A National Historic Mechanical Engineering Landmark

Quincy No. 2 Mine Hoist (1920)
Hancock, Michigan
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The American Society of Mechanical Engineers

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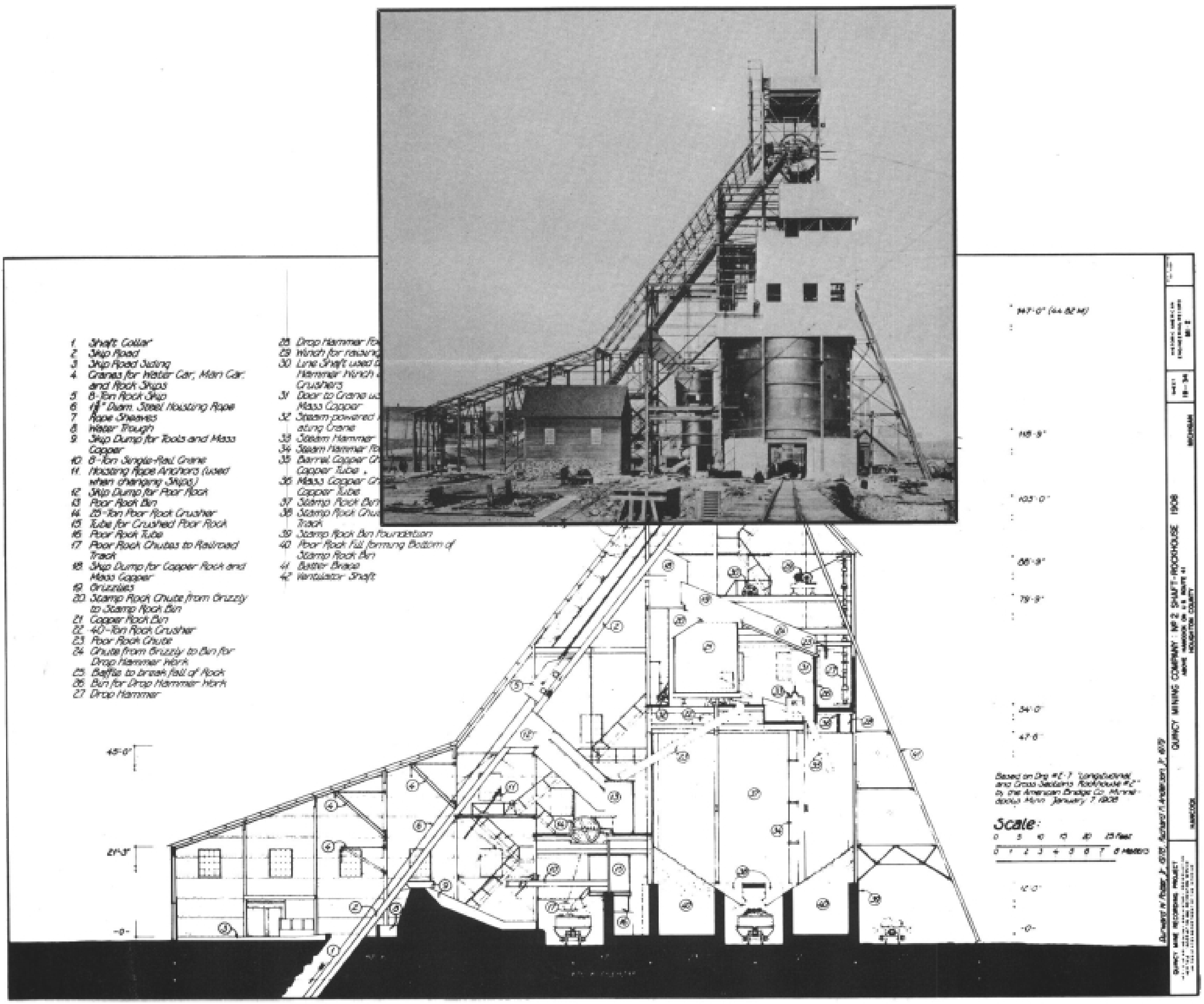


Many of the ships of the Great Lakes fleet occasionally make a trip through the Keweenaw Ship Canal in Lake Superior. This canal cuts through the Keweenaw Peninsula, which for more than 100 years has been famous for its copper mines. The area is known as the "Copper Country," just as the iron mining areas of Minnesota, Michigan, and Wisconsin are called the "Iron Country."

