

GWINN MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1 9 1 7.	AMOUNT 1 9 1 6.
40% Powder, Red Cross	200	.1765	35.30	
50% " " "	39,650	.1632	6473.97	9114.55
60% " " "	3,000	.2054	616.24	
60% Gelatin	61,950	.2639	16345.28	1723.94
80% "	50	.3016	15.08	
<u>Total Powder</u>	<u>104,850</u>	<u>.2240</u>	<u>23485.87</u>	<u>10838.49</u>
Fuse	274,700	6.275	1723.64	1105.09
Caps	54,100	12.50	676.41	561.97
Cap Crimpers	25	.37	9.22	4.30
<u>Total Fuse, Etc.</u>			<u>2409.27</u>	<u>1671.36</u>
<u>Total All Explosives</u>			<u>25895.14</u>	<u>12509.85</u>
Product			161,963	144,066
Pounds Powder per ton Ore			.647	.512
Cost per ton for Powder			.145	.0752
" " Fuse, Caps, Etc.			.015	.0116
" " All Explosives			.160	.0868
Avg. Price per lb. for Powder			.224	.1469

JOPLING MINE.

The work for the year was confined to extending the 7th level drift from the Gwinn Mine to a point beneath the line of the Jopling shaft, raising the shaft a distance of about 94 feet, and drifting on an elevation of 85 feet above the 7th level drift from Gwinn Mine. The work in detail is as follows:

At the close of 1916 the 7th level drift had reached a point 402 feet East of the Gwinn Mine property line. This drift was extended 150 feet due East, then South-East 155 feet. At a point 70 feet North-West of the breast of this drift a drift was extended 55 feet North-West which brought it to a point beneath the line of the Jopling shaft. The ground near the shaft was then sliced out to make room for material and for a puffer, preparatory to starting to raise the shaft. A tail drift was also driven from the shaft a distance of 74 feet to the North-West to provide room for motor cars for handling the material coming from the raise. The raising of the shaft was then started, but after reaching a height of about 95 feet above the 7th level the raise had to be abandoned on account of the large inflow of water, which amounted to over 400 gallons per minute. It was decided to drift from the raise towards the foot-wall to see if it would be possible to cut off the water. Accordingly a drift was started from the raise at a level of 85 feet above the 7th level and was extended 42 feet North-East across the formation to the foot. This drift cut about eight feet of lean ore, consisting of limonite and blue steel ore averaging about 50% Iron. It was then decided to drift along the strike of this ore to the South-East in order to develop it and, if possible, to decide whether this ore was the downward extension of the main ore body developed by diamond drilling on the Jopling property. It was also necessary to drift here in order to open the ground in an effort to drain the water away from the raise. The drift to the South-East showed up 80 feet of lean ore, after which it passed into jasper and slates. There was evidently a roll in the foot-wall here, which threw the foot much further to the South. The drift was then turned to

the South-West to cross-cut the formation. Up to the close of the year the drift had been driven a total distance of 300 feet from the raise - the last 220 feet being in foot-wall material. The last 50 feet of the drift was driven in a banded formation of lean ore and jasper, which is probably the ore formation. The dips and strikes of the formation encountered in the drift had been very irregular, indicating that the formation here is very irregular. The last of the year a raise was started near the breast of this drift, as the dips indicated that a raise would develop the ground here much more rapidly than a drift. This raise was put up about 30 feet by the end of the year without showing any change in material.

No further work will be done at this time in the South-East drift as explorations can be conducted from the end of the drift by diamond drilling to better advantage than by drifting. A drift will now be driven to the North-West of the raise following this ore, to determine if there is any change in the grade, or the width of this enrichment. Two plans can then be followed: first - either to attempt to again put up the raise in the line of the shaft to an elevation near the bottom of the ore shown up by drill holes or to put up a small raise on the line of the ore and conduct explorations at various elevations. On account of the water, which is not yet entirely cut off at the raise, it would appear advisable to put up a raise following the ore. Labor conditions have rendered it impossible to push this work rapidly, and the unsatisfactory working conditions, due to the large inflow of water, has rendered it almost impossible to keep men working here. This is another strong argument in favor of conducting explorations by raising on the line of the ore where there is practically no water.

As a general conclusion it may be stated that the results of explorations on the Jopling property have been extremely unfavorable. The finding of so large a flow of water in the line of the shaft at a depth of nearly 900 feet below surface indicates that the formation is porous and badly broken up. Such a condition, if it should develop that it persists in the formation, might readily lead to the encounter of a flow of water which would render

it impossible to conduct mining operations. The discovery of a narrow seam of lean ore near the contact at a depth of about 900 feet, does not indicate that the ore body discovered by diamond drilling persists on its dip to this depth. From the fact that the ore body on the Jopling property extends directly up to the sand, which fact has eliminated about half the tonnage shown up by diamond drilling, there is, as yet, only a small amount of developed ore on the property unless it is later found that this ore body extends to greater depth. As stated before, however, the development work conducted from the raise does not indicate that the main ore body extends down any distance below the point found by the diamond drilling. If labor conditions will permit, the development work should be conducted during the coming year, and it is hoped results will be conclusive enough to permit of an outline of future operations at this property.

FRANCIS MINE:

The principal work of 1917 at the Francis Mine consisted in the development of the 4th and 5th levels, and in cutting the sump and pump house. In the latter part of January and the entire month of February all development work was temporarily stopped while the runners in the skip and cage compartments were being over-hauled and repaired, and casing plank put in between the skip and cage compartments. At this time several of the steel sets, which had buckled due to swelling of the ground near the 3rd level, were taken out and four wooden sets installed in their place. Considerable ground was removed behind them, the opening being filled with lagging in the hope that no future trouble would develop at this point. Development work was resumed on March 1st, and continued on two 8-hour shifts throughout the balance of the year.

The product for 1917 was as follows:

Ore,	1,778 tons
Rock,	<u>19,642 "</u>
Total Hoist Ore and Rock,	21,420 "

The greater part of the product was obtained from No. 1 cross-cut on the 5th level. The estimate of ore in sight, based on diamond drilling, which has been made for the Michigan State Tax Commission, was 102,200 tons. The figure used by the Tax Commission for the past several years has been 250,000 tons. The development work of 1917 has not been sufficient to permit of an estimate, based on the actual ore in sight, so that no attempt was made to change the previous estimates. The work in detail for the year is as follows:

Up to January 1st, 1917, the only work done on the 4th level had consisted in cutting in 10 feet on the East side and South Side of the shaft. During 1917 the plat was completed and the ground excavated for a loading pocket, and pocket installed. The main haulage drift has been extended to the south-east for a distance of 467 feet. This drift was driven in granite and

arkose for a distance of about 420 feet, at which point the contact of the decomposed slate was encountered. No. 1 cross-cut was turned off to the South at the contact and extended 85 feet. This cross-cut reached the contact of the slate and ore after advancing 58 feet, and up to December 31st had passed through 27 feet of high-grade ore. The average analyses of this ore was: Iron 60.50: .080 Phos. When the curve for No. 1 cross-cut was turned off, the main haulage drift was continued ahead a short distance, so that drifting could be resumed here later on.

FIFTH LEVEL:

On the 5th level the work of cutting a plat and installing pocket was completed early in the year, after which drifting to the ore body was started. The main haulage drift was extended to the south-east a distance of 680 feet from the shaft, and was then turned and driven due South 125 feet across the formation. It reached the contact of the arkose and slate at a point about 560 feet from the shaft. After cutting through 10 feet of decomposed gray slate it passed through 75 feet of graphitic slate and then into a decomposed ferruginous slate. It was then turned South across the formation, as it was expected that it would cut the extension of the ore passed through by No. 1 cross-cut 150 feet to the West. At the end of the year it had advanced as far to the South as No. 1 cross-cut, but no ore as yet has been found. Two raises have been cut out on the side of this drift and ore will soon be encountered above the level.

No. 1 cross-cut was started at a point 440 feet south-east of the shaft and driven due South for a distance of 300 feet. This cross-cut reached the contact of the arkose and decomposed slate after advancing 84 feet. It passed through 10 feet of this material, then through 25 feet of lean ore and jasper, and then 20 feet of decomposed slate and into ore. It then passed through 120 feet of good ore averaging about 58.50 Iron, with the phosphorus ranging from .030 to .600. It then passed through ten feet of slaty paint rock, beyond which about 20 feet of second-class ore was encountered. It was continued beyond the ore a distance of about 30 feet in decom-

posed slate and arkose. The formation in the North end of this cross-cut dipped to the South while the formation near the breast dipped to the North. Dips taken at several points between the two contacts varied from horizontal to half a circumference or 180° , while near the center of the deposit the foot wall was struck in the bottom of the drift. The ore body at this point was found in a trough, the width of which, from foot-wall to foot-wall, is approximately 175 feet, of which 140 feet is ore. It is evident that the pitch and dip of the ore body, as calculated from diamond drilling, does not hold true for this part of the 5th level. The formation on the upper levels, which is regular and dips about 50° to the South, has flattened out and rises again on the South side of the ore body. It was decided advisable to drill a hole across the formation from the breast of this cross-cut to find out if the roll in the foot, which produced the trough here, was merely local, in which case it was probable that ore might be again encountered on the other side of the roll, further to the South. If the cross-cut was actually in the bottom of the trough it would not be possible to strike the other side of the roll within a reasonable distance. This diamond drill hole was drilled horizontally across the formation for a distance of 322 feet, the first 226 feet being in arkose, then 34 feet in granite, beyond which there was eight feet of arkose and the hole was stopped in hard granite. The information obtained from this drill hole proved, beyond question, that the ore cut by No. 1 cross-cut is undoubtedly the bottom of the trough at this point. Two raises have been put up from No. 1 cross-cut in order to develop the ore. No. 1 raise, which is located about 15 feet South of the foot-wall was put up a height of 52 feet above the back of the level - 39 feet being in ore and 13 feet in slate. The contact of the ore and hanging slate was 54 feet above the floor of the main level. No. 2 raise is located 50 feet South of No. 1 raise, ~~cut~~ and was extended to a height of 45 feet above the back of the level, 22 feet being in ore and 20 feet in hanging slate. The contact of the ore and slate was 32 feet above the floor of the cross-cut.

SUBS ABOVE THE 5TH LEVEL:

In order to determine the size, dip and pitch of the ore body it was decided to open two sub-levels above No. 1 cross-cut. This would permit of the ore body being actually outlined with all its irregularities, which it was impossible to do on the main level. A sub was started from No. 1 raise, 41 feet above the floor of No. 1 cross-cut and drifts driven due East and West from the top of the raise. At the close of the year the West drift was in 26 feet and the East drift 12 feet. The material encountered so far in both drifts has been very low grade. The formation dips in the regular manner to the South at this point, but the enrichment of the ferruginous slate has not been complete. In an effort to encounter good ore, both drifts are being turned to the North towards the foot-wall, and when good ore is encountered it will be followed by both drifts.

A sub-level has been started 24 feet above the floor of the main 5th level from #2 raise. Two drifts were started; one to the East and one to the West, the same as in No. 1 raise. The total drifting on this sub-level, up to the close of the year, amounted to 40 feet. The greater part of the material developed thus far has been second-class ore. It also appears here that the enrichment of the ferruginous slate has not been complete, as small masses and pieces of altered slate are frequently found in the ore. The formation in this sub-level dips to the North. The results of the work thus far on the sub-levels has been rather discouraging. Both No. 1 and No. 2 raises continued in good ore all the way up to the slate, yet when drifts were started some distance below the slate very lean ore was found on both subs.

No. 2 diamond drill hole was drilled from the side of the main haulage drift at a point 265 feet South-east of the shaft. This was a horizontal hole, drilled to the South across the formation. The following materials were passed through: Arkose, 92 ft: slate 26 ft: arkose 43 ft: ferruginous slate 49 ft: second-class ore 10 ft: ore 10 ft: second-class ore 35 ft.

The hole was stopped in second-class ore at a depth of 265 feet, on account of caving ground. As good ore and second-class ore were encountered in this hole it shows unmistakable evidence of the ore formation extending this far to the West. It may, however, be the upper part of the ore body, or merely a local enrichment in the ferruginous slate. This will later be determined by drifting on the sub levels.

The last of the year the tail drift at the shaft was extended 105 feet West of the pocket.

PUMP HOUSE:

The pump house was excavated in the granite about 50 feet North-east of the shaft. It was planned to locate two pumps here, a large pole pump and a smaller centrifugal pump. The pump house is divided and supported by a granite pillar 12 feet thick. The ground here is firm, and it has been possible to cut the pump house without installing any supports. Concrete foundations for both pumps have been installed and a concrete floor laid over the bottom of the entire pump house. The pole pump has arrived at the mine and it will now be installed. As soon as this pump is in commission the centrifugal pump, which is now operating on the 3rd level, will be moved down to its permanent location.

SUMP:

At the close of 1916 a drift had been started from the cage compartment 12 feet below the main 5th level and extended 12 feet to the East. Work was resumed on this drift in March, 1917, it being turned slightly to the North to come under the line of the suction for the two pumps. It was extended 100 feet to the East, at which point it branched: one drift being driven to the south-east and connected on an incline to the 5th level; the other drift was driven to the North for 140 feet in hard granite. This latter drift was then stripped to a width of about 16 feet and a height of 10 feet, this drift forming the main part of the sump. To complete the sump it will be necessary to put in a concrete seal at the shaft; also several walls about 6 feet high to separate the settling basin from the suction; also to separate

the suction of the two pumps. At the bottom of the shaft a drift was driven to the North, which is used to clean up the dirt that spills from the loading pockets and skip. Near the breast of this drift it is planned to put up an incline raise, which will hole to the settling basin of the sump. This raise will later be used to draw off the mud which accumulates in the sump.

Barring unforeseen accidents, it is hoped to have the pumping plant at the Francis Mine completed and in operation by April 1st, 1918.

S U M M A R Y:

Development work only has been done during the past year at the Francis Mine. This work has not yielded results as rapidly as would have been the case if this mine had been developed on the old system of opening at the top of the ore body, near the sand, and mining downward. It has been necessary to develop levels at a depth where there was very little information available from diamond drilling, and where even the location of the drill holes are subject to considerable variation, due to deviation of the holes. The expense connected with the work of 1917 has been heavy, due to the high wages and to the large increased cost of supplies. The mine has not yet reached the point where it is possible to start mining. It must be borne in mind that the over-burden of sand at the Francis Mine is very deep and that all the ore mined here must be taken without breaking the hanging. This has rendered it advisable to find the bottom of the ore body and start mining at this point, working upward towards surface. At this time it is uncertain whether the 5th level is the bottom of the deposit. The indications thus far are that it is located near the bottom of the deposit, but it is possible that at some point not yet developed the ore may be found to go deeper. The width of the ore developed in No. 1 cross-cut is due to the flattening of the deposit, and does not indicate that the ore body is any thicker than was indicated by the diamond drilling. If ore has been found in No. 2 cross-cut it would have indicated a large horizontal area at the

bottom of the trough, but ore has not yet been encountered here, which tends to the opinion that the horizontal extent of the ore on the 5th level is not very large. The physical character of the ore bears out the conclusions reached from a study of the diamond drill cores. The ore is evidently an enrichment of the ferruginous slate, and as such is very soft and plastic in character. It resembles the plastic ores of the Stephenson and Princeton Mines. The general phosphorus content varies from .030 to .600, indicating that the product from this territory will probably run from .200 to .300 in phosphorus.

BROTHER JONATHAN
BOND

FRANCIS SURFACE:

Considerable surface work has been done during the past year at the Francis, and the mine is now practically equipped, ready for operation, as far as the surface plant is concerned. A small amount of additional work remains to be done in dividing up the old boiler house into a boiler room and storage room for supplies, as well as an oil house.

During the year an addition was made on the North end of the shop building to make the building large enough to accommodate the Machine, as well as the Carpenter and Blacksmith Shops.

Concrete piers and timber supports were put in for a water tank which has been set up on a platform, 25 feet above the ground. This tank will provide water pressure sufficient to supply the heating plant and dry, the water for it being obtained from well points driven into the sand near the engine house.

The old concrete foundations for the permanent hoist were blasted out early in the year and the foundations installed for the two new permanent hoists. The cage hoist was installed and went in operation on July 22nd. One skip was put on with the cage, and they have been operated in balance. The cage hoist was received late in the summer, and it has been set up on the foundations; the motor, however, has not yet arrived at the mine.

A steel pulley stand has been received and erected between the engine house and shaft house.

The permanent trestle leading to the stocking ground was completed during the year; there were 22 bents erected on this trestle, and seven temporary bents for stocking ore. A small stockpile collar has been laid sufficient to hold a few thousand tons of ore. Owing to the shortage of labor throughout the summer it was not possible to do much grading of stockpile grounds. The stocking grounds are located about 600 feet from the shaft. This was made necessary through complications in ownership of the land adjacent

to the shaft, which made it advisable to stock the ore on a piece of land which was owned entirely by The Cleveland-Cliffs Iron Company. To do this it was necessary to have a very long trestle leading to the stockpile grounds. This fact, together with the high cost of labor and supplies, has materially increased the cost of the trestles for the Francis Mine over the general cost at other mines. A permanent rock trestle was also erected on the North side of the shaft. There were seven permanent bents and seven stocking bents erected for this rock trestle.

The top tram system has been laid out so that one top tram car will carry both the ore and rock. Concrete piers have been placed under the legs of the permanent ore and rock trestles, this work being about 60% completed by the end of the year.

A top tram shanty was erected on the landing floor, near the shaft, this building being of wooden frame with concrete plastered walls and concrete floor, in order to make it fire proof. An endless-rope top tram plant of the latest design has been installed, and has been in operation during the last two months of the year.

The work of grading for the pocket and stockpile tracks was started by the C. & N. W. Railway company late in the year. This work has not yet been completed, but has advanced to a point which will permit of its being completed by the time of the opening of the shipping season in 1918.

FRANCIS MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR - 1917.

<u>GRADE</u>	<u>IRON</u>	<u>PHOS.</u>
Francis,	57.77	.203

ORE STATEMENT - DECEMBER 31ST, 1917.

FRANCIS NO. 2

Output for Year,	1,778
Shipments,	0
Balance on Hand,	1,778

Ore encountered in sinking shaft during 1917.

MACKINAW MINE.

The work of re-opening the Mackinaw Mine was started in September 1916. By the close of the year supplies had been received and the work of assembling the equipment necessary for unwatering the shaft was completed. The actual work of unwatering was started on January 2nd, 1917, and by the evening of the 4th the water had been removed to a point 30 feet above the bottom of the shaft. The water was taken out by one large bailer, operating in the cage compartment. During the next few days an electric pump was installed in the small pump house 300 feet below surface, which started to operate on Sunday, January 7th. On January 8th a No. 9 pump was taken to the bottom of the shaft and connected up, and the 30- feet of water in the bottom pumped out. Sinking was started on Wednesday, January 10th.

The work for the year was confined to sinking the shaft, cutting plats on four levels, and to drifting on the 4th level and on the sump level twelve feet below the 4th.

SHAFT SINKING.

When work was stopped at the Mackinaw Mine in 1915, the bottom of the shaft was 401 feet below the top of the concrete collar at surface. Actual sinking was started January 10th and continued through the year up to August 1st, at which time the bottom of the shaft had reached a depth of 947 feet below the collar. The following table gives the monthly progress of sinking and cost per foot:

<u>MONTH:</u>	<u>FEET SUNK.</u>	<u>COST PER FOOT:</u>
January,	34-1/2	\$158.37
February,	90	75.62
March,	94	82.47
April,	80	74.44
May,	115-1/2	65.00
June,	59	75.03
July,	72	81.10
Sunk in 1917,	545	

Average cost per foot - \$80.32

The summary of the work in the shaft for the year was: 546 feet of sinking, 89 sets of timber and 5 sets of bearing pieces installed. The first

six feet of sinking was through lean ore, averaging about 52% Iron, below which hard black jasper was encountered. Slow progress was made in sinking throughout January due to the very hard ground, also to the fact that a new type of sinking drill was in use and it required some time for the men to learn to handle it.

In February better ground was encountered, but there were some delays during this month due to trouble in blasting. When sinking was started a blastering battery was used for firing charges, delay action fuzes being used, but trouble developed in blasting. The last of February new wires were put down the shaft, after which the blasting was done directly by electric current, which eliminated all trouble.

