MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

ATHENS MINE:

In the engine house a new regulator and high pressure cylinder head were installed on the Ingersoll-Rand compressor and valves cleaned on both cylinders during February. In May the intercooler was replaced with a repaired unit which reduced the temperature by 20 degrees. The old unit was repaired and held as a spare. A new Worthington pump, capacity 250 GPM, head 50 feet, was installed to provide better cooling. Hoist and motor-generator sets gave no trouble during the year.

In the headframe new plates in the skip dump pocket and a new butterfly complete with shaft and bearings were installed. New steel liners were inserted on both skip head sheaves.

On surface the cooling water tank was cleaned. The new Brownell stoker was received in April, but due to the strike was not installed until August. A temporary boiler moved from Cliffs Shaft Mine was used during this installation period. All fire extinguishers were tested and filled during January and June.

Underground the large ventilating fan on the 10th level was cleaned and painted and new V-belts installed. A new pump was installed at the Breitung shaft to replace the old one whose motor had burned out. During an electrical storm in August this new motor burned out and was replaced by the old one, which had been repaired. A new plunger was installed on the #1 Prescott pump on the 10th level. The Marlo packing installed by a factory expert on this pump proved unsatisfactory and was removed after 48 days service. A by-pass valve was replaced on this pump. In July a locomotive was lowered from the 4th to the 6th level.

Tests on the first skip equipped with extended guides proved satisfactory and the other skips were similarly rebuilt. On January 13th a new hoisting rope was installed on the cage hoist. During June the skip ropes were oiled and a new counterweight rope installed. In August a new galvanized rope was installed on the north skip and in December changed end for end.

In the shaft twenty-two feet of 6" airline was replaced.

ATKINS MINE:

During June month a 2000 GPM 200 foot head pump was mounted on a scow in the pit and dewatering started July 2nd. In July five new Euclid 15-ton trucks without engines were received and a few days later new Buda 150 HP engines arrived and were installed in the trucks. A 54-B diesel 2½ yard shovel was shipped over from the Holman-Cliffs Mine and stripping started August 26th, continuing the rest of the year. A 500 GPM pump replaced the 2000 GPM unit when dewatering was completed in September.

In December an 85-B electric 2½ yard shovel was received from the Canisteo Mine and erected as a spare for the 54-B. It will also be used to clean up along the belt conveyor location.

On October 7th the 60 foot square wooden garage burned down with a loss of $25,000 worth of equipment, including one new truck. Within ten days a 40 foot square garage was started of concrete blocks and erected in six weeks. This is large enough for all repairing and overhauling.

A new 54-B 2½ yard shovel has been ordered for this mine.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

CAMBRIA-JACKSON MINE:

Painting of the engine house and all machinery, wires, pipes, etc. in safety code colors was completed in April. The Laidlow compressor purchased from the Holmes Mine of the Oliver Iron Mining Company was in operation on the 15th of January. During September, due to excess carbon, the air temperature rose above normal and tripped the motor. Intervals between cleaning of the valves were shortened, but again in November this machine shut down due to excess heat. The ario compressor oil was changed to D.T.E. heavy medium made by the Socony-Vacuum Company. Up until the present time this machine has operated satisfactorily. A new coupling with brake flange was installed on the hoist. The new emergency brake and engine were installed during June and all piping completed in July and they are operating perfectly.

On surface a new stack was installed on the change house boiler to replace the old stack which broke in two. It was decided to replace the old shop with new ones of concrete block construction. Contract was given to McDonald and Kaake and by the end of the year the foundations were in and walls half way up. The new building is located just back of the office to the south west.

Underground the 7th level sump was cleaned in November of 85 skips of mud. The new Gould pump on the 7th level was installed and in operation during July. After 15 days of operation the valves and seats became pitted and were replaced with valves and seats of our own design. No further trouble has been experienced. Credit of $125.00 was received from the company for this replacement work. A test run on pump pole lubrication using present pole grease on one pole and a drip cup containing rock drill oil on the second proved the life of packing much longer at this mine using rock drill oil. All pole lubricators have been changed to the drip type. Building of foundations in the 7th level pump house for the Prescott pump purchased from the Holmes Mine was begun in August. The motor driving the Ingersoll-Rand pump on the 325 foot level supplying water to the air compressors burned out and was replaced.

During January and again in December all wearing shoes on skips and cages were replaced with new shoes. During June the west skip and cage were changed. In September a new double deck cage was installed in the east compartment replacing the old single deck cage. The east skip rope was changed in January and the west rope in December.

Some work was done on the 6 inch discharge line in the shaft.