A number of stories have been written about this interesting part of Michigan—the mining by the Indians, the first explorers and prospectors, the early days in the mining camps and the boom days when Michigan copper ruled the world markets.

A prominent landmark in this area is the old mine shaft house, which can be seen high on the hill above the town of Hancock. The shaft house, or as it is known locally, the "Quincy No. 2 Rock House," was built above one of the inclined shafts through which the Quincy mine raised the ore to the surface through its No. 2 shaft. The mine has been inoperative since 1945.

The shaft house has three purposes: (1) to provide a building for a crusher to break up the ore hoisted from the mine, (2) to house storage bins for this crushed ore so that the train which carries it to the mill can be loaded quickly and (3) to hold the sheave carrying the rope between the mine car, or "skip" and the hoisting engine. The sheave has to be high enough so that when the skip load of ore is dumped it will flow by gravity through the crusher and into the storage bins. This explains why the rock house must be high (120 feet). It must be well constructed because the weight of the ten-ton skip of ore, and of the more than 9,000 feet of 1$\frac{5}{8}$" rope (18 tons) must be supported by the 12-foot diameter sheave.

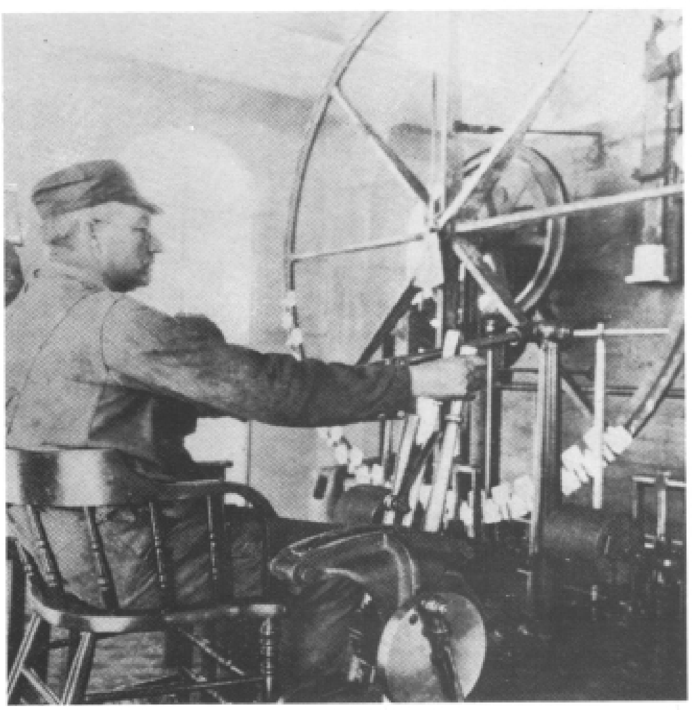
Mining at Quincy

The Quincy mine was one of the great mines of the district. The Quincy Mining Company was organized in 1846 and the Pewabic Mining Company, which later became part of the Quincy, was started in 1853. It was not until 1856, however, that these companies found the lode that was to bring them riches.

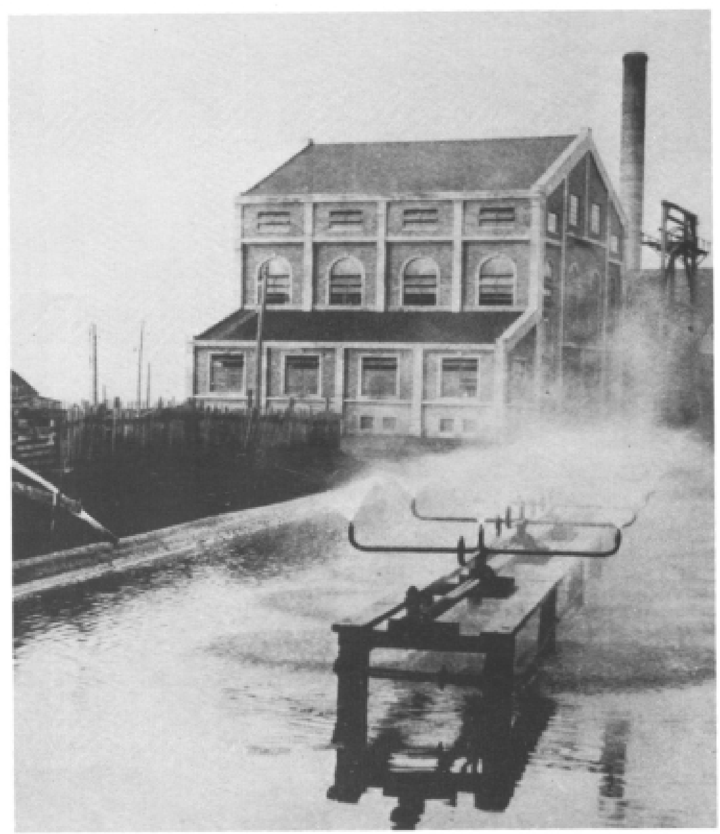
Dividends were first declared in 1862 and before the mine closed more than $27,000,000 had been paid to stockholders. Because of a series of continuous dividends, the Quincy mine earned the title of "Old Reliable." It is said that the Quincy Mining Company paid dividends annually without interruption from 1867 until 1921.