In March the 1st level was reached and a drift was driven in a distance of 35 feet, to be used as a temporary sump. The shaft was sunk 94 feet for the month in addition to the 35 feet of drifting. About 11:30 A. M., March 31st, there was an accident to the compressor, and no work was done at the mine for the balance of the day on the 31st; also on April 1st, 2nd, 3rd and 4th, by which time new parts had been received from the factory and the compressor was repaired.

There were only twenty days work in the shaft in the month of April. During this month the 2nd level plat was cut out for a distance of 11 feet to the East of the shaft; in April the shaft passed through the slate and at the end of the month was in arkose.

In May the best footage was made, the shaft being sunk 115-1/2 feet and 19 sets of timber installed. A portion of the plat was also cut on the 3rd level, a drift being driven 14 feet to the East of the shaft.

In June the shaft reached the elevation of the 4th or 850-ft. level. Considerable drifting was also done in this month, the plat being cut on the West and North sides of the shaft.

Sinking was temporarily stopped the latter part of July until after the Gardner shaft had been sunk. During this month the ground was excavated

for a loading pocket on the 4th level and a drift started 12 feet below the 4th for tramming the rock which came from the sump drift. At a point 45 feet below the 4th level a drift was driven a distance of eleven feet back of the skip compartment from which a raise will later be put to tap the settling basin of the sump.

In August a drift was driven near the bottom of the shaft for handling the dirt which would spill from the skip pit pocket. The following is a record of the work done on the various levels:

FIRST LEVEL:

The 1st level is located 563 feet below the collar of the shaft. When sinking had reached this point a plat was cut on the South side of the shaft and a drift extended to a point 35 feet South of the shaft. A concrete dam was built across this drift at a point about 14 feet South of the shaft, and the drift beyond the dam has been used for a sump.

SECOND LEVEL:

The 2nd level is located 663 feet below the collar of the shaft; at this point a drift has been extended 11 feet to the South of the shaft.

THIRD LEVEL:

The 3rd level is 763 feet below the collar of the shaft; at this point a drift was driven 14 feet South of the shaft.

FOURTH LEVEL:

The 4th level is located 863 feet below the collar of the shaft. The work of cutting a plat and pocket was started in June, but was then stopped until the shaft had been sunk 84 feet below the level, or to a depth of 947 feet. After completing the sinking, the plat was cut, after which the pocket was installed. The main haulage drift was then extended 122 feet to the South, at which point the drift branches; one drift going to the south-west towards the ore body and the other to the south-east towards the Gardner shaft. The drift towards the ore was only carried in a short distance, so that work could later be resumed here without injury to the main air lines. The main work done on this level has been confined to the drift to the Gardner. On December 31st this drift had reached a point

8672 feet from the Mackinaw shaft, or 143 feet from the Gardner shaft. It is intended to start raising as soon as the Gardner shaft is reached, in order to hasten the work of sinking the Gardner shaft. In December more miners and trammers were taken on in order to provide work for some of the men thrown out of employment at the Stephenson and Austin. They have started a drift to the south-west towards the ore body, which, by the end of the year, had advanced 60 feet from the forks of the main haulage drift. The drift to the Gardner will improve the ventilation in both mines, and will also provide a second outlet. It is, therefore, planned that one-half the cost of this drift should be taken up by the Mackinaw and one-half by the Gardner.

SUMP LEVEL:

When the shaft was being sunk, a drift was driven in a short distance twelve feet below the 4th level. Work was resumed on this drift in September - it being driven 20 feet due North; it was then turned to the North-East at right angles to the formation and was extended 157 feet. The drift was in soft decomposed arkose near the shaft, and it was hoped that by crossing the formation, firmer ground would be encountered which would permit of driving a large drift, but as there was no change of ground in 157 feet, it was decided to stop. A drift has since been driven on a curve around the East side of the shaft to a point about eighty feet South of the shaft. This drift will later be connected with the permanent pump house. For the year there have been a total of 428 feet of drifting on the sump level, which has provided a capacity of 160,500 gallons. A large amount of work remains to be done before completing the sump, as it is desired to have a sump capacity of at least 350,000 gallons. The drifts on sump level are about 7 ft. x 7 ft. in size, this being as large as they can be made without timber, owing to the soft ground.

GENERAL REMARKS:

The Mackinaw shaft will be sunk to a depth of about 1,340 feet, or approximately 400 feet deeper. The bottom level will be 1,263 feet below

surface which is below the lowest ore shown up by diamond drilling on this property. If a large body of ore is proved up at this depth it will be necessary to sink the shaft again as it is planned to start mining on the bottom of the deposit. Sinking will probably be completed in 1918, and some ore may be obtained from development work before the end of the year.

MACKINAW SURFACE:

Early in the summer the work of clearing and leveling off the timber yard and stockpile grounds near the shaft was started. Labor was scarce and this work was continued with a small crew all through the Summer. The timber yard has practically been completed, but a large amount of work remains to be done on the stockpile grounds.

A standard brick oil house was erected in the fall, the equipment was installed in November, since which time the oil house has been used.

A contract was let for a brick heating plant in December and work on foundations was started. The heating plant will be built on the end of the dry, so that the boiler can be cared for by the regular dry man. Additional heating capacity is badly needed, as well as increased dry room.

The M. M. & S. E. Railway have started the construction of tracks into the mine from the main line and expect to complete construction work during the winter.

Foundations for a water tank were installed late in the fall. The tank will be set up 30 feet above the ground and will provide a water supply for the mine buildings. A fire pump will be kept installed to increase the pressure in case of a bad fire.

GARDNER MINE.

It had originally been planned to start sinking operations at the Gardner shaft just as soon as men were available. Labor conditions were such, however, that it was not possible to hire men for this work. The Mackinaw shaft reached the elevation of the 4th level in August, from which point it was planned to drive a drift over to the Gardner so that the Gardner shaft could be raised. A part of the shaft sinking crew was transferred immediately to the Gardner and sinking has been continued since September.

The work of re-opening the Gardner shaft started about the middle of July, the material being assembled at the shaft, preparatory to unwatering. The shaft had previously been sunk to a depth of 335 feet. The shaft made more water than the Mackinaw, and up to the time of closing down no pump station had been made. It was realized that the first work necessary would be to cut a pump station and sump. The actual work of unwatering was started in the first week of August and completed in two days. The original plan of opening the Gardner Mine contemplated the opening of a level 309 feet below surface. This is very close to the ledge and it was not probable that mining could ever be conducted in this territory. In order to make a small pump house and sump it was decided, however, to drive a drift at the elevation of the 1st level, as originally planned. This drift was extended 58 feet to the North of the shaft, the inside 40 feet being stripped to a width of 12 feet. Fifteen feet North of the shaft a concrete dam, 6 feet high, was put across the drift, which, it was figured, would provide a sump of sufficient capacity to hold the water for twelve hours. It has only required two pumpmen - one on the day and one on the night shift to take care of the water at the Gardner shaft. Some delay was experienced in starting the sinking after the completion of the pump house from the fact that the bottom sets of shaft timber were badly out of line. After they had been taken out and the shaft re-timbered, sinking was started; for a time the work was done on two shifts, as there was

not sufficient men available to permit of taking the entire shaft sinking crew from the Mackinaw. Men were obtained, however, by the middle of September, since which time the work, with the exception of a short period in November, has been continued on three shifts.

During the month of September the shaft was sunk 58 feet, and aside from the shortage of men, progress was slow due to the hard jasper, which was standing almost vertical, making it difficult to drill and blast. The monthly progress of sinking for 1917 was as follows:

<u>MONTH.</u>	<u>SINKING.</u>	<u>COST PER FOOT.</u>
September,	58'	\$92.95
October,	82'	92.31
November,	65'	94.57
December,	<u>86'</u>	84.94
Total for 1917,	291'	Avg. cost per foot, \$91.07

The increased cost per foot, over the cost of the Mackinaw shaft, was due almost entirely to the increase in wages.

Sinking in November was decreased owing to trouble with the shaft sinking crew, who struck for higher wages on November 15th. The men were discharged and paid off at once, a new crew was obtained, and sinking resumed on November 21st. For some time, however, there were only five men on a shift instead of eight (the full crew) so that the progress of sinking was slow for more than two weeks.

The summary of the shaft work for the year was as follows: -
Sinking 291 feet; 47 sets of timber and two sets of bearing pieces installed. Portions of two plats were cut on the North side of the shaft, one a depth of 455 feet below surface and one at a depth of 555 feet below surface. They were excavated the full width of the shaft for a distance of 12 feet.

The work on the 4th level, done from the Mackinaw shaft, consisted in extending the drift from the Mackinaw boundary line 650 feet south-east towards the Gardner shaft. On December 31st, the drift had reached a point 143 feet from the line of the Gardner shaft, while the bottom of the shaft was about 235 feet above the 4th level. The drift will be extended to a point directly under the shaft and a vertical raise will be put up in the line of the shaft. Sinking and raising will be continued until the raise and the shaft hole.

GARDNER MINE:

The work done on the Gardner property in 1917 will permit of a rapid development of the ore body in 1918. The drift from the Mackinaw will be used as the ore tramming drift from the Gardner ore body to the Gardner shaft. Only a few hundred feet of drifting remains to be done to reach the ore body, and with the completion of the shaft in about ninety days, it will only be a short time until some ore will be obtained from development work.

*Damascus
Bond*

GARDNER SURFACE:

The work of clearing for stockpile grounds and timber yards was started in the fall, but owing to the scarcity of surface labor it was not possible to complete this work.

The ground at the shaft is being filled with rock, this filling being necessary on account of the timber tunnel which has been built eight feet above surface. The fill has been extended so as to permit of the construction of the permanent bents of the ore and rock trestles.

The C. & N. W. Ry. Company has promised to have the railroad tracks installed at the Gardner Mine by May 1st, 1918. This will permit of shipping any ore that may be obtained from development work next Summer.

*Damascus
Bond*

GARDNER-MACKINAW MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR - 1917.

GRADE	IRON	PHOS.	SILICA	MANG.
Mackinaw,	54.70	.125	10.16	.655

This analysis represents 51 tons.

ORE STATEMENT - DECEMBER 31ST, 1917.

	<u>MACKINAW</u>
Output for Year,	51
Shipments,	0
Balance on Hand,	<u>51</u>

Ore encountered in sinking shaft during 1917.

GENERAL SURFACE.

GWINN DISTRICT CRUSHING PLANT:

E. & A. No. 207:

The Gwinn District crushing plant was closed down in November, 1916, and resumed operations on April 26th, 1917. During the time that the crusher was idle, a total of \$907.64 was spent in remodeling and repairs. Chutes of a different design were made and installed, with the result that a greater tonnage was crushed, at less expense, in 1917, than in the previous year. The crusher was operated seven hours only in the month of April, 720 tons being crushed. In May the crusher was operated sixteen days, 831 tons being crushed per day. This was not nearly the capacity of the crusher, but represented the total amount of ore received, practically all of which came from pockets. In June, the crusher was put on a double shift, 40,629 tons being crushed; the crusher was operated twenty-nine days in this month. In July, 64,332 tons were crushed, the crusher operating twenty-nine days. In August, the tonnage crushed was 68,944 tons, the crusher operating twenty-nine days, there being 2,377 tons crushed per day on two ten-hour shifts. In September there were 65,669 tons crushed, the crusher operating twenty-nine days on double shift. In October there were 53,304 tons crushed, the crusher being operated thirty days on double shift. In November there were 5,782 tons crushed, the crusher being operated ten days only. The total tons crushed for the year was 312,680. The total cost, including switching and depreciation of .03¢ per ton, was 8.1¢ per ton. The actual operating cost for the year 1917 was 3.7¢ per ton as compared with 5.1¢ per ton in 1916.

The results obtained from the operation of the crusher during 1917 shows an improvement over results obtained in 1916, but even better results could have been obtained the past year if it had been possible to keep the plant operating steadily, particularly towards the latter part of the season when there were a number of delays due to lack of ore. The repairs necessary to be made this winter will be very slight as compared with the previous winter.

The plant, as now constructed, operates very efficiently, but there still remains one or two problems to solve before the plant is entirely perfected. The main trouble now lies with the rubber conveying belt which carries the ore from the crusher to the loading pockets. The greatest trouble is with the Stephenson Ore, although all the ores in the district cause trouble following heavy rains. The ore sticks to the conveying belt and drops from the under-side of the belt, as it returns from the loading pockets to the crusher. This amounts, during the season, to a large amount of ore, and there is a considerable labor expense for cleaning up this ore. A number of schemes are under consideration for remedying this defect, and it is hoped that a practical one will be found by next season.

CENTRAL POWER PLANT:

An unusual amount of repairs to the boiler plant have been necessary during the past year. This was due to more continued operation of all the boilers on account of operating the steam turbine more than in the previous year. Only a few cars of slack coal came in to the dock in 1917, some of the 3/4 coal was crushed at the Gwinn District Crushing Plant and some 3/4 coal was dumped directly into the dock. The crushed coal was not quite small enough for the automatic stokers and parts were frequently broken. A coal crushing plant was ordered last summer which reached the mine in December; the work of installing this plant is now under-way and it is expected it will be in commission by March 1st, 1918. The 3/4 coal in the dock, as well as the coal which was crushed at the ore crushing plant last summer will be run through the new plant at the power house and no further breakage of stoker parts is expected. Owing to the labor situation it has been very hard to hire men to tram coal from dock to stokers, as the men prefer to work in the mines where they can earn higher wages.

GWINN TOWNSITE:

There were a number of new buildings erected in the Gwinn Townsite in 1917. The company built five double houses and two single cottages on Pine Street, all of which are now occupied. Concrete basements were put under all these houses, which has greatly improved the appearance of the houses, as well as added to their convenience. No sheds were built on the lots as it is planned that the tenant use the basement for storage of wood and coal. During the year two lots were sold as follows:

Lot 7 - Block 13
Lot 18 - Block 27.

A small cottage was erected on Lot 7, and a two story house is being erected on Lot 18.

During the summer of 1917 the balance of the double roadway on Pine Street was macadamized, as also a piece 300 feet long on the county road between Maple and Pine Streets.

During the oast year eighty American White Elms were planted in the park-way on Pine Street, the greater number of which have made a good growth. It is planned to continue the planting of elm trees on other streets, as the maple trees have not proven successful in the sandy soil.

WATER SUPPLY AND WATER SYSTEM:

The winter of 1917 proved the most severe on the water system of any year since it was installed. Very cold weather came without any snow fall and the frost penetrated the ground to a depth of six to eight feet. Many of the large 8 inch mains froze solid, and whole blocks of houses in Gwinn were without water for weeks. Steam and electric thawing outfits were in constant use during January, February and March. A large part of the system at the Austin was also frozen and out of commission for several months.

The water supply has continued good during 1917. The settling basin used at the American Mine has proven very successful and the river water is entirely free of iron ore discoloration. Considerable work was done in December on the dam across the river at the pumping plant. Rock has been placed on both faces of the dam and the height of the dam raised over 12". The East bank of the river had cut away beyond the dam and it was necessary to extend the dam upstream on this side and also to riprap the river bank for some distance upstream.

The company employees in the Gwinn District responded splendidly to the government's request to plant gardens. Over 500 bushels of seed potatoes were bought by the company and sold to the men. The unusual season proved disastrous to a number of the gardens, especially in Gwinn, where there was a killing frost in every one of the summer months. The majority of employees are anxious to try again, but they are asking for lots on the higher ground near the Austin and Princeton Mines.

GWINN ASSOCIATION.

The past year has been a very active one for the Gwinn Association. The total attendance at the various activities has been slightly less than in the previous year, due to increase in gardening work. This continued during the summer months, since which time the attendance has been larger than in 1916.

The night school work, which was started in 1915, was continued during 1917, the attendance being 1,378 as compared with 1,157 in 1916.

During the summer the attendance at the moving picture shows was poor, due to people working in gardens until dark, but during the past few months the attendance has been in excess of the seating capacity. Only high class pictures have been shown, the general run of pictures being better than those shown in Ishpeming.

Books have been purchased each month for the public library and there are now nearly 500 books on the shelves. During the year 2,265 books were loaned from the library.

The local orchestra has continued to practice and have furnished music for all the dances and a number of other public functions.

The Association building has been used on an average of twice a month by the churches - socials and sales being held.

In the fall a garden and canned vegetable exhibit was held at the Club House and prizes were awarded. The display was of great educational value to the people, many of whom had never seen any garden products, except potatoes, other than the canned goods they purchased at the stores. This exhibit compared favorably with the exhibit at the County Fair at Marquette, there being over 30 exhibitors.

The Red Cross activities of Forsyth Township naturally center at the Club House. This work made a slow start, but greater interest is being shown every day by the women. The church societies have become interested and each nationality is now working as separate units through the church societies. There

are 1,018 Red Cross members in the township, or roughly 30% of the entire population.

A Lyceum Course was secured of four musical entertainments, one number of which was given in December. It was necessary to use the high school auditorium as there is no assembly room at the Club House large enough for a public entertainment.

The following table gives the number attending the various activities of the Association during the year:

Number attending	Night Schools,	1,378
" "	Motion Pictures,	35,942
" "	Gym and Swimming Classes	2,567
" "	Dances,	2,775
" "	Basketball Games	1,250
" "	Camp at Bass Lake,	900
" "	Boy Scout Meetings	112
" "	Campfire Girls,	160
	Total Recorded Attendance,	45,084

The actual attendance was much greater, as the figures given do not include those using the reading rooms, bowling alleys, and pool and billiard tables.

The Gwinn Club House should have an addition on the West side to enlarge the seating capacity of the room given over to the motion pictures and to increase the size of the gym room. The addition should be 30 feet in length which would make the movie room large enough to seat 400 people. The floor should be set on an incline so as to make all seats in the hall equally good. All large public gatherings, such as patriotic meetings, could then be held in this room. A larger gym is needed for basket-ball, for at present the room will not permit of many spectators without encroaching on the players space. The question of an addition to the building was discussed in 1917, but no action taken; it is hoped that favorable action will be taken early in 1918.

STEPHENSON MINE.

COST DATA FOR YEARS 1917-1916.

ANALYSIS OF MINING COSTS FOR 1917-1916.

	YEAR 1917		YEAR 1916		INCREASE	DECREASE
Shifts and Hours,			1-8-Hr.	1-8-Hr.		
Product,	Product for year,		253,266	303,562		50,296
Average Daily Product,	Average Daily Product,		898	1,019		121
Number of Days Operated,	Number of shifts and hours,		282	298		16
Number of Days Idle,	1917	PER TON	1916	PER TON	1917	PER TON
Number Men - Surface,			50	58		8
Avg. Rate Per Day - Surface,	2,816.91	.011	\$3.31	\$2.75	.56	
Tons Per Man - Surface,	2,829.34	.011	15.96	17.04		1.08
Number Men - Underground,			144	178		34
Avg. Rate - Underground,	10,821.25	.043	\$3.95	\$3.21	.74	
Tons Per Man - " "	14,765.42	.059	5.73	5.67	.06	
Total Avg. Men,	16,135.25	.060	194	236		42
" " Rate,	14,577.64	.057	\$3.78	\$3.10	0.68	
Tons per man per day,	60,499.14	.238	4.22	4.25		.03
General Expense - Per Ton,	100,273.22	.596	0.154	0.125	0.029	
Maintenance " " "	21,725.72	.086	9.134	0.125	0.009	.001
Mining Expense, " "	50,599.24	.200	1.148	0.964	0.184	.001
Cost of Production " "	173,232.72	.684	1.436	1.214	.222	
Avg. Daily Cost - Labor,	528.44	.002	\$825.00	\$769.00	\$56.00	.001
" " - Supplies,	22,698.37	.091	\$464.00	\$468.00		4.00
" " - Total,	23,426.91	.093	\$1289.00	\$1237.00	\$52.00	

	<u>LABOR</u>	<u>PER TON</u>	<u>SUPPLIES</u>	<u>PER TON</u>	<u>TOTAL</u>	<u>PER TON</u>
Year 1917,	232,767.17	.919	130,962.91	.517	363,730.08	1.436
Year 1916,	229,164.45	.755	139,465.35	.459	368,629.80	1.214
<u>INCREASE,</u>	<u>3,602.72</u>	<u>.164</u>		<u>.058</u>		<u>.222</u>
<u>DECREASE,</u>			<u>8,502.44</u>		<u>4,899.72</u>	

MISCELLANEOUS:

WAGE RATES, Increased: May 1st and October 1st, 1917.

Feb. 1st, May 1st, Dec. 16th, 1916.

STEPHENSON MINE.

ANALYSIS OF MINING COSTS FOR 1917-1916. DECREASE IN VARIOUS ACCOUNTS BETWEEN YEARS 1917 AND 1916.

