

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1941

CLIFFS SHAFT MINE:

Small jib cranes were installed at "A" and "B" shaft houses for handling material on the trucks.

The idler shaft on the picking belt broke on January 30th. A new shaft was made at the General Shops and installed with no delay to hoisting operations.

On February 2nd. the pans, pan chain and rollers were changed on the picking belt. The old set was repaired and kept as a spare.

The steel trestle on the "B" shaft end had a broken channel on the second bent from the shaft house. Repairs were made on March 9th. by electric welding. In August some repairs were made to the first bent on the "A" shaft trestle. It was about 3" low on the south side. Steel fillers were placed between the bent and girder to level the track. In October several cracks were discovered in this trestle. Repairs were made by electric welding.

In March the new shower room in the dry was completed.

On May 29th. the condition of the hoist drums became very bad and the crack in the "B" shaft drum started to lengthen. Two jacks were placed inside to support the shell and hoisting operations were delayed about 2½ hours. A temporary crane was installed on Sunday, June 1st. to be ready for any emergency that might arise. The drums continued to get worse. On July 3rd. work started to change the shells on both the "A" and "B" shaft drums. This was completed on July 10th. and both hoists are now in good condition.

Air filters are being installed in the intake of the air compressors.

A new heating boiler was installed in the new addition to the laboratory.

During the shut down for hoist repairs, a new bowl section was installed in the #8 crusher.

In December the adjusting bolt on the "B" shaft hoist drum broke, causing considerable trouble and delay. The skip dropped to the bottom of the shaft and the counterweight broke the head sheave. The overwind operated satisfactorily but the speed of the skip and momentum of the drum was too much for the emergency brake to stop in so short a distance. The brake and sheave have been repaired and are now in good condition. A new adjusting screw has been installed on the "A" shaft brake band.

All other equipment gave good service for the year.

MATHER MINE:

On January 27th. the temporary air compressor installation was completed. The machine was formerly used at the Cliffs Shaft Mine. We had some trouble with this compressor in March. The water in the intercooler froze, splitting several tubes. Repairs were made by plugging the tubes with pine plugs so that operations could be continued. No further trouble was experienced with this machine.

The new sinking cage and crosshead were put in operation on March 28th.

In May it was necessary to ventilate the shaft. The 14" counterweight pipe is being installed as the shaft is sunk and used as a ventilating pipe with a fan on surface.

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MATHER MINE: (Continued)

The new Allis-Chalmers crusher was received and unloaded on September 23rd. The 35-ton electric traveling crane was received on September 23rd.

On October 9th. the Type PRE 30"-18" x 21", 2700 cu. ft. Ingersoll-Rand air compressor was received and unloaded in the engine room. Erection of this machine was started on November 11th., and it will be ready to go into operation about February 15, 1942. On October 15th. the air receiver was received. The piping from receiver and aftercooler to compressor has been completed. The water circulating pumps for compressor have been installed, and the cooling system piping is almost completed. The air intake is completed and filters will be installed about February 10th.

On October 9th. the six 325 G.P.M., 3000 ft. head Aldrich Triplex pumps purchased from the Calumet & Heckla Company were received and unloaded in the Hard Ore yard. The two Goulds 300 G.P.M. 120 ft. head booster pumps for the mine water supply were received on October 24th.

The Worden-Allen Company started to erect the headframe on October 9th.

On October 27th. four carloads of cage hoist parts were received and unloaded in the engine room. The erecting engineer from the Nordberg Company started erecting the cage hoist on November 17th. This hoist will be ready for operation about February 15th, 1942.

Three 12 foot sheaves were received on November 3rd. and one on November 12th, complete with bearings.

On November 13th. four cars of skip hoist machinery were received. The erector is now installing the skip hoist.

Two hoist ropes were received on November 21st.

The motor for the second air compressor was received on November 19th.

The slip regulator for the skip hoist was received on December 26th.

All mechanical equipment operated satisfactorily during the year.

TILDEN MINE:

A very bad crack developed in the base of the #8067 - 10" Allis-Chalmers crusher. A new base was ordered in February. It was received and installed in April.

The concave section of the east crusher was turned on July 10th. A set of new concaves were installed in the west crusher on September 26th.

A new track was purchased and installed on the #46 shovel.

