

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

ATHENS MINE:

One serious accident to mechanical equipment at this property occurred during February when the south skip was dropped to bottom, a distance of 280 ft., when struck by load of ore let loose from 4th level pocket when skip was ascending at 8th level location. Cause of pocket unloading prematurely was due to "hair-trigger action" of 4th level measuring pocket door operating mechanism. Since the accident, which resulted in severe damage to skip and skip road at shaft bottom, all measuring pocket door mechanisms of operating levels were re-conditioned.

In the engine house a major breakdown occurred to hoisting equipment when the service brake toggle base casting of cage hoist broke, rendering this brake inoperative. A new casting was secured and repair made over a week end. The hoist was not out of service during production hours as the manually operated hand wheel brake on opposite side of drum could be used.

A second major breakdown occurred in December when the east main bearing of main motor-generator set seized when direct connected lubricating oil pump failed. Since then the set has been equipped with an independent lube oil pump operated from pressure switch. This unit supplements the direct connected pump.

The initial installation of an underground belt conveyor system was made at this property during the year. This 24" Joy-Ladell Conveyor was installed in a block cave area on 4th level. The belt worked quite satisfactorily, but the shuttle feeder proved entirely too light for the work intended and numerous delays were incurred. The unit was kept in operation until that portion of the block cave area it served was mined out, then it was removed to surface and has not been installed since. The consensus of opinion was that a 40 HP double drum slusher hoist was a more practical and economical means of ore transportation in the block cave transfer subs than a belt conveyor equipped with shuttle feeder because of moving ground conditions and size of material being handled.

Subsidence of ground about surface installations continued to give alarm during the year. It was noted that settlement of stocking trestle was causing the headframe to pull to the west and so the connection between the two structures was severed to allow for free movement of the trestle. Numerous cracks appeared in masonry about the Miners' Dry and all piping systems had to be equipped with swing joints and/or expansion couplings to prevent rupture due to excessive strain.

In the shops, the drill press and circular saw were equipped with individual electric motor drives and a 20" jointer was transferred here from Hard Ore Shops.

CAMBRIA-JACKSON MINE:

The major change in the engine house concerned the replacement, in August, of the 500 HP, 435 RPM hoist motor with a 700 HP, 390 RPM wound rotor motor removed from Maas Mine skip hoist. To maintain the same hoisting speed, a new pinion shaft with larger integral herringbone pinion was purchased and installed. At the same time the pinion shaft pedestal bearings were modified to take adjustable bases so that alignment could be easily adjusted and maintained. The change in motors was made merely to reduce overload condition and no increase in skip factor is anticipated.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

CAMBRIA-JACKSON MINE: (Continued)

New surface installations included changes in Miners' Dry heating and plumbing along with remodeling of water heating and storage facilities. The hand-fired engine house boiler was equipped with underfeed stoker.

Underground, a new 200 lb. discharge air compressor was installed in 4th level pump house to aid in charging plunger pump cushion chambers.

Planning of underground winze conveyor belt haulage system was completed and equipment ordered. Excavation of winze began in latter part of the year. This installation will involve a 30" belt conveyor system having 556 ft. centers and total lift of 144 ft. It is planned to install the belt conveyor in three sections as winze sinking progresses so that same can be used for winze muck removal.

CLIFFS SHAFT MINE:

In the engine house the coupling brake wheels on both hoists were renewed because of excessive friction checking on braking surface. The new cast steel replacements are of a design to better dissipate the heat generated by emergency braking and are proving out very well. A stand-by 300 GPM water circulating pump was installed in pump house for cooling water requirements.

In the shops all power driven equipment was equipped with individual motor drive and overhead line shaft removed. Old style pipe radiators were removed and heating in all shop buildings is now furnished by overhead steam operated unit heaters. In the drill shop the IR-54 Drill Sharpener was provided with U. S. Rubber vibration dampeners and inertia block foundation to successfully dampen out impacts that were affecting delicate balances in adjacent Ore Analysis Laboratory.