		YEAR 1917	YEAR 1916.
<u>GENERAL EXPENSE:</u>			
Product for year, Year 1917,	2735.11	253,266	per ton 303,562
Average Daily Product, 1916,	5060.31	898	" " 1,019
Number of shifts and hours,	325.20	1 8-hr. 282	1 8-hr. 298

	1917	PER TON	1916	PER TON	1917.	PER TON
	AMOUNT	TON	AMOUNT	TON	INCREASE	DECREASE
<u>MAINTENANCE:</u>						
150-Air Pipes,	2,816.91	.011	3,355.20	.011	INCREASE	.010
166-Cave In,	12.43		4.62			
TOTAL,	2,829.34	.011	3,359.82	.011		
<u>SUPERINTENDENCE:</u>						
160-Capt. & Bosses,	10,821.25	.043	8,274.96	.027	.016	
161-Dry House,	3,944.17	.016	2,601.71	.008	.008	
TOTAL,	14,765.42	.059	10,876.67	.035	.024	
<u>POWER:</u>						
151-Compressors, Expanded,	15,185.25	1.060	16,338.58	.054	Cost.006	ton .039
152-Hoisting,	14,577.64	1.057	9,234.08	.030	" .027	" .027
153-Pumping, TOTAL,	30,736.25	.121	24,025.49	.079	INCREASE	.042
TOTAL,	60,499.14	.238	49,548.15	.163	.075	
<u>MINING.</u>						
156-Breaking Ore,	100,273.32	.396	106,470.51	.351	.045	
157-Tramming,	21,725.72	.086	20,968.40	.069	.017	
158-Filling,	72.62	1.000	155.70	.001	Cost per ton	.001
159-Timbering,	50,699.24	1.200	55,655.90	.183	" .017	" .016
164-Sorting Ore,	461.82	.002	821.44	.003	INCREASE	.001
TOTAL,	173,232.72	.684	184,072.04	.607	.077	
<u>DEVELOPMENT.</u>						
154-Sinking & Shift.Reps.	528.44	1.002	856.94	.003	Cost per ton	.001
155-Drifting,	22,898.37	1.091	25,351.53	.083	" .008	" .037
TOTAL,	23,426.81	.093	26,208.47	.086	INCREASE	.007
<u>HANDLING OUTPUT.</u>						
162-Top Landing,	8,500.90	.034	7,781.52	.026	.008	
163-Stocking Ore,	7,489.39	.029	10,845.47	.036	" .007	" .007
TOTAL,	15,990.29	.063	18,626.99	.062	.001	

TOTAL MINING, 290,743.72 1.148 292,742.14 .964 " .184 " .125

MAINTENANCE:

Tracks and Yards,	1697.83	Cost per ton,	.007
(Acct. #125)	532.75	" " "	.002
	1865.47	INCREASE,	.005

The increase is due to a charge of approximately \$1300. from WPA&E Ry. for additional tracks used in loading ore. The actual expense for year in this account, except for above item, was about \$100.00 less than in 1916.

STEPHENSON MINE.
ANALYSIS OF COST SHEETS, EXPLAINING INCREASE OR DECREASE IN
VARIOUS ACCOUNTS BETWEEN YEARS 1917 AND 1916.

	<u>GENERAL EXPENSE:</u>			
Engineering, (Acct. #27)	Year 1917,	2735.11	Cost per ton	.011
	Year 1916,	<u>3060.31</u>	" " "	<u>.010</u>
	DECREASE	325.20	INCREASE,	.001

The decrease is due to less work at mine by engineers in 1917, also to the shut-down early in December.
The increase in cost per ton is due to the decreased product of 1917.

Analysis, (Acct. #28)	Year 1917,	11451.97	Cost per ton	.045
	Year 1916,	<u>10722.75</u>	" " "	<u>.035</u>
	INCREASE,	729.22	INCREASE,	.010

The increase is due to increase of 34% in wages in 1917, while the increase in cost per ton is due to the decreased product of 1917. In 1917, 496,712 tons were shipped, in 1916, 335,164 tons. In 1917, there were 36,512 determinations, costing .182 each, in 1916, 39,324 determinations, costing .181 each. The decrease in number of determinations in 1917, was due to the decreased number of working places in the mine.

Personal Injury Expense: (Acct. #30)	Year 1917,	7240.21	Cost per ton	.029
	Year 1916,	<u>8280.47</u>	" " "	<u>.027</u>
	DECREASE	1040.26	INCREASE,	.002

The decrease is due to smaller number of serious accidents in 1917 requiring compensation, while the increase in cost per ton is due to the decreased product.

Mine Office, (Acct. #30-a)	Year 1917,	5755.59	Cost per ton	.023
	Year 1916,	<u>4889.37</u>	" " "	<u>.016</u>
	INCREASE,	866.22	INCREASE,	.007

The increase is due to the increases in wages.

District Office, (Acct. #30-b)	Year 1917,	11695.95	Cost per ton	.046
	Year 1916,	<u>10966.73</u>	" " "	<u>.037</u>
	INCREASE,	729.22	INCREASE,	.009

The increase is due to advance in wages in 1917. The starting up of the Mackinaw-Gardner absorbed some of the District Office charges, otherwise the increase would have been greater.

TOTAL GENERAL EXPENSE,	Year 1917,	39009.60	Cost per ton	.154
	Year 1916,	<u>38038.45</u>	" " "	<u>.125</u>
	INCREASE,	971.15	INCREASE,	.029

	<u>MAINTENANCE:</u>			
Tracks and Yards, (Acct. #125)	Year 1917,	1697.23	Cost per ton.	.007
	Year 1916,	<u>533.76</u>	" " "	<u>.002</u>
	INCREASE,	1163.47	INCREASE,	.005

The increase is due to a charge of approximately \$1300. from MM&SE Ry. for additional tracks used in loading ore. The actual expense for year in this account, except for above item, was about \$100.00 less than in 1916.

MAINTENANCE: (Cont'd)

Docks, Trestles & Pockets, (Acct. #126)	Year 1917,	387.57	Cost per ton	.002
	Year 1916,	<u>1992.42</u>	" " "	<u>.007</u>
	DECREASE,	1604.85	DECREASE,	.005

The large decrease in cost in 1917 was due to erection of no permanent trestle in 1917 and to less repairs to stock-pile collar.

Buildings: (Acct. #127)	Year 1917,	2402.08	Cost per ton	.009
	Year 1916,	<u>535.43</u>	" " "	<u>.002</u>
	INCREASE,	1866.65	INCREASE,	.007

The large increase in 1917 was due to a number of improvements in the mine buildings. The hospital room was plastered and painted and shower baths and lockers installed in the shift bosses' room at a cost of \$500.00; a timber tunnel was driven through the approach to the coal dock at a cost of \$460.00; new hose cart and fire hose cost \$262.00; a porch at rear of engine house cost \$105.00; equipment for oil house cost \$452.00 and part of cost of oil house cost \$245.00. The balance of 1917 expense covered ordinary repairs to buildings.

Boiler Plant, (Acct. #129)	Year 1917,	433.27	Cost per ton	.002
	Year 1916,	<u>108.11</u>	" " "	<u>.000</u>
	INCREASE,	325.16	INCREASE,	.002

The increase was mainly due to expense of erecting new stack and to purchase of new 6" valve for header.

Hoisting Machinery, (Acct. #130)	Year 1917,	3217.51	Cost per ton	.012
	Year 1916,	<u>1415.87</u>	" " "	<u>.005</u>
	INCREASE,	1801.64	INCREASE,	.007

The large increase is due to installation of over-winding device costing \$1404.00. One new cage rope was put on during the year. There was also an unusual expense for repair of the reverse mechanism on the skip hoist, which broke several times.

Compr. & Pwr. Drills: (Acct. #131)	Year 1917,	735.47	Cost per ton.	.003
	Year 1916,	<u>1241.62</u>	" " "	<u>.004</u>
	DECREASE,	506.15	DECREASE,	.001

The decrease is due to the purchase of less drill machines in 1917. In 1916, two Leyners and seven auger machines were charged out; in 1917, three auger, one stoping and one Leyner machine.

Pumping Machinery, (Acct. #132)	Year 1917,	10358.40	Cost per ton	.041
	Year 1916,	<u>2946.97</u>	" " "	<u>.010</u>
	INCREASE,	7411.43	INCREASE,	.031

This account shows an abnormal increase over the cost in 1916. In December the charges were \$4206.97 due to flooding of the mine on December 4th. The balance of the increase was due to taking up charges for cutting pump house and sump on 6th level, for concrete floor and seals for 6th level pump house and for preparing 5th level pump house for new pump.

MAINTENANCE: (Cont'd)

Top Tram Engine & Cars, (Acct. #133)	Year 1917,	3103.67	Cost per ton	.012
	Year 1916,	<u>12273.58</u>	" " "	<u>.040</u>
	DECREASE,	9169.91	DECREASE,	.028

The large decrease is due to the extraordinary expense of 1916, due to charging out E. & A. #293 covering installation of three electric top tram equipments. One new top tram car was built in 1917 and 5500 feet of 5/8" wire rope charged out; the balance of charges cover ordinary repairs and replacements.

Skips and Skip Roads, (Acct. #134)	Year 1917,	1434.17	Cost per ton	.006
	Year 1916,	<u>1808.16</u>	" " "	<u>.006</u>
	DECREASE,	373.99	- - - -	.000

The decrease is due to there having been no accidents in the skip roads in 1917. The years charges cover cost of ordinary repairs to skips and to the skip-roads.

U. G. Trax & Cars, (Acct. #135)	Year 1917,	1569.18	Cost per ton	.006
	Year 1916,	<u>1926.54</u>	" " "	<u>.006</u>
	DECREASE,	357.36	- - - -	.000

The decrease is due to less new sub-level cars charged out in 1917. The charges of 1917 cover cost of repairs of sub-level cars and cost of rail taken underground for extension of sub-level tracks.

Electric Tram Plant, (Acct. #136)	Year 1917,	8144.24	Cost per ton	.032
	Year 1916,	<u>12707.33</u>	" " "	<u>.042</u>
	DECREASE,	4563.09	DECREASE,	.010

The large decrease is in supplies and is due to purchase of less equipment in 1917. There is also a reduction of about \$500.00 due to all expense in this account being stopped by the flooding of the mine on December 5th. In the last two months the mine operated the charges were higher due to two men overhauling roller bearings on all motor cars. During the year \$1638.10 was spent in cleaning tracks.

Telephouse & Safety Devices, (Acct. #137)	Year 1917,	493.97	Cost per ton	.002
	Year 1916,	<u>359.42</u>	" " "	<u>.001</u>
	INCREASE,	134.55	INCREASE,	.001

The increase is due to installing lighting system on 6th level. The total extension of lighting system in 1917 was considerably greater than in 1916 and the maintenance charges were higher due to increased cost of supplies.

TOTAL MAINTENANCE,	Year 1917,	33976.76	Cost per ton	.134
	Year 1916,	<u>37849.21</u>	" " "	<u>.125</u>
	DECREASE,	3872.45	INCREASE,	.009

MINING EXPENSE.

Air Pipes, (Acct. #150)	Year 1917,	2816.91	Cost per ton	.011
	Year 1916,	<u>3355.20</u>	" " "	<u>.011</u>
	DECREASE,	538.29	- - -	

The decrease is due to less extension of 3 and 4 inch lines on main levels in 1917. In 1916 over 1500 ft. of 3" line on 5th level was replaced with 4".

Compressors, (Acct. #151)	Year 1917,	15185.25	Cost per ton	.060
	Year 1916,	<u>16338.58</u>	" " "	<u>.054</u>
	DECREASE,	1153.33	INCREASE,	.006

The decrease is due principally to the mine closing on December 5th, due to flooding. In July the compressor repairs were completed and change from electric drive to steam power was made. In October the operating charges were about \$900.00 above the average monthly cost due to heavy charges for repairs to the boiler plant. In 1917, the plant was operated electrically for 6-1/2 months and by steam for 5-1/2 months.

Hoisting, (Acct. #152)	Year 1917,	14577.64	Cost per ton	.057
	Year 1916,	<u>9234.08</u>	" " "	<u>.030</u>
	INCREASE,	5343.56	INCREASE,	.027

The increase is principally due to the increased in wages during 1917, partly to the increased charge for power from boiler plant on account of higher price of coal and partly to the increased operating cost of December, when extra brakemen were on duty day and night on account of operating the bailers.

Pumping, (Acct. #153)	Year 1917,	30736.25	Cost per ton	.121
	Year 1916,	<u>24025.49</u>	" " "	<u>.079</u>
	INCREASE,	6710.76	INCREASE,	.042

The increase is due to pumpmen working on three 8-hour shifts for twelve months in 1917, as against two months in 1916; to increase of wages in 1917, and to increased power cost on account of more water pumped.

Sinking & Shaft Repairs, (Acct. #154)	Year 1917,	528.44	Cost per ton	.002
	Year 1916,	<u>856.94</u>	" " "	<u>.003</u>
	DECREASE,	328.50	DECREASE,	.001

The charges in 1917 were all incurred in making repairs to shaft. The 1916 charges were higher due to cost of concreting the 6th level plat.

Rock Drifting, (Acct. #155)	Year 1917,	22898.37	Cost per ton	.091
	Year 1916,	<u>25351.53</u>	" " "	<u>.083</u>
	DECREASE,	2453.16	INCREASE,	.008

The decrease is due to 140 feet less rock drifting in 1917. The cost per foot shows a decrease of \$0.44 due to softer ground in drifts which permitted of faster progress and the use of a lower grade dynamite. This reduced the cost per foot in spite of the advances in wages.

Breaking Ore, (Acct. #156)	Year 1917,	100273.32	Cost per ton	.396
	Year 1916,	<u>106470.51</u>	" " "	<u>.351</u>
	DECREASE,	6197.19	INCREASE,	.045

The decrease is due to mine closing down on December 5th, while the increased cost per ton is due to the increase in wages and cost of supplies. There was a decrease of about 20 gangs breaking ore in 1917 as compared with 1916.

MINING EXPENSE:			
Tramming, (Acct. #157)	Year 1917,	21725.72	Cost per ton .086
	Year 1916,	<u>20968.40</u>	" " " .069
	INCREASE,	757.32	INCREASE, .017

The increased cost is due to increases in wages. The increase would have been greater if the mine had not closed down on December 5th.

Filling, (Acct. #158)	Year 1917,	72.62	Cost per ton .000
	Year 1916,	<u>155.70</u>	" " " .001
	DECREASE,	83.08	DECREASE, .001

In 1917, the only expense for Filling was in the month of January, when some capping was blasted down on the 2nd sub below the 4th level near the Section 29 boundary line.

Timbering, (Acct. #159)	Year 1917,	50699.24	Cost per ton .200
	Year 1916,	<u>55655.99</u>	" " " .183
	DECREASE,	4956.75	INCREASE, .017

The greater portion, or about \$3800.00, of the decrease is due to the mine closing down on December 5th; the balance is due to less timber used in 1917 account of less raising, also to less timber used on account of decrease in number of miners employed. The actual decrease in amount of timber used for year was considerable, as all labor charges were increased on account of increases in wages. The increase in cost per ton is due to the decreased product.

Cart. & Bosses, (Acct. #160)	Year 1917,	10821.25	Cost per ton .043
	Year 1916,	<u>8274.96</u>	" " " .027
	INCREASE,	2546.29	INCREASE, .016

The increase is due entirely to the increase in wages.

Dry House, (Acct. #161)	Year 1917,	3944.17	Cost per ton, .016
	Year 1916,	<u>2601.71</u>	" " " .008
	INCREASE,	1342.46	INCREASE, .008

The increase is due to the increase in wages and to the increase in price of coal burned since October.

Top Landing & Tramming, (Acct. #162)	Year 1917,	8500.90	Cost per ton, .034
	Year 1916,	<u>7781.52</u>	" " " .026
	INCREASE,	719.38	INCREASE, .008

The increase is due to the increase in wages.

Stocking Ore, (Acct. #163)	Year 1917,	7489.39	Cost per ton, .029
	Year 1916,	<u>10845.47</u>	" " " .036
	DECREASE,	3356.08	DECREASE, .007

The large decrease is due to less expense for erection of stocking trestles in fall of 1917. There was also less expense for repairs to temporary trestles.

Sorting Ore, (Acct. #164)	Year 1917,	461.82	Cost per ton .002
	Year 1916,	<u>821.44</u>	" " " .003
	DECREASE,	359.62	DECREASE, .001

The decrease is due to less labor expense for picking rock and ore from stockpiles. Greater care is exercised underground and less expense has been necessary on surface.

TOTAL MINING EXPENSE,	Year 1917,	290743.72	Cost per ton, 1.148
" " "	Year 1916,	<u>292742.14</u>	" " " .964
	DECREASE,	1998.42	INCREASE, .184

COST OF PRODUCTION,	Year 1917,	363730.08	Cost per ton	1.436
	Year 1916,	<u>368629.80</u>	" " "	<u>1.214</u>
	DECREASE,	4899.72	INCREASE,	.222

WAGE RATES. Increased May 1st: October 1st, 1917.
February 1st, May 1st, December 16th, 1916.

Discontinued mining operations on December 5th, 1917, account of mine
being flooded.

AUSTIN MINE.

COST DATA FOR YEARS 1917-16.

	YEAR 1917	YEAR 1916	INCREASE	DECREASE
Shifts and Hours,	1 8-hr. 190 2 8-hr. 11	1, 8-hr. 148		
Product,	51,659	16,193	35,466	
Avg. Daily Product,	257	144	113	
Number of days operated,	201	148	53	
Number of days idle,	112	165		53
Number men - surface,	18	6	5	
Avg. rate per day - surface,	3.50	2.76	.74	
Tons per man - surface,	14.86	9.42	5.44	
Number men - Underground,	35	17	18	
Avg. rate - underground,	4.36	3.21	1.15	
Tons per man underground,	4.99	3.17	1.82	
Total avg. men,	46	23	23	
" " Rate,	4.15	3.10	1.05	
Tons per man per day,	3.74	2.37	1.37	
General Expense per ton,	.145	.189		.044
Maintenance per ton,	.148	.247		.099
Mining Expense per ton,	1.228	1.548		.32
Cost of Production per ton,	1.521	1.984		.463
Avg. daily cost - Labor,	287.54	143.80	143.74	
" " " - Supplies,	103.29	73.25	30.04	
" " " - Total,	390.83	217.05	173.78	

<u>COST OF PRODUCTION</u>	<u>LABOR</u>	<u>PER TON</u>	<u>SUPPLIES</u>	<u>PER TON</u>	<u>TOTAL</u>	<u>PER TON</u>
Year 1917,	57,796.38	1.119	20,762.57	.402	78,558.95	1.521
Year 1916,	21,278.93	1.314	10,840.94	.670	32,119.87	1.984
<u>INCREASE,</u>	36,517.45		9,921.63		46,439.08	
<u>DECREASE,</u>		.195		.268		.463

MISCELLANEOUS.

WAGE RATES: Increased May 1st: October 1st, 1917.
Feb. 1st, May 1st, December 16th, 1917.

AUSTIN MINE

ANALYSIS OF MINING COSTS FOR 1917-1916.

	<u>YEAR 1917.</u>	<u>YEAR 1916.</u>
Product for year,	51,659	16,193
Average Daily Product,	257	144
Number of shifts and hours,	1 8-hr. 190 2 8- " 11	1 8-hr. 148

	1917 AMOUNT	PER TON	1916 AMOUNT	PER TON	PER TON INCREASE	PER TON DECREASE
<u>MAINTENANCE:</u>						
150-Air Pipes,	485.48	.009	396.89	.025		.016
166-Cave-In,	3.64	.000	31.59	.002		.002
TOTAL,	489.12	.009	428.48	.027		.018
<u>SUPERINTENDENCE:</u>						
160-Capt. & Bosses,	2,866.96	.056	1,063.27	.066		.010
161-Dry House,	711.97	.014	153.39	.009	.005	
Total,	3,578.93	.070	1,216.66	.075		.005
<u>POWER:</u>						
151-Compressors,	3,200.72	.062	1,700.13	.105		.043
152-Hoisting,	1,242.23	.024	739.90	.046		.022
153-Pumping,	258.86	.005	22.13	.001	.004	
TOTAL,	4,701.81	.091	2,462.16	.152		.061
<u>MINING.</u>						
156-Breaking Ore,	22,707.83	.536	8,933.07	.552		.016
157-Tramming,	7,383.66	.143	3,032.93	.187		.044
158-Filling,	22.20	.000				
159-Timbering,	11,761.83	.228	5,095.26	.315		.087
164-Sorting Ore,	65.94	.001			.001	
TOTAL,	46,941.46	.908	17,061.26	1.054		.146
<u>DEVELOPMENT.</u>						
154-Sinking & Sht.Reps.	2,613.25	.051	1,324.88	.082		.031
155-Drifting,	3,147.69	.061	1,907.69	.118		.057
TOTAL,	5,760.94	.112	3,332.57	.200		.088
<u>HANDLING OUTPUT.</u>						
162-Top Landing,	1,685.49	.035	511.69	.034		.001
163-Stocking Ore,	269.19	.005	105.47	.006		.001
TOTAL,	1,954.68	.038	657.16	.040		.002
TOTAL MINING,	63,426.94	1.228	25,058.29	1.548		.320

AUSTIN MINE.
ANALYSIS OF COST SHEETS EXPLAINING INCREASE OR DECREASE IN
VARIOUS ACCOUNTS BETWEEN YEARS 1917 AND 1916.

