

MECHANICAL DEPARTMENT  
ANNUAL REPORT  
YEAR 1940

CLIFFS SHAFT MINE:

In January the head on the #8 McCully crusher was cut down about 1" to get a larger percentage of lump ore. In October a bad crack developed in the upper shell and it was turned October 19th. to transfer the work to the opposite side. A new steel shell has been ordered and will be installed as soon as received.

A new cylinder was installed on the 6 $\frac{1}{4}$  x 24" Prescott pump in April to replace a cylinder that was cracked.

A new check valve was installed on the 15th. level centrifugal pump in November to replace one that was in too bad condition to repair. In December the thrust bearing was rebabbitted as it was in poor condition.

In May a new set of pans complete with rollers was installed on the picking belt to replace the worn out set which will be repaired and used as a spare set. In December the keyway in the propelling shaft stripped. A new shaft was made at the Hard Ore shops.

In June on inspection of the "A" and "B" shaft hoist drums it was found they were in very poor condition. In 1919 several cracks developed in the horizontal ribs and repairs were made at that time by installing a center hub on the drum shaft with jacks out to the inside of the drum shell to support it in the center. This repair has taken care of the drums up to the present. In June a very close examination showed that the cracks were getting a little longer and extending into the drum shell and it was decided to purchase new drum shells. The drums shells have been ordered and will be installed shortly after they are received.

All the mechanical equipment at this mine operated satisfactorily during the year.

The new 250 kw motor generator set was installed and is operating satisfactorily. This unit is of General Electric Company manufacture, 2300 volt, 300 H.P., motor driven, 250 kw, 275 volt D.C. This unit connects to the new feeder cable installed in "B" shaft, doubling the capacity of the previous installation.

TILDEN MINE:

This mine started loading ore on May 3rd. and completed shipments of 163,629 tons on November 16th.

In June it was necessary to repair the track on the D-8 caterpillar tractor. New grouser strips were welded on which put the track in good condition.

The #4 locomotive boiler mud ring was repaired by welding and building up the side plates.

A crankpin on the #3 locomotive became loose in August and a new pin was made at the Hard Ore Shops to make the necessary repairs.

In August the saddle block bolts broke on the #46 shovel and the unloading coil on the air compressor burned out. Repairs were made without any delay to shipments.

In September the ram on the drill sharpener broke and was repaired.

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TILDEN MINE: (CONT'D.)

In September the #29 shovel dipper sticks broke. These sticks will be repaired and used as spares. New sticks have been ordered as the old ones are in poor condition.

The boom foot on the #31 shovel broke on September 17th. Temporary repairs were made and a new foot ordered.

General repairs are being made to the equipment this winter to put it in good condition for next season's operations.

All equipment operated satisfactorily during the year.

The usual routine changes and extensions were made in the electric distribution lines.

ATHENS MINE:

On January 20th. a leak developed in the 10" pump discharge line in the shaft. As this pipe had developed several leaks 510 ft. of 10" pipe were ordered to replace the upper portion. This pipe was received and installation completed on May 1st.

New roller bearing rubber lined sheaves were installed on the skip hoist idler stands in April. This change has shown considerable increase in tonnage for skip ropes. Several dividers in the skip roads in shaft house were replaced in July due to poor condition.

The main header of the new heating system in the change house has been completed.

All mechanical equipment at this mine operated satisfactorily during the year.

New control equipment has been ordered from the General Electric Company for the skip hoist. The original control apparatus has reached an age that trouble is probable and it seemed wise to replace this with more modern equipment. The new control is to be Amplidyne, which is a recent development and used extensively in steel mills. It will be the first application to mine hoist controls and we believe will give a refinement and reliability not previously possible.

MAAS MINE:

In January a flange broke on the 10" pump discharge line in the shaft about 100 ft. above the 3rd. level. Repairs were made by electric welding the two pipes together.

The crankpin bearings on the Prescott pump on the 3rd. level burned out on April 22nd. and were repaired with a spare set. A crankpin on the 3rd. level prescott pump which was in poor condition was turned in place and new bearings fitted in October.