"B" Shaft headframe structure was completely renovated by the Intrusion-Prepakt Company who installed 3500 sq. ft. of concrete patches to make this shaft house structurally sound. They also installed four louvered openings in top of dome which will materially aid in venting moisture-laden shaft air and prevent seepage into construction joints with resultant freezing and spalling.

In July a new steel railroad car loading pocket was completed in Crusher Building.

LAKE MINE DEFERRED:

Dewatering operations began here on December 10th with the installation of a 1500 GPM centrifugal pump borrowed from the Tilden Mine. Lindberg & Sons were engaged to remove the overburden and load out the ore, using our Tilden Mine Euclid trucks. Plans were being rushed at end of year to utilize a portion of the old Lake Mine buildings for Euclid truck storage and maintenance. Diversion of water flowing over mining area to Lake Mine will be by means of installation of 14" spiral welded pipe line on hand at Mather Mine "A" Shaft.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

LLOYD MINE:

During the first half of the year the 8th level winze hoist gave a lot of trouble and considerable delay was experienced with failure of main shaft bearings until old cast iron units were replaced with forged steel caps and cast steel bases. In July a serious accident occurred with this winze hoist when operator dozed on night shift and pulled loaded cage into head sheave and severed the hoist rope which allowed cage and loaded car to drop 170 ft. to the winze shaft bottom. Fortunately a spare cage, head sheave and rope were on hand and production was resumed with one day loss. Since that time the hoist has been equipped with an over-travel alarm and emergency coupling brake.

Some changes in pumping arrangements were made and a new 6" discharge column was installed from 8th to 7th level to effect a continuous 6" water column from 9th to 7th levels inside the mine.

MAAS MINE:

On surface the main discharge line was relocated to allow L. S. & I. Railroad Company to install a new 7-track storage yard. Considerable replacement of deteriorated structural members of the headframe was required. This work will continue as steel crew is available until the shaft house is structurally sound.

In the engine house the major change was the conversion of the skip hoist drive from A.C. to D.C., utilizing war surplus motors and generators and auxiliaries plus new Cutler-Hammer control equipment. The old A.C. drive motor was transferred to the Cambria-Jackson Mine. The drum shell rope spout on the cage hoist failed by cracking up around rope entrance point, which made for a serious condition until noted and repaired because the cage rope started to sever over the sharp broken edges. A cast steel rope spout attachment was bolted in place to lead the rope to anchorage over longest possible radius.

Plans were made to sink the inside winze from 6th to 7th level so the single drum winze hoist previously used was reconditioned in Hard Ore Shops and installed on 5th level ready for sinking operations to begin. Work began on construction of two cages which will be used to transfer 65 cu. ft. cars of ore from 7th to 6th level by means of balanced hoisting.

MATHER MINE "A" SHAFT:

On surface, revision of stocking trestle track arrangement by company crews and erection of no. 3 stocking trestle by Wisconsin Bridge & Iron Company were the largest projects. At the end of the year, no. 3 trestle was 90% complete. Due to excessive maintenance costs and delays due to breakdown of Lake Shore All-Way Dump Top Tram Cars, an intensive study of suitable replacements was made and final decision reached to engage a competent designer to design a 250 cu. ft. top tram car complete with hydraulic brakes and door operating levers which would be pushed by separate 8-ton locomotive. The Design Service Co., Inc. of Cleveland handled the design and before the end of the year, an order for three cars and three locomotives was placed for delivery prior to commencement of 1950 stocking season.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

MATHER MINE "A" SHAFT: (Continued)

In the headframe, the north railroad loading pocket was redesigned and fitted with six air cylinder-operated doors for simultaneous loading of two cars. A study of suitable screening and crushing equipment for headframe installation was made and orders placed for manganese feeder, shake-out screen and jaw crusher. This equipment will be installed during 1950 vacation period.