<u>GENERAL EXPENSE:</u>			
Engineering, (Acct. #27)	Year 1917,	497.35	Cost per ton, .010
	Year 1916,	<u>308.71</u>	" " " <u>.019</u>
	INCREASE,	188.64	DECREASE, .009

The increase is due mainly to the mine operating eight months in 1917 as compared with six months in 1916, which increased the cost of engineering work in 1917. The increase is also due to increase in wages. The decrease in cost per ton is due to the large increase in product in 1917.

Analysis, (Acct. #28)	Year 1917,	2135.14	Cost per ton, .041
	Year 1916,	<u>1030.49</u>	" " " <u>.064</u>
	INCREASE,	1104.65	DECREASE, .023

The increase is due to the increased number of determinations in 1917 on account of larger product. In 1917, there were 8,434 determinations costing \$.199 each, while in 1916 there were 4,796, costing \$.172 each. The decrease in cost per ton is due to larger product of 1917.

Personal Injury Expense, (Acct. #30*)	Year 1917,	683.71	Cost per ton, .013
	Year 1916,	<u>95.75</u>	" " " <u>.006</u>
	INCREASE,	587.96	INCREASE, .007

The increase is due to more compensation paid on account of more personal injuries in 1917. More men were employed in 1917 and the mine operated nearly two months longer.

Mine Office, (Acct. #30-a)	Year 1917,	1832.66	Cost per ton, .036
	Year 1916,	<u>554.22</u>	" " " <u>.034</u>
	INCREASE,	1278.44	INCREASE, .002

The large increase in labor is due to charging entire time of one policeman to Austin Mine in 1917, while in 1916, only 1/4 of one watchman's time was charged. The increase is also partly due to increase in wages in 1917.

District Office, (Acct. #30-b)	Year 1917,	2287.74	Cost per ton, .044
	Year 1916,	<u>1021.22</u>	" " " <u>.063</u>
	INCREASE,	1266.52	DECREASE, .019

The increase is due to increased percentage of district office charges being taken up by Austin Mine on account of larger pay-roll in 1917. The decrease in cost per ton is due to the increased product of 1917.

GENERAL EXPENSE TOTAL,	Year 1917,	7476.20	Cost per ton, .145
	Year 1916,	<u>3054.37</u>	" " " <u>.189</u>
	INCREASE,	3421.83	DECREASE, .044

The increase is due to more men employed, to increase in wages and larger product in 1917, while the decrease in cost per ton is due to large increase in product.

MAINTENANCE.

Tracks and Yards, (Acct. #125)	Year 1917,	20.84	Cost per ton,	.000
	Year 1916,	<u>130.90</u>	" " "	<u>.008</u>
	DECREASE,	110.06	DECREASE,	.008

In 1916, the Austin re-opened after being idle for several years and the expense in this account was consequently higher than in 1917.

Docks, Tres. & Pockets, (Acct. #126)	Year 1917,	1222.49	Cost per ton,	.024
	Year 1916,	<u>374.77</u>	" " "	<u>.023</u>
	INCREASE,	847.72	INCREASE,	.001

The increase is due to decision to operate Austin Mine during winter of 1917-18, which made it necessary to repair and extend the old permanent trestles and lay new collar plank. The charges of 1916 covered repairs to trestles and pockets necessary on re-opening the mine after several years shutdown.

Buildings, (Acct. #127)	Year 1917,	191.26	Cost per ton,	.004
	Year 1916,	<u>107.45</u>	" " "	<u>.007</u>
	INCREASE,	83.81	DECREASE,	.003

The increase is due mainly to purchase of fire hose in 1917, costing \$75.00. The greater part of the balance of 1917 charges were incurred on account of installing concrete foundations for No. 2 shaft house. The decrease in cost per ton is due to larger product.

Hoisting Machinery, (Acct. #130)	Year 1917,	467.25	Cost per ton,	.009
	Year 1916,	<u>442.57</u>	" " "	<u>.027</u>
	INCREASE,	24.68	DECREASE,	.018

The 1917 charge is due to trouble with the hoist motor. The motor of 150 H.P. was not powerful enough and finally burned out in September. The Princeton motor of 200 H.P. was then transferred to the Austin. The expense of 1916 was incurred on account of overhauling the hoisting plant when the mine re-opened after the three-year shutdown.

Compr. & Power Drills, (Acct. #131)	Year 1917,	858.22	Cost per ton,	.017
	Year 1916,	<u>1918.18</u>	" " "	<u>.118</u>
	DECREASE,	1059.96	DECREASE,	.101

The large decrease is due to the purchase of less drills in 1917. When the mine re-opened in 1916 it was necessary to purchase a total of 17 drill machines. In 1917, 6 machines were purchased as more were needed on account of increase in working force in the mine.

Pumping Machinery, (Acct. #132)	Year 1917,	2799.94	Cost per ton,	.054
	Year 1916,	<u>46.03</u>	" " "	<u>.003</u>
	INCREASE,	2753.91	INCREASE,	.051

The very large increase is due to the flooding of the mine in December, 1917. An effort was made to keep the Stephenson Mine water out of the Austin by installation of concrete dams but the water came through the caved ground. An attempt was then made to pump the water, but this was also unsuccessful.

Top Tram Eng. & Cars, (Acct. #133)	Year 1917,	166.94	Cost per ton,	.003
	Year 1916,	<u>144.03</u>	" " "	<u>.007</u>
	INCREASE,	52.91	DECREASE,	.004

The small increase is due to more repairs necessary to top tram equipment in 1917. In 1916, rock only was trammed but the rock car and puffer had to be thoroughly overhauled on account of

MAINTENANCE: (Cont'd.)

re-opening the mine. In 1917, the greater part of the expense was due to preparation for stocking ore on account of mine operating during the winter. The decrease in cost per ton is due to larger product.

Skips and Skip Roads, (Acct. #134)	Year 1917,	439.38	Cost per ton,	.008
	Year 1916,	<u>189.12</u>	" " "	<u>.012</u>
	INCREASE,	250.26	DECREASE,	.004

The increase is due principally to rebuilding skip in 1917, while the decrease in cost per ton is due to the larger product.

U. G. Trax & Cars, (Acct. #135)	Year 1917,	1383.82	Cost per ton,	.027
	Year 1916,	<u>535.62</u>	" " "	<u>.033</u>
	INCREASE,	748.20	DECREASE,	.006

The increase is due to building new main and sub-level cars in 1917. A number of the old main line cars were also equipped with new roller bearing trucks. There were also more gangs mining ore in 1917, consequently more extensions of sub-level tracks. The decrease in cost per ton is due to larger product.

Tel. & Safety Devices, (Acct. #137)	Year 1917,	105.67	Cost per ton,	.002
	Year 1916,	<u>148.22</u>	" " "	<u>.009</u>
	DECREASE,	42.55	DECREASE,	.007

The decrease is due to less expense for safety devices in 1917. When the mine re-opened in 1916, after being idle for three years, there was a considerable expense for safety devices.

TOTAL MAINTENANCE,	Year 1917,	7655.81	Cost per ton,	.148
	Year 1916,	<u>4007.21</u>	" " "	<u>.247</u>
	INCREASE,	3648.60	DECREASE,	.099

The large increase in maintenance cost in 1917 was due principally to the extraordinary expenses on account of the mine flooding in December; also to the extra expenses entailed on account of operating during the winter, which made it necessary to prepare for stocking ore. The decrease in cost per ton is due to larger product.

MINING EXPENSE.

Air Pipes, (Acct. #150)	Year 1917,	485.48	Cost per ton,	.009
	Year 1916,	<u>396.89</u>	" " "	<u>.025</u>
	INCREASE,	88.59	DECREASE,	.016

The increase is due to higher wages paid pipemen and increased cost of pipe, while the decrease in cost per ton is due to increased product.

Compressors, (Acct. #151)	Year 1917,	3200.72	Cost per ton,	.062
	Year 1916,	<u>1700.13</u>	" " "	<u>.105</u>
	INCREASE,	1500.59	DECREASE,	.047

The increase is due to mine operating more days in 1917 and to higher cost per 1000 cu. ft. of air. The air cost more on account of higher wages paid compressor engineers, to higher cost of coal and to increased maintenance charges in 1917.

Hoisting, (Acct. #152)	Year 1917,	1242.23	Cost per ton,	.024
	Year 1916,	<u>739.90</u>	" " "	<u>.045</u>
	INCREASE,	502.33	DECREASE,	.021

The increase is due to increase in wages, and to operating 1, 8-hr. shift, 190 days and 2, 8-hr. shifts, 11 days in 1917, as compared with 1, 8-hr. shift 148 days in 1916. The decrease in cost per ton is due to the increased product.

MINING EXPENSE:

Pumping, (Acct. #153)	Year 1917,	258.86	Cost per ton,	.005
	Year 1916,	<u>22.13</u>	" " "	<u>.001</u>
	INCREASE,	236.73	INCREASE,	.004

The increase is due to attempt to keep the water out of the mine in December, 1917, when pumps were operated a short time on 5th and 3rd levels.

Sinkg. & Shft. Repairs, (Acct. #154)	Year 1917,	2613.25	Cost per ton,	.051
	Year 1916,	<u>1324.88</u>	" " "	<u>.082</u>
	INCREASE,	1288.37	DECREASE,	.031

The increase is due to more work at #2 shaft in 1917. The decrease in cost per ton is due to the increased product.

Rock Drifting, (Acct. #155)	Year 1917,	3147.69	Cost per ton,	.061
	Year 1916,	<u>1907.69</u>	" " "	<u>.118</u>
	INCREASE,	1240.00	DECREASE,	.057

The increase is due to more rock drifting in 1917 on account of preparations for mining shaft pillar on upper levels. In 1917, there was 464 feet of rock drifting costing \$6.78 per foot; in 1916, 170 feet, costing \$11.22 per foot. The decreased cost per ton is due to the increased product.

Breaking Ore, (Acct. #156)	Year 1917,	27707.83	Cost per ton,	.536
	Year 1916,	<u>8933.07</u>	" " "	<u>.552</u>
	INCREASE,	18774.76	DECREASE,	.016

The increase is due to mine operating more days in 1917, to increased wages, to increased cost of supplies and to more men mining ore. The decreased cost per ton is due entirely to adjusting ore shortage on old stockpiles loaded in 1916. The cost per ton in 1916, ignoring the adjustment (which decreased product of 1916, 5,138 tons) was .417 per ton, or .119 lower than in 1917.

Tramming, (Acct. #157)	Year 1917,	7383.66	Cost per ton,	.143
	Year 1916,	<u>3032.93</u>	" " "	<u>.187</u>
	INCREASE,	4350.73	DECREASE,	.044

The increase is due to higher wages paid trammers, and to more ore trammed in 1917. The decrease in cost per ton is due to loss of 5,138 tons in 1916 product due to adjusting stockpile shortage. Without this adjustment, the cost per ton for two years was practically equal due principally to better hoisting conditions after 200 H.P. motor from Princeton was installed on Austin hoist.

Timbering, (Acct. #159)	Year 1917,	11761.83	Cost per ton,	.228
	Year 1916,	<u>5095.26</u>	" " "	<u>.315</u>
	INCREASE,	6666.57	DECREASE,	.107

The increase is due to mine operating more days in 1917, to higher wages paid timberman, and to slight increase in amount of timber used per ton of ore. Floor lagging was used in a larger territory in 1917, than in 1916, and there were more old drifts retimbered. The cost per ton for the two years is practically equal if the adjustment in 1916 on account of stockpile shortage is ignored.

MINING EXPENSE:

Capt. & Bosses, (Acct. #160)	Year 1917,	2866.96	Cost per ton,	.056
	Year 1916,	<u>1063.27</u>	" " "	<u>.066</u>
	INCREASE,	1803.69	DECREASE,	.010

The increase is due to increase in wages while the decreased cost per ton is due to the increased product.

Dry House, (Acct. #161)	Year 1917,	711.97	Cost per ton,	.014
	Year 1916,	<u>153.39</u>	" " "	<u>.009</u>
	INCREASE,	558.58	INCREASE,	.005

The increase is due to increase in wages paid dryman and to increase in cost of heating dry due to higher price of coal.

Top Ldg. & Trammimg, (Acct. #162)	Year 1917,	1685.49	Cost per ton,	.033
	Year 1916,	<u>551.69</u>	" " "	<u>.034</u>
	INCREASE,	1133.80	DECREASE,	.001

The increase is due to operating mine after close of the shipping season, when ore was stocked, to increase in wages and to operating for eleven days in December on double shift.

Stocking Ore, (Acct. #163)	Year 1917,	269.19	Cost per ton,	.005
	Year 1916,	<u>105.47</u>	" " "	<u>.005</u>
	INCREASE,	163.72	- - -	-

The increase is due to expense connected with preparations to stock ore. The 1916 charges were incurred on account of re-opening the mine.

TOTAL MINING EXPENSE,	Year 1917,	63426.94	Cost per ton,	1.228
	Year 1916,	<u>25058.29</u>	" " "	<u>1.548</u>
	INCREASE,	38368.65	DECREASE,	.320

The increase is due to larger product of 1917, to increase in wages, and to increase in cost of supplies. The decrease in cost per ton is due to increased product. If the tonnage taken from hoist to adjust stockpile shortage is included for 1916, the cost per ton in 1916 was .053 lower than in 1917. The mining cost in December 1917, was very high due to putting mine on double shift and to gradual decrease in product due to flooding of the mine, the same number of men being employed in removing equipment, etc.

WAGE RATES, Increased: May 1st, 1917: Oct. 1st, 1917.
February 1st, May 1st, December 16th, 1916.

Discontinued mining operations on December 21st, 1917, account of mine being flooded.

GWINN MINE.

COST DATA FOR YEARS 1917-1916.

	YEAR 1917	YEAR 1916	INCREASE	DECREASE
Shifts and Hours,	2,8-hr. Jan. Jul 1,8-"Jul. Dec. 15th 2,8-hr. Dec. 15	2,8-hr.		
Product,	161,963	144,066	17,897	
Average Daily Product,	540	479	61	
Number of days operated,	300	301		1
Number of days idle,	13	12	1	
Number men - surface,	33	40		7
Avg. rate per day - surface,	3.38	2.74	0.64	
Tons per man - surface,	16.33	12.13	4.20	
Number men - underground,	120	141		21
Avg. rate underground,	4.03	3.16	.87	
Tons per man "	4.44	3.29	1.15	
Total Avg. Men,	153	181		28
" " Rate,	3.89	3.09	0.80	
Tons per man per day,	3.49	2.66	0.83	
General Expense, per ton,	.161	.174		.013
Maintenance " " "	.133	.136		.003
Mining Expense " "	1.547	1.462	.085	
Cost of Production" "	1.841	1.772	.069	
Avg. Daily Cost - Labor,	626.00	547.00	79.00	
" " " - Supplies,	368.00	300.00	68.00	
" " " - Total,	994.00	847.00	147.00	

	<u>LABOR</u>	<u>PER TON</u>	<u>SUPPLIES</u>	<u>PER TON</u>	<u>TOTAL</u>	<u>PER TON</u>
Year 1917,	187,906.14	1.160	110,354.89	.681	298,261.03	1.841
Year 1916,	164,746.45	1.144	90,326.18	.628	255,072.63	1.772
INCREASE,	23,159.69	0.016	20,028.71	.053	43,188.40	.069

MISCELLANEOUS:

WAGE RATES, Increased: May 1st: October 1st, 1917.
February 1st, May 1st, December 16th, 1916.

GWINN MINE.

ANALYSIS OF MINING COSTS FOR 1917-1916.

	<u>YEAR 1917</u>	<u>YEAR 1916.</u>
Product for year,	161,963	144,066
Average Daily Product,	540	479
Number of shifts and hours,	2-8-hr. 177	2-8-hr. 301

	1917 AMOUNT	PER TON	1916 AMOUNT	PER TON	PER TON INCREASE	PER TON DECREASE
<u>MAINTENANCE:</u>						
150-Air Pipes,	3,177.30	.020	2,676.76	.018	.002	
166-Cave-In,			2,6			
TOTAL,	3,177.30	.020	2,676.76	.018	.002	
<u>SUPERINTENDENCE:</u>						
160-Capt. & Bosses,	7,329.61	.045	4,565.35	.032	.013	
161-Dry House,	5,403.21	.033	3,983.84	.027	.006	
TOTAL,	12,732.82	.078	8,349.19	.059	.019	
<u>POWER:</u>						
151-Compressors,	17,585.87	.108	13,512.85	.094	.014	
152-Hoisting,	9,319.34	.057	7,745.21	.054	.003	
153-Pumping,	7,753.55	.048	7,259.64	.050		.002
TOTAL,	34,658.76	.213	28,517.70	.198	.015	
<u>MINING:</u>						
156-Breaking Ore,	109,518.16	.676	73,835.14	.513	.163	
157-Tramming,	16,948.77	.105	19,340.07	.134		.029
158-Filling,	135.42	.001	217.45	.002		.001
159-Timbering,	29,532.84	.182	17,436.27	.121	.061	
164-Sorting Ore,	438.96	.003	373.88	.003		
TOTAL,	156,574.15	.967	111,202.81	.773	.194	
<u>DEVELOPMENT.</u>						
154-Sinking & Shft. Reps.,	7,031.94	.043	21,669.60	.151		.108
155-Drifting,	30,118.21	.186	28,073.82	.195		.009
TOTAL,	37,150.15	.229	49,743.42	.346		.117
<u>HANDLING OUTPUT.</u>						
162-Top Landing,	5,118.96	.032	6,040.01	.042		.010
163-Stocking Ore,	1,236.87	.008	1,487.91	.010		.002
TOTAL,	6,355.83	.040	7,527.92	.052		.012
TOTAL MINING,	250,555.35	1.547	210,506.85	1.462	.085	

GWINN MINE.
ANALYSIS OF COST SHEETS, EXPLAINING INCREASE OR DECREASE IN
VARIOUS ACCOUNTS BETWEEN YEARS 1917 AND 1916.

<u>GENERAL EXPENSE:</u>			
Engineering, (Acct. #27)	Year 1917,	2586.92	Cost per ton, .016
	Year 1916,	<u>3083.90</u>	" " " <u>.021</u>
	DECREASE,	496.98	DECREASE, .005

The decrease in engineering expense in 1917 is due to less time put in by engineers on Gwinn Mine work. The raising of the shaft from 9th to 8th levels increased the engineering work in 1916.

Analysis, (Acct. #28)	Year 1917,	8729.06	Cost per ton, .054
	Year 1916,	<u>8890.67</u>	" " " <u>.062</u>
	DECREASE,	161.61	DECREASE, .008

The decrease is due to there having been 1,488 less determinations in 1917. In 1917, 188,070 tons were shipped; in 1916, 143,708 tons. The decrease, therefore, comes in the number of determinations of underground samples, which was due to the mine operating on single shift from July 15th to Dec. 15th. In 1917, there were 32,635 determinations costing \$1.192 each, in 1916, 34,123 determinations costing \$.182 each.

Personal Injury Expense, (Acct. #30)	Year 1917,	1648.55	Cost per ton, .010
	Year 1916,	<u>1565.61</u>	" " " <u>.011</u>
	INCREASE,	82.94	DECREASE, .001

The small increase of 1917 is due to more money having been paid out as compensation for personal injuries. This was mainly due to higher rate paid men which increased the weekly compensation rate. The decrease in cost per ton is due to larger product in 1917.