Copper found in this district was very pure and needed only to be separated from the rock to be ready for use. The only impurity was a little silver, but since this improved the copper for many purposes, it

Frank Nancarrow in the driver's seat of the big Nordberg hoist at No. 2. (HAER)



Two cooling ponds alongside the No. 2 hoist house served the cross-compound condensed Nordberg engine. After passing through the condenser, hot water went through sprays to be cooled before recycling.



probably should not be called an impurity. Most of the copper in the rock was of the size of an air gun pellet or smaller, but there were many large masses of practically pure copper discovered—some weighing ten or more tons.

Copper in most mines in the district was found in lodes averaging from six to 12 feet thick. Such lodes at the Quincy mine dipped into the ground at about 45 degrees. Copper in the lodes was not continuous but the more uniform the mineralization, the easier and cheaper it was to mine. Copper was found in the deposit mined by the Quincy Mining Co. for a distance of more than two miles along the lode and a depth of over 9,100 feet on the incline, a vertical depth of more than a mile below the shaft opening.

Engineers have made measurements in the Michigan copper district and have found that for every 105 feet of vertical depth the rock temperature goes up one degree, Fahrenheit. With an average surface annual temperature of 40 degrees the calculated temperature of the rock at the bottom of the Quincy mine was 90 degrees. This corresponds with actual readings.

Ventilation kept the temperature below 90 degrees in the working places, and shoes, trousers and a hard hat were the regular attire for the miners. Anyone who knows Northern Michigan winters would naturally wonder what would happen to a miner who left his working place and less than a quarter of an hour later was on the surface where the temperature was below zero.

