THE NEWHOUSE MINES AND SMELTERS

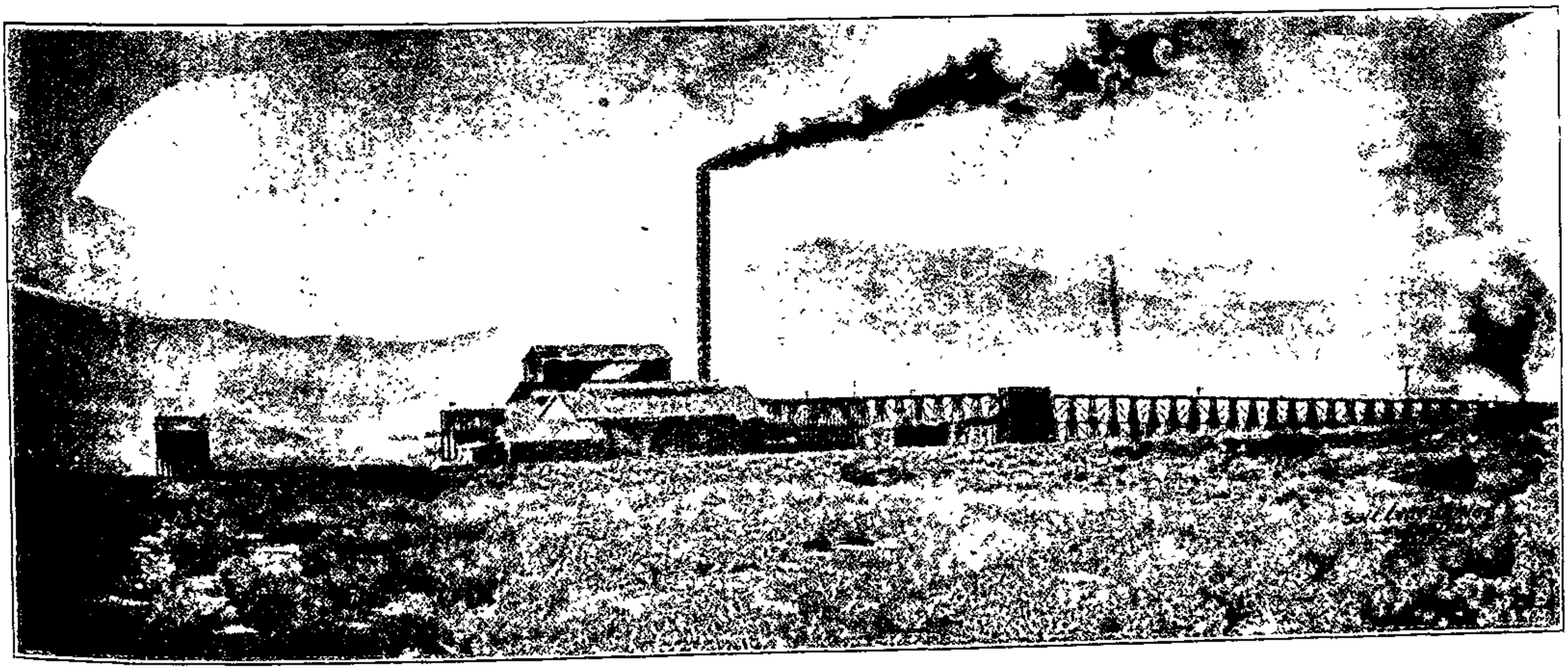
A MODERN COPPER MINING PROPERTY

Application of Steam Turbines and Electric Motors to Mine and Mill Work

Description of Mine and Equipment.

It was a master mind and daring heart that planned and carried out the reclamation of the Cactus mine, and the man behind this enterprise, without question, is a man who has been successful in carrying out gigantic undertakings; a man who has had a world of experience in mining affairs, and one who would rather make millions out of a low grade mining proposition than to pin his faith and risk his reputation on a small and rich but fickle deposit of the precious metals.

The new mining property at Newhouse may well be regarded as a model of progressiveness in engineering as well as commercial fields, and close study of its details will reveal many points of practical interest and value to the mine operators accustomed only to the old order of things. Not the least important of the many vital features is the use of steam turbines and electric motors for serving the entire property with power and light. The Newhouse officials with characteristic foresight have taken the lead in the adoption of turbines in western mining work, and the successful operation of the system has brought a well deserved reward. The power system is treated in detail under the following subject: "Power and Mill Equipment."