Mine Office, (Acct. #30-a)	Year 1917,	4442.25	Cost per ton, .027
	Year 1916,	<u>2894.20</u>	" " " <u>.020</u>
	INCREASE,	1548.05	INCREASE, .007

The increase is due to one policeman having been employed during the greater part of 1917, and to increases in salaries paid clerks.

District Office, (Acct. #30-b)	Year 1917,	8594.89	Cost per ton, .053
	Year 1916,	<u>8452.20</u>	" " " <u>.059</u>
	INCREASE,	142.69	.006

The district office expense in 1917 was increased due to increased salaries and to variations in percentages of charges taken up by the different mines. The decrease in cost per ton is due to the increased product.

TOTAL GENERAL EXPENSE,	Year 1917,	26121.08	Cost per ton, .161
	Year 1916,	<u>25005.77</u>	" " " <u>.174</u>
	INCREASE,	1115.31	DECREASE, .013

MAINTENANCE.

Tracks & Yards, (Acct. #125)	Year 1917,	787.76	Cost per ton,	.005
	Year 1916,	<u>735.31</u>	" " "	<u>.005</u>
	INCREASE,	52.45	- - -	

The slight increase is due to more expense for cleaning surface around the mine; due to advance in wages. The largest item of 1917 was for cleaning and grading the ground where the old shop building burned in 1916.

Docks, Trestles & Pockets, (Acct. #126)	Year 1917,	582.33	Cost per ton,	.003
	Year 1916,	<u>3472.83</u>	" " "	<u>.024</u>
	DECREASE,	2890.50	DECREASE,	.021

The large decrease is due to the making of less new stocking ground in 1917. The Gwinn #2 stockpile ground was extended slightly and collar laid in spring of 1917, while in 1916 an entirely new stocking ground was made for Gwinn Bessemer ore on account of wrecking the old Bessemer trestle and not shipping sufficient ore to permit of rebuilding the old trestle.

Buildings, (Acct. #127)	Year 1917,	619.29	Cost per ton,	.004
	Year 1916,	<u>550.81</u>	" " "	<u>.004</u>
	INCREASE,	68.48	- - -	

The small increase is due to increases in wages in 1917, the actual repairs for the two years were practically equal. The most important work in 1917 consisted of repairs to hospital room in dry, building of shed for hoisting ropes and to putting new roof on barn.

Boiler Plant, (Acct. #129)	Year 1917,	152.63	Cost per ton,	.001
	Year 1916,	<u>802.36</u>	" " "	<u>.006</u>
	DECREASE,	649.73	DECREASE,	.005

The large decrease is due to unusual expense in 1916 when a 150-H. P. boiler was installed in the heating plant. The only expense in 1917 was for covering this new boiler.

Hoisting Machinery, (Acct. #130)	Year 1917,	2668.83	Cost per ton,	.016
	Year 1916,	<u>2037.22</u>	" " "	<u>.014</u>
	INCREASE,	631.61	INCREASE,	.002

The increase is due principally to the advance in cost of supplies and advance in wages. Three new hoisting ropes were put on in 1917, the same number as in 1916. A new sheave was purchased in 1917 to replace a worn out sheave on top of the shaft house. The 1917 charges cover ordinary maintenance only, while the most of the 1916 charges were incurred on account of deepening the shaft from 8th to 9th levels.

Compr. & Power Drills, (Acct. #131)	Year 1917,	2948.85	Cost per ton,	.018
	Year 1916,	<u>2316.56</u>	" " "	<u>.016</u>
	INCREASE,	632.29	INCREASE,	.002

The increase is due partly to the purchase of more drills in 1917. In 1916, 5 Leyners, 2 Stoppers and 3 Auger drills were purchased, costing \$1833.32; in 1917, 14 Auger drills and one Sullivan DR-6 machine, costing \$1965.00. In 1917, 5, 6" expansion joints costing \$258.13 were installed in the 6" air line from Central Power Plant. A larger amount of alcohol, costing more per gallon, was used in 1917 in the air line from Central Power Plant and Francis to prevent freezing.

MAINTENANCE: (Cont'd)

Pumping Machinery, (Acct. #132)	Year 1917,	1462.28	Cost per ton,	.009
	Year 1916,	<u>789.17</u>	" " "	<u>.005</u>
	INCREASE,	673.11	INCREASE,	.004

The increase is due to more expense for cleaning and repairing sumps and to expense connected with starting up the new electric pump on 9th level.

Top Tram Eng. & Cars, (Acct. #133)	Year 1917,	1273.55	Cost per ton,	.008
	Year 1916,	<u>2054.99</u>	" " "	<u>.014</u>
	DECREASE,	781.44	DECREASE,	.006

The decrease is due mainly to less repairs required by top tram cars. In 1916, one new rock car was built and the two ore cars thoroughly overhauled; in 1917, very few repairs were required. A new rope, costing \$282.71 was put on in 1917, and flood lights costing \$131.64 were installed, the balance of charges cover repairs and replacements of top tram equipment.

Skips & Skip Roads, (Acct. #134)	Year 1917,	1339.35	Cost per ton,	.008
	Year 1916,	<u>674.08</u>	" " "	<u>.004</u>
	INCREASE,	665.27	INCREASE,	.004

The increase is due to more repairs being necessary in 1917. During the past year two skips have been rebuilt, the cage overhauled and the small skip used in #2 winze entirely rebuilt. There has also been considerable expense account of repairs to the deflector and plates in skip dumps in the shaft house.

Underground Trax & Cars, (Acct. #135)	Year 1917,	1772.03	Cost per ton,	.011
	Year 1916,	<u>1389.89</u>	" " "	<u>.010</u>
	INCREASE,	382.14	INCREASE,	.001

The increase is due entirely to the building of a number of new sub-level cars. This became necessary when the mine went on single shift on July 15th, as about 15 new contracts were added.

Electric Tram Plant, (Acct. #136)	Year 1917,	7394.23	Cost per ton,	.046
	Year 1916,	<u>4093.95</u>	" " "	<u>.029</u>
	INCREASE,	3300.28	INCREASE,	.017

The increase is due to purchase of three motor cars in 1917, and to more repairs being necessary to locomotives and cars; also to more extensions of haulage system due to opening of 9th level. There was also considerable expense connected with the removal of haulage system from 5th to 6th levels.

Tel. & Safety Devices, (Acct. #137)	Year 1917,	583.47	Cost per ton,	.004
	Year 1916,	<u>642.84</u>	" " "	<u>.005</u>
	DECREASE,	59.37	DECREASE,	.001

The small decrease is due to less expense in 1917 for safety devices. The expense of 1917, was for extension and upkeep of lighting system underground, for new equipment for hospital room, and for brattice cloth.

TOTAL MAINTENANCE,	Year 1917,	21584.60	Cost per ton,	.133
	Year 1916,	<u>19560.01</u>	" " "	<u>.136</u>
	INCREASE,	2024.59	DECREASE,	.003

MINING EXPENSE:

Air Pipes, (Acct. #150)	Year 1917,	3177.30	Cost per ton,	.020
	Year 1916,	<u>2676.76</u>	" " "	<u>.018</u>
	INCREASE,	500.54	INCREASE,	.002

The increase is due principally to the increased wages paid pipe-men. The largest item in 1917, was for installation of main air lines on 6th and 9th levels.

Compressors, (Acct. #151)	Year 1917,	17585.87	Cost per ton,	.108
	Year 1916,	<u>13512.85</u>	" " "	<u>.094</u>
	INCREASE,	4073.02	INCREASE,	.014

The large increase is due principally to purchase of air from Francis Mine; also to increase in charges for air from Central Power Plant. The air pressure at the working places in the mine is from 5 to 8 pounds higher than in 1916 due to air from Francis compressor. The Central Power Plant charge was very high in October due to unusual repairs to boiler plant and also in December due to Stephenson and Austin Mines closing down, which made the Gwinn Mine stand the greater part of operating cost. The cost of operating the Central Power Plant compressor was increased the last few months of the year due to higher cost of coal. The Central Power Plant compressor was operated electrically for 6-1/2 months, and by steam for the last 5-1/2 months of the year.

Hoisting, (Acct. #152)	Year 1917,	9319.34	Cost per ton,	.057
	Year 1916,	<u>7745.21</u>	" " "	<u>.054</u>
	INCREASE,	1574.13	INCREASE,	.003

The increase in labor cost is due entirely to the increase in wages. The power cost increased due to the large product and to hoisting from greater depth in 1917.

Pumping, (Acct. #153)	Year 1917,	7754.55	Cost per ton,	.048
	Year 1916,	<u>7259.64</u>	" " "	<u>.050</u>
	INCREASE,	494.91	DECREASE,	.002

The increase is due to the increase in wages, while the decrease in cost per ton is due to the increase in product.

Sinking & Shift. Repairs, (Acct. #154)	Year 1917,	7031.94	Cost per ton,	.043
	Year 1916,	<u>21669.60</u>	" " "	<u>.151</u>
	DECREASE,	14637.66	DECREASE,	.108

The large decrease is due to less sinking in 1917. In 1916, the shaft was sunk from 8th to 9th levels, and 65 feet below the 9th; there was also the cost of cutting out for loading pocket and installing same; also for skip pit drift and pocket at the bottom of the shaft. In 1917, #2 winze was sunk 110 feet from 9th to 10th levels and pockets built for handling dirt on 9th level.

Rock Drifting, (Acct. #155)	Year 1917,	30118.21	Cost per ton,	.186
	Year 1916,	<u>28073.62</u>	" " "	<u>.195</u>
	INCREASE,	2044.39	DECREASE,	.009

The increase in 1917 is due to advance in wages and in cost of supplies. In 1916, there was 3,336 feet of rock drifting, costing \$8.42 per foot, while in 1917, there was 3,031 feet, costing \$9.93 per foot.

MINING EXPENSE:

Breaking Ore,
(Acct. #156)

Year 1917,	109518.16	Cost per ton,	.676
Year 1916,	<u>73835.14</u>	" " "	<u>.513</u>
INCREASE,	35683.02	INCREASE,	.163

There was a very large increase in this account due to increases in wages, to increase in cost of supplies, to a larger product, to more unfavorable mining conditions and in a small measure to the confusion caused by suddenly putting the mine on double shift again on December 10th. Mining operations were scattered over several levels and there was an extraordinary amount of drifting in ore necessary in proportion to stoping. The flat ore deposit on 8th level is thin and rolling, which increases the cost of mining, while the ore obtained from the pillars between the square set rooms between the 6th and 7th levels has been expensive, due to the small ore area on each sub-level. In 1916, the bulk of the product came from the sub-levels above the 5th level; in 1917, the ore came from 5th, 7th, 8th and 9th levels.

Tramming,
(Acct. #157)

Year 1917,	16948.77	Cost per ton,	.105
Year 1916,	<u>19340.07</u>	" " "	<u>.134</u>
DECREASE,	2391.302	DECREASE,	.029

The decrease is due principally to operation of electric haulage for handling practically all product in 1917, while in 1916 there was considerable hand tramming on 4th and 9th levels. The cost was also reduced due to operating the mine on single shift from July 15th to December 10th; the same product being handled during this period with one-half the labor cost.

Filling,
(Acct. #158)

Year 1917,	135.42	Cost per ton,	.001
Year 1916,	<u>217.45</u>	" " "	<u>.002</u>
DECREASE,	82.03	DECREASE,	.001

The decrease is due to breaking less capping in 1917. The ground on lower levels has caved as soon as mining has been finished. When mining on top subs in pillars between square set rooms above the 7th level, it was necessary to break some capping to form a matt.

Timbering,
(Acct. #159)

Year 1917,	29532.84	Cost per ton,	.182
Year 1916,	<u>17436.27</u>	" " "	<u>.121</u>
INCREASE,	12906.57	INCREASE,	.061

The large increase is due to more timber used in mine in 1917, and to the increase in wages. More timber was used for the following reasons: First, larger product: Second, over 2,000 feet of cribbed raises put up in 1917; Third, on account of mining the thin flat deposit on the 8th level. To keep the product clean here it is necessary to lag the floors very carefully; also to use 10" to 12" timber to keep the drifts open. It, therefore, has required more board feet of timber per ton of ore in this territory. During 1917 there has also been an extraordinary amount of drifting in ore in developing the 8th level deposit for mining and in opening the 9th and 10th levels, all of which has required timber.

Capt. & Bosses,
(Acct. #160)

Year 1917,	7235.95	Cost per ton,	.045
Year 1916,	<u>4565.35</u>	" " "	<u>.032</u>
INCREASE,	2670.60	INCREASE,	.013

The increase is due to the increase in wages, and to employing another shift boss account of opening the 10th level.

MINING EXPENSE.

Dry House,
(Acct. #161)

Year 1917,	5403.21	Cost per ton,	.033
Year 1916,	<u>3983.84</u>	" " "	<u>.027</u>
INCREASE,	1419.37	INCREASE,	.006

The increase is due to increase in wages, to high cost of water for dry in early months of 1917 due to freezing of water system, and to increased cost of coal purchased last summer. When the mine was operated on single shift there was no saving in labor as the 10th level work was continued on double shift through the summer.

Top Landing & Traming,
(Acct. #162)

Year 1917,	5118.96	Cost per ton,	.032
Year 1916,	<u>6040.01</u>	" " "	<u>.042</u>
DECREASE,	921.05	DECREASE,	.010

The decrease is due to one less man on top landing during the greater part of 1917 and to operation of mine on single shift from July 15th to December 10th. The decrease would have been greater except for the wage increases.

Stocking Ore,
(Acct. #163)

Year 1917,	1236.87	Cost per ton,	.008
Year 1916,	<u>1487.91</u>	" " "	<u>.010</u>
DECREASE,	251.04	DECREASE,	.002

The decrease is due to less expense in 1917 for tearing down and re-erecting temporary trestles.

Sorting Ore,
(Acct. #164)

Year 1917,	438.96	Cost per ton,	.003
Year 1916,	<u>373.88</u>	" " "	<u>.003</u>
INCREASE,	65.08	- - -	

The increase is due principally to charging some labor underground for picking rock from ore. Less sorting was necessary on surface on account of hoisting a cleaner product.

TOTAL MINING EXPENSE,

Year 1917,	250555.35	Cost per ton,	1.547
Year 1916,	<u>210506.85</u>	" " "	<u>1.462</u>
INCREASE,	40048.50	INCREASE,	.085

COST OF PRODUCTION,

Year 1917,	298261.03	Cost per ton,	1.841
Year 1916,	<u>255072.63</u>	" " "	<u>1.772</u>
INCREASE,	43188.40	INCREASE,	.069

The increase in cost of production is due principally to increase in wages and cost of supplies.

WAGE RATES, Increased May 1st: October 1st, 1917.
February 1st, May 1st, December 16th, 1916.

Mine operated on two 8-hour shifts from Jan. 1st to July 15th, 1917.
" " " one 8-hour " " Jul. 15th " Dec. 10th, 1917.
" " " two-8-hour " " Dec. 10th " Dec. 31st, 1917.

REPUBLIC MINE.

PRODUCTION.

The total product for the year 1917 totalled 153,425 tons, composed of the following grades:-

	<u>TONS</u>	<u>%</u>
Bessemer Ore,	101,263	66.1
Basic "	30,682	20.0
Pascoe "	21,480	13.9
<u>TOTAL,</u>	<u>153,425</u>	<u>100.0</u>

The product for the previous year was as follows:-

	<u>TONS</u>	<u>%</u>
Bessemer Ore,	99,014	57.3
Basic "	38,904	22.4
Pascoe "	35,178	20.3
<u>TOTAL,</u>	<u>173,096</u>	<u>100.0</u>

Altho' the total production for 1917 was considerably less than that of 1916, the amount of Bessemer ore was greater. The Bessemer ore hoisted during 1915 was 92,002 tons or 49.7% of the total product.

The rock hoist totalled 44,674 tons compared with 63,441 tons for 1916.

MONTHLY PRODUCTION AND TONS PER MAN PER DAY.							
1916	PRODUCT	TONS PER DAY	NO. MEN	TONS PER MAN PER DAY			ROCK HOISTED
				SURFACE	U.G.	TOTAL	
Jan.,	13,171	527	267	8.91	2.52	1.97	8,000
Feb.,	13,665	547	271	8.81	2.61	2.01	7,206
Mar.	14,728	545	274	8.96	2.57	1.99	6,770
Apr.	13,755	598	285	8.37	2.77	2.08	4,858
May,	15,137	561	280	7.44	2.74	2.00	4,720
Jun.	15,074	603	279	8.14	2.94	2.16	5,627
Jul.	13,931	557	272	7.68	2.78	2.04	5,441
Aug.	14,600	540	276	7.42	2.66	1.96	5,662
Sep.	14,070	563	274	8.34	2.72	2.05	4,943
Oct.	15,618	600	267	9.28	2.97	2.25	3,796
Nov.	12,661	528	248	7.96	2.90	2.13	2,827
Dec.	12,088	504	239	7.84	2.85	2.09	3,582

MONTHLY PRODUCTION AND TONS PER MAN PER DAY.

1917	PRODUCT	TONS PER DAY	NO. MEN	TONS PER MAN PER DAY			ROCK HOISTED
				SURFACE	U.G.	TOTAL	
Jan.	13,863	533	237	9.12	2.98	2.24	3,415
Feb.	13,869	578	238	9.45	3.25	2.41	4,210
Mar.	14,850	550	240	8.93	3.06	2.28	4,562
Apr.	11,583	504	251	7.02	2.79	1.99	3,975
May,	15,225	586	260	7.44	3.23	2.32	4,214
Jun.	12,969	519	255	6.69	2.90	2.02	4,423
Jul.	12,150	486	255	6.34	2.72	1.90	5,411
Aug.	13,067	484	246	6.57	2.82	1.97	4,747
Sep.	13,602	567	241	8.23	3.28	2.36	2,749
Oct.	12,332	457	235	6.91	2.71	1.94	3,088
Nov.	9,846	394	222	6.02	2.51	1.77	2,136
Dec.	10,069	420	219	6.67	2.84	1.99	1,744

Production decreased steadily from June until the close of the year. The product for the first five months of this year was just about the same as last. The reason for the decreased tonnage is mostly due to the lesser number of available tramming places. The ore on stulls on January 1st, 1916, was 177,934 tons; on January 1st, 1917, the total was 132,630 tons, which by January 1st, 1918, had shrunk to 73,538 tons. About half of this latter tonnage was in two stopes while the rest was scattered in small lots on the various levels. In the last three months of the year we were also handicapped by shortage of trammers. The tons per day should have averaged at least 500, which production could have been maintained by the steady employment of at least 36 trammers. Production is also hindered because we are becoming more and more dependent on the working stopes for our daily production. From these stopes in which the miners are employed, the surplus ore only can be drawn off. It frequently happens that no ore can be drawn from any of these stopes for a day or two. The trammers then must secure their product from the ore held in reserve in the stopes where mining has been finished. When these latter stopes are few in number, it is with difficulty that a suitable filling place can be found for the trammers and consequently, it is hard to hold the trammers.

During the past year we had trouble in June, July, August, October and November, keeping trammers fully employed. The month of September showed a good product and December showed some improvement over November. In these two months we had stopes from which ore could be drawn when the regular working places did not provide the ore.

It will be noted from the statement shown previously that the total number of men has decreased, the close of the year showing the least men employed ever since the Cleveland-Cliffs Iron Company acquired the property. This saving was accomplished as follows:-

First, we operated the Crusher in 1917 with six men. During 1916, seven men were employed and in 1915, eight were used at the Crusher. This saving was made possible by having only one man to unload the cars from the shovel and by appointing the Master Mechanic foreman of the Crusher crew.

Secondly, the teaming at the close of the year was done by one teamster, the choreman at the superintendent's house driving the second team.

Third, the Blacksmith Shop was reduced to six men and a foreman. During 1916, nine men were employed.

Fourth, the pipemen and trackmen underground were reduced from four to two men.

Fifth, the timber gang which numbered a foreman and six men in 1916, was reduced to a foreman and two men.

Sixth, the health officers were abolished.

Seventh, the number of blockholers in the Pascoe Shaft were reduced from eight to four men.

Eighth, the car pickers were reduced two in number.

TRAMMING.