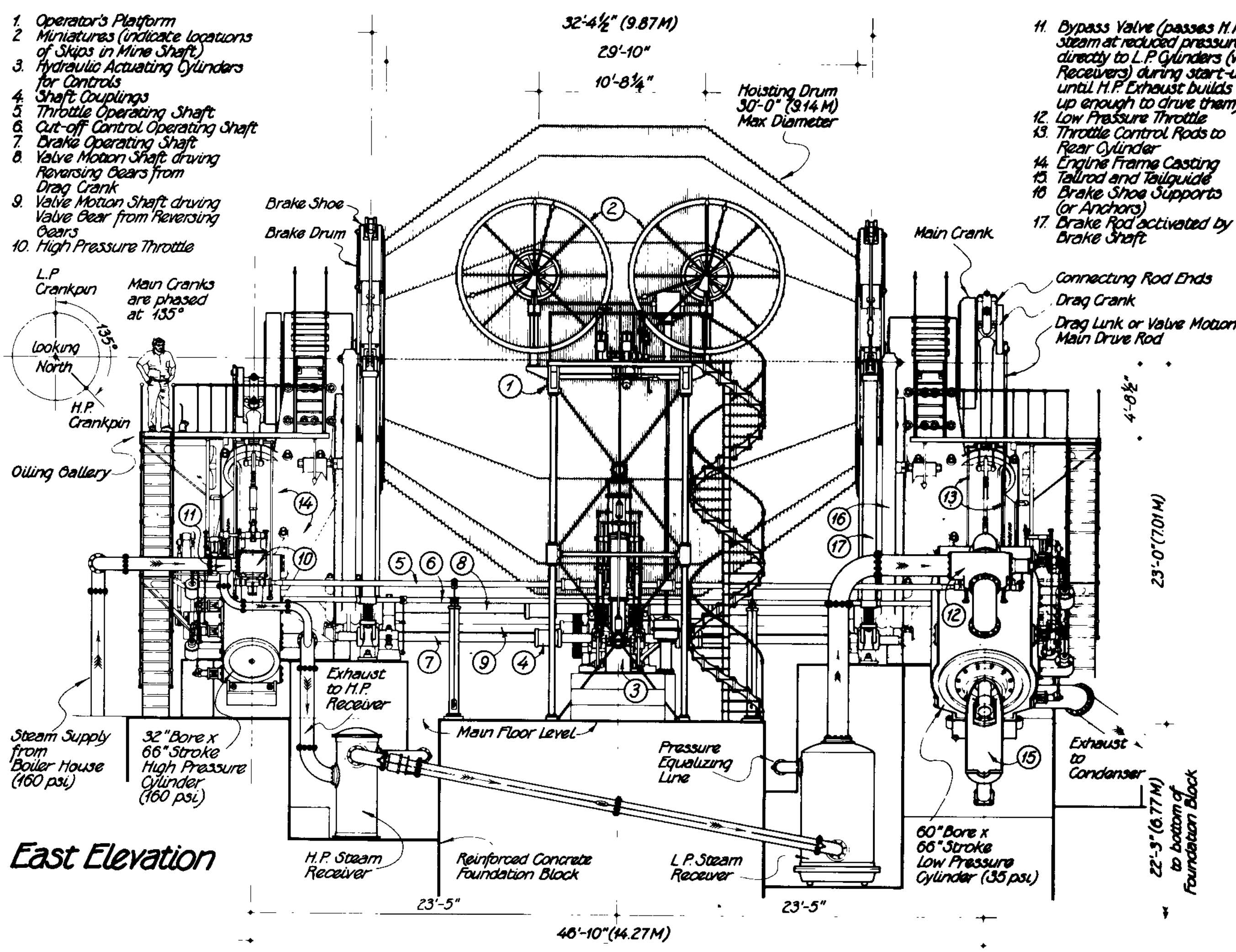
The Michigan copper district was the scene of the first big mining camp in this country and made fortunes for some and lost money for others. Development of copper deposits in Montana, Utah, Arizona and in foreign countries, and the fact that the Michigan mines were deep and expensive have been contributing factors to the decline in Michigan copper mining.

World's Largest Mine Hoist

The hoisting of copper rock at the Quincy Mine, necessitated the installation of machinery of extraordinary capacity in order to hoist from still greater depths. This condition was met and resulted in designing the largest steam hoisting engine in the world which is located in the No.2 hoist house. The hoist operated in balance at a speed of 3,200 feet per minute (36 mph), using steam at 160 lbs. per sq. in. boiler pressure and is capable of hoisting ten tons of copper rock per trip.

The engine is cross-compound, condensing, with two high-pressure cylinders set at 45 degrees from the vertical, mounted on a triangular frame at one end of the drum shaft and two low-pressure cylinders sim-

This drawing, delineated by Richard Anderson, call out the major components of the No. 2 Nordberg hoist. (HAER)



ilarly set and mounted at the opposite end of the drum shaft. The cylinder dimensions are 32" and 60" x 66".