Considerable repairs were necessary to the steel in the head frame and pockets as some of the steel was in very poor condition, due to rust.

A few of the new type valves were installed in the Ingersoll-Rand compressor to try to eliminate breakage. Valve repair has caused considerable trouble and expense which it is hoped the new type valve will eliminate.

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MAAS MINE: (CONT'D.)

Repairs were made to the crusher plant in April. New plate liners were installed in the pockets and a new ring gear and spider were installed in the crusher. The thread on the mantle shaft was changed and the new type V-thread nut was used.

The brake band on the cage hoist broke in August and it was repaired by electric welding.

The heating boiler was in very poor condition. Repairs were made to the mud ring, new corners added in the fire-box and a new set of tubes installed. This boiler is now in first class condition.

Some of the unit heaters and the main steam header have been completed in the change house.

All mechanical equipment operated satisfactorily during the year.

NEGAUNEE MINE:

In February we started to move the 1000 G.P.M. Aldrich pump from the 11th. to the 12th. level to give us a spare unit. The pump drive was changed from a flat belt to a V-belt drive. This shortens the distance from motor to pump and makes the drive more positive. This work was completed in April.

An automatic stoker was installed in the heating boiler in the shops in February.

The weight levers on the cage hoist brake cracked on March 14th. New levers were made at the Hard Ore Shops and installed on March 16th.

A crankpin bearing on the #1 pump on the 10th. level broke on June 23th. Repairs were made and a new bearing purchased to replace the broken one.

The 6" air line in the shaft about 400 ft. below surface is in poor condition. A bad leak was repaired on June 16th. by using Dresser couplings. A portion of this line may have to be replaced sometime in the near future.

The skip hoist drum is in poor condition. About six years ago a crack developed in the drum shell. It was repaired and has operated satisfactorily up to the present time. In August of this year this drum showed signs of further weakening so an order was placed for a new drum which has been received and will be installed as soon as possible without interfering with the mine operations.

Work is progressing on the dry changes; the heating system is in operation and the shower baths are almost completed. The dirty clothes hangers are being installed and clean clothes lockers are being rearranged.

All mechanical equipment operated satisfactorily during the year.

LLOYD MINE:

New bearings were installed in the skip hoist motor to replace the old ones which were badly worn.

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LLOYD MINE: (CONT'D.)

An 8" pump discharge line was installed in the shaft in March for the Aldrich pump. This pump was formerly in service at the Stephenson Mine and stored in the Gwinn shed. It was changed from size 13 x 16", 1600 G.P.M., 530 ft. head to 9 $\frac{1}{4}$  x 16", 805 G.P.M., 1000 ft. head, the cost of this change being \$4,446.00. Installation was completed in December.

Considerable repairing is being done to the head frame as some of the steel is in very poor condition.

All mechanical equipment operated satisfactorily during the year.

A new motor generator haulage set was installed replacing obsolete equipment. This is a Westinghouse, 150 kw generator, 275 volts, driven by a 250 H.P. synchronous motor, 2300 volts, 80% power factor.

SECTION 2 MINE:

A 6'x0" x8'2" Ottumwa hoist formerly in service at Section 6 shaft was dismantled and moved to this mine. It has been erected and is ready to go into service sinking shaft.

An Allis-Chalmers 1000 cu. ft. air compressor at the Cliffs Shaft Mine was dismantled and moved to Section 2. This compressor will be ready to operate about January 27th.

A boiler for heating the buildings was taken from the old river pump station at Princeton and is now in service.

A cage and two cars for sinking are being built at the Hard Ore Shops and a rotary dump for the shaft cars has been ordered.

Preliminary electric wiring has been completed and the engineering studies and general layout are well underway. Electric equipment for the hoists should be under order by January 15, 1941.

SPIES-VIRGIL MINE:

In February the skip dumps were repaired and put in good condition.

The crank shaft bearings on the #2 pump were rebabbitted in February.

New steel liners were placed in the skip head frame sheave and the cage was overhauled and put in good condition in May.

The heating boiler has caused some trouble on account of leaks and fire cracks in the fire box. This boiler was retubed with a complete set of Electronite seamless tubes. A new Iron Fireman automatic stoker was installed in the heating boiler and put in operation on September 12th.