A statement was made previously regarding the scarcity of trammers. This is shown by the following tables which give the average number of trammers employed, cars filled, etc. Altho' the number of trammers employed has decreased, their efficiency has increased because during the last half of 1917, the average was increased about one car per man per day

YEAR	AVE. NO. OF TRAMMERS	TOTAL CARS TRAMMED.	DAYS	CARS PER TRAMMER PER DAY
1914	33	67,519	5353	12.6
1915	39	150,969	12172	12.4
1916	38	140,725	11429	12.3
<u>1917</u>				
Jan.	33	10,968	868	12.6
Feb.	36	11,019	840	13.1
Mar.	34	11,499	913	12.5
Apr.	32	9,377	720	13.0
May,	36	12,331	949	11.9
Jun.	34	10,814	857	12.6
Jul.	30	9,917	757	13.1
Aug.	28	10,381	759	13.6
Sep.	28	10,381	706	14.7
Oct.	27	9,805	728	13.4
Nov.	20	6,433	483	13.3
Dec.	23	6,831	520	13.3
TOTAL- 1917,	30	119,883	9122	13.1

COST OF PRODUCTION.

The statement shown below shows the costs for the last two years:-

1916 MONTH.	LABOR STATEMENT			COST SHEET		
	LABOR COSTS PER TON			COST OF PRODUCTION.		
	SURFACE	U.G.	TOTAL	LABOR	SUPPLS	TOTAL.
Jan.	.290	1.091	1.381	1.412	.568	1.980
Feb.	.317	1.126	1.443	1.476	.446	1.922
Mar.	.310	1.151	1.461	1.493	.448	1.941
Apr.	.331	1.072	1.403	1.383	.637	2.020
May,	.383	1.144	1.527	1.451	.585	2.036
Jun.	.350	1.100	1.450	1.400	.549	1.949
Jul.	.374	1.139	1.513	1.446	.627	2.067
Aug.	.390	1.210	1.600	1.501	.680	2.181
Sep.	.350	1.198	1.548	1.475	.683	2.158
Oct.	.315	1.103	1.418	1.352	.662	2.014
Nov.	.374	1.109	1.483	1.448	.724	2.172
Dec.	.399	1.176	1.575	1.562	.714	2.276
1916 Average	.348	1.135	1.483	1.321	.692	2.013

COST OF PRODUCTION.

1917 MONTH	LABOR STATEMENT			COST SHEET		
	LABOR COSTS PER TON			COST OF PRODUCTION.		
	SURFACE	U.G.	TOTAL	LABOR	SUPPLS	TOTAL.
Jan.	.362	1.188	1.550	1.532	.604	2.136
Feb.	.352	1.087	1.439	1.428	.626	2.054
Mar.	.368	1.139	1.507	1.495	.645	2.140
Apr.	.467	1.265	1.732	1.658	.833	2.494
Mar.	.471	1.204	1.675	1.581	.686	2.267
Jun.	.529	1.319	1.848	1.728	1.232	2.958
Jul.	.555	1.412	1.967	1.837	.932	2.328
Aug.	.535	1.379	1.914	1.761	1.128	2.889
Sep.	.435	1.200	1.635	1.587	1.048	2.635
Oct.	.568	1.545	2.113	2.032	1.110	3.142
Nov.	.657	1.657	2.314	2.218	1.164	3.382
Dec.	.600	1.476	2.076	2.018	1.166	3.184
1917 Average	.482	1.306	1.788	1.628	.966	2.594

A comparison of the costs for the last two years shows an average increase of 58¢ per ton for the last twelve months, or an increase of 30%. The supplies have increased 27¢ per ton or 40% and the Labor 31¢ or 24%. The cost for Labor has increased due to the increases in wages and smaller daily average hoist. The increases in wages were 10% effective May 1st, and 10% effective October 1st. There was also an increase of 10% on December 16th, 1916, which affected the first four months of 1917. This makes an average increase of 26% in wages over last year compared with the 24% shown on the Cost Sheet, indicating a slight increased Labor efficiency over last year. Costs were increased by the rocky condition of the ore drawn from the stopes in No. 9 Shaft. The explanation is simple. The Stull Statement of two years ago, showed thirteen stopes, each containing over 5,000 tons of available broken ore. The Stull Statement attached to this report shows only two. The rest of them contain small amounts of ore on top of which lie thousands of tons of hanging and foot rock, usually Soaprock or Quartzite. This rock occurs in large masses and must be sledged or blasted in order to get at the ore because a good deal of rock becomes mixed with the ore.

The cycle of tramming from any stope shows that the first ore comes clean and rock becomes more and more mixed with the ore until finally the stope must be abandoned. Take a typical stope for example: No. 7 Stope, 1950' Level, Pascoe Shaft. The following are the cars of ore and rock handled monthly, viz:-

	ORE	ROCK
Mar., 1916,	30	3
Apr. "	675	131
May, "	325	27
Jun. "	140	20
Jul. "	495	50
Aug. "	1095	151
Sep. "	970	314
Oct. "	1975	1100
Nov. "	660	249
Dec. "	510	921
Jan., 1917,	1165	1265
Feb. "	935	1115
Mar. "	1170	570
Apr. "	230	350
May, "	490	370
Jun. "	710	647
Jul. "	365	520

This plainly shows that as a stope is cleaned out, the expenses increase due to the rock handled. Car-pickers must be provided to sort out the rock and blockholers constantly employed to break up the chunks. This is proven again by an examination of the statement shown later in this report wherein the explosives used by the blockholers exceeded those used by the miners when the rock picked from the belt in No. 9 Shaft exceeded 1500 tons.

Costs were also increased by the small size of the ore bodies at present being worked. The ore in this mine is of such a nature that it can not be cheaply broken except when in lenses at least 20 feet wide. A statement shown later in this report shows this very clearly. An examination of the maps in the No.9 Shaft shows the last sizable ore body along the hanging wall on the 1935' Level. Even at that the ore here was much smaller than the corresponding ore body on the 1815' Level. The 2082' Level showed what appears to be a good sized ore body on the Maps but is in reality a stope of ore badly mixed with Jasper.

In the Pascoe Shaft, a fair sized stope called #1 West, was opened up.

Another item of increased expense was the high cost of coal. The only source of power, except the Water Power Plant, was steam, the mine not being electrically equipped as most of the other Cleveland-Cliffs Iron Company's properties are. The coal was also of very inferior grade and consumption was thereby increased.

The average depth from which ore is hoisted is also constantly increasing.

The explosive item is also a serious one at this time. the ore is very hard and the rock drifting and blockholing requires a large amount of explosives. The cost of explosives is increasing and consumption will vary depending largely on the nature of the ore.

The force employed has been pruned down to the minimum as long as both the No. 9 and Pascoe Shafts are operated. If all the ore was diverted to No. 9 Shaft, expenses would be less. Plans are now being put into execution which will gradually eliminate the Pascoe Shaft as a producer.

SHIPMENTS.

The shipments for the year amounted to 168,250 tons.

The ore was consigned to the following points:-

SHIPPED TO:-	BESSEMER		BASIC		PASCOE		TOTAL	VIA: R.R.
	LUMP	CRUSHED	LUMP	CRUSHED	LUMP	CRUSHED		
A.C.Leslie, Ashland Furnace	87			1012			87	DSS&A.
L.S.&I. Docks,	31659	59518	18358	17622	14260	25734	167151	C&NW. C&NW & LS&I.
TOTAL,	31746	59518	18358	18634	14260	25734	168250	

The Lump ore for which there was an unusual demand, totalled 64,364 tons compared with 64,161 tons for the previous year. The total shipments for 1917 were 40,000 tons less than those for 1916.

GRADING AND MIXING CARGOES.

The same method of mixing the ores in the docks was used as in the previous year. That the ore was mixed properly and thoroughly is proven by the close checks between the Mine and lower Lake chemists.

COMPARATIVE ANALYSIS.

	MINE ANALYSIS		LOWER LAKE	
	IRON	PHOS.	IRON	PHOS.
Bessemer Lump,	63.78	.037	64.59	.039
Basic "	63.75		63.96	
Bessemer Crushed,	62.60	.038	62.80	.038
Basic "	61.59		61.89	

We shipped four grades of ore to Lower Lake ports made up as follows:-

Bessemer Lump:-

Bessemer Lump,	1,000 tons,	72.7%
Pascoe "	378 "	27.3%
Total,	1,378 "	100.0%

Basic Lump:-

Bessemer Lump,	30,659 tons,	48.8%
Basic "	18,358 "	29.2%
Pascoe "	13,882 "	22.0%
Total,	62,899 "	100.0%

Bessemer Crushed:-

Bessemer Crushed,	51,438 tons,	67.5%
Pascoe "	13,909 "	18.3%
Abbotsford, "	1,149 "	1.5%
Holmes "	9,619 "	12.7%
Total,	76,115 "	100.0%

Basic Crushed:-

Bessemer Crushed,	8,080 tons,	21.4%
Basic "	17,622 "	46.8%
Pascoe "	11,825 "	31.4%
Abbotsford "	176 "	.4%
Total,	<u>37,703 "</u>	<u>100.0%</u>

The Basic Lump cargoes which averaged 63.75% Iron did not carry all the Pascoe Lump possible, due to the impossibility of securing Lump on account of the preponderance of "Fines" in the ore. The Pascoe grade ore ran heavily to "Fines" and at times we carried a balance of over 2,000 tons of unavailable Pascoe Crushed ore at the dock.

The shipments for the season contained 91,264 tons of Bessemer ore compared with 90,809 tons, estimated production. The Basic grade shipped totalled 36,992 tons, while the estimate called for 33,473 tons. The Pascoe grade was not all shipped, there being a balance on hand of about 14,000 tons on November 15th, 1917.

SORTING ORE.

The sorting of the ore becomes more and more important as the stopes are becoming exhausted. During August, September and October, the ore ran off grade day after day, due to the rocky condition of the No. 9 Shaft stopes. The ore on the 1815' Level, No. 9 Shaft, is particularly bad in this respect. As the stopes become exhausted, we have no choice except to take the ore as it comes. You will note from the Picking Belt statement shown elsewhere that in July and August nearly 30% of the material hoisted as ore was discarded. In the Pascoe Shaft, conditions were also bad. In No. 9 Shaft in 1915, 22.4% of the ore drawn from stopes was sorted as rock. In 1916, the discarded rock amounted to 28.4%. In 1917, the total was 30.6% as shown.

CARS OF ORE & ROCK FROM STOPES.

MONTH AND YEAR.	PASCOE SHAFT				NO. 9 SHAFT			
	CARS ORE	%	CARS ROCK	%	CARS ORE	%	CARS ROCK	%
Year 1915,	34948	70.5%	14621	29.5%	48481	77.6%	13842	22.4%
" 1916,	41552	67.9%	19637	32.1%	53136	71.6%	21191	28.4%
Jan., 1917,	2607		1733		4433		1261	
Feb. "	3857		1694		3011		1135	
Mar. "	3267		1541		4748		1297	
Total for 3 months,	9731	66.2%	4968	33.8%	12192	76.7%	3693	23.3%
Apr., 1917,	2589		1448		4109		1379	
May, "	3221		1190		4954		1998	
Jun. "	3285		1487		3951		2493	
Total for 3 months,	9095	68.8%	4125	31.2%	13014	69.0%	5870	31.0%
Jul., 1917,	2783		1398		5082		3927	
Aug. "	2838		621		5551		3354	
Sep. "	3348		745		4759		1989	
Total for 3 months,	8969	76.4%	2764	23.6%	15392	62.4%	9270	37.6%
Oct., 1917,	3449		1210		4340		1772	
Nov. "	2253		586		2839		1120	
Dec. "	3475		791		2452		470	
Total for 3 months,	9177	85.2%	1587	14.8%	9631	74.2%	3362	25.8%
TOTAL FOR YEAR,	36972	73.4%	13444	26.6%	50229	69.4%	22195	30.6%

STEAM SHOVEL LOADING.

Only one Shovel was operated during the past season.

The old Republic Iron Company Shovel was in such bad shape that breakdowns occurred daily during the latter part of 1916, and it was cheaper to move the one shovel from pile to pile rather than suffer the daily delays when operating the second shovel.

The following table gives tonnages loaded and costs for the last two years:-

YEAR	TONS LOADED	LABOR	SUPPLIES	TOTALS	COST PER TON.
1916	101,580	2728.49	1115.63	3844.12	.0389
1917	80,776	2366.20	2421.31	4787.51	.0590

Costs for 1917 were high due to increased wages, extensive repairs made during winter season, increased cost of coal and delays due to poor car service. We rarely received cars before 9 A.M., and then only enough for about 6 hours work. During 1916, we averaged 40 cars per day but 30 was the maximum given us during 1917.

ANALYSIS.

The various items on the cost sheet will be taken up under the individual headings.

ENGINEERING.

This work is done by the Engineering Department from the Central Office. The expense for 1916 is not much over that of 1917 notwithstanding the increased wages. The monthly survey is usually finished in one day. The expenses were largely due to the Geological survey of the mine made by Messrs. Derby and Miller. A complete set of Geological Maps of all the levels has been completed.

ANALYSIS.

The Mine and Crusher samples are analyzed by a chemist at the mine office who devotes nearly half of his time to the shipping. The cost per determination has increased about 40% compared with last year. This is due to the increased price of chemicals and wage increase. The number of determinations also dropped 20% which of course increased the unit cost as the overhead expense is about the same.

PERSONAL INJURY EXPENSE.

We have been fortunate regarding injuries. The usual run of accidents are bruised fingers and feet. Sledging rock and ore also caused some minor injuries.

During 1915, there were 111 accidents; in 1916, we reported 99. The 1917 total was 79.

The personal injury expense for 1917 was greater than that for 1916, due to higher rate of compensation and large cash settlement to Emil Ringuette, injured on August 9th, 1916.

MINE OFFICE.

There are still employed a Mine Clerk, Time Keeper and Warehouse man. In addition, the shipping is handled by the chemist who devotes half of his time to the Laboratory and the other half to the office, calculating mixtures, cargoes, etc. The Mine Office expense is very high considering the number of men employed.

TRACKS & YARDS.

Considerable cleaning up was done around the mine surface. Several old buildings, trestles, head frames, etc., out of use, were torn down. We salvaged considerable timber and rail and scraped the material that could not be used.

The C. & N. W. Ry. lowered the railway tracks at the Pascoe Shaft Pockets one foot to permit loading the standard L. S. & I. cars. Heretofore wooden cars or steel cars of the "400" class only could be used which caused endless trouble at the Screening Plant, because these special cars always had to be switched out.

DOCKS, TRETTLES & POCKETS.

The Pascoe Shaft railraad pockets were rebuilt during the winter. This cost in the neighborhood of \$500.00. These pockets were in very bad shape and repairs had to be made.

The coal dock also needed repairs. The ties and stringers were badly decayed and the approach to the dock was fixed up.

At the Crushing and Screening Plant the railway pocket was braced, the Lump ore pocket repaired and the No. 9 storage pockets repaired so as to last out the season. These are now in very bad shape and will have to be re-built.

The rock trestles at the Pascoe and No. 9 Shafts needed attention from time to time. The No. 9 Trestle was not extended but swung to the South. The maintenance on the trestles was considerably less than the previous year.

BUILDINGS.

This item on the Cost Sheet showed a decreased expense. The only work done on the Mine Dwellings was that which was absolutely necessary, such as repairing roofs, chimneys, doors, and windows.

The horses were moved into the building just South of the old barn. The new building is warmer and the old barn is used to store farm machinery, wagons, etc., that formerly were exposed to the weather. We sold the team of ponies which were only a bill of expense and realized \$100.00.

SHOP MACHINERY.

Less money was expended for 1917 than for 1916. The Shops was equipped with a D. B. #13 Machine for punching holes in Hollow Drill steel. Several leather belts were purchased and tool steel placed in stock for making dies for the drill sharpener. The drill sharpener requires a lot of dolly pin steel each month and the maintenance on springs is heavy. A new horizontal cylinder for the drill sharpener was purchased at a cost of \$160.00.

BOILER PLANTS.

New grate bars were purchased and installed at the No. 5 Plant. 1500 feet of $\frac{1}{2}$ " wire rope was installed on the Aerial Coal Tram, which conveys coal from the coal dock to the No. 5 Boiler House.

The water main connecting the No. 5 Plant with the pumping plant in the Central Engine House burst in a half dozen places during the winter on account of the frost, and a large part of this line was re-built.

The feed water heater in the Central Engine House was moved and piped so that the exhaust steam from the hoist would heat the water fed the boilers. This heater was not operating efficiently but is now giving good results.

NO. 9 SHAFT HOUSE.

A stairway was constructed leading to the Picking Belt landing which does away with the ladderway. These stairs provides a safer way to reach the Picking Belt.

The channels carrying the skip runners were strengthened to avoid the possibility of the skip getting out of the guides.

NO. 9 SHAFT PULLWY STANDS.

Some of the old stands were in imminent danger of toppling over and new ones made of timber replaces the old ones which were made of flimsy 4" pipe. We strengthened some of the old stands also.

NO. 9 SHAFT COUNTER WEIGHT.

The installation of the 12" pipe took five Sundays. It was a big job to lower the pipes weighing over a ton each down 2200 feet in No. 9 Shaft, but the pipes were all installed without an accident. We only had a space about 30" square to lower them in. The procedure was as follows:-

The skip rope was taken off the skip and run over a sheave placed over the centre of the Counter-weight compartment and fastened to the pipes one at a time. These pipes had previously been hoisted into a vertical position in the Shaft House by an auxiliary hoist. Onto the bottom of the pipe was fastened a cone shaped piece of wood to ward the pipe away from obstructions. Underneath the flange at the top of the pipe was a collar made of wood, which prevented the flange from getting caught on the Shaft timbers. The pipes were lowered in about thirty minutes from surface to the bottom of the shaft. They were fastened to the Shaft timbers by "U" Bolts. At the very bottom of the Shaft, the pipe rests on rails imbedded in concrete. The second length from the bottom is held in position by two 20" I Beams, concreted into the walls of the Shaft in such a manner that the bottom length can be removed without disturbing the rest of the pipes. These "I" beams will safely support the 60 tons of pipe line which they support using a factor of safety of 6. At five other intervals heavy clamps made of 5" x 1" Wayne Iron are fastened onto the pipe, the clamps resting on 12" x 12" timber fastened to the walls of the Shaft independent of the Shaft timber.

The purpose of these clamps is to carry the weight of the pipe if by accident the pipe line should be severed. The pipe compartment is adjacent to the skip and is not placed in as safe a position as the pipes are in the standard C. C. I. Co.'s Shafts.

This Counter-weight has given us no trouble whereas the old one was a constant source of trouble and break-downs. The coal consumption has been reduced, but it is hard to estimate this due to the operation of the electric light engine and the increased depth of the shaft.

NO. 5 HOISTING PLANT.

During the first five months of 1917, this hoist gave endless trouble. The hoist was over-loaded because the Counter-weight was out of commission. During January, hoisting was delayed five times, the delays running from two to four hours. In February there was no great loss in production that can be attributed to this hoist. On March 27th, we were delayed a half shift due to broken friction gear. The following month shows three more delays varying from one and one-half to three hours.

The expense of changing and making new brakeshoes is also quite an item. Half of the brakeshoes had to be removed every five days. Since the Counter-weight is running, we get three weeks service out of the shoes. The reason for the excessive wear is due to the small size of the break band.

COMPRESSORS & POWER DRILLS.

We purchased during the year five D.R.6 Sullivan Drilling Machines. They drill our Jasper about 25% faster than the Ingersoll No. 18 Machines, but repair costs are high. Breakages are frequent and machines are in the shop a great deal of the time. We also purchased six No. 248 Ingersoll-Leyner Machines, which are supposed to be an improvement over the No. 18.

These have only been running a short time but appear to be giving good satisfaction. Four D.P.33 Sullivan Jack Hammers were also put into service. These were used in sinking No. 9 Shaft after the Shaft entered the Diorite and have lately been used by the block-holers.

The steam compressor was operated more during 1917 than during 1916 with consequent increased costs for air, due to the high cost of fuel. During August and September, the water level in the river was low and steam compressor was operated.

PUMPS.

No change was made in the pumping equipment except that a motor on the 1223' Level, Pascoe Shaft, pump burned out and a new one was installed.

We plan on taking out the 1950' Level, Pascoe Shaft, pump, and running the water from this sump over to No. 9 Shaft. This pump should be placed either on the 7th or 8th Level, No. 9 Shaft, and pump the water direct to the 1153' Level pump, thereby eliminating the 4th or 1640' Level pump. There are also three air pumps being operated on the 2232' Level, No. 9 Shaft, 2172' & 2272' Levels, Pascoe Shaft. These should be electrically operated because we will have plenty of power when the new wheel is installed.

TOP TRAMS.

The motor on the No. 9 Shaft Top Tram is hardly adequate for the work it is called upon to do. During the year, this motor was out of commission four times from one and one-half to three hours. We finally installed a new 15 H.P. motor and since then have had no delays.