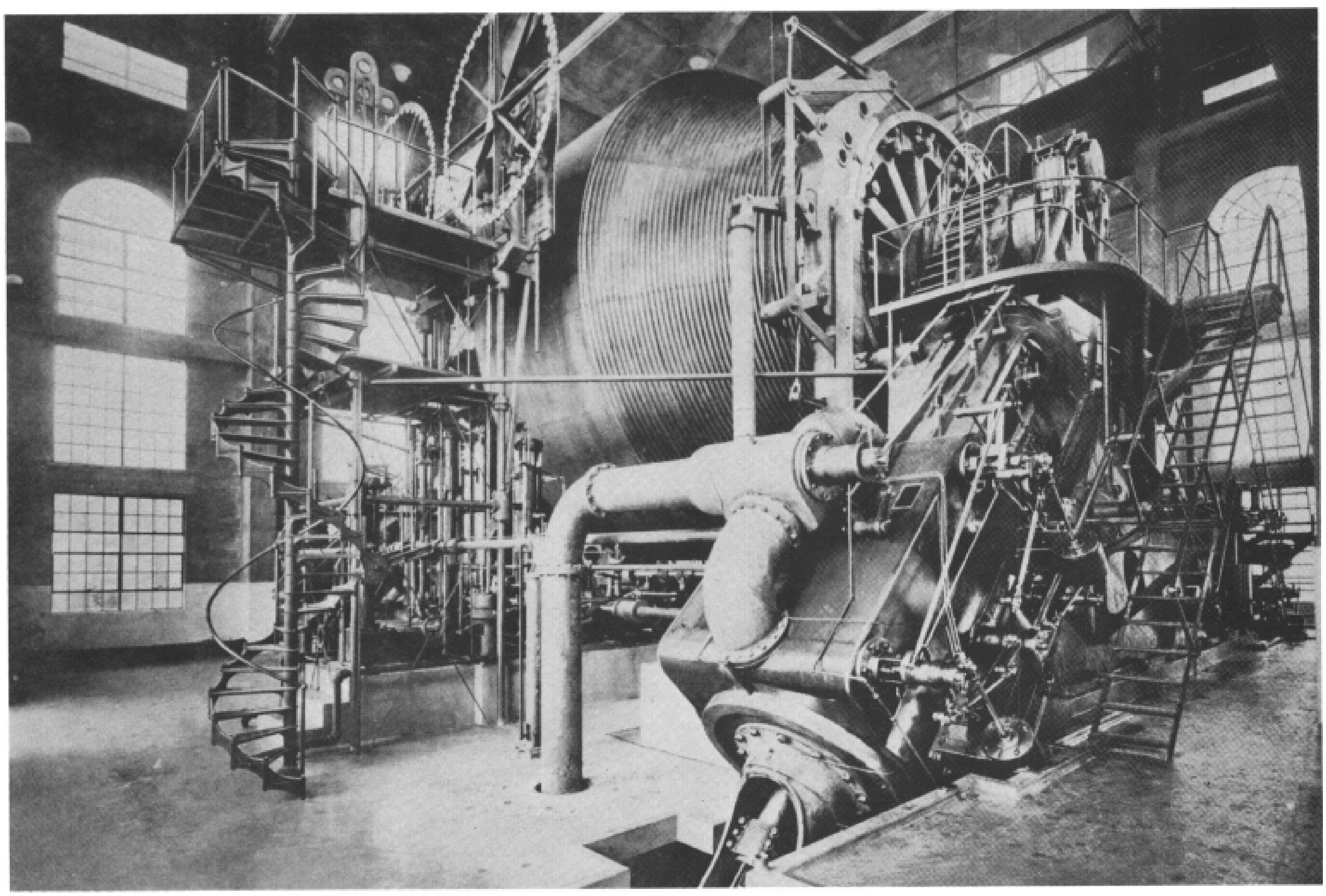
The drum is cylindro-conical (cylindrical in the center with conical ends) having 16-foot end diameters, 30-foot center diameter and is 30 feet long with a capacity of 13,300 feet of 1⅝" rope. The drum is built up of 48 sections, bolted together and thoroughly trussed within, thereby preventing any deflection in the drum shaft. There are two take-up drums, one mounted at each end and within the main drum to carry the surplus rope. They are operated independently of the main drum by 10 h.p. Dake engines. The eight impulses per revolution, together with the great mass of drum, which weighs 516,000 lbs. eliminates practically all pulsation in the hoisting rope.

At each end of the drum is a set of brakes of the improved parallel motion type, which are actuated by an oil cylinder. The brakes are applied by a fixed weight and relieved by a thrust cylinder using oil pressure. The oil is pumped by two triplex pumps to an accumulator which is of the loaded plunger type. The accumulator furnishes oil at 100 lbs. pressure to the hydraulic thrust cylinders for the operation of the throttle, brake and reverse. In case the pressure of the oil should fail the brakes would be automatically applied.

The operation of the hoist is fully protected by an improved safety stop, whereby the throttle valve is automatically closed as the skip approaches the brace, and in a case of overwinding the brakes are applied automatically. The controls are so arranged that at the completion of a trip the operator cannot open the throttle until the engine has been reversed. Over-speeding is prevented by a governor which controls the cut-off cams of the valve gear.