In June a 5 H.P. fan was installed in the Virgil shaft to increase ventilation.

In July the intercooler on the Ingersoll-Rand air compressor was cleaned and repaired.

All mechanical equipment operated satisfactorily during the year.

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MACKINAW MINE:

A new belt was installed on the 4th. level Aldrich quintuplex pump as the old belt was completely worn out.

A new drum shell was installed in the 10' x 8' Wellman-Seaver-Morgan hoist to replace the old shell which was in very poor condition. This change was made in August.

Work dismantling the underground equipment was started in December and will continue until all equipment has been taken to surface.

GENERAL:

The General Shops have been very busy during the year. We have about 6 to 8 weeks work ahead of us at all times. However, we have been able to keep the mines and shovels operating without any delays.

There is considerable repairing to do on the steam shovels to put them in condition for next season's operations.

The garage has been able to service all the company cars and trucks with only two men employed.

MESABA RANGE:

CANISTEO MINE:

Due to moving the washing plant from old location to new one next to the pit the plant did not start operating until May 28th. and closed in October, washing 478,339 tons.

During January a 20-ton Walters four wheel drive truck equipped with 150 H.P. Cummins Diesel engine and using hydraulic steering was tested 8 hours each day keeping its place in line with the 15-ton Euclids in stripping on the south side of the pit. It proved it could keep going on a poor road where the Euclid would mire down, that it steered easier, and that it could carry a heavier load at the same speed with the same engine used by the Euclid trucks. Until it proves its endurance compared to an Euclid it can not be given serious consideration.

The Worden-Allen Company started erecting the washing plant in its new location in January and by the end of February had it assembled with machinery in position, but the riveting was not completed until the middle of March. During March and April the new steel for the 36" belt conveyor leading from crusher plant in pit to top of washing plant was erected, and the machinery installed. The following new equipment was received.

- 1 - 12" Hydroseal pump for tailings disposal
- 2 - 85-B Bucyrus shovels equipped with  $3\frac{1}{4}$  yd. welded dippers
- 5 - 10-yd. Euclid trucks
- 1 - 1500 G.P.M. 260 ft. Goulds centrifugal pump
- 1 - 29-T Electric blast hole drill equipped with structure drilling attachment

At the same time one 120-B shovel No. 35 was shipped to the Hill-Trumbull Mine and the other, No. 32, to the Holman Mine. Locomotives No. 104 and 106 were also moved to the Holman Mine.

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CANISTEO MINE: (CONT'D.)

A new power line was installed in the pit for the electric shovels and drills.

Some trouble was experienced after the washing plant started in May. A new 100 H.P. General Electric motor driving one of the 3 flights of belt conveyor burned out in June and was rewound. The speed of the Hydroseal sand pump was reduced from 720 to 600 R.P.M. and gave better service. The hold back brakes on head pulleys of conveyor belts proved too light and were replaced. A 10" Morris pump was installed as a spare to take care of tailings sand if the Hydroseal pump needed repairs. By the time the season closed the washing plant equipment was giving satisfaction.

In August the steel buildings were given a coat of aluminum paint that decidedly improved their appearance.

During December stripping on the south bank was renewed using 2 - 85-B shovels and 12 trucks and moving over 10,000 yds. per day.

HOLMAN-CLIFFS MINE:

In January the work of overhauling the washing plant was approved and orders placed to get it in operation by May. Deliveries were slow and the mill did not start until June 4th. It closed October 17th. with a total for the season of 425,274 tons concentrates. Several changes were necessary to bring it up to date as it had not operated since 1931.

A new 5' x 14' double deck vibrating screen was purchased from the Robins Conveying Belt Company to replace the old revolving screen.

A new 25 ft. log washer from the Lake Shore Engineering Company was installed to replace the one moved to the Canisteco Mine.

Four Akins classifiers were purchased to replace the old Dorr bowl classifiers.

Two 4' x 6' Allis-Chalmers single deck vibrating screens were installed, one on each discharge of the 25 ft. logs to reduce the moisture in the concentrates.