In the engine house, the two war surplus Ingersoll-Rand compressors were installed and placed in operation. This plant now has a total air plant capacity of 10,800 CFM of free air at 100 lbs. pressure. Each of the four units have 5-step control which makes for a very flexible system that can adequately maintain 90 lb. air pressure at all points of the system. In addition to the installation of the two compressors, the air receiver and piping from compressors to same was remodeled and one additional receiver installed.

Underground, a new 2" fire protection water line was installed in shaft from surface to first level. Final touches were made to 6th level pump station where three 500 GPM Worthington Duplex Plunger Pumps are ready for service. The extension of the main shaft to open up the 7th level was made and involved extension of 14" counterweight pipe, 12" compressed air line and temporary water discharge lines. The single drum winze hoist used for handling shaft sinking rock was not removed from its foundation as it will be used to handle skip pit spillage.

Considerable experimental work was done on design of solid rubber tire skip guide rollers in an effort to lessen wear on 80 lb. rail used as skip guides. The set installed in July proved successful and their use will be adapted to the second skip in the near future.

In the shops the only major changes involved transfer of overhead traveling crane from original warehouse location to machine shop area and installation of new oil-fired forging furnace for handling drill steel heating.

MATHER MINE "B" SHAFT:

During the year 1949 many changes took place on the surface of this new property. The permanent engine house structure was completed by MacDonald & Kaake and all main machinery foundations constructed. The Nordberg cage hoist erection started March 1st and was completed except for adjustments that had to wait until power was available. Skip hoist erection began in July and the mechanical portion of that hoist was erected and driving motors applied before end of year. Erection of cage hoist synchronous motor driven M-G set was started as well as main M-G flywheel set, but installations were not complete at end of year. The first of two 500 HP synchronous motor driven Ingersoll-Rand war surplus air compressors was erected. A used, 35-ton capacity overhead traveling crane was erected in engine house and used for all heavy machinery erection.

McDowell & Company began erection of new headframe in April, and job was complete by August. A. H. Proksch & Son Company completed the crusher house enclosure subsequent to the erection of heavy flow sheet machinery items such as two heavy manganese steel rock feeders, a shake-out screen and jaw crusher.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

MATHER MINE "B" SHAFT: (Continued)

A. H. Proksch & Son Company was awarded the general contract for construction of main dry, shops, office and boiler plant buildings. The six week strike in the fall seriously delayed their work but by the end of the year the boiler house was enclosed and boilers in place and the main dry portion of the buildings was far enough along to permit inside work to continue.

Conveyor belt stocking arrangement was worked out so that orders could be placed for all equipment necessary for initial north-south belt installation.

Shaft sinking progressed very satisfactorily during the year and shaft was completed in August; however permanent cage and skip road fir guides were not yet installed at year's end. The permanent 12" air line in shaft was completely installed.

Decision was made to try a bottom dump skip at this new property, to work in balance with a standard Kimberly skip. Before the end of the year the design of the new bottom dump skip was completed and fabrication of same in our own shops was started. The Kimberly skip design was completed and order for one unit placed with National Iron Company of Duluth.

NEGAUNEE MINE:

After mining operations ceased at this property April 27th, all underground mining machinery was removed to surface. Maintenance of pumping equipment was the largest mechanical item after the shut-down as there has been a definite increase in pumping load since then.

At the end of the year the option was exercised on the used double-drum, double-clutched, Allis-Chalmers mine hoist at the Kennedy Mine, Amador County, California. This unit will be repaired and ultimately installed in the Negaunee Mine engine house as new skip hoist which will be initially used to sink shaft from present 1500 ft. depth to proposed 3500 ft. depth.