A fire in the bit sharpening shop destroyed the building completely in March. A temporary building was built over the equipment and a few repairs put it back in operating condition. A new steel building was purchased and erected in December.

Crushing operations started May 2nd. and stopped on November 25th. and tonnage totaled 302,943 tons.

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TILDEN MINE: (Continued)

The firebox on the #2 locomotive was repaired on May 2nd. New bearings were placed in this locomotive in July.

On November 19th. the ram on the bit sharpener broke and repairs were made at the General Shops.

The wabblers shaft on the #29 shovel broke on November 22nd. It was replaced with a new one from stock. The A frame brace on the #31 shovel broke on November 22nd. and temporary repairs were made to finish the season.

A new chunk hoist was installed in the crusher building on September 26th.

ATHENS MINE:

On January 25th. two spokes broke in the drum spider on the cage hoist. This spider was replaced on February 2nd. with a spider from the Barnes-Hecker skip hoist. The brake support on the cage hoist broke in April and a new one from the Lake Shore Engineering Company was installed on April 6th.

In February some repairs were made to the bottom deck of the double deck cage.

The changes to the heating system and shower baths in the dry were started in March and completed in April.

The center skip dump plates dropped about 2" in April. The supporting steel was in very poor condition. It has been replaced with new steel.

In August one of the water cylinders on the underground pump developed some sand holes. After several attempts to repair it by welding it was necessary to replace it with a new cylinder.

Due to age the original control on the ore hoist reached a point where it was difficult to keep it in a safe operating condition. It was decided, therefore, that best practice required a new control. After careful consideration a new type called an Amplidyne was purchased, which had been used extensively on various industrial applications but never before applied to a mine hoist. This was purchased from the General Electric Company and put in service during June and July. After final adjustments and minor changes were made it operated very satisfactorily. It gives very smooth control and introduces definite limiting features that tend to prevent accidents and allows a slight increase in hoisting capacity. This, together with a new Lilly safety control, serves to give a reliable, economical and satisfactory hoist control which is easier to operate than the one replaced.

MAAS MINE:

A valve chamber on the third level Prescott pump that was leaking very badly was repaired at the General Shops on January 21st. On September 26th. a new crank pin was pressed in the crank disc to replace a loose pin. A motor on the Allis-Chalmers centrifugal pump was sent to the factory for balancing and it was returned on August 27th. A complete new shaft and impellers were installed in the 3rd. level Allis-Chalmers pump on July 18th.

The changes to the heating system and showers in the dry were completed in March.

The intercooler on the #2 air compressor developed a leak. It was replaced on February 27th.

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MAAS MINE: (Continued)

On February 6th. the eye bolt on the adjusting turnbuckle of the skip hoist broke. A new one was installed without delay to hoisting. On June 7th. the brake band on the cage hoist broke and repairs were made on Sunday, June 8th. A new lilly hoist controller was installed on the cage hoist in October to replace the old one which was in poor condition.

A new pocket and screening plant for the Cliffs Shaft ore was constructed during March and April. This plant was put in operation on May 7th.

On May 19th. several links broke in the pan conveyor. Repairs were made and operations started on May 20th. Repairs have been ordered to overhaul this conveyor before shipping starts next season.

NEGAUNEE MINE:

In February a crack developed in the crank shaft on the 6" x 7" Aldrich pump on the 13th. level. A new crank shaft was ordered and installed.

The new skip hoist drum was installed on March 29th. Several new cracks developed in the old drum shell which made it necessary to make the change. The brake levers on this hoist broke on May 14th. New levers were made at the General Shops and installed on May 18th.

A fire in the Ingersoll-Rand air compressor on June 9th. split the discharge line. The thermostat cutout was tested and it tripped at 330°F. Air filters on the intake have been installed which should eliminate any future trouble. The intercooler on this compressor was changed on June 15th. on account of leaking tubes. On September 2nd. bearing trouble developed on both air compressors. On the Nordberg the main pillow block bearing burned out completely. It was necessary to install a complete new bearing. This compressor was out of service from 4:30 P.M. to 8:30 A.M. On the Ingersoll-Rand compressor the main bearing became so hot it was necessary to remove and scrape. This compressor was out of service from 5:00 PM to 4:30 AM. The cause of the trouble was stoppage of oil, due to small particles of waste getting into the oil system. A new cylinder has been ordered for the #2 Prescott pump on the 10th. level to replace one that is in poor condition.