At the substation three 250 kva transformers were installed as the previous bank was found too small. As these units were not received until May two 100 kva transformers were connected up temporarily in April to try out the machines ready for operation.

During February the 7000 G.P.M. pump was operated in the pit, lowering the water 28 feet. This was low enough for all operations in the west pit so a smaller 1600 G.P.M. pump was used in March and the remainder of the season.

In April the shops were reopened and required considerable repairs to place them in good condition again. It was necessary to revamp the round house to care for steam locomotives in the north end and 15-ton Euclid trucks in the south end.

The heating boiler was replaced with a repaired steam shovel boiler from the Hill-Trumbull Mine and set up in a new building just east of the blacksmith shop. A vacuum pump was purchased in overhauling the heating system.

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HOLMAN-CLIFFS MINE: (CONT'D.)

A locomotive pit was built of concrete in the round house and a pit jack was installed that was transferred from the Canisteo Mine.

A new power driven hack saw was set up in the machine shop.

The motor driven compressor from the washing plant replaced the worn out one in the machine shop and a larger compressor was purchased second hand from the village of Marble for use at the washing plant.

HILL-TRUMBULL MINE:

As the stripping program was completed in January all equipment was moved to the shops and overhauled.

At the washing plant the 4' x 12' revolving screen was scrapped and replaced with a 5' x 14' double deck vibrating screen purchased from the Robins Conveying Belt Company. This change required some resetting of structural steel supports.

The washing plant started operations May 6th. and shut down October 1st. producing 797,085 tons of concentrates. The pit operations continued after this date direct shipping a total of 239,980 tons.

In April the No. 35 120-B shovel from the Canisteo Mine was erected in the pit and operated for the season.

Considerable repairs were needed on the 350-ton Marion shovel. The caterpillar traction wheels developed cracks and were patched and welded. As present plans call for the use of this machine for only one more year no extensive repairs will be made on it. In August the 3-yd. bucket was replaced with a 6-yd. to use in ore loading.

In October when the washing plant was shut down and the machines dismantled for inspection it was found that the 8' pan conveyor head sprocket had cracked almost half way through. This was welded but a second sprocket will be purchased to eliminate any extensive delays in the future.

Due to the better performance of the Akins classifiers at the Holman plant it was decided to replace one worn out Dorr bowl classifiers with two new Akins classifiers and work started in December to change the structural steel to fit the new machines. To fit them in properly it was necessary to raise the 25-ft. logs and shift the belt conveyors leading to the crushers.

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Total connected load at Mesaba Range Mines December 31, 1940	5,825 H.P.
"    "    "    "    Spies-Virgil    "    "    "    "	1 440 "
"    "    "    "    Ishpeming District Mines Dec. 31, 1940	28 009 "
Total spare motors on hand at Ishpeming District Dec. 31, 1940	7,499 H.P.
"    "    "    "    "    "    Mesaba Range Mines    "    "    "	2 273-3/4 H.P.
"    "    "    "    "    "    Spies-Virgil Mine    "    "    "	150 "

D. C. GENERATORS AND MOTORS

Total underground haulage generators - Ishpeming District	2,025	K.W.
"    exciters and generators    -    "    "	2 424-3/4	"
"    motors    -    "    "	5 250	H.P.
Spare D.C. generators    -    "    "	500	K.W.
"    U.G. haulage generators    -    "    "	100	"
"    D.C. motors    -    "    "	195	H.P.
"    "    exciters    -    "    "	52	K.W.

MESABA RANGE MINES

Total haulage generators	80	K.W.
"    exciters and generators	1,246	"
"    D.C. motors	1 203-1/4	H.P.
Spare D.C. motors	40	"

SPIES-VIRGIL MINE

Total haulage generators	100	K.W.
"    exciters	10	"
Spare haulage generators	100	"
Total D.C. motors	88	H.P.
Total mine transformers	290	2,661 K.V.A.