The Pascoe Top Tram only broke down twice during the year.

We have been delayed not to exceed six times with Top tram cars off the track. This used to be a weekly occurrence and one week in 1915, the cars were off the track three times. This is due to the large chunks getting caught in the door and jarring loose and dropping out when the cars makes the return trip. This trouble has been eliminated by a single change in the design of the catcher on the doors which prevents the chunks from getting jammed in the door.

The maintenance for the Top Trams was less for 1917 than 1916.

SKIPS & SKIP ROADS.

The Pascoe Shaft skip-road continues to be a big item of expense. During January a wreck occurred in the shaft which required the re-building of two skips and repairs on the skip-road alone cost \$1,617.30. There was another accident in July which cost us over \$60.00. Another in September at a cost of \$66.78. There was still another wreck on Thanksgiving eve which tied up the hoisting for that night. The average monthly labor cost for Timbermen alone for the Sunday repairs in the Pascoe Shaft averaged \$325.00 per month. To this must be added the cost of the sleepers, runners, rails, etc., which will add at least 50% more to the cost. The teaming, shop work, supervision, hoisting, etc., expense added to the previous total makes the Pascoe Shaft maintenance a very heavy item of expense. Greasing the sheaves in the foot and hanging costs us at least \$150.00 per month. We purchase on an average of 40 sheaves per month which cost us \$120.00 exclusive of Machine Shop labor. I dare say that when all the items are figured up, the Pascoe Shaft entails an expense of at least \$750.00 monthly.

Notwithstanding the amount of repair work carried on, accidents occur due to rotten condition of sleepers and runners. This road is inspected twice daily by timbermen and twice a week by the timber boss.

No. 9 Shaft is in pretty fair shape, the only place that is liable to give trouble being in the wide shaft, so called, about 750 ft. below surface. There is a stretch of shaft here about 25 feet long by 20 feet wide which is inspected weekly, so as to be on the lookout for broken timbers. We also had trouble in No. 9 Shaft on May 18th, 1917. The skip got beyond the control of the engineer and descended to the bottom of the shaft where it crashed through a timber pentice, temporarily placed after the rock pentice was blasted out. The skip tore out seven sets of timber below the pentice and finally stopped jammed in by the wreckage. Hoisting was delayed three shifts. Excellent time was made on the repairs because the skip was loaded and difficult to handle.

UNDERGROUND CARS.

We put twenty sets of roller bearing car wheels in service, but the wheels did not hold up as they should have. They ran nicely for a few weeks and then certain parts wore out and gave trouble. We also put dumping cradles on all the levels in No. 9 Shaft. Since they have been installed, the car trucks have stood up a great deal better because the old method of dumping the cars was especially severe on the wheels and trucks. Nearly all the cars in the mine have steel bodies and the man formerly employed as a car-repairer has been laid off. He formerly was kept busy repairing the wooden bodies and the substitution of steel for the wood will make a saving of nearly \$100.00 per month.

WATER POWER PLANT.

During December, the West turbine was closed down and the shaft driving the air compressor cut in two and an electric generator installed. The new generator is 300 H.P. capacity which is about triple the capacity of the No. 5 Plant. The transmission line from the Power Plant to the mine switch board is finished. The East turbine is being run up to full capacity to make all the air possible so as to make the minimum amount of air with the steam air compressor. The Water Power Plant was only shut down from Saturday midnight to Monday, A.M., while the new governor was installed. A hole had to be cut through the concrete wall between the plant and the forebay and the governor connected up to the gate. In order to do this work, the water was drained out of the forebay. The Mechanical Department thought that operations at the plant might have to be suspended for a few days, but we made all the changes and sealed the openings so that water was let in again on Monday morning, causing a shut down of only about two hours.

MAINTENANCE COST.

The maintenance for 1917 was just about double that of 1916. The items which increased the cost were; first, the rebuilding of the Pascoe Shaft railway pockets, secondly, the installation of the No. 9 Shaft Counter-weight at a cost of \$6590.00 which was \$1500.00 less than General Superintendent Elliott's estimate, thirdly, the heavy expenditure for the upkeep in the Pascoe Shaft and fourthly, the purchase and installation of generator and equipment at the Water Power Plant.

SCRAP.

At the close of the year, the accumulated scrap did not exceed five tons. There were however two hoists and an old steam shovel that were being dismantled. In the last two years, we have shipped out fifteen car loads of scrap.

FARM.

Enough hay was grown to supply the needs of the barn and to permit us selling about ten tons. The hay crop was not very good and about ten acres of the farm was plowed up and parcelled out to the men. About 2,500 bushels of potatoes and other garden produce was grown. Another small piece of land was turned over to the High School boys. Owing to the lack of fertilizer which could not be secured, the potatoe crop on the boys plot only averaged about 100 bushels to the acre. The cost of operating the farm was \$329.34 and the crop of hay amounted to 24 tons. For "Food Preparedness" we spent \$81.40.

ELECTRICAL EQUIPMENT.

The close of the year still found us operating the old No. 5 over-loaded equipment, but the new generator at the Water Power Plant will shortly go into commission which will increase our electric power three fold.

The delays due to current interruption were frequent, especially during the Spring of the year. We were never tied up over an hour and consequent loss of production was not serious, but the delays were very annoying. The only way we managed to get along was by doing our pumping when the Screening Plant was idle and by careful handling of the Top Tram, Shop and Coal Tram motors.

TOWNSHIP LIGHTING.

Current was supplied the Township of Republic. The cost per K.W.H. for the last six months of the year was about .0295 per K.W.H. Current is sold @ 3¢ per K.W.H., so that the Company has not been making much profit on its sales. After the generator is installed at the Water Power Plant, the cost will be about .0065 per K.W.H.

YEAR	K.W.H.	RATE	AMOUNT
1915	33637	3¢	1,009.11
1916	36789	"	1,103.67
Jan., 1917,	4560	"	136.80
Feb. "	4205	"	126.15
Mar. "	4332	"	129.96
Apr. "	3129	"	93.87
May "	2880	"	86.40
Jun. "	2775	"	83.25
Jul. "	2078	"	62.34
Aug. "	2173	"	80.19
Sep. "	3245	"	97.35
Oct. "	4220	"	126.60
Nov. "	4569	"	137.07
Dec. "	5080	"	152.40
TOTAL,	43246	"	1,297.38

STOCK PILE BALANCES.

The ore in stock on December 31st, 1917, was as follows:-

Bessemer Ore,	9,690 tons,
Basic "	1,765 "
Pascoe "	15,617 "
Presque Isle:-	
Bessemer,	226 "
Basic,	189 "
TOTAL,	27,487

You will note that the Pascoe Ore Balance has been considerably reduced. Two years ago it was 54,619 tons and last year 27,769 tons.

ESTIMATED PRODUCTION.

The production for the ensuing shipping season is based on a tonnage of 500 tons per day and it will keep us hustling to make good. The reason for this being that the available ore on stulls is only about half what it was for last season which in turn was only three-fourths of that the year previous. The available tonnage is less than one-third of what it was when the Cleveland-Cliffs Iron Company acquired the Mine. These conditions make the daily output more and more dependent on the stopes that the miners are employed in, which retards production as only a limited quantity can be drawn off at a time which necessitates frequent shifting of the trammers.

DELAYS.

Only the delays which seriously retarded production are listed. We frequently have delays of from 1/2 to 1 hour:-

DATE	HOURS LOST.	SHAFT	CAUSE	LOSS OF PRODUCT
Jan. 9	3	No. 9,	Top Tram Motor broken down,	50 tons
" 15	2	Pascoe,	Broken rails in shaft,	65 "
" 15	2	No. 9,	Broken Friction Band,	35 "
" 16	4	"	" " "	75 "
" 16	8	Pascoe,	Pascoe Shaft Wreck,	175 "
" 17	16	"	"	350 "
" 17	4	No. 9,	Friction on hoist out of order,	75 "
" 18	3½	"	Top Tram brake broken,	60 "
" 18	16	Pascoe,	Pascoe Shaft Wreck,	350 "
" 19	16	"	"	350 "
" 20	12	"	"	250 "
" 22	16	"	"	350 "
" 23	8	"	"	175 "
" 24	2	"	Broken rod in Engine House,	40 "
" 24	3	No. 9,	Broken Friction Bracket,	50 "
Feb. 7	1	Pascoe,	Timbermen repairing rollers,	25 "
" 9,	2	" & #9,	No Electric Power,	45 "
" 13,	1	Pascoe,	Changing Skip Wheel,	25 "
" 17	3	"	Broken rails in Shaft,	60 "
" 22	2	"	Timbermen repairing rollers,	50 "
Mar. 5	1½	"	Top Tram Motor broken,	75 "
" 10	2¾	"	Broken Skip Axle,	100 "
" 20	2	"	Broken rail on skip-road,	75 "
" 27	4	No. 9,	Broken friction gear on hoist,	100 "
" 30	4½	Pascoe,	Broken Top Tram rope,	125 "

DELAYS. (CONTINUED)

DATE	HOURS LOST	SHAFT	CAUSE	LOSS OF PRODUCT TONS
Apr. 3	3	No. 9,	Friction band trouble,	60
" 5	2	Pascoe,	Repairing hoist,	25
" 9	1½	No. 9,	Broken bracket on hoist,	25
" 13	2	Pascoe,	Hoist Rope damaged,	25
" 16	4½	"	Splicing hoisting rope,	60
" 17	8	No. 9,	No. 9 Shaft wreck,	170
" 18	16	"	"	340
" 20	3	Pascoe,	Broken axle on skip,	75
" 23	1	"	Broken wheel on skip,	25
" 28	3½	"	Broken rail in shaft,	50
May 18	2½	No. 9,	Truck broke on Top Tram car,	40
" 22	1½	Pascoe,	Wheel broke on skip,	50
Jun. 5	2½	"	Skip road damaged,	50
" 18	3	No. 9,	Poor Electric Power,	100
" 19	1½	"	Hoist Broke down,	75
" 20	2	Pascoe,	Timbermen repairing rollers,	50
" 29	8	"	Skip off track,	125
Jul. 7	4	"	Repairing skip-road,	75
" 9	2½	"	Trouble with hoisting rope,	50
" 19	1	"	Repairing broken skip fan,	25
" 27	3	"	Timbermen repairing skip road,	50
Aug. 8	8	"	Skip off track,	200
Oct.30	5½	"	Hoist rope damaged,	75
" 31	5	"	New rope put on,	75
Nov.28	8	"	Skip off track-road damaged,	135
Dec.27	3½	"	Top Tram car axle broken,	35

These delays show a loss in production of 5,315 tons. An analysis of the delays shows that the great majority of them occurred before June 1st. Of the thirty-seven enumerated before that date, eight were due to break-downs on the over-loaded No. 9 Shaft hoist. The Counter-Balance was installed in June and since its installation, we have had no delays from that source. Another annoying series of delays occurred from broken skip axles and wheels and rails in the Pascoe Shaft. These were nine in number before June 1st. They were due to the poor condition of the concreted section of the Pascoe Shaft. The concrete runners and sleepers were removed and wood substituted. Since then, we have had no delays on that account. You will also note a few delays due to poor or no electric power. This will be remedied shortly. The Pascoe Shaft wrecks were the most expensive and serious delays. They were due to the poor condition of the skip-road.

DELAYS. (CONTINUED).

Repairs made on every week end did not catch up with the work necessary to be done until August 1st. A great deal of repairing was done the last nine months of 1916 as well as the first six months of 1917, but the poor condition of the shaft is directly due to the lack of repairs during 1914, 1915 and the first three months of 1916. The other few delays mentioned were not serious and altho' all machinery is inspected daily, the weak points were not apparent. It must be remembered that we are operating a great deal of old machinery and break-downs are to be expected.

LABOR & WAGES.

We had no difficulty keeping all positions filled except trammers. During the first six months of the year, we did not suffer much, but during the last four months especially, the shortage has been acute. Wages were increased twice during the year and the higher the trammers' wages are raised, the less they seem to be inclined to work.

SHAFT SINKING.

During the year the Pascoe Shaft was deepened to the 2272' Level. The back of the Shaft from the 2172' to the 2272' levels was Soaprock and consequently had to be timbered throughout. Development work on the new level was delayed at least two months. The timbers were blasted out a number of times and the back always had to be most carefully trimmed after every blast. The new level should reach the ore by June 1st, 1918, but we hope to get there sooner. The ground between the Shaft and the ore is a very hard Jasper.

The No. 9 Shaft was also sunk from the 2082' Level to a point about 60 feet below the 2232' Level. Excellent time considering the nature of the ground was made. The most of the work was done in 1916 but the shaft was finished and drifting started on the 2232' Level in May, 1917.

Sinking for the past three years has been 150 feet, 187 feet and 148 feet, respectively.

ROCK DRIFTING.

Rock work for the year totalled 2,138 feet, which is a little less than last year's total of 2,623 feet. During 1915, 1,894 feet of rock work was done. It will be seen that considerable development work is being carried on which is very expensive with the present high cost of explosives and wages. The powder consumption shows a slight reduction during the past year.

LBS. OF EXPLOSIVES USED PER FT. OF ROCK DRIFTING.

Year 1915,	17.5# per Foot.
Year 1916,	17.8# " "
Year 1917,	17.4# " "

The cost per foot for Rock Drifting for the year 1916 was \$12.42. The cost per foot for 1917 was \$10.66, even though wages were increased nearly 30%, because the wage increase of December, 1916, did not materially effect the 1916 costs. Explosives on hand December 31st, 1916, averaged in cost \$.116 per lb. The same date in 1917 showed a cost of over 22¢ or 100% increase in price. The rock drift on the 1335' Level, Pascoe Shaft, charged out under Account No. 176, is included in the above figures.

Our rock drifting for the year therefore shows up remarkably well as we have decreased our costs despite the increased wages and increased price of powder. The cost for powder alone was \$3.59 per foot, which is about double the previous year's cost for explosives. I think that one reason for the decreased cost is due to driving the rock drifts a little wider which altho' it increases the rock to be handled, makes the cuts break more readily. The chief reason however is due to the introduction of tamping bags which made the explosives more effective. Previous to the introduction of these, I have seen cut after cut that did not break properly and had to be drilled and blasted the second time. After the men became accustomed to the use of tamping bags, a cut that failed to come out properly was a rare occurrence.

BREAKING ORE.

The unit cost per ton of broken ore for 1916 and 1917 by months was as follows:-

MONTH	YEAR, 1916.			YEAR, 1917.		
	TONS BROKEN	COSTS		TONS BROKEN	COSTS	
		TOTAL	PER TON		TOTAL	PER TON
Jan.	13225	9727.79	.739	5913	8672.18	1.462
Feb.	9680	8837.09	.913	5899	7820.99	1.327
Mar.	7823	9553.50	1.221	8525	8387.67	.973
Apr.	8250	9370.65	1.246	6480	7721.13	1.191
May	7812	11919.27	1.525	8670	9852.15	1.138
Jun.	10945	10860.57	.993	7324	10761.33	1.482
Jul.	9036	10116.89	1.119	8609	11010.12	1.280
Aug.	12419	11322.10	.912	8671	11457.50	1.323
Sep.	12210	10279.98	.842	8715	11264.29	1.291
Oct.	13423	11306.82	.842	8867	13171.56	1.482
Nov.	9876	9378.76	.950	10121	12121.79	1.117
Dec.	8495	9240.31	1.088	7254	10271.27	1.416
TOTAL,	123194	124089.53	1.007	94048	122519.98	1.302

The unit cost increased from 1.007 in 1916 to 1.302 in 1917, an increase of 29%, which compares very favorably with the other mines operated by the Company, especially the hard ore properties, in fact, our increase was less than that of the chief producers.

A close examination of the increased breaking ore costs at the other hard ore mines for the same period shows close similarity to our increased unit costs. The increased cost of Acc't #156 is due to a number of reasons.

First, the breaking ore costs include the labor and supplies used by the blockholers that break up the large chunks for the trammers. One man must be employed on every level where ore is being trammed in order to keep the trammers busy. To show how serious this item is, a table has been compiled showing the number of men and the explosives used by the blockholers.

	NUMBER OF BLOCKHOLERS	TONNAGE HANDLED	LBS. EXPLOSIVES	LBS. PER TON	TONS ROCK FROM STOPES	% OF ROCK IN PRODUCT
3 Mo. 1915	14	48139	28189	.58	42694	18.8%
Year, 1916	14	173096	61964	.36	61241	26.1%
Jan., 1917	14	13863	6685	.48	4491	24.4%
Feb. "	14	13869	5025	.36	4243	23.4%
Mar. "	14	14850	5625	.38	4257	23.5%
Apr. "	14	11583	6325	.55	4240	26.8%
May, "	14	15225	5975	.39	4782	23.8%
Jun. "	14	12969	7400	.57	5970	31.5%
Jul. "	14	12150	9000	.74	7987	39.7%
Aug. "	14	13067	8200	.63	5962	31.2%
Sep. "	14	13602	8775	.65	4101	23.2%
Oct. "	14	12332	5450	.44	4473	26.4%
Nov. "	10	9846	3900	.40	2659	21.2%
Dec. "	10	10069	3550	.35	2012	16.7%
Total, "		153425	76910	.50	55077	26.4%

You will note that the largest consumption of explosives occurred in July, 1917, when the rock from the stopes was the greatest. This is due to the fact that when the ore is badly mixed with rock, the rock usually occurs in large masses or chunks which holds back the ore and have to be sledged or balsted. This condition usually exists when the stopes are nearly depleted. The first few months the ore comes fairly clean and as the stope is cleaned out the percentage of rock becomes greater and greater.

In August for example, the total expenses for breaking ore were \$11,457.50; of this total \$2672.10 was due to the blockholers or nearly one-fourth of the entire expense.

Secondly, the breaking ore cost is influenced by the size of the stopes. The table shown below gives the average monthly cross-sectional area of all the stopes in the mine for the last three years. These figures were obtained by averaging the Captain's bi-monthly measurements:-

YEAR	NO. 9 SHAFT	PASCOE SHAFT
1915	1369 sq.ft.	1381 sq.ft.
1916	2009 "	1202 "
1917	983 "	872 "

NOTE:- The high average in No. 9 Shaft for 1916, was confined to the first four months. After that the monthly average fell to 944 sq. ft., or actually less than the average for 1917. The average number of stopes breaking ore for the same years, was: 6.7, 6.7 and 6.3. It is obvious without going into detailed explanation that inasmuch as the stopes have decreased in area over 42% and their number has remained the same, that breaking ore costs must rise regardless of wages or increased cost of supplies. The miners can not possibly break the ore as well in the narrow and constricted working places. It takes more powder and more labor in the smaller stopes and the number of holes drilled multiply rapidly as the stopes decrease in size. Take a typical stope for example, No. 1 West on the 2172' Level:-

MONTH	DIMENSIONS OF STOPE		CROSS SECTIONAL	FATHOMS BROKEN.	TONS	EXPENSES	
	LENGTH	WIDTH				LABOR	SUPPLIES.
Jan.	43	15	645	35	1050	606.81	231.79
Feb.	55	19	1045	73	2190	633.71	311.39
Mar.	58	18	1044	70	2100	566.28	182.82
Apr.	81	20	1620	127	3810	623.90	186.90
May,	100	20	2000	58	1740	802.96	349.54
Jun.	100	22	2200	71	2130	702.21	219.79
Jul.	107	24	2568	85	2550	738.14	239.18
Aug.	106	24	2484	135	4050	729.04	239.06
Sep.	113	26	2938	128	3840	716.53	299.89
Oct.	119	26	3094	250	7500	904.10	257.30
Nov.	104	26	2704	88	2640	809.12	249.28
Dec.	Worked out.						

You will note from above record that if the 10% increase in wages on May 1st and October 1st, is taken into consideration, that the labor cost is just about the same month for month. The supplies with the exception of February and May, are also just about the same not withstanding nearly a 100% increase in price of explosives. You can readily see that with any where near favorable conditions, a large tonnage could be broken cheaply. The ore in this stoppe in October was broken for about 15¢ per ton. During the same month one contract, #14, on another level, broke only 320 tons at a cost of over \$1.00 per ton.

