



Canisteo Mine: Crushing plant in pit; belt conveyor gallery and transfer stations, leading to concentrator at ground level

## Improvements

## at the

# CANISTEO MINE

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The Canisteo iron-ore mine at Coleraine, Minn., has been modernized by many changes; truck haulage has replaced steam haulage in the pit, the concentrating plant has been moved to the pit edge, a belt conveying system installed from the coarse crushing plant in the pit bottom to the concentrating plant. These with other major improvements have resulted in a most compact and efficient operation.

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THE Canisteo Mine is an irregular shaped open pit covering approximately 220 acres. It was opened by the Oliver Iron Mining Company in 1906 and operated by them through the year 1925. Approximately 18,000,000 tons of merchantable ore and concentrates were mined and shipped from the property, exhausting all of the Direct Shipping Ore and leaving a grade which would require further concentration. In 1924 the mine was returned to the lessor, the Canisteo Mining Company, and held by that Company until 1929, when it was leased to The Mesaba-Cliffs Mining Company. It was operated by the latter Company through the year 1938 and approximately 4,000,000 tons of ore were mined and shipped. The lease was terminated on January 1, 1939, leaving in the property sufficient wash ore to produce approximately 6,000,000 tons of concentrates.

### Mining Costs Had Been High

High taxes, high labor rates, and a gradually increasing mining cost made the property expensive to operate under the existing mining methods. The high mining costs were due to the following conditions:

1. The stripping was expensive, for the waste dumps were so situated that a five-mile haul was entailed.
2. The track costs were excessive in that there were approximately 15 miles of track to maintain.
3. The ore haulage costs were high; the haul from the pit bottom was about six miles, with a maximum grade of 2½ per cent, and as the pit deepened this haul increased through numerous switch-backs.
4. The ore body was irregular and

proper grading required constant switching of shovels and loading tracks, which meant opening and maintaining several loading places, and the track extensions often required extensive rock work.

5. The concentrating costs were high for, in addition to a long haul for the crude ore, the water supply for washing had to be augmented by pumping from the pit. This meant a lift of about 350 feet through approximately 6,000 feet of pipe line.

6. The general open pit expenses, including pumping and general pit maintenance, were excessive unless a large tonnage of ore was mined.

7. The winter repair costs on the locomotives and cars were very high, for an adequate supply of crude ore required the use of six locomotives and 24 dump cars. This equipment was used in both the mining and stripping,

and the necessary repairs were quite extensive.

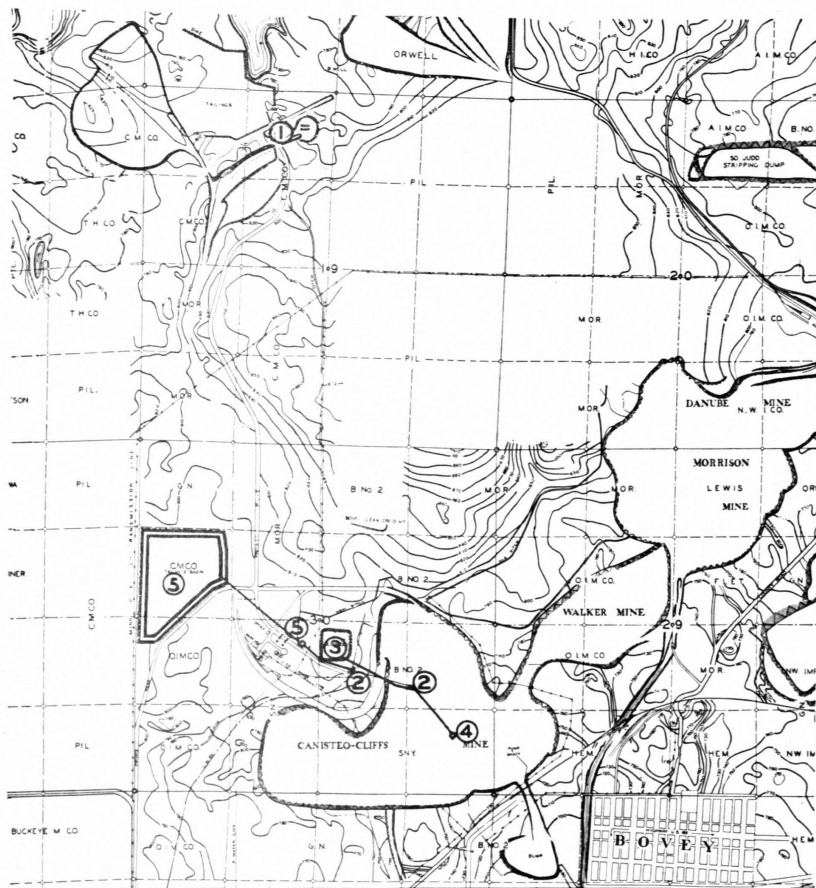
### Canisteo Company Plans for More Efficient Operation