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COMPARATIVE TABLES

<u>YEAR</u>	<u>TONS ORE AND ROCK HOISTED</u>	<u>CU. FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>	<u>G.P.M.</u>
<u>CLIFFS SHAFT MINE:</u>					
1931	315,492	592,506,000	1,878	350,061,000	
1932	92 125	188 127 000	2 042	369 057 075	
1933	61 623	160 033 500	2 596	362 896 379	
1934	235 639	394 168 500	1 672	348 670 324	
1935	288 053	516 140 000	1 791	366 504 523	692
1936	484 310	907 194 600	1 873	389 395 743	739
1937	579 759	1,102,635,000	1 901	370 765 799	705
1938	352 983	735 452 000	2 083	362 700 824	689
1939	415 682	790 875 000	1 902	363 540 036	693
1940	573 487	1 053 990 000	1 837	362 590 686	686
<u>ATHENS MINE:</u>					
1931	254,660	686,750,000	2,696	136,215,501	
1932	77 639	209 925 000	2 703	205 070 447	
1933	49 506	152 235 000	3 075	194 073 179	
1934	166 412	334 485 000	2 009	179 244 454	
1935	205 683	527 355 000	2 561	154 911 562	292
1936	318 604	698 985 700	2 193	134 999 491	255
1937	455 512	884 565 000	1 941	134 521 343	257
1938	276 800	643 005 000	2 322	165 316 266	313
1939	416 225	819 405 000	1 968	173 774 003	331
1940	526 456	1,196,505,000	2 272	185 418 833	351
<u>MAAS MINE:</u>					
1931	332,206	756,405,000	2,076	585,922,823	
1932	97 295	210 825 000	2 166	576 727 573	
1933	143 845	367 560 000	2 555	554 157 402	
1934	294 372	601 920 000	2 044	550 020 020	1 127
1935	370 399	686 520 000	1 853	597 349 626	1 129
1936	549 615	897 919 800	1 634	674 397 310	1 279
1937	784 328	1 251 710 000	1 595	686 467 622	1 307
1938	438 359	742 635 000	1 694	752 268 448	1 429
1939	528 389	1 005 165 000	1 902	726 916 014	1 386
1940	709 755	1 288 665 000	1 815	710 849 782	1 346
<u>NEGAUNEE MINE:</u>					
1931	346,533	620,641,000	1,791	482,294,599	
1932	86 650	209 970 000	2 423	477 360 416	
1933	65 661	166 050 000	2 528	448 928 213	
1934	240 808	437 985 000	1 818	435 724 897	
1935	311 446	481 680 000	1 546	485 600 207	918
1936	530 844	737 716 000	1 389	483 287 423	916
1937	839 283	1 096 200 000	1 306	562 290 718	976
1938	439 588	771 210 000	1 754	534 118 975	1,015
1939	577 510	1 026 945 000	1 778	532 642 228	1 015
1940	890 598	1 296 675 000	1 455	377 169 929	714

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<u>YEAR</u>	<u>TONS ORE AND ROCK HOISTED</u>	<u>CU. FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>	<u>G.P.M.</u>
<u>TILDEN MINE:</u>					
1931	137,010				
1932	19 957				
1933	94 194				
1934	167 688				
1935	190 511				
1936	291 341				
1937	305 418				
1938	85 889				
1939	170 276				
1940	205 612				
<u>LLOYD MINE:</u>					
1933	4,554				
1934	136 951	145,926,000	1,065		
1935	248 410	289 426 500	1 165		
1936	377 572	383 994 000	1 017		
1937	545 274	559 512 000	999		
1938	286 864	293 247 000	1 022		
1939	323 639	273 042 000	843		
1940	487 287	398 308 500	839		
<u>MACKINAW MINE:</u>					
1931	80,801	489,240,000	6,054	172,438,518	
1932	24 781	126 495 000	5 122	119 155 845	
1933	3 944	49 770 000	12 619	103 051 726	
1934	79 187	291 510 000	3 681	82 416 531	
1935	138 507	446 625 000	3 224	72 964 993	136
1936	185 954	692 415 000	3 723	67 049 662	126
1937	172 823	547 515 000	3 168	61 135 735	114
1938	48 824	256 234 000	5 248	44 633 865	90
1939	0	2 295 000		125 447 426	239
1940	0	4 185 000		136 981 169	259