The condensing apparatus is of the counter current jet type and consists of a dry air pump set in tandem with the steam cylinder, while the pumps for the circulating water are located on a lower floor and are driven through a rocker arm from the piston rod of the dry air pump. The steam cylinder is 14" x 36" and the dry air pump cylinder 22" x 36". The two water pumps are each 24" x 12" single acting. The hoist exhausts into a steam drum 8 feet in diameter and 17 feet long, containing a series of trays over which the water flows in the form of curtains and through which the exhaust steam must pass. This drum is provided with a vacuum breaker which prevents the accidental flooding of the low pressure cylinders. The steam cylinder of the condenser apparatus also exhausts into this drum thereby running condensing; the air pump exhausts to the atmosphere. The condensing equipment is designed to take care of 1,460 lbs. of steam per trip of 10,000 feet.

Nordberg took this promotional photo to showcase the world's largest steam hoist. (Courtesy of Rexnord)



The combined weight of the hoisting engine and the condensing equipment is 1,765,000 lbs.

The hoisting efficiency was greatly increased by the installation of this new equipment as compared with the old 48" x 84" simple duplex, Corliss, non-condensing hoist equipped with a cylindrical drum. During the year 1921, with the mine operating at about 57% capacity, the coal consumption by this new hoist was **2,400 tons less** than previously used for doing the same amount of hoisting.

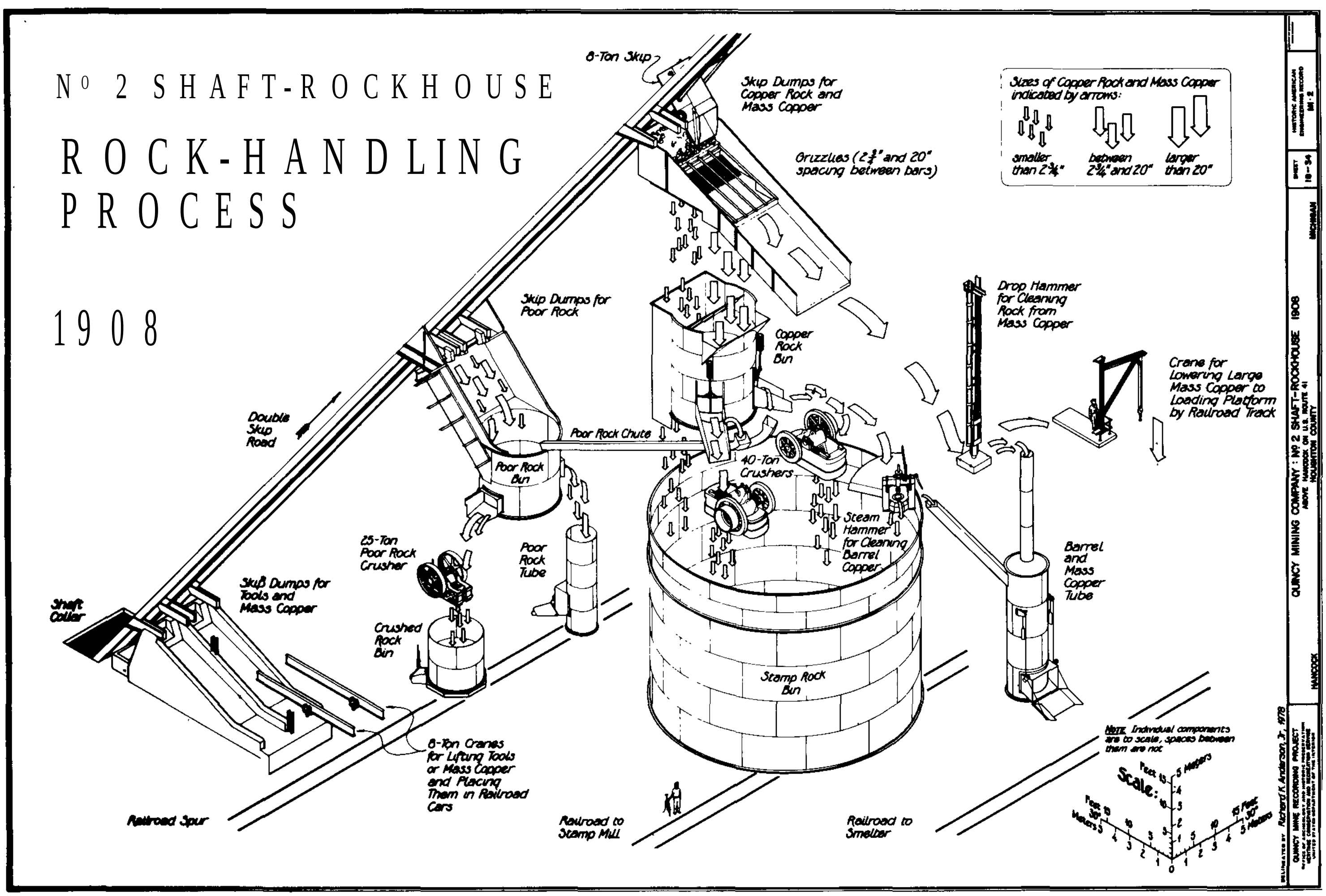
The hoisting engine and condensing equipment are set on the largest block of reinforced concrete that has ever been poured for an engine foundation. This foundation is 54 feet wide, 84 feet long and contains 3,200 cu. yards of material. The reinforcing material used consisted of 8 tons of steel rails and 8,000 feet of discarded 1½" diameter plow-steel hoisting rope, which had been annealed. This foundation rests on hardpan having a bearing value greatly in excess of the loads carried, which was determined by soil bearing tests made at intervals over a period of six months.