After the Mesaba-Cliffs terminated the lease, the Canisteo Mining Company decided itself to operate the property. A study was made of the existing conditions with the view of developing a more economical method of mining. Electric haulage, using pilot cars and operating on steeper grades than steam, was considered. A combination of truck and steam equipment, in which the material would be hauled by truck to a pit pocket where it would be transferred to dump cars and delivered to the concentrator, was also investigated. The Canisteo Mine problems seemed best solved by a combination of truck haul and conveyor belt delivery from the pit bottom to

the top of a concentrator located at the edge of the pit, for the following reasons:

1. Lands were available for waste dump sites adjacent to the various areas requiring surface stripping, which permitted hauling of waste material by trucks a very short distance.
2. The concentrating plant could be moved to the edge of the pit and a conveying system installed to the pit bottom without tying up any mineable ore.
3. An excellent tailings basin site was available within a half-mile of the proposed new washing plant location.
4. There were sufficient worked-out areas in the pit for disposal of all pit rock and any rock which would be discarded in the crushing plant in the pit. These areas could also be used as dumps for waste rock and paint-rock stripping in the pit bottom.
5. The large inflow of pit water would furnish an ample supply for all concentrating purposes.
6. A truck operation would not only make available isolated bodies of ore and the deposits formerly tied up in track benches, but it would greatly simplify grading problems.

A plan was adopted early in the spring of 1939 and an arrangement was made with The Cleveland-Cliffs Iron Company to act as "Operating Agent." Since there was not sufficient time to affect a complete change-over, it was decided to operate during the 1939 ore season with a combination of truck haulage and delivery by steam equipment. The ore was hauled from the power shovels to a transfer pocket in the pit, loaded into dump cars and hauled by steam to the washing plant. Three, four-car trains and six trucks were required for the gathering and



Plant layout, with revisions and additions recently completed

- 1.—Old location of washing plant and railroad from pit.
- 2.—New location of washing plant.
- 3.—Pond for water storage.
- 4.—Pump in pit delivering 1,500 G.P.M. through 10-in. pipe line to storage pond.
- 5.—Tailings pump and 12-in. pipe line to tailings pond.

delivery of the ore. Six Euclid 15-ton rear-end-dump trucks, a D-8 "Caterpillar" tractor, and a Road Patrol were purchased, the latter two machines being used in building and main-

taining roads, using material at hand. The operation worked out very well and demonstrated the economy of truck haulage in this type of mining.