CANISTEO MINE:

Due to strike at the mine from February 8th to May 22nd ore operations did not start until June 24th, the washing plant working two 8 hour shifts per day and 5 days per week. The season closed November 8th, producing a total of 547,398 tons of concentrates. The west wing of the washing plant was used until October 1st for flotation testing by the Minerals Separation North American Corporation.

Two 2½ yard and one 4 yard electric shovels operated in the pit on stripping and crude ore until November, when one 2½ yard was repaired and shipped to the Atkins Mine to replace the 2½ yard Diesel unit which will be returned to the Holman pit. In December a 4½ yard Harnischfeger electric shovel was received and erected on the north bank near the washing plant. This will be ready to start stripping in January, giving the pit two 4 yard shovels and one 2½ yard. It is planned to ship the 2½ yard electric moved to the Atkins to Ishpeming for stock pile loading when the Atkins Mine receives its new 54-B Diesel shovel.

CANISTEO MINE: (Continued)

Two new Walters four-wheel drive 20-ton trucks equipped with Buda diesel engines were received and placed on comparative test with two Euclid 20-ton trucks equipped with Cummins Diesel engines. During the first month both front and rear transmissions had to be changed in the Walters truck. A new oil was tried and seems to have corrected this trouble. A years operation should develop some interesting information on these.

CLIFFS SHAFT MINE:

A repaired triplex pump was installed in the basement of the engine house to supply cooling water for the compressors. Water pipe lines to all compressors were changed to copper, and the compressors were thoroughly cleaned. A small Westinghouse Air Brake Company compressor with 5 H.P. motor was installed to supply air to the new emergency hoist brakes when the large compressors are idle.

The new emergency brakes for "A" and "B" shaft hoist were installed and in operation by July. They are operating satisfactorily, though minor adjustments must still be made before they can be classed as perfect.

In the crusher house a rebuilt pan conveyor was installed during July and a new D. O. James speed reducer was placed in operation during December. A new mantle, eccentric, gear, bottom and spout wearing plates were needed on the No. 8 crusher. A new chute was put in between the crusher and screen.

A new Granby type car was placed in service on the "A" shaft upper tram. A new 8'-0" sheave was installed for the "B" shaft counterweight rope. New idler pulley supports of welded pipe construction were installed for both "A" and "B" shaft ropes, replacing the old decayed wood supports.

A temporary boiler was set up at the change house and during January the old boiler was dismantled and removed. In July the new boiler was installed and the temporary boiler taken to the Athens Mine. A larger stack was added to the heating boiler at the laboratory.

Work was begun in July installing the new 1000 GPM 1000 foot head Worthington pump in the new 5th level pump house. During a test run in August the crosshead guide on the motor side was scored. This scoring was caused by poor work at the factory. It was found necessary to practically dismantle the pump, rebore the guide and install an oversize crosshead, before the pump operated satisfactorily. Repairs were immediately begun on the old Prescott pumps as soon as the new one could carry the load.

A new skip box replaced the old one at "A" shaft.

The 80-B electric shovel was received from the Tilden Mine during December. It was erected and stored for stockpile loading next shipping season.

HILL-TRUMBULL MINE:

Due to many changes necessary in washing and retreat plant the ore production did not start until July 1st, with only the washing plant in operation. With non-delivery of screens from Allis-Chalmers Co. due to strikes the retreat plant started September 12th at half capacity and continued at this rate for the season. Both plants closed down October 31st, producing 590,040 tons of concentrates.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

HILL-TRUMBULL MINE: (Continued)

At the washing plant the four Selective Media Concentrators were set up on table jig floor and 24" conveyor belts installed to move their product to the shipping bins. The strike at Allis-Chalmers has eased off sufficiently to ship our screens in the fall and the work on retreat plant this winter will complete it for full production next May. A ball mill is being added on the table floor to reduce size on some types of jig ore. Tests were made on new Pettibone Mulliken tailings pump installed for a try out and its performance warranted ordering a size larger unit to carry the load. The tailings basin is full and next year the pump will have to carry a higher head than formerly.

In the pit no change was made in shovel equipment for the year, but it was necessary to replace some of the worn-out Euclid trucks with new ones of better design. Improvement consists in adding more metal at the weak points and locating the engine to give the repair men a better chance to service it.

HOLMAN-CLIFFS MINE:

The washing plant started June 24th and shut down Novembef 8th, producing 529,070 tons of concentrates. This, with 5,433 tons direct shipping ore, totaled 534,503 tons. While the mine was closed down from February to May, details were completed covering belt convcyor system in pit and the moving of washing plant. Orders were placed in February with most of deliveries ranging from 8 to 12 months. During the summer foundations were built not only in pit for conveyor system but on the south bank ready for moving the washing plant. Piling was driven for loading pocket piers and grading completed for water reservoir. Dismantling of washing plant started in November and was about completed by the end of the year.