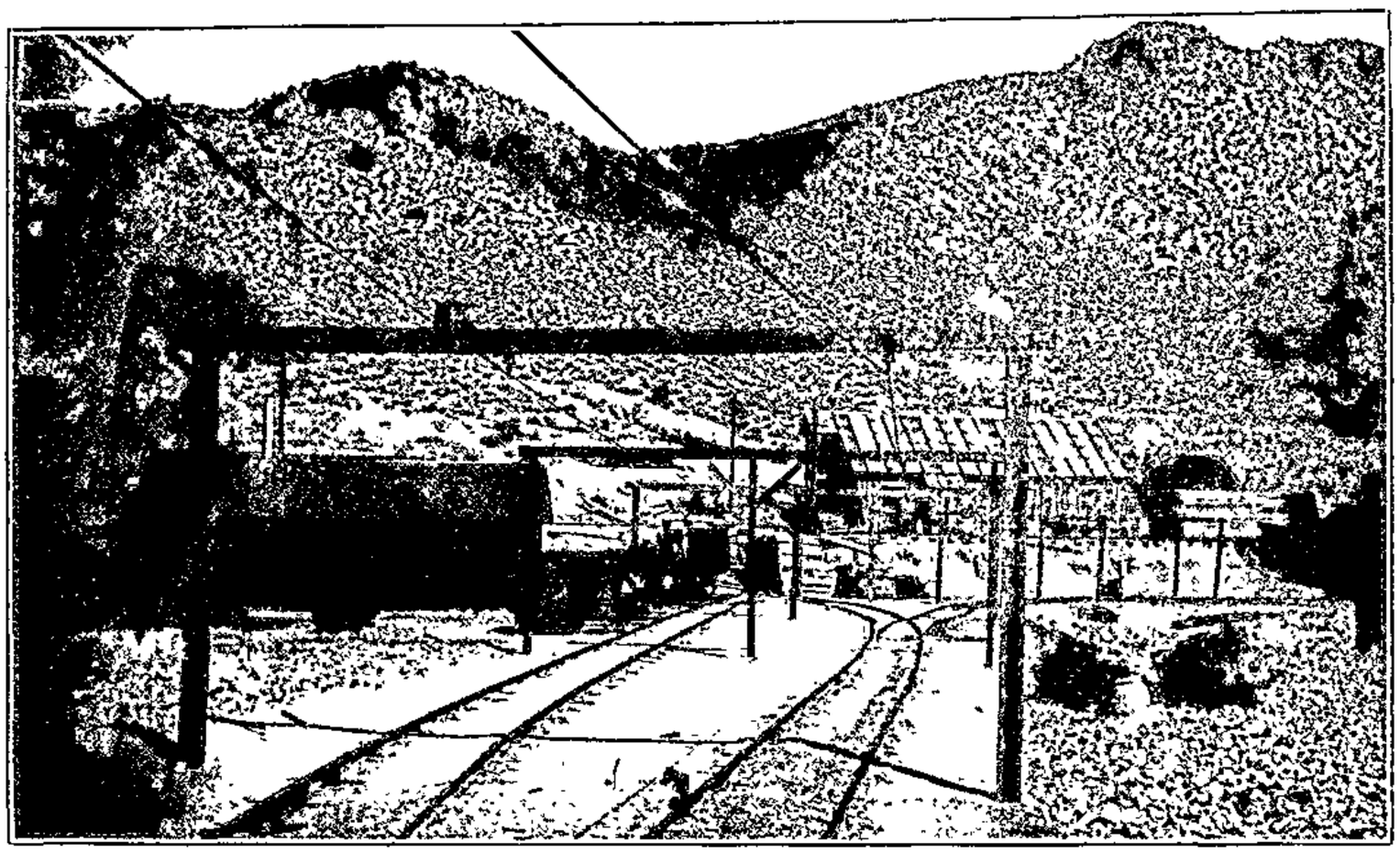
The Newhouse Mill, and Trestle Approach, View from the East

During the past few years Utah has made a marvelous record as a producer of

copper bearing ores, and at the present time our state is attracting widespread attention because of its rapidly growing output of the red metal, and because of the wonderful possibilities it offers in this direction.

Butte, Montana, as a magnificent producer of copper ore, is in close competition with the mines of Michigan in the matter of immense outputs of the red metal. In drawing a comparison between these two great copper producing sections, it is well to state, in this connection, that Bingham, Utah, promises to become a formidable rival to Butte, and that there is every reason to believe that another section of our commonwealth will, in a short time, become a second Bingham as a producer of immense quantities of copper ore with which is associated appreciable quantities of gold and silver as a by-product.

The locality under consideration is Copper Gulch, in San Francisco district, Beaver county, Utah, the home of the Cactus copper mine and which is but a few miles from Frisco, for years past made famous in mining circles by the possession of the Horn Silver mine which has already paid nearly five and a half millions in dividends to its fortunate owners. The discovery of the Cactus mine was nearly contemporary with that of the Horn Silver, and for several years desultory work in its development was carried on by the late Allen G. Campbell and his associates, the then owners of the Horn Silver mine. Later on two French companies began operations in the gulch. One of these, the Cactus company, owned and developed the mines, while the other put in a smelter for the treatment of Cactus ores. A short but successful run was made at the smelter when a disagreement arose between the two associations, the result being that the plant was closed, and it has since remained idle, while work at the mine was indefinitely suspended. About ten years ago the reduction company and the Cactus company arrived at an understanding and the former then built one of the finest concentration plants to be found in this intermountain region at that time; but a brief run had hardly been made when trouble broke out again between the interested parties, and this disagreement, together with the great scarcity of water for milling operation, occasioned another close down, notwithstanding the fact that in the mine workings immense bodies of fine milling ore were blocked out ready for extraction and the mill. This disagreement led to a lawsuit which ended in the sale of the properties of the two companies under the hammer, the bondholderds being the purchasers. The period of redemption ended with the bondholders in peaceful and legal possession, thus leaving them free to consummate a deal then pending, which resulted in the acquisition of this magnificent piece of mining property by the Newhouse Mines & Smelters company, of which Mr. Samuel Newhouse is the head, and under whose direction it has been so extensively developed and so splendidly equipped.