The ventilating fan heaters for the #2 shaft are being installed, the boiler is in place and installation will be completed in January.

LLOYD MINE:

Considerable repairs were made to the headframe replacing steel that was in very poor condition.

The spider cap on the #6 McCully crusher broke on April 26th. Temporary repairs were made, a new cap was ordered and installed.

On October 3rd. repairs to the heating plant boiler were completed. A complete set of tubes and a mechanical stoker were installed in this boiler.

PRINCETON MINE:

Pumping was started at the #1 pit on October 18th. Pumping in the #3 shaft started December 24th. The cage hoist foundation for #3 shaft has been completed. Foundation for the air compressor has been started. The boiler for the heating plant at the #3 dry, engine house and shops has been installed.

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PRINCETON MINE: (Continued)

The steel headframe taken from the Gardner shaft is being erected at the #2 shaft. It should be completed about February 15th. Repairs are being made to the timber in #2 shaft and as soon as completed pumping will be started with a 500 G.P.M. pump in this shaft.

GENERAL:

The steam shovels operated all season with few delays. They are now being conditioned for the 1942 season. We received two shovels, an 85-C and an 88-C, from the Mesaba Range. They are being repaired and will be put in operation the coming summer.

A new 40 ft. addition to the Hard Ore blacksmith shop was erected during the year. A set of plate rolls were installed. They were purchased second hand from the Ishpeming Boiler Works.

The steel headframe at the Francis Mine was blasted down and steel is being salvaged from it to replace worn out parts on Gardner headframe erected at the Princeton #2 shaft.

HILL-TRUMBULL MINE:

The structural steel changes necessary at the Washing Plant to install the two Akins classifiers were completed in the spring and the classifiers installed before ore season started April 18th. Concentrates for the year totaled 975,546 tons, with an additional 279,030 tons of direct shipping. The season closed October 31st.

Another change was necessary at the washing plant to improve operation. The 5' x 14' double deck Robbins screen came equipped with perforated plate. This was replaced with wire screen cloth to eliminate plugging. This vibrating screen gave some trouble during the summer from spring breakage. It seems too light for this heavy operation.

The storage pile equipment was heavily used during the season due to poor shipping service caused by scarcity of railroad cars.

In the pit practically all equipment was overhauled. Repairs were made on booms and dipper sticks of Shovels No. 34 and 35. The 30-yard cars were overhauled at the rate of one per week. One bad accident occurred in May when a 15-ton truck was driven head on over the bank, dropping 25 feet and bending the main frame. The driver jumped off.

In July the boom engine on 350-ton shovel was wrecked due to bank caving and catching dipper.

In October plans were underway to build a half unit heavy density cone plant near washing plant. Grover Holt was employed as consulting engineer and the Chemical Construction Corporation of New York City did the drafting.

It was also decided to run a 36" belt conveyor from a crushing and screening plant in bottom of pit thru a drift inclined at approximately 14° to a receiving pocket located on the south bank near the boundary line between the Hill and the Trumbull Mines. The drift is being driven and the conveyor equipment as well as structural steel for screening plant and receiving pocket have been ordered. This change will release the ore now in railroad approach running thru the center of pit. The locomotives will only be used to haul the cars from top of pit bank to washing plant.

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HOLMAN-CLIFFS MINE:

As it was necessary to work the bottom of the Holman pit to get the required 1941 ore tonnage the 7000 G.P.M. pump was operated full time during the months of January and February. Ore operation started April 21st. and was completed October 30th. The tonnage of concentrates for the season was 988,485, all but 49,722 tons being shipped.

In March a new electric Marion shovel, size 4101, was received and erected in the pit. This machine is equipped with a $3\frac{1}{4}$ yard bucket and carries C.C.I. #51. This, with the two 4 yard Bucyrus shovels Nos. 32 and 34, will supply the ore from the pit for this season. Considerable repairs were needed on No. 32 shovel which was equipped with new caterpillars treads and drive sprockets. On the No. 34 shovel the ball bearings on motor generator set gave some trouble but lasted through the season.

In the shops the four locomotives, Nos. 17, 104, 105 and 106, were overhauled as well as the 30 yard cars. The only serious trouble experienced with them for the season was the wreck on No. 105 when the four car train got away and smashed into it at the pocket, killing one man. It was repaired at the Hill-Trumbull shop.