In the pit No. 35 shovel replaced No. 57 on stripping in January, while No. 55 and 32 were overhauled at the shop. At the end of the season No. 57 was moved to the shop to be converted into a dragline for stripping work. In October No. 32 was put out of commission by a fall of dirt from the high bank but no one was hurt. In July the No. 55 shovel was repaired and shipped to the Atkins Mine to start stripping there.

The old Layne and Bowler pump sold to this mine from the worked out Stevenson Mine was rented to Pickands Mather Co. for $4,000 per year to drain half of Rabbit Lake on the Cuyuna Range. It is still operating there.

At the shops a second-hand lathe 22" swing by 72" centers was set up to replace a worn-out machine that had been there since 1912. Some trouble was experienced from Cummins engine bearings failing in the trucks. Comparative tests between these and the Buda engine show longer service from the Buda make.

LLOYD MINE:

In the engine house the Sullivan compressor developed sufficient heat in the discharge line to operate the thermal relay trip in spite of frequent cleanings. D.T.E. heavy medium oil in place of the ario compressor was tried and proved satisfactory. Examination and cleaning of the valves have shown much less carbon deposit.

The two second hand hoists moved to the mine for shaft sinking were stored on surface until needed elsewhere. New cup leathers were installed in the skip hoist brake engine to stop a bad air leak.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

LLOYD MINE: (Continued)

Minor repairs were made on the crusher in the headframe, the skip dump was repaired and a new sheave was installed on the pulley stand.

On surface the stoker in the dry was repaired in January. In May the stoker used at Princeton #2 was installed at the shaft house boiler replacing the old one which was in poor condition. Changes were made in the Morris Mine water supply lines and water supply pump.

Underground repairs were made to the Eimco loader and to the drilling jumbo.

During August both cage and skip ropes were replaced with new ropes.

MAAS MINE:

In the engine house repairs were made on the air compressor during July. A new all steel welded anchor base was installed on the skip hoist power brake, replacing the old cast iron base which was cracked. Repairs were also made on the cage hoist brake.

During June the crusher was repaired.

Underground the installation of the new Aldrich 800 GPM 1200 foot head pump on the 3rd level was completed and in operation during September. Repairs were begun on the #1 Aldrich on this level. The Prescott pump on the 3rd level was repaired several times. Two new valve pots were ordered for this pump, the old pots being in such poor condition, further repairs were inadvisable. These pots are promised for delivery in February. Repairs were also made to the pots and valves on the 5th level Prescott. A small triplex pump from the Princeton Mine now being overhauled in the General Shops will be installed on the 6th level. A leak in the discharge column was repaired by welding.

The stock pile shovels worked into December with the shipping season closing later than usual.

MATHER MINE:

In the engine house new Fisher & Porter flow meters and copper cooling water piping were installed on the air compressors. Compressors were thoroughly cleaned and the cylinders and other hot areas were given a trial coat of heat resisting paint.

Foundations were poured for the columns supporting the extension to the top tram trestles. The hydraulic system on the Larry cars was repaired to prevent oil leakage and the bodies raised one half inch to give more clearance when crossing switches. The cars were equipped with hold downs to prevent tipping while unloading on stockpile. A repair shed for top tram cars was built on the east rock pile.

In the headframe air lines for braking railroad cars were installed for loading ore from pockets. Openings were made in the ore chutes above landing to permit easier cleaning of sticky ore. A new railroad pocket was built on the south side incorporating the roller door which has proved successful underground. The north pocket is now being rebuilt.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

MATHER MINE: (Continued)

On surface the mouth of the east timber tunnel was concreted. The heating boiler was cleaned and repaired. The lines running from the heating coils in the boiler are becoming badly corroded and will need replacing soon. More clothes racks were installed in the dry, additional showers installed in the captain's office and some changes made in the miners toilets.

Underground ore cars are being enlarged from 90 to 100 cubic foot capacity. Car dumping cylinders were installed on the 6th level.

The two 500 GPM pumps on the 1000 foot level were made to operate automatically. A 250 GPM 400 foot head centrifugal pump from the Cambria was installed on the 2200 foot level. Two 500 GPM 2400 foot head Worthington horizontal duplex pumps driven by 350 HP motors were received and will be installed on the 2200 foot level when excavation of pump rooms is completed.