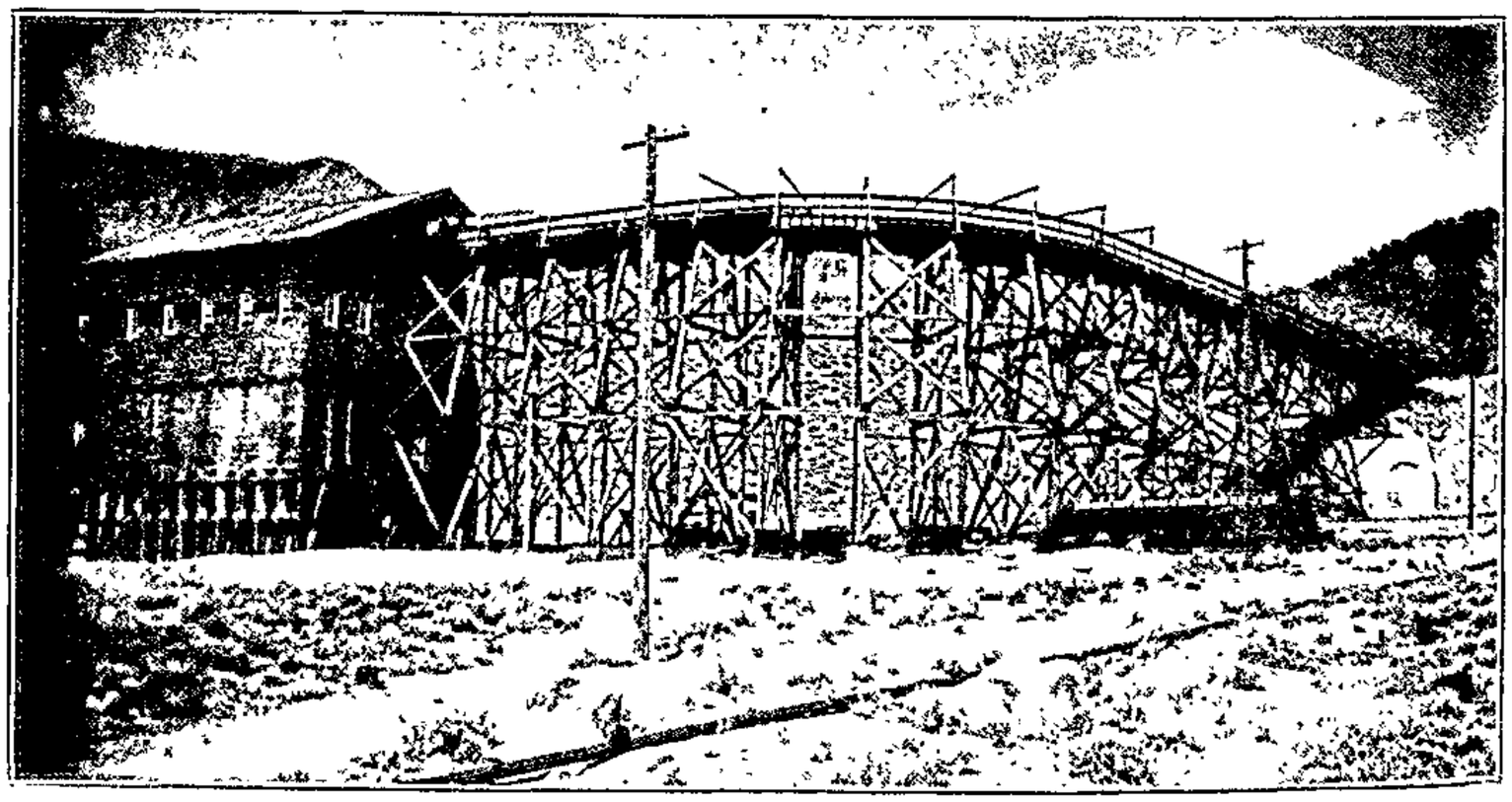
Main Tunnel Entrance to the Cactus Mine

Mine Operation and Development.

The Cauctus mines were acquired by Mr. Newhouse in the year 1901, and active work was at once inaugurated in their extensive and systematic operation and development under the supervision of M. M. Johnson.