The main building enclosing the hoist is 72 ft. 4 in. x 76 ft. x 82 ft. high, and that part of the building enclosing the condensing equipment is 23 ft. 1 in x 76 ft. x 32 ft. high and built as a leanto on the main structure. The construction is entirely of reinforced concrete. The design of the building is such that 20 pilasters carry the loads directly to their respective footings. The walls between the pilasters are brick veneer and the concrete is covered with green glazed Imperial Spanish tile.

The building is securely anchored to the main foundation by both steel and concrete girders, all of which were poured integral with the reinforced concret floor. The superstructure of the building is braced at a point 26 ft. above the main floor by the leanto roof which was designed for that purpose. All the windows are glazed with horizontal ribbed glass and are mechanically operated for ventilating purposes. A traveling crane of 40-ton capacity having a span of 67 ft. and made up of two 30", 200 lbs. per foot, I-beams was installed for the hoist erection.

The circulating water from the condenser is pumped by the condenser pump to a cooling pond where it passes through a spraying system of 45 nozzles at the rate of 1,800 gallons per minute. This water then flows to a second cooling pond where a second set of sprays can be used if the temperature of the water has not been sufficiently lowered by the first spraying. A centrifugal pump is used to pump the water through the second set of sprays. The cooling ponds are contructed of concrete and are 50 feet x 150 feet with a total capacity of 340,000 gallons of water.

The lander at No. 2 could dump skips on three levels. (HAER)



ACKNOWLEDGEMENTS

The Milwaukee Section of the American Society of Mechanical Engineers is most grateful to the Quincy Mine Hoist Association for its assistance with this landmark designation. The Quincy No. 2 Mine Hoist is the 71st National Historic Mechanical Engineering Landmark designated since the historical recognition program began in 1973. In addition there are 7 Regional and 16 International Landmarks. Each represents a progressive step in the evolution of mechanical engineering. Each is judged by its influence on society, whether it is of significance in its immediate locale, in the United States, or throughout the world. For a complete list, write to ASME, Public Information Department, 345 E. 47th St., N.Y., N.Y. 10017.

The material in this brochure was compiled from the following sources: "Compound Steam Hoist Installation of the Quincy Mining Company 1920, Ray W. Armstrong, Engineer, Quincy Mining Company; *Old Reliable, an Illustrated History of the Quincy Mining Company,* Larry D. Lankton and Charles K. Hyde; and "Story of Ancient Shaft House," September, 1953 Bulletin, Vol. 42, No. 5, Frank G. Pardee, State Geologist (ret'd) and cofounder of Quincy Mine Hoist Association, Inc.

In the summer of 1978, the Historic American Engineering Record (HAER) fielded a team to document the history and physical development of the Quincy Mine in Hancock, Michigan. The team of historians, engineers, and architects wrote historical monographs, produced measured drawings, and documented the mine photographically. The HAER project was cosponsored by the Michigan History Division, the Quincy Mining Company, the W. Parsons Todd Foundation, the Quincy Mine Hoist Association and Michigan Technological University. For further information regarding the HAER program, write to the Historic American Engineering Record/Heritage Conversation and Recreation Service/440 "G" St. NW—Rm 327/Washington, DC 20243.

The American Society of Mechanical Engineers
345 East 47th Street
New York, N.Y. 10017

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