A steel wall and door were built for the ignitron room on the 1900 foot level.

The 1750 and 2200 foot level trenches were equipped with safety screens and rope stands. Grizzly bars were installed on the 6th level pocket.

During July the north skip was replaced by the spare and the south skip replaced by the repaired north skip. In December the spare skip was equipped with pneumatic tired wheels to save wear on the shoes and was installed on December 29th. By covering the steel rail skip guides with pump pole grease each week end the skip shoes life was increased from 3 to 60 days during the summer. In the winter the grease flaked off due to cold and the shoes did not last so long.

NEGAUNEE MINE:

In the engine house the various machines and equipment were painted in National Safety Code colors. A small air compressor from the Princeton Mine was installed in the engine house. A main bearing on the Ingersoll-Rand compressor burned out and was replaced by a spare from the Maas Mine.

Both skip dumps in the headframe were repaired. Both north and south skips were changed and overhauled.

On surface the heating plant for underground air at #2 ventilating shaft was shut down March 8th. During the summer the boiler and stoker were overhauled. The stoker will last this winter, but a new and larger unit will be necessary for the following winter. At the dry heating plant a new stack was added to the boiler and a pump and tank installed in boiler room. Three-hundred feet of 3 inch pipe was installed for fire protection at the sawmill and timber yard.

Underground all pumps operated without trouble during the year. A 4" air line is being installed on the 11th level connecting with the Athens Mine as an emergency measure in case of compressor trouble at either mine. A Buffalo blower fan, size 5½, bought from the Princeton Mine was assembled, equipped with a new base and will be used underground.

The 120-B electric shovel was used for stockpile loading during the shipping season and is now being dismantled and moved to the Mather Mine.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

PRINCETON MINE:

The Princeton Mine ceased operations permanently during July month. The main items of equipment moved so far are as follows:

Description	Shipped To
U.G. Centrifugal pump No. 2 Shaft 500 GPM 500' Head	Maas Mine
Plunger pump, Aldrich, 500 GPM 500' Head	Left in mine
Motor for above pump, 150 HP, 580 RPM	Princeton Shop
Mine cars	Cambria
Motor-generator set	Spies-Virgil
Locomotives, 6-ton	1 - Cliffs Shaft
	2 - Mather
	3 - In Dry
Air Hammer	Mather Mine
Small compressor, 20 HP motor	Negaunee Mine

SPIES-VIRGIL MINE:

The most severe trouble encountered during the year was in pumping, many repairs being made to the pumps and discharge column. The principal cause was very dirty water, the sumps not being cleaned as often and thoroughly as necessary. Ore production was finally discontinued for a period of 6 weeks during September and October, new settling basins were cut out and all sumps cleaned.

The Aldrich quintuplex pump on the 6th level underwent the following repairs. The motor pulley became ragged and worn and caused much damage to the belts and a new pulley was ordered and installed in November. With the new pulley, new leather belt, plungers, valves and seats and packing this pump is now in good condition. The two Prescott pumps on the eighth level were equipped with new herringbone pinions and shafts. Repairs were also made to the 3rd level Deane and the 4th level Aldrich pumps. All pumps now are in good operating condition.

Work on the discharge column consisted of removing practically all flanges and butt welding the joints, replacing several hundred feet of old pipe with new, repairing many leaks and anchoring the column much more solidly to the shaft steel. A diamond drill hole on the 4th level was plugged.

The discharge column was installed in the air shaft and 1600 feet of 6 inch line laid on surface connecting the discharge column to the main Spies discharge creek.

The old concrete cooling pond was repaired and new piping installed replacing the old wood tank which was decayed and leaking badly.

The No. 15 and 30 shovels were repaired during the winter and were used for stockpile loading during the shipping season.

The north skip rope was changed end for end in May and a new cage rope installed in September.

TILDEN MINE:

In the crusher house 8 diaphragm liners, 3 rib liners and a lower mantle were installed on the 42 inch crusher. The motor bearings were sent to the General Shops for rebabbiting and boring.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

TILDEN MINE: (Continued)

On the east 10 inch crusher a lower mantle was installed, concaves changed and bearings changed in the motors before the operating season. During September two new wearing plates and new concaves were installed.

On the west 10 inch crusher new gears in the oil pump, new eccentric and new concaves were installed. Later in the season the rebabbited eccentric was installed.

After the season closed the main pocket was cleaned out and repaired with new timbers and plank lining. Twelve new grizzly bars were installed.

A new jack shaft, complete with clutches and V-belt pulley, was installed on the No. 7-29-T churn drill. No. 7 and 8-29-T churn drills, complete with motors and transformers, were shipped to the Steep Rock Mine, Antikokan, Ontario, Canada.