SPIES MINE:

Underground, the maintenance of the pumping system required the greater portion of the Mechanical Department's time. In January, an increase in the acidity of the water being pumped from inside 4th level to air shaft was noted and an all-bronze 40 HP motorpump was purchased and installed. This unit gave good service from April throughout the year. On the 5th level the 800 GPM Aldrich Quintuplex Pump gave trouble when 5 ft. dia. belt wheel worked loose on pinion shaft. Emergency replacement of shaft was made. To channel the acid mine water from 4th to 6th level, the initial installation of a rigid plastic pipe line was made. This light weight plastic 4" line has proven to be acid-proof and will take pressures up to 145 p.s.i.g.

On the surface, an addition (30' x 22') was made to the main dry to provide new facilities for surface men and shift bosses. Also, the interior of the miners' dry was re-arranged to alleviate over-crowded conditions.

The McCully gyratory crusher in headframe was completely reconditioned by using parts from identical unit at idle Princeton Mine.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

TILDEN MINE:

There were no outstanding changes in plant or mechanical equipment at this property during the year. Regular overhaul of all processing machinery was carried on after close of operating season.

GENERAL:

HARD ORE SHOPS:

The footings and curb walls of a 30' x 99' addition to the east side of the north end of Blacksmith Shop were erected and the Truscon enclosure would have been completed except for the six week strike in October-November. Weather conditions after resumption of work were such that completion was postponed until spring. This addition will house steel set fabrication machinery which will adequately handle 500 complete sets per month.

TUNGSTEN-CARBIDE ROCK BIT APPLICATION:

The usage of tungsten-carbide insert rock bits became quite prevalent during 1948 and as their introduction interjected many new problems, an experienced engineer was hired for the Mechanical Department in January, 1949, and assigned to spend his full time in following up the application of this new drilling aid and its allied equipment in all the Marquette Range mines. Splendid results were obtained as evidenced by the decrease in insert bit cost per foot of hole drilled from average of \$.092 in 1948 to \$.0713 for the last nine months of 1949 at our Cliffs Shaft Mine which is the largest consumer of rock bits due to its hard ore.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

COMPARATIVE TABLES

<u>CLIFFS SHAFT MINE:</u> <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>
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
1947	562 650	1 527 345 000	2 715	424 721 789	809
1948	603 745	1 607 625 000	2 663	382 905 017	726
1949	504 513	1 124 105 000	2 228	433 229 875	821

ATHENS MINE:

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	204 533 558	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	1 990	168 139 933	317
1947	533 366	1 191 510 000	2 234	178 537 561	340
1948	527 876	1 183 970 000	2 243	169 128 786	320
1949	550 977	992 700 000	1 801	176 437 598	334

MAAS MINE:

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	894 963	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
1947	721 051	1 506 960 000	2 090	571 767 866	1 090
1948	683 074	1 389 825 000	2 035	569 972 839	1 081
1949	621 946	1 233 540 000	1 983	550 080 422	1 043

NEGAUNEE MINE:

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
1947	531 492	717 300 000	1 350	390 741 304	744
1948	386 215	743 625 000	1 925	402 657 133	757
1949	79 699	233 415 000	2 928	464 467 219	880

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1949

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*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
1947	548 027	628 515 000	1 147	190 950 934	363
1948	496 083	548 896 500	1 106	171 964 375	325
1949	438 064	508 050 000	1 159	173 342 402	328

(*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)

LLOYD MINE:

1940	487 287	398 308 500	839		
1941	572 778	534 456 000	933	40 031 200	91 (10 Mos.)
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
1947	262 395	254 470 500	970	69 182 000	131
1948	128 672	285 111 000	2 216	48 334 500	91
1949	209 161	231 241 500	1 105	50 828 500	96

MATHER MINE "A" SHAFT:

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
1947	817 145	1 144 800 000	1 401	133 005 294	253
1948	1 100 225	1 901 700 000	1 728	103 059 168	195
1949	1 154 538	1 207 350 000	1 045	91 876 158	174

TILDEN MINE:

1940	205 612
1941	302 943
1942	235 207
1943	139 991
1944	214 824
1945	197 476
1946	101 968
1947	168 669
1948	140 692
1949	88 503