Following is a table showing the stoppes worked during the year:-

SHAFT	LEVEL	STOPE	AVERAGE MONTHLY TONNAGE REPORTED	MONTHS OPERATED
Pascoe,	1335'	#2,	330	1
"	1500'	#2,	1520	8
"	1500'	#4,	250	2
"	1570'	#1,	835	2
"	1710'	#1,	1175	4
"	1950'	#8,	1015	4
"	1950'	#7,	550	1
"	2172'	#1 E.	1630	4
"	2172'	#1 W.	2160	7
"	2172'	#2 E.	1030	1
No. 9,	1815'			
"	1935'	#1,	590	3
"	1935'	#2,	90	1
"	1935'	#2 Hanging	740	5
"	1935'	#3,	2000	1
"	1935'	#4,	885	6
"	2082'	#1,	660	5
"	2082'	#2,	760	7
"	2082'	#3,	560	2

NOTE:- The tonnages reported above include only ore broken on stulls and deductions are made for rock in the stoppes.

You will note that there were only two sizable stoppes in the whole mine for the year, from which cheap ore could be expected and one of those stoppes, #3 on the 1935' Level, No. 9 Shaft, only lasted one month, leaving us with a single stoppe only that could be expected to give low costs.

An examination of the stull statement of two years ago shows stopes breaking as much as 4,000 tons per month and during the latter half of 1915, all the stopes together averaged 2,000 tons and better per month.

Our breaking ore costs will continue to be very high until we get more favorable conditions underground. In order to increase the efficiency, we have moved our men from stope to stope until we found the contract that would break the most ore in each particular stope. Three different contracts worked #1 West Stope, 2172' Level, during the seven months it existed. Two contracts were employed in the #1 East Stope on the same level. Three contracts were employed in the #4 Stope, 1935' Level, No. 9 Shaft, and so on.

Another item that increases our costs is the rock drifting as discussed before. The dead work necessary to reach an ore body is expensive and with the short life of the stope as shown in the table above, the dead work must be repeated again and again. The average life of a stope the past year has been only three and one-half months.

TRAMMING.

The tramping of the ore to the shafts has gotten to be a serious problem as shown previously in this report. The ore lenses are getting farther away from the shafts and the labor situation is such that it is difficult to discipline the trammers. We have been compelled to discharge trammers even from our depleted force for not filling cars to capacity. The cost of tramping has increased from .221 to .284 or an increase of 28.5% All tramping in this mine is done by contract and the increased cost is due entirely to the wage increase. A previous statement shows that the efficiency of the trammers increased nearly a car per man per day compared with the two previous years.

FILLING.

The only expense for filling has been the work done in #1 Stope, 1780' Level. The costs under this item has been about half what they were last year, due to the fact that the floor pillars around No. 1 Shaft were all taken out in 1916. The filling material for the #1 Stope was secured very cheaply as but little of it had to be trammed. There is now about 15,000 tons of high grade Basic ore available in the back of the 1710' Level after the stull timber has been erected on the filling.

TIMBERING.

During 1916, the timber gang consisted of 10 men. About the first of the year, we cut the number to 7 and in November reduced our gang to 2 men. We still carry a timber boss on the Pay-Roll. When the mine had more stopes than mining contractors, it was advisable to have the timbermen erect the stulls in the stopes, the miners being employed breaking ore in some other stope in the mean time. Now since our ore bodies are reduced in number as well as size, we have no place to put the miners while timbering is in progress. We therefore make them put in their own timber. They are paid timbermen's wages while doing this work and appear on the Labor Statement as Timbermen. Timbering costs are much larger for 1917 than 1916, due to the larger number of stulls erected. In 1916, about 300 lineal feet of stull timber was erected, but in 1917, we put over 900 feet in place. One reason for the increased footage is due to all the stopes opened up this year being provided with stulls while last year a number of stopes were opened up with the raise and pillar system of mining, which system was discarded due to its danger and high cost which was stated in Mr. Bush's Annual Report of two years ago. We have found by averaging the cost of a great number of stopes that the expense of putting in the stulls including cost of timber, handling on surface, handling in

Shaft, hoisting and labor of erecting stulls amounted to about \$1.00 per lineal foot of stull before the last 10% increase in wages became effective. Take any stope for example and it will cost about the same to break one fathom of ground in the stope as it will to drive a drift one foot in ore. The fathom contains 30 tons of ore while the foot of drift only breaks 7 tons, the ore costing therefore, over four times as much. The ore from the drift will cost over \$1.00 per ton just for explosives, labor and drill supplies. If the ore is won by the raise and pillar system, a drift must be driven on the sill floor, raises put up and a drift driven to connect the top of the raise. By the other system of mining, a drift only on the sill floor is necessary, the ore being immediately broken the full width of the stope and 17 feet high. This ore breaks very cheaply. Then the stull is put in at a cost of about \$1.00 per foot which is less than the cost of the raises alone by the other system. When the ore is drawn off the trammers are always protected by timber and in the other system, all the broken ore can not be secured without blasting out the pillars which exposes these men to the open stope, which is very dangerous in our ground.

DRY HOUSE.

The No. 9 Dry building is badly in need of repairs. The floor is nearly worn through and sills are in bad shape. This building should be repaired next season.

SORTING ORE.

In the Pascoe Shaft the rock is sorted from the ore by underground rock-pickers. In the No. 9 Shaft, this work is done on the Picking Belt. A table has been compiled showing the particularly rocky condition of the No. 9 Shaft ore during the summer of 1917. One month nearly 40% of the entire hoist was discarded as rock as shown previously in this report. To the Picking Belt rock must be added the rock picked out underground. At times the filling places will become filled with rocky material that is hoisted as rock to avoid unnecessary handling on the Belt.

NO. 9 SHAFT.

MONTH & YEAR	PRODUCT	PICKING BELT ROCK.	PER CENT DISCARDED.
May, 1915,	9849	712	7.2%
Jun. "	7430	945	12.7%
Jul. "	9626	881	9.2%
Aug. "	11227	811	7.2%
Sep. "	10731	913	8.5%
Oct. "	10260	982	9.6%
Nov. "	8744	1081	12.4%
Dec. "	8313	1171	12.9%
Jan., 1916,	7613	1067	14.0%
Feb. "	7262	1407	19.3%
Mar. "	6561	1208	18.4%
Apr. "	6441	816	12.7%
May, "	6443	831	12.9%
Jun. "	7129	989	13.9%
Jul. "	6831	1018	14.9%
Aug. "	6106	981	16.1%
Sep. "	6554	800	12.2%
Oct. "	7572	633	8.4%
Nov. "	6422	742	11.6%
Dec. "	5042	575	11.4%
Jan. 1917,	7386	687	9.3%
Feb. "	6236	617	9.9%
Mar. "	7776	768	9.9%
Apr. "	7041	833	11.8%
May, "	8794	1185	13.5%
Jun. "	6586	1517	23.0%
Jul. "	6705	1948	29.0%
Aug. "	7611	2149	28.3%
Sep. "	6733	1258	18.7%
Oct. "	6194	1113	18.0%
Nov. "	5160	743	14.4%
Dec. "	3975	631	13.7%

SUPPLIES.

GENERAL:-

This includes office supplies, expense accounts, engineering department, laboratory, hoisting ropes, etc. This item was 50% larger than last year, due to extraordinary supplies furnished the Water Power Plant for the new electric equipment. The hoisting rope item was also a heavy one, the rope costing us about \$5000.00 compared with \$2400.00 the previous year. This increased cost was due to the increased price of rope and the short life of one rope in the Pascoe Shaft.

IRON & STEEL:-

The expense under this head was increased by the heavy increase in the price of these materials. Nearly all of the wooden underground cars were rebuilt of steel plate. Some of this rebuilding was done in 1916, but the most of it was done in 1917. Due to the wrecks in the Pascoe Shaft, two skips were rebuilt and No. 9 cage rebuilt. These repairs were necessary regardless of the high cost of angles and plates.

OILS, GREASE & CANDLES:-

Cost under this head increased while consumption remained the same. We expect to decrease the cost largely through the closing down of the Pascoe Shaft next season. One-half of the monthly grease consumption is due to the greasing of the foot and hanging rollers in this shaft.

MACHINERY SUPPLIES:-

We charged off the cost of the new generator and the counter-weight pipe for No. 9 Shaft, which cost nearly \$10,000.00. With the exception of this item, the outlay for machinery supplies is only 16% more for 1917 than during 1916.

The principal expense under this head is repair parts for the underground drills. Due to the high cost of these, we plan on making the majority of them during 1918; in fact, we have already started to make the feed screws, bushings, bolts and nuts and chuck nuts. We plan on making chucks, rifle nuts, rotating nuts, back heads, front heads, feed nut nuts, front cylinder washers and back cylinder washers.

EXPLOSIVES:-

The records show that the explosives for 1916 totalled:-

	RED CROSS	GELATINE	TOTAL
Shaft Sinking,	1,500 lbs.	4,150 lbs.	5,650 lbs.
Rock Drifting,	23,002 "	23,828 "	46,830 "
Breaking Ore,	101,457 "	57,853 "	159,310 "
Grand Total,	125,959 "	85,831 "	211,790 "

The consumption for 1917 was as follows:-

	RED CROSS	GELATINE	TOTAL
Shaft Sinking,	1,100 lbs.	5,500 lbs.	6,600 lbs.
Rock Drifting,	1,375 "	32,922 "	34,297 "
Breaking Ore,	74,065 "	91,426 "	165,491 "
Grand Total,	76,540 "	129,848 "	206,388 "

The explosives listed under Breaking Ore include those used by the blockholers. In 1916, 61,964 lbs. out of the 159,310 lbs. shown above or 39% of the total was used by the blockholers. In 1917, the blockholers used considerably more powder due to the rocky condition of the ore as explained previously. The total for the year shows 46.5% used by them or nearly one-half the total. The close of the year showed some improvement, because only about one-quarter of the powder consumption was charged to the blockholers.

MINE TIMBER:-

More timber was used underground during 1917 than 1916 due to three causes: First, both shafts were sunk and timbered one lift, whereas last year, only one lift was timbered in the Pascoe Shaft; Secondly, during 1916, a number of stopes were opened up using the raise and pillar system of mining which does not require timber, but is very expensive in other ways as pointed out in Mr. Bush's Annual Report of 1915. Due to the danger involved in taking out the pillars and cleaning out the broken ore from the stopes, this method was discontinued and all stopes timbered in 1917. Thirdly, more stopes were opened up in 1917 than 1916. Then also the increased price of timber must be taken into consideration. We hope to show some improvement under this head by using smaller size legs than has been customary in the past. The timber boss and Captain are agreed that 10" to 12" legs are not necessary, the weak place in the Republic system of timbering being the cap and the half round timber, called the wall plate, placed on top of the legs. There is no side or lateral pressure on the legs as in the soft ore mines. We therefore plan on using 8" to 10" legs, 10" to 12" caps and 12" to 14" wall plates during the coming year. This will decrease our timbering costs because the 8" to 10" legs will cost 40% less than the 10" to 12" and two legs are used with every cap. A 10" to 12" leg and cap totals at least 24 lineal feet costing 7¢ a foot or \$1.68. The new scheme requires a 10 ft. cap and two 7 ft. legs at a cost of \$1.40. It will also be easier to handle this smaller timber.

REPUBLIC MINE.

FUEL:-

The coal consumption increased 133 tons over 1916. This is wholly due to the inferior quality of the coal. We thought that the coal furnished us in 1916 was bad, but that coal we are now burning is very inferior to last year's coal. While the percentage of ash has not increased much, there does not seem to be the proper heating value in the coal. The Firemen complain constantly as to the quantity of coal that must be burned to keep the steam pressure up. The coal consumption should have decreased due to smaller tonnage hoisted and operation of counter-weight in No.9 Shaft and several changes made in the boiler plants which increased the temperature of the feed water for the boilers.

UNDERGROUND.

The close of the year does not find the mine in very good shape. Our ore reserves have been diminished further and the stopes we expected to develop on the 2082' Level, No. 9 Shaft, and the 2172' Level, Pascoe Shaft, failed to materialize. The stopes on the former level were small, disconnected and rocky. The stopes on the latter level were only two in number, whereas on the next level higher up, there were nine stopes. The big disappointment was the #2 North-end Stope, which first appeared on the 2050' Level near the hanging and which gradually pinched out going to the 1950' Level, thereby indicating that the ore body went down. Instead it pinched out 50 feet below the 2050' Level. This stope should have turned out 25,000 tons, but instead we got only a few hundred tons.

In order to maintain production, mining the Pascoe Shaft pillar was started towards the end of the year. This ore body was estimated to contain 242,800 tons by the Republic Iron Company,

UNDERGROUND.

but the first Cleveland-Cliffs Iron Company estimate contains only 122,200 tons, the reduction being due to the rocky condition of the ore on the 1710' and 1780' levels and the probable loss in tonnage, as it will be impossible to completely mine all the pillars.

The 2272' Level, Pascoe Shaft, is being drifted upon and a drift was driven out into the hanging on the 2082' Level, so that a winze can be sunk in the hanging to the 2232' Level.

NO. 9 SHAFT.

1815' LEVEL:-

Tramming from the stulls on this level was carried on until all the broken ore except some in the stope nearest the shaft was hoisted. The remaining broken ore is now dropped down to the 1935' Level and will be trammed from #1 and #3 Stopes. A little deposit of high grade Bessemer ore was opened up in the foot-wall and this will probably go up to within about 50 feet of the 1640' Level.

1935' LEVEL:-

The No.2 Hanging Stope was worked during the first half of the year, but conditions here were not favorable for producing cheap ore. The ore body was inclined so that the ore had to be re-handled and the ore in the back of the stope kept slabbing off and some had to be left in place to keep the Quartzite hanging from dropping and mixing with the ore. The ore was high grade Bessemer but expensive to mine.

Pillars were mined in the No. 2 foot stope and the ore ore drawn off. This stope is nearly cleaned out except a few pillars that remain to be taken.

NO. 9 SHAFT.

The #4 Stope was opened up and stulls put in and two contracts broke ore of Pascoe grade. The ore body here is about 225 feet long but only 8 ft. to 10 ft. wide, making it necessary to maintain cribbed ladderways and mills instead of the caving mills used when the ore is 12 feet wide or over. These cribbed mills are an extra expense.

The #5 Stope was opened up back in the foot-wall and drifting started both to the North and South from the line of the main drift. The ore here is badly mixed with rock and therefore low grade Pascoe.

2082' LEVEL:-

This level has been a big disappointment during the year. Although the drill holes put down from the 1935' Level to prove up the ore on this level showed no ore worth mentioning, we hoped however, to find the downward extension of the Bessemer ore developed on the 1935' Level, but found the ore on the 2082' Level badly mixed with rock. The #1 and #2 Stopes are situated so as to be in line with the large #2 Stope on the 1935' Level. The #1 Stope on the 2082' Level, although only about 60 feet long and 7 feet wide at the start is increasing in length and width. This stope is up nearly two-thirds of the distance between the levels. The #1 Stope shows a width of 30 ft. and a length of over 100 feet on the sill floor, but the ore is badly mixed with rock. This stope was only carried up about 35 feet and mining is now confined to the end near #2 Stope. The ore here is better grade and will probably go through and connect with #2 Stope. There is about 50 feet of ground left between the two stopes.

The drift in the extreme N. end of the level is in Pascoe grade ore. This ore body is about 60 feet long and 20 feet wide to date. One contract is drifting ahead and another stoping out

NO. 9 SHAFT.

the back. We are in hopes that this ore will go up to the next level so that the stope can be converted into a storage chute to store the broken ore which can be trammed into it from the #4 and #5 Stopes on the 1935' Level.

A drift 35 feet long has been driven into the hanging and winze will be sunk 150 feet from the end of this drift down to the 2232' Level. This drift was driven in the hanging rock in order to keep the winze in the Quartzite which is easier to drill and blast than the foot-wall rock.

2232' LEVEL:-

This level is in about 100 feet from the shaft, drifting being discontinued due to the unfavorable nature of the ore bodies on the 2082' Level. The present plan is to sink a winze from the 2082' Level to the 2232' Level out near the ore body in order to prove up the ore on the lower level.

PASCOE SHAFT.

1335' LEVEL:-

The ore lens in #2 Stope became too small to permit mining and this contract was removed to the 1570' Level.

The rock drift going West was carried 300 feet farther West at the request of the Geological Department, to provide a Diamond Drill station out in the West Republic territory.

1500' LEVEL:-

Contract #14 drove a rock drift Southwest heading for the ore found in an old Diamond Drill hole. The stope proved small, the ore extending only a few feet either side of the drill hole. The stope was worked out in less than three months' time.

PASCOE SHAFT.

Contract #4 drove a drift following a seam of ore North and holed to #1 Stope coming up from the 1570' Level. This stope was filled with broken rock secured from the rock drifting mentioned above and when #2 foot and hanging stopes were cleaned out, all the rock was also dumped down into this stope. Contracts #4 and #12 worked in #2 foot and hanging stopes which were mined out in August and all the broken ore trammed out in September. These stopes were small and ore inclined to the Southwest at about 45° from the perpendicular, making it hard for the miners to break good tonnages. These stopes averaged about 1,750 tons monthly.

1570' LEVEL:-

A rock drift was driven about 200 feet West from the Pascoe Shaft and ore body cut in Diamond Drill hole #373 found and opened up. This stope called #1 is now up half way to the 1500' Level and adding 1,000 tons monthly to the broken ore reserves.

1640' LEVEL:-

This level which connected with No. 9 is now caved down near the Pascoe Shaft, due to the mining of the ore in #1 Stope on the 1710' Level. A great deal of broken rock formerly above this level was blasted down to fill the open stope between the 1780' and 1710' Levels, which will make the ore pillar left between the 1710' and 1640' Levels available.

1710' LEVEL:-

No. 1 Stope near the shaft is mined up to the 1640' Level but there is still about 15,000 tons left inside that will be available in a few weeks after the open stope is entirely filled, which at present underlies the ore left in place. The filling was practically all secured from the 1640' Level, but a small area still exists which is being filled with broken material from old #3 stope.

PASCOE SHAFT.

The ore left in place is high grade Basic and breaks easily because the ground is full of slips. Cheap ore could easily be secured if all the ore was of this nature. The men in #1 Stope broke 85 fathoms one month or 2,500 tons, although the dimensions of the stope were only 57' x 18'.

1780' LEVEL:-

A contract was put to work here in December to take a part of the shaft pillar.

1850' LEVEL:-

No. 7 Stope was exhausted early in the year and the ore was drawn from the remaining stopes until the level was bare. Only a little unavailable ore remains in #3 Stope underneath the Pascoe Shaft.

1950' LEVEL:-

Contract #22 started mining the ore near the shaft and at the close of the year were up half way to the 1850' Level. This stope called #8 was a big disappointment. The ore on the 1850' Level was 200 feet long and 35 feet wide, while the area of the stope at the close of the year was only 26' x 37' or about one-eighth of what it was on the upper level. The stope was also growing smaller and apparently the big floor of ore on the 1850' level must cut off right below the sill floor. During the early stages of this stope, it produced 1,400 tons monthly, but this was cut to less than 1,000 tons due to the small size of the stope. We had hoped to put two gangs here and produce at least 3,000 tons monthly but were disappointed by the small area of the stope. No. 7 Stope from which a large amount of ore had been trimmed for months was exhausted early in the year. An examination of the area near this stope revealed a narrow seam of ore and miners put to work here opened up a stope about 40 ft. long by 15 ft. wide shaped like a letter "U".

PASCOE SHAFT.

I expect this ore to go to the 1850' Level where a similiar ore body was 50 feet long and 30 feet wide. This stope was opened up in November and should produce a fair tonnage monthly. Ore was trammed also from #4 Stope which is cleaned out.

2050' LEVEL:-

No work was done here during the year and all the stopes have had all the available ore removed.

2172' LEVEL:-

This level on January 1st, 1917, looked like a winner but the balance of the year did not show up the ore bodies expected. In fact we only developed one stope that went through to the 2050' Level. On the latter level, nine stopes had been opened up and the largest of these, #2 N. end, had Magnetic ore next to the hanging which is always a favorable sign for ore at depth. To our surprise this ore pinched out 50 feet below the level which was proven by drilling inclined holes from the 2050' Level. The #3 stope which was now to the 2050' Level could not be found on the lower level either. The #2 Stope near the Pascoe Shaft had reduced in size to a few inches on the lower level. That eliminated all of our chances along the hanging which was explored for over 600 feet. In the foot-wall on the 2050' Level were six stopes and search was made for the downward extension of these. We found only two and only one of these went through to the 2050' Level. This latter stope produced one-fourth of the entire tonnage broken in the entire mine for the year. This stope produced some very cheap ore although it was not such a large stope either, being only about 119 feet long and 26 feet wide in its largest cross-section. The cost per ton including supplies and percentage of Shop Expense, teaming, etc., was 15.5¢ per ton.