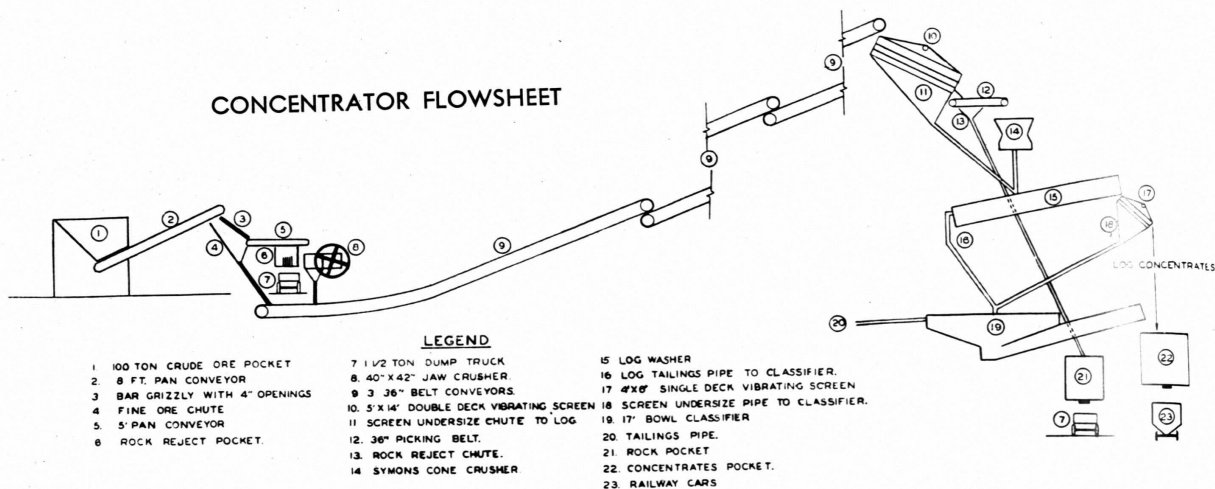
Following the 1939 ore season, work was started to complete the change-over to the conveyor system. The railway tracks were removed from the property and the concentrator was moved to its new location near the edge of the pit.

A new tailings pond was located and encircled with a dike 15 feet high and 18 feet wide at the top, using surface material which was hauled by truck from adjacent stripping operations. The equipment installed to handle the tailings consisted of 800 feet of 16-inch pipe, through which the tailings were flumed to a 12-inch Hydro-Seal pump. From here they were forced against a 20-foot static head, 1,700 feet through a 12-inch pipe line into the tailings basin.



15-ton truck dumping into receiving bin at crushing plant

## CONCENTRATOR FLOWSHEET



A 10,000,000-gallon capacity clean water reservoir was provided adjacent to the mill and water was fed by gravity to pumps located on the ground floor of the concentrator. Water was pumped to the reservoir through a 16-inch pipe line from the pit by means of a 1,500 gallon-per-minute high pressure pump, and through a return line from the settling basin, using a 2,000 gallon-per-minute low-head pump.

A 100-ton capacity concrete pocket and the crushing plant were erected in the pit. They were located on the pit floor in a rocky worked-out area and connected with the concentrator building by a 1,000-foot long conveying system. The latter is a 36-inch belt conveyor built on an 18° slope and covered with a steel gallery. It was constructed in three sections with two transfer houses.

The main haulage roads are 50 feet wide—one leading to the pit pocket from the south side and one from the east side of the pit. They were built up with material at hand, using taconite and paint-rock for the main fills, and dressed with a rubbly material. The high fills were built up in low lifts, compacting the material under truck traffic, and thus avoiding any appreciable settlement later.

In addition to the six trucks, the tractor and the grader, which had been formerly purchased, two 85-B Bucyrus-Erie shovels with 3 1/4-yard welded dippers, two Bucyrus-Erie 27-T combination blast hole and structural drills, and a road sprinkler, were purchased. The latter is used to lay the dust and to help maintain a smooth, hard hauling surface.

### Changes Completed for 1940 Season

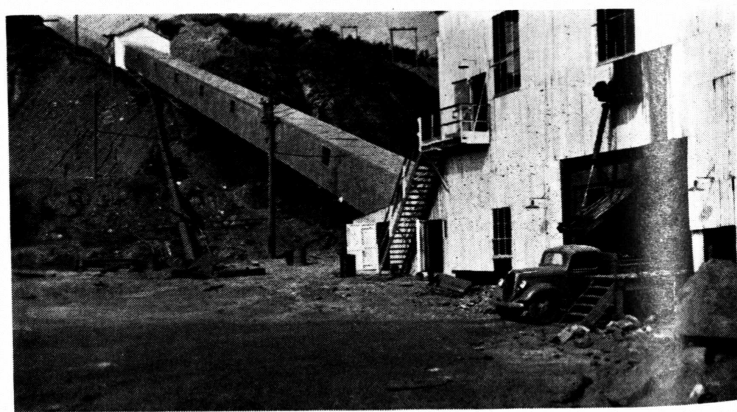
The preparatory work was not finished until late in May, and the 1940 ore season was started on May 29, using four to five 15-ton trucks, hauling from two shovels. A 600-ton per hour supply of crude ore is trucked to the pit pocket, the haul averaging 2,400 feet, with a maximum grade of 8 per cent.

Dumped into the 100-ton pocket, the crude ore is carried by an eight-foot pan conveyor to a four-inch grizzly. The undersize from the latter is fed through a chute direct to the 36-inch belt conveyor. The oversize falls on to a five-foot pan conveyor, leading to a 40-inch by 42-inch primary jaw crusher. The large rock is scalped from the five-foot pan and dropped into the rock chutes from which it is hauled by truck to adjacent waste dumps.

The oversize ore material is crushed to four-inch size in the primary crusher

and fed through a chute to the 36-inch belt conveyor, falling upon a cushion of undersize material. By means of the conveyor it is delivered 1,000 feet on an 18° slope to the top of the washing plant, passing through two transfer houses. At the top of the mill it is dumped on to a five-foot by 14-foot double deck vibrating screen, the undersize going directly to log washers. The oversize is carried on 36-inch picking belts, where additional rock is hand-picked, to secondary cone crushers which reduce the material to a five-eighths-inch size and then feed it into the log washers.

The log product is passed over four-foot by six-foot vibrating screens, where it is delimed and fed directly into the concentrate bin. The log tailings and the tailings from the delimiting screens are carried to 17-foot Dorr bowl classifiers for further concentration. The classifier product is taken to the concentrate bin by means of 24-inch cross conveyors, where it



Side of crusher building, truck for rock disposal being loaded

is mixed with the log product and fed directly into ore cars for shipment. The classifier tailings are carried through the tailings disposal system to the settling basin.

### Nearly 500,000 Tons of Concentrates Produced in 1940

Operation of the mine for 1940 was completed early in October, having produced nearly 500,000 tons of concentrates.

The new method of mining worked out very well in a smooth, continuous operation, and it was found that our anticipations were actually bettered. In this particular operation the following advantages of truck gathering and conveyor belt delivery over steam locomotives gathering and delivery, were demonstrated:

1. With a short haul to adjacent dumps and with a lower initial expense, surface stripping costs were re-

duced. In the case of taconite and rock stripping in the pit bottom a further reduction was realized through the elimination of the long expensive haul to surface stripping dumps.

2. In the gathering and delivery of crude ore, the cost of truck and conveyor operation and maintenance, including all road costs, was less than half the cost of operating locomotives and cars and providing and maintaining hauling and loading tracks.

3. The grading problem was very much simplified through a flexible operation. Shovels were moved on established roads, and the cost of shifting a truck operation was but a fraction of that required in the use of locomotives, cars and loading tracks.

4. Costly rock work was reduced through the elimination of rock cuts for track grades and through lower pit rock costs. The latter, when encountered in mining, could either be

cast aside in the rocky area, or hauled by truck to adjacent worked-out areas in the pit, saving the long costly haul to the surface stripping dumps.

5. An increased tonnage of ore was made available through the elimination of track benches. Isolated deposits and deep ore bodies could likewise be mined readily.

6. The labor cost per ton was reduced through the elimination of large track gangs and shop crews. With fewer men and with practically every man a producer, the operation could be conducted efficiently on a small, as well as large program.

7. The maintenance cost on the motorized equipment was very much less than that required for locomotives and cars.

In short, the new method of mining proved to be simple, flexible, and economical and especially adapted to a pit of this type.

### Minimum Coal Prices to be Reviewed

Secretary of the Interior Harold L. Ickes announced that the Bituminous Coal Division of the Department of the Interior will open a hearing on May 21 to determine changes in the costs of producing coal since the cost-base for minimum prices was established.

The hearing, he said, will provide the basis for making necessary changes in the minimum prices to keep them in line with the coal industry's operations costs. It will be held in Washington, D. C., before a Division trial examiner.

Preliminary figures, based upon 1940 mining operations recently released by the Division, indicate a substantial reduction in costs in each of the minimum price areas, and an average national reduction of approximately 18 cents per ton.

However, Secretary Ickes pointed out, the Division also will receive evidence concerning current changes in costs, including the effect of increases in wages paid by the industry as a result of the negotiations between producers and miners which opened this spring.

The Coal Act requires minimum prices to be revised appropriately whenever it has been determined that the "weighted average cost" of producing coal in any minimum price area has changed in excess of two cents per ton. The minimum prices were established to maintain a "cost floor" under the sale of coal at the mine and to end the destructive price-cutting which has kept the coal industry in a demoralized condition for many years.

The Division has announced that a

pre-hearing conference will be held at its offices in Washington on May 19 at 10 a. m., at which time matters of procedure will be discussed with all interested persons with a view toward expediting the hearing which opens May 21.

The initial stages of the hearing will be concerned with the determination of cost changes, but the full scope of the hearing will cover both the cost phase and any appropriate adjustment of minimum prices based upon cost changes.

The order setting the hearing provides that all interested parties will be given a full opportunity to be heard, to examine and cross-examine witnesses, to present evidence relating to the correctness or incorrectness of the Division's preliminary cost figures and to present their own evidence relating to the extent of changes in costs in excess of 2 cents per ton. Interested persons also will be afforded full opportunity to participate in a similar manner in the price-adjustment phase of the hearing.

The order states that all parties desiring to participate in the hearing must file a notice to that effect with the Division on or before May 19, 1941.

The Division recently released cost computations covering mining operations for 1938, 1939 and 1940. It announced in the hearing order that the individual sworn cost reports filed by producers, from which these computations were made, have been made available for inspection by interested persons at the Division's offices in Washington. This will afford all interested persons an opportunity to check the accuracy of the Division's compilations, and to enable them to prepare their evidence and participate in the hearing.

The present minimum prices were based on 1936-1937 "adjusted" costs, and the costs of operations for 1940 indicate a decrease of 18 cents per ton under the cost-base for the present price schedules.

### Cuffey Act Extension Does Not Affect Code Membership

After the Guffey Act was extended for two years by Congress in April, a statement was issued by Director Harold Gray of the Bituminous Coal Division, clarifying the status of code members under the Act as extended, as follows:

"Code members are advised that their membership in the Bituminous Coal Code as promulgated pursuant to the Bituminous Coal Act of 1937, does not expire or terminate on April 26, 1941. Section 19 of the Bituminous Coal Act of 1937, as originally passed by Congress, provided that the Act was to expire on April 26, 1941. Recently Congress has amended Section 19 so as to provide that the Act shall continue to be in effect until April 26, 1943.

"However, any producer who desires to present for consideration of the director a request for withdrawal from the code predicated upon the April 26, 1941, expiration date provided in the Bituminous Coal Act of 1937, may do so by making formal application to that effect not later than fifteen (15) days from the date hereof. Non-code members are subject to the tax imposed by Section 3 (b) of the Act, of nineteen and one-half (19½%) percent of the sale price or the market value of all the coal sold or otherwise disposed of."