At the Washing Plant it was necessary to rebuild the Robbins 5' x 14' double deck screen. Its speed was increased 100 R.P.M. and this improved the performance, and its condition when dismantled showed the machine is built too light for our heavy production. Repairs were needed during the shipping season due to frequent spring breakage.

As ore operations started in April it was necessary to build the pit pocket of timber and hold the structural steel pocket ordered for the pit for some future need. It is now being used in the heavy density cone plant being designed for the Hill-Trumbull Mine.

During the season's pit operation a new sump was dug about 50 feet below the present one and the 4400 G.P.M. pump installed on a floating platform. A pump of 2000 G.P.M. was installed in December to reduce the mine power peaks and give continuous operation.

A bad derailment due to broken car axle occurred in September that caused the loss of one shift. This only occurs at rare intervals as the axles seldom break.

Due to wet weather in August a 600 G.P.M. pump was flooded in a sinking cut but was recovered the next day.

CANISTEO MINE:

Ore operations started May 5th. and closed October 8th, producing 585,679 tons concentrates. All was shipped with the exception of 30,066 tons held in stockpile for the 1942 season. In January a winter stripping program continued with all trucks operating that were not being overhauled. Overhauling continued during the spring so that all machines were in good condition for ore production.

In the pit a new floating raft was built for the 1500 G.P.M. Gould pump supplying clean water to the mill. A similar raft was built for the 2000 G.P.M. pump discharging over the south bank. The piping for these pumps was revamped so that both pumps could be used to lower the pit water.

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CANISTEO MINE: (Continued)

At the Washing Plant the structural steel floor under 25 ft. logs was lowered four feet in November; after it was found a better operation could be secured by placing the 66" Akins classifiers directly under the 25 ft. logs.

In April two Akins classifiers were installed to replace one Dorr bowl classifier that was in poor condition. Results during the summer proved the Akins classifiers were superior to the old Dorr machine so two more were purchased to be installed next spring.

In October during several days of heavy rains five wood supports under middle flight of 36" belt conveyor were washed out and had to be replaced in November with rock material and steel supports. This makes a stronger job than the original.

Some changes were made with tailings pump equipment. A sand pump of too small capacity for full operation formerly used for a spare was replaced with a 12" rubber lined Hydroseal pump duplicating the present pump. No slowing down of washing plant operations will be necessary in the future due to tailings pumps.

Three new Euclid 15-ton trucks equipped with superchargers were received in December and are now in use on the stripping. The old trucks are being overhauled as they can be spared so all machines will be in good condition by next ore season.

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Total connected load at Mesaba Range Mines December 31, 1941	7,733 H.P.
" " " " Spies-Virgil " " " "	1 440 "
" " " " Ishpeming District Mines Dec. 31, 1941	26 174 "
Total spare motors on hand at Ishpeming District Dec. 31, 1941	1 330 "
" " " " " " Mesaba Range Mines " " "	1 108½ "
" " " " " " Spies-Virgil Mines " " "	150 "

D. C. GENERATORS AND MOTORS

Total underground haulage generators - Ishpeming District	1 935	K.W.
" exciters and generators - " "	2 388-3/4	"
" motors - " "	5 370	H.P.
Spare D.C. generators - " "	500	K.W.
" U.G. haulage generators - " "	90	"
" D. C. motors - " "	195	H.P.
" " exciters - " "	10	K.W.

MESABA RANGE MINES

Total haulage generators	80	K.W.
" exciters and generators	1,660	"
" D. C. motors	1 691-1/4	H.P.
Spare D. C. motors	53	"

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	309	3,026-1/2 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>					
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
1941	677 249	1 218 780 000	1 799	343 850 964	655
<u>ATHENS MINE:</u>					
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
1941	638 178	1 350 945 000	2 116	185 835 174	354
<u>MAAS MINE:</u>					
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	
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
1941	849 963	1 646 145 000	1 936	595 239 587	1 135
<u>NEGAUNEE MINE:</u>					
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
1941	1,077,854	1 500 165 000	1 391	338 385 511	644

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<u>TILDEN MINE:</u>					
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				
1941	302 943				
<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		
1941	572 778	534 456 000	933	40,031,200 (10 Mo.)	91