921.
Lease surrendered 1921.
Product is stockpile overrun.

HILL-TRUMBULL MINE
ANNUAL REPORT FOR 1922

Ore operations at the Hill-Trumbull Mine for the year 1922 resulted in the production of 529,858 tons of wash ore and 3,084 tons of direct shipping ore. From the wash ore, 346,931 tons of concentrates were secured. This production compares with 437,871 tons of wash ore, yielding 277,954 tons of concentrates, and 29,084 tons of direct ore during the ore season of 1921.

Ore activities were begun May 10th, 1922, and closed on October 30th.

Our maximum estimate of production for 1923 has been placed at 550,000 tons, but as the Mesaba-Cliffs Iron Mining Company will not require this tonnage, we have also made an estimate of 300,000 tons and we are making our plans for operation in line with the latter estimate.

The expected analysis for the two estimates is as follows:

ESTIMATED PRODUCTION - 550,000 TONS

	Tons	Fe.	Phos	Sil.	Mois.	Fe.Nat.
Hill-Direct Shipping Ore---	75,000	58.00	.055	13.00	8.00	53.36
Hill Bessemer Concentrates-	10,000	58.50	.045	8.75	9.00	53.24
Hill Non-Bess. " -	165,000	60.00	.060	7.00	6.50	56.10
Trumbull Bessemer " -	36,000	58.00	.045	9.20	9.00	52.78
Trumbull Non-Bess. " -	264,000	59.00	.060	8.00	7.00	54.87
TOTAL---------	550,000					
Average Bessemer Grade-----	46,000	58.11	.045	9.10	9.00	52.88
Average Non-Bess. " -----	504,000	59.18	.059	8.42	6.99	55.04

ESTIMATED PRODUCTION - 300,000 TONS

	Tons	Fe.	Phos	Sil.	Mois.	Fe.Nat.
Hill-Bessemer Concentrates-	10,000	58.50	.045	8.75	9.00	53.24
Hill Non-Bess. " -	140,000	59.75	.060	7.25	6.50	55.86
Trumbull Bessemer " -	6,500	58.00	.045	9.20	9.00	52.78
Trumbull Non-Bess. " -	143,500	58.75	.060	8.25	7.00	54.64
TOTAL---------	300,000					
Average Bessemer Grade-----	16,500	58.30	.045	8.93	9.00	53.05
Average Non-Bess. " -----	283,500	59.24	.060	7.76	6.75	55.24

In the case of the 550,000 tons estimate, we would operate on double shift from the opening to the close of navigation, whereas to produce 300,000 tons, we figure on working day shift only, at least for the most part. The 300,000 tons program we look upon with favor, on account of conditions in the

pit. To start with, in producing the smaller tonnage we will not crowd the stripping contractor and we will have a better opportunity to dispose of the taconite and lean material, which overlies the southerly part of the Trumbull deposit now stripped. Further than this, in securing the smaller tonnage, it will not be necessary to sink our ore cuts below the water level. Should we operation on the 550,000 tons schedule, all of the available territory will have to be worked and the ore cuts will be carried below the ground water level. We mined to the water level during 1922 and endeavored to take sinking cuts below, but we found that the moist ore would not run in the washing plant conveyor chute and operations were slowed down to an appreciable extent. It would, therefore, be necessary to drain the ore below the water level before mining.

To secure the 550,000 tons of ore, we would be obliged to extend our cuts in Area "A" to the water surface in the old pit. At present the bottom of the cuts in Area "A" are 11' above the water level in the pit. As the ore remaining in Area "A" is only approximately one cut in depth, a large amount of track work would be required to produce a comparatively small tonnage of ore. Taking all of these conditions into consideration, we feel that the mining costs to produce 300,000 tons of ore would be more favorable than for the larger tonnage. Working under either schedule, the cost per ton of concentrates in cars will be somewhat higher in 1923 than it was during the past year. This will be largely due to the fact that a part of the ore remaining in Area "A" and the top layer of ore in the south end of Area "B", is of a very inferior grade and we will not be able to secure a high percentage of recovery. It is quite likely that we will have to stock some of the lean ore on account of its very poor structure and low iron content. Practically all of the 1922 tonnage was mined with one steam shovel, while next season it will be necessary to use two machines in order to do the necessary grading and absorb as much of the low grade material as we can handle at the mill.