The conveyor motor armature and bearing will be repaired at the General Shops during the winter.

A new pinion on the swing motor, a shipper shaft on the boom machinery and a new latch plate on the dipper was installed on the No. 46 shovel and the lighting system repaired.

The No. 29 shovel was dismantled and shipped to the Cliffs Shaft Mine during October, where it will be used for stockpile loading. The No. 31 shovel was dismantled and shipped to the Athens Mine during December, where it will be used for stockpile loading.

The old railroad dump cars were sold for scrap as all ore hauling is done by 15-ton Euclid trucks.

GENERAL:

Ernest Keast retired May 1st. due to age and poor health. His work was divided between Folke Johnson and Wilfred Tousignant.

At the end of the year six men in the shops that were over 65 were retired. Some of them had been kept on due to war conditions, the age of the oldest being 72.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

COMPARATIVE TABLES

CLIFFS SHAFT MINE: YEAR	TONS ORE AND ROCK HOISTED	CU. FT. AIR USED	CUBIC FT. AIR PER TON HOISTED	GALLONS OF WATER PUMPED	G.P.M.
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
1942	733 970	1 223 325 000	1 666	339 185 356	643
1943	669 300	1 368 045 000	2 044	376 325 326	718
1944	614 214	1 459 890 000	2 376	448 361 410	851
1945	567 691	1 194 570 000	2 104	444 687 684	848
1946	415 426	968 670 000	2 331	397 294 033	751
ATHENS MINE:					
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	1 305 945 000	2 116	185 835 174	354
1942	699 590	1 351 440 000	1 931	204 553 558	387
1943	532 590	1 013 220 000	1 902	195 041 792	372
1944	443 576	900 765 000	2 030	162 835 951	308
1945	429 136	873 710 000	2 035	174 073 654	331
1946	376 417	745 605 000	1 980	168 139 933	317
MAAS MINE:					
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
1942	894 045	1 703 655 000	1 905	553 194 582	1 049
1943	782 074	1 916 100 000	2 450	575 868 620	1 098
1944	614 836	1 542 835 000	2 509	578 257 239	1 097
1945	572 652	1 205 145 000	2 104	555 380 166	1 058
1946	487 523	965 880 000	1 981	607 511 502	1 148
NEGAUNEE MINE:					
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
1942	1 128 737	1 432 260 000	1 268	345 945 101	656
1943	978 130	1 137 375 000	1 162	401 169 615	765
1944	760 871	1 165 140 000	1 531	375 706 897	713
1945	671 220	873 270 000	1 301	357 175 559	681
1946	418 232	542 025 000	1 295	360 778 626	682

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1946

COMPARATIVE TABLES

YEAR	TONS ORE AND ROCK HOISTED	CU. FT. AIR USED	CUBIC FT. AIR PER TON HOISTED	GALLONS OF WATER PUMPED	G.P.M.
CAMBRIA-JACKSON MINE:					
*1943	155,513	216,657,000	1,393	123,714,000	431
1944	286 761	410 875 000	1 432	196 252 831	372
1945	319 222	386 626 500	1 211	190 159 826	362
1946	303 881	374 013 000	1 230	159 192 131	300
LLOYD MINE:					
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 mos)	91
1942	588 749	588 451 000	999	39 486 100	74
1943	531 260	525 280 500	988	65 024 800	124
1944	391 057	436 293 000	1 115	51 625 550	97
1945	334 117	419 088 500	1 254	59 943 400	114
1946	243 836	264 838 500	1 086	51 014 600	84
MATHER MINE:					
1943	29 517	(First hoisting in September)			
1944	127 438	425 700 000	3 340	74 006 311	140
1945	258 028	378 600 000	1 467	134 384 517	256
1946	417 677	542 250 000	1 298	97 460 579	184
TILDEN MINE:					
1937	305 418				
1938	85 889				
1939	170 276				
1940	205 612				
1941	302 943				
1942	235 207				
1943	139 991				
1944	214 824				
1945	197 476				
1946	101 968				
PRINCETON MINE:					
1942	83 918				
1943	248 845	490 680 000	1 971	109 444 342	250 (10 mos)
1944	236 310	434 091 000	1 836	104 716 106	198
1945	280 491	362 925 000	1 293	119 237 162	227
1946	28 438	(Mine abandoned; no ore hoisted after Feb. 8th.)			

(*Mine operated by The Cleveland-Cliffs Iron Co. since June 1, 1943 and the above figures are for the last 7 months of the year only.)