Our expected analysis for 1923 is somewhat lower than that for the past season. This is on account of the poor quality of some of our 1923 ore. We have test pitted the material along the south rim of Area "A" and the southerly part of the Trumbull ore to be mined in Area "B" next season.

HILL-TRUMBULL ORE ESTIMATE OF JANUARY 1ST. 1923

Following is an estimate of the ore in sight at the Hill-Trumbull properties on January 1st., 1922, the tonnage mined during the past year and the estimate of January 1st., 1923.

A factor of 14 cubic feet per ton was used in the direct shipping ore and 18 cubic feet per ton for the wash material.

ORE ESTIMATE OF JANUARY 1ST. 1922

	Tons.
Hill Bessemer Direct Shipping Ore	642,000
Hill Non-Bessemer Direct Shipping Ore	1,484,000
Hill Bessemer Concentrates	1,444,000
Hill Non-Bessemer Concentrates	1,204,000
TOTAL HILL ORE IN SIGHT JANUARY 1ST., 1922	4,774,000
Trumbull Bessemer Direct Shipping Ore	85,000
Trumbull Non-Bessemer Direct Shipping Ore	310,000
Trumbull Bessemer Concentrates	2,417,000
Trumbull Non-Bessemer Concentrates	1,718,000
TOTAL TRUMBULL ORE IN SIGHT JANUARY 1ST., 1922	4,530,000
GRAND TOTAL HILL AND TRUMBULL ORE IN SIGHT JANUARY 1ST., 1922	9,304,000

ORE MINED DURING 1922

Hill Non-Bessemer Direct Shipping Ore	3,084
Hill Bessemer Concentrates	4,136
Hill Non-Bessemer Concentrates	175,147
TOTAL HILL- ORE MINED DURING 1922	182,367
Trumbull Bessemer Concentrates	16,828
Trumbull Non-Bessemer Concentrates	150,820
TOTAL TRUMBULL ORE MINED DURING 1922	167,648
GRAND TOTAL HILL AND TRUMBULL ORE MINED DURING 1922	350,015

ORE ESTIMATE OF JANUARY 1ST., 1923

Hill Bessemer Direct Shipping Ore	642,000
Hill Non-Bessemer Direct Shipping Ore	1,481,000
Hill Bessemer Concentrates	1,440,000
Hill Non-Bessemer Concentrates	1,029,000
TOTAL HILL ORE IN SIGHT JANUARY 1ST., 1923	4,592,000
Trumbull Bessemer Direct Shipping Ore	85,000
Trumbull Non-Bessemer Direct Shipping Ore	310,000
Trumbull Bessemer Concentrates	2,400,000
Trumbull Non-Bessemer Concentrates	1,567,000
TOTAL TRUMBULL ORE IN SIGHT JANUARY 1ST., 1923	4,362,000
GRAND TOTAL HILL AND TRUMBULL ORE IN SIGHT JANUARY 1ST., 1923	8,954,000

HILL-TRUMBULL MINE.

The tonnages are all given as direct shipping, or in the case of the wash ore, reduced to a concentrated basis, a factor of 60% being used as our expected gross recovery.

Further ore operations to the west of the taconite island tend to confirm our belief that check drilling should be done to the north before any stripping is attempted in this locality. While we have not sufficient information to warrant changing our ore estimates at this time, the drilling of the area in question will no doubt lead to a revision. This drilling may result in re-classifying some of the wash ore as non-washable, but on the other hand we may show some extension of the wash ore body to the eastward. It is quite likely that the taconite island will extend in a northwesterly direction and that a washable grade will be developed to the north and east. The Oliver drill holes, which are spaced 300' apart are not sufficient to determine the limits of the deposit definitely. We do not anticipate doing any stripping in this area for the next several years, and a certain amount of check drilling should be done prior to any additional stripping here.

The south Hill ore bank in Area "A" is somewhat leaner than we had anticipated, but we have encountered no rock in this area and the estimating factor should be ample to cover the reduction in the percentage of gross recovery and, therefore, our ore estimate should not be changed.

We do not contemplate any exploratory work at the Hill-Trumbull properties during 1923, further than test pitting ore to determine grades ahead of the shovel cuts. The outline of the ore body is quite well established and we do not anticipate adding to our ore reserves by future explorations.

The average analysis of the ore in the Hill and Trumbull properties on January 1st., 1923, is as follows:

HILL MINE

	Tons	Fe.	Phos	Sil.	Fe.Nat.
Bessemer Direct Shipping-----	642,000	58.00	.045	13.00	53.36
Non-Bess. " " -----	1,481,000	58.00	.055	13.00	53.36
Bessemer Concentrates--------	1,440,000	60.50	.045	7.50	56.00
Non-Bess. " --------	1,029,000	61.00	.059	6.50	56.43
TOTAL AND AVERAGES----------	4,592,000	59.46	.051	9.82	54.88

TRUMBULL MINE

	Tons.	Fe.	Phos	Sil.	Fe.Nat.
Bessemer Direct Shipping-----	85,000	56.40	.040	12.79	51.32
Non-Bess. " " -----	310,000	58.04	.060	9.85	52.82
Bessemer Concentrates--------	2,400,000	60.00	.043	8.00	55.50
Non-Bess. " --------	1,567,000	60.00	.080	8.00	55.50
TOTAL AND AVERAGES----------	4,362,000	59.79	.057	8.22	55.23

STRIPPING

The A. Guthrie Company stripped 1,033,510 cubic yards from the Hill-Trumbull properties during the past year. The total stripping on their 3,000,000 yard contract amounts to 1,848,403 cubic yards, as of January 1st., 1923. This leaves a balance of 1,151,597 yards to be moved during 1923 to complete their contract, under the terms thereof.

The Model "300" Marion shovel, which had been taken into the Hill-Annex Mine for winter work, was returned to the Hill-Trumbull on March 4th. The machine was moved to the west end of the pit, where it was repaired. This work was started on March 18th and was completed April 12th. The shovel was found to be in much worse shape than anticipated, and although practically a month's time was spent on repairs, the machine was not put in first class shape and a number of breakdowns occurred during the operating season.

Actual stripping operations were started in Area "A" on April 13th. In the first cut, the shovel traveled toward the south and loaded on the approach track, the surface material being cleaned to the top of the ore. This cut was finished May 4th and the machine was turned back for the second cut. The dirt from the second cut was loaded onto a track laid on the old Oliver berm. This formed a hog's back between the two cuts. The second cut stripped to the southerly limits of Area "A". Good progress was made in the early operation of the second cut, but the ground changed at the northeast end to a wet blue clay with a coating of muskeg. This slowed operations down to a considerable extent, due to the material sticking in the cars and the sliding of the bank. The second cut was finished June 19th and the shovel then dug out the hog's back between the two cuts, loading the material on a track laid along the south stripping face.

The original estimate of stripping to be removed from Area "A" was approximately 300,000 cubic yards. This figure was exceeded by 100,000 yards, due entirely to the sliding of the clay banks. This has been the only place in the Hill-Trumbull pit where our banks have slid to any extent. A portion of the dirt removed from Area "A", amounting to 45,765 cubic yards, was taken from

the Oliver property. It was necessary to remove this material in order to provide a berm for the protection of future ore cuts when mining operations are carried to the property line.

Upon the completion of the work in Area "A" on July 12th, the shovel was moved across the approach and started the first cut in Area "B" at about the center of this area. The north one-half of the cut was taken first in order to uncover Trumbull ore in the shortest possible time. In taking the north one-half of the first cut, an old surface drainage ditch was dug out. From this point to the end of the cut, the top half of the bank sluffed quite badly. The ground in the vicinity of this ditch was somewhat saturated and it would not stand up. The north one-half of the first cut in Area "B" was completed September 14th and the shovel was turned back toward the south, cleaning the surface of the ore and removing the material which had sluffed from the top of the bank. This clean up work was finished September 25th and the shovel started digging a full 80' bank. The cut progressed southward to the Trumbull line. Stripping conditions here were very favorable, as the bank stood up very well and the material was loaded on one of the approach tracks. The yardage for the last three months of the year would have been much larger if there had not been considerable delays due to breakdowns of the shovel.

The cut was completed on November 26th and the machine was then laid up for repairs. Work was resumed December 1st, the shovel moving diagonally into the high bank in order to secure a full width of cut.

Due to very severe weather conditions, it was decided to suspend stripping operations December 20th. The "300" shovel and other equipment will be thoroughly overhauled this winter by the contractor. Mr. Baxter, General Manager of the A. Guthrie Company, advises us that stripping operations will be resumed as early in the spring as weather conditions permit. He now figures on resuming work by the middle of March.

On account of the sluffing of the stripping bank south of Area "A" it is deemed advisable to take a clean-up cut with a small shovel prior to the opening of navigation in 1923. Considerable material has slid out to the edge of the ore and it is advisable to clean this back to prevent a wash into the pit.

We expected to do this work last fall, but weather conditions were so severe that we had to postpone it until spring.

The 1922 stripping was mostly placed on the two main dumps, a third dump having been in use only during the last three months of the year. One of the old dumps extends from the concrete culvert across the muskeg swamp and the material is fanned to the south, the second being an extension from the southeast corner of the old Oliver ground. The material placed in the muskeg was washed from the cars during part of the year. The water in Mud Lake finally reached such a low elevation that the contractor had to stop pumping here. During the balance of the season the bulk of the material was handled from the old Oliver extension and from the new dump, which was made by raising a track across the grounds to the south line of the NW¼ of the NE¼ of Section 29, 56-23 and fanning eastward.

The following table shows the quantity and cost of the stripping by months for 1922:

MONTH	CUBIC YARDS	COST PER YARD	TOTAL COST
April--------	81,578	$ .2877	$23,470.61
May----------	163,881	.3041	49,835.23
June---------	126,277	.2946	37,200.26
July---------	99,002	.3067	30,366.85
August-------	142,812	.3213	45,886.03
September----	118,517	.3325	39,404.06
October------	156,534	.3548	55,534.55
November-----	93,861	.3552	33,337.73
December-----	51,048	.3400	17,359.57
TOTAL--------	1,033,510	$ .3216	$332,394.89

The increase in the price per yard during the year was due to the higher price paid for coal and labor by the contractor.

The proposed stripping program for 1923 consists of two cuts, one of approximately 3,500' in length and extending north across Area "B" onto Hill ground west of the taconite island. The second cut will be 1,800' long and it is entirely in Trumbull ground.

REPAIRS TO RENTED HOUSES

The houses in Marble, which were purchased during 1919 and 1920, were inspected by the Master Carpenter during the summer. It was found that all of them were in need of repairs and working upon his suggestions and recommendations, estimates were made and approved and the work was done by the mine carpenters. These houses are now in fair shape.

The following table shows the estimates and costs of the work done on the houses:

HOUSE NO.	OCCUPANT	DESCRIPTION OF WORK	ESTIMATED COST	ACTUAL COST
1	H. C. Bolthouse	Interior Finish-------	$ 49.90	$ 46.80
		Plastering----------	7.50	9.32
		Shingling----------	148.00	127.59
		Repairing Porches-----	10.00	2.88
		TOTAL----------	$215.40	$186.59
2	Ray Wilson	Interior Finish-------	$ 65.20	$ 65.98
		Repairing Porch-------	8.00	22.38
		Repairing Foundation--	200.00	118.61
		TOTAL----------	$273.20	$206.97
3	G. S. Hayden (Old Office)	Shingling----------	$ 43.50	Not Done
		Foundation----------	125.20	126.23
		Painting----------	8.00	8.30
		TOTAL----------	$176.70	$134.53
4	Wm. O'Melia	Shingling----------	$146.60	$153.12
		Repairs to Porch------	148.70	35.22
		Basement----------	84.92	To be done in Spring.
		Plastering----------	90.00	68.04
		Interior Finish-------	81.40	111.13
		TOTAL----------	$551.62	$367.51
5	Lester Phelps	Toilet Addition-------	$225.00	$227.21
		Interior Finish-------	24.60	13.09
		TOTAL----------	$249.60	$240.30

TRACKS

The A. Guthrie Company extended the west approach track into the pit and made the necessary connections. This completed our double track system from the pit to the dumps and we have operated to very good advantage with the contractor during the past year.

The track work in connection with mining operations during 1922 was almost entirely confined to ore loading tracks in the pit, only a few days having been spent on the main line from the pit to the washing plant.

Our track crew only averaged five or six men, the locomotive crane being used to very good advantage in lining and transferring tracks.

During the shut down in October, when we were cut off of railway cars, the pit crews from the steam shovels and the blasters were added to the track gang. A line was laid the full length of the stripping cut in Area "B" and all of the old ties and loose material about the pit were gathered up and taken to the yards.

The reason that so little work was necessary on the main tracks was entirely due to the excellent condition in which they were put after the ore season in 1921. This year the ore season closed much later and we thought it was more advisable to remove the dirt from the approach track and backfill with wash ore, than to spend any time on the main line tracks. When the approach job was completed the weather conditions were such that track work would have been expensive and we can do what work is necessary to much better advantage next spring.

The approach tracks from the south limit of Area "A" to the north rested on from 3' to 7' of surface material. As the ore has been cleaned on both sides of the approach, it was considered advisable to remove this surface material and utilize wash ore in its place. The surface material would have continued to wash out onto the ore and considerable hand cleaning would have resulted. Further than this, it was difficult to keep the tracks up, on account of the material being clay. This work was completed the middle of December, the Model "36" shovel being used in excavating the surface material and the 88-C Bucyrus for digging the lean ore for filling.

REPAIR WORK

The repair work on equipment was started at the close of the ore season in 1921 and was carried on with a small force of men until the spring of 1922.

The 88-C Bucyrus shovel received a general overhauling, but no heavy repair work was necessary. This machine has operated with practically no breakdowns during the past summer, but as it handled the bulk of our ore, it will no doubt require considerable repair work this winter.

The 85-C Bucyrus shovel was taken down and overhauled. The boom and dipper sticks were rebuilt. This machine has done very little work during the year and the repairs this winter will be comparatively light.

It was necessary to give the Model "36" revolving shovel a complete overhauling. This machine was not used extensively last year and the repairs this winter will be correspondingly light.

Locomotives Nos. 101, 102 and 103 were found to be in very good shape and received only minor repairs last winter. Locomotives Nos. 17 and 19, purchased from Butler Brothers in 1919, were found to be in very poor condition and extensive repairs were necessary.

The 20-yard dump cars were gone over and some slight alterations were made in the dumping mechanism. The repairs were relatively small and they should not be at all extensive this year.

The 12-yard dump cars were relined and the doors were repaired.

Quite a considerable portion of the washing plant repairs were made in the shops during the months of January and February. The material was loaded onto a flat car and taken to the shops, as it is practically impossible to work to advantage in the unheated mill.

Practically no winter repair work has been started on the open pit equipment, as a part of it was in service until the middle of December and we are only carrying a very small force in the shops. Repair work will be started on the shovels and locomotives early in the year.

It will not require a large force of men to do the necessary work to put the equipment in condition for operation by the opening of navigation.

HILL-TRUMBULL MINE.

DRAINAGE DITCH NORTH OF PIT

In order to control the surface water to the north of the Hill-Trumbull and Hill-Annex properties, the Interstate Iron Company dug a surface drainage ditch, extending from a point 900' east of our east line onto the property north of the east Trumbull forty. The waters from this ditch will be drained into the stream which feeds Mud Lake. The ditch dug by the Interstate Company is approximately 5,700' long and involved the handling of approximately 32,000 cubic yards of dirt. The work was started the middle of February and completed by the end of March. The ditch handled the surface waters in a very satisfactory manner and the wash along our north and east banks is now of no consequence.

ORE OPERATIONS

Ore operations were started on May 10th and continued until the 30th of October.

Preparations were made for direct ore loading and the small revolving shovel was moved to the east end of the pit. We had anticipated moving a substantial tonnage of direct shipping ore and the shovel was cut into the ore bank in readiness to load when necessary. The shovel was only operated two shifts in June and as it was decided to postpone our direct ore shipping schedule, the machine was moved onto other work at the west end of the pit.

The tonnage and analysis of the direct ore produced follows:

	Tons.	Fe.	Phos	Sil.
Hill Non-Bessemer Direct Ore---------	3,084	56.92	.056	14.38

Wash ore operations were begun in Area "A" with the 88-C Bucyrus shovel, the work during May and June being largely in the nature of sinking cuts, which were dead-ended near the southwest extremity of the cleaned area. The revolving shovel was used to extend the cuts to the stripping limits during the latter part of the season.

In one of the last sinking cuts, the shovel encountered water, the elevation being 1312, and although this did not interfere with pit work, it was found that the ore would not run in the mill chutes and mining activities

were not carried below this level. This reduced the tonnage of available Trumbull ore from Area "A", as the water level was several feet above that in the old pit and we had figured on sinking several feet below that.

When the cuts had reached the maximum permissable depth, the high ore bank was gopherholed and blasted ahead of the shovel. This was done, as the bank was too high to reach with the dipper and we found it cheaper, as well as affording a larger product, to shake the ground. The wear on the dipper teeth was quite excessive while digging in a solid bank. The cost of renewing teeth was greater than the expense of gopherholing and blasting. The blasting crew never consisted of more than five men.

All of the ore cuts were taken with the shovel headed toward the southwest until the middle of August. By this time the bank had been cut back to the east some distance and the Trumbull cuts were becoming very short. In order to secure the maximum amount of Trumbull and minimum Hill ore, the shovel was turned around and the remaining cuts in Area "A" were taken with the machine headed northeast.

We found that it would be impossible to secure the expected tonnage of Trumbull ore from Area "B" on account of the slow progress made by the stripping contractor. We, therefore, did everything possible to secure the very maximum tonnage of Trumbull ore from Area "A".

The season's shipping schedule called for a total of 152,000 tons from Area "A", 121,000 tons from Area "B", 17,000 tons from the old pit and 60,000 tons of direct ore. It was decided early in the season not to take the direct ore and it was impossible to carry out the wash ore schedule, as the ore in Area "B" was not available until the first of October and it was necessary to produce the material from Area "A" and the old pit. Only two shallow cuts were taken in Area "B".

The first cut in Area "B" was not started until October 4th, when the 85-C Bucyrus was cut in near the Hill line. It was necessary to operate the 88-C machine in Area "A" until this sinking cut had progressed some distance, in order to insure sufficient ore to keep the washing plant operating to capacity. The

85-C shovel was worked until October 12th, when the hoisting drum failed. This machine was taken out of the pit and the 88-C completed the season's work in Area "B". Two sinking cuts were taken in Area "B". On account of encountering a capping of taconite at the south end of these cuts, the shovel was moved back into Area "A" the last few days of the season.

The wash ore produced from Area "B" was of very good quality, with the exception of the material from the south end of the cuts. Here lean ore under a rock capping was encountered and the grade of concentrates fell off decidedly. It will be necessary to operate one shovel in a better grade material when we are handling this very lean ore.

Taken as a whole, the wash ore operations for the season were satisfactory. The average quality of ore produced was good and we only handled 1,011 tons of rock in the pit and 1,883 tons at the plant.

While we had practically no delays in wash ore operations in the pit, due to accidents or breakdowns, the Great Northern car service was such that our equipment was idle upon numerous occasions. From October 13th to 19th, inclusive, we had to discontinue loading ore, due to the fact that we had a very large tonnage in dock and no boats named.

The bulk of the ore shipped during 1922 was of Non-Bessemer grade, only 20,964 tons of Bessemer ore having been produced. The schedule called for a considerably larger tonnage than this, but that portion of Area "A" from which we had expected to obtain Bessemer ore proved to be of such low grade that it could not be handled by itself and secure any tonnage result at the mill. There was no high grade Bessemer ore available to be mixed in with this lean material.

The tonnage and analysis of the wash ore produced during 1922 follows:

	Tons.	Fe.	Phos	Sil.
Hill Wash Ore----------	270,744	46.15	.047	27.66
Trumbull Wash Ore----------	259,114	45.38	.050	27.16
TOTAL AND AVERAGES---------	529,858	45.77	.048	27.42

WASHING PLANT

The repair work at the washing plant was discontinued during January and February on account of the very severe weather. A crew of four men was taken into the shop to work on the conveyor rollers and such other parts as could be conveniently moved. The work at the plant was resumed early in the spring. The machines were reassembled, the conveyor belt put on and everything made ready for the ore season. Several lengths of 14" pipe were laid, extending from the concrete launder. This was done to carry our tailings out to a point where the grade was sufficient to carry them away. The tailings basin, immediately east of the washing plant, had been filled to the level of the launder.

Washing operations were started May 10th and after the first few days, when adjustments were made, everything ran very smoothly.

The average quality of the crude ore treated throughout the season was very good and only in exceptional cases was the operation of the mill slowed down on account of poor material. Some of the Trumbull ore from the south end of the property was of such a fine structure and contained so much paint rock, that it was necessary to run on a very light feed. Even the concentrates from this material were of quite satisfactory grade. As we only handled 1,883 tons of rock at the mill, this item was not of serious consequence.

The character of the ore washed during 1922 was such that the screen and logs carried most of the load. Fortunately the analysis of the screen and log product was very good. The percentage of product from the turbos and tables was relatively small and the analysis was unusually low.

The delays to operations on account of mechanical trouble were not frequent and none of them were serious. The heavy loads carried on the logs caused the 25 HP motors to overheat. By diverting slightly more than half of the load to one of the logs and replacing the 25 HP motor with a 40 HP, this difficulty was overcome.

The conveyor belt, which had been in service since washing operations were started in 1920, was in pretty bad shape by the end of the season, but we managed to get through without putting on the new belt. A total of 1,159,592

tons of crude ore has been handled on the belt. The old belt was subjected to very severe service the first few weeks that it was in operation and we feel that the new belt should handle a larger tonnage.

The principal cause of delays at the mill during the past season was the insufficient supply of empty railroad cars. During the first two months of the season, the situation was not serious, but during the rest of the year, our operations were affected quite materially. The total loss of time on account of not having railroad cars amounted to 207½ hours.

The season's tonnage was secured by operating day shifts only. Some overtime was worked, as well as several Sundays. If the supply of cars had been ample, it would not have been necessary to work any overtime or Sundays to secure our tonnage.

The average number of men employed per shift was 15 and it was found that the operation could be carried on very satisfactorily with this number. If we were to handle any quantity of rock, we would, of course, have to employ additional men.

The washing season was completed on October 30th and after draining all pipe lines, the crew immediately started on winter repairs. The pumps were disconnected and all of the machines in the plant were taken apart for inspection. The conveyor belt was removed and the rollers were taken off for cleaning and greasing.

The largest job to be undertaken is the re-riveting and straightening of the pans on the 8' conveyor. When this machine was built the links were put on with button head rivets and when these shear off, the pans become loose and cause considerable trouble. All of the pans are being taken to the shops, where they will be taken apart and reassembled with countersunk rivets.

The tailings basin has been filled to the top of the dyke for a distance of 800'. The small revolving shovel was engaged the last six weeks of the year in building up the low points in the dyke with the dewatered tailings. The dyke will be of sufficient height to take care of the tailings for next season. It is comparatively cheap to build up the dyke with tailings from time to time as the occasion demands.

The outside surface of the metal covering of the washing plant buildings has become quite rusty and a contract was let for painting it. The work was started in October and was all completed, with the exception of the crusher building, when the severe weather made it advisable to discontinue. The job will be finished next spring.

Following is the tonnage and analysis of the crude ore treated and the concentrates produced during the season's of 1921 and 1922:

	Tons	Fe.	Phos.	Sil.
Crude Ore Treated During 1921-------	437,871	46.77	.048	26.34
Crude Ore Treated During 1922-------	529,858	45.77	.048	27.42
Concentrates Produced During 1921---	277,954	62.08	.053	5.60
Concentrates Produced During 1922---	346,931	60.48	.061	5.53

Ratio of Recovery for 1921 ---------- 63.48%
Ratio of Recovery for 1922 ---------- 65.48%

Recovery of Iron Units for 1921 ---------- 83.71%
Recovery of Iron Units for 1922 ---------- 86.68%

Although the analysis of the crude ore and concentrates for 1921 is somewhat higher than for 1922, the ratio of recovery and the recovery of iron units were better last year. The structure of the 1922 ore was somewhat better and there was considerably less rock.

The composite samples of the 1922 shipments follow:

	Tons	Fe.	Phos	Sil.	Mn.	Alum	Lime	Mag.	Sul.	Loss
Hill Bessemer Concentrates-	4,136	58.99	.046	8.84	.10	.59	.13	.15	.013	5.33
Trumbull " " -	16,828	59.82	.046	5.63	.19	.60	.14	.16	.011	7.33
TOTAL BESSEMER----------	20,964	59.65	.046	6.26	.17	.60	.14	.16	.012	6.93
Hill Non-Bess. Concentrates-	175,147	61.08	.062	5.49	.10	.68	.15	.16	.014	6.09
Trumbull Non-Bess. " -	150,820	59.91	.063	5.58	.13	.56	.13	.17	.015	7.82
Hill Non-Bess. Direct-------	3,084	57.29	.057	13.64	.11	1.51	.16	.16	.013	2.69
TOTAL NON-BESSEMER----------	329,051	60.53	.062	5.61	.11	.63	.14	.16	.014	6.85

The average analysis of the product from the several machines during 1921 and 1922 follows:

1-9-2-1	Fe.	Phos	Sil.
Screen----------	60.23	.059	8.56
Log----------	61.60	.055	7.09
Turbo----------	58.93	.043	11.35
Tables----------	56.17	.037	16.06
Tailings--------	18.18	---	---

1-9-2-2	Fe.	Phos	Sil.
Screen----------	61.20	.065	4.30
Log----------	61.07	.064	4.93
Turbo----------	54.75	.054	15.83
Tables----------	47.07	.045	27.33
Tailings----------	15.75	---	---

The iron content of the product from the screens and logs averaged

about the same for the two years, but the turbo and table product was much lower in 1922. This is due entirely to the structure of the ore, there having been less high grade material in the fines last season.

The estimate of product from the several machines was as follows:

Screen---------- 26%.
Logs------------ 71%.
Turbo & Tables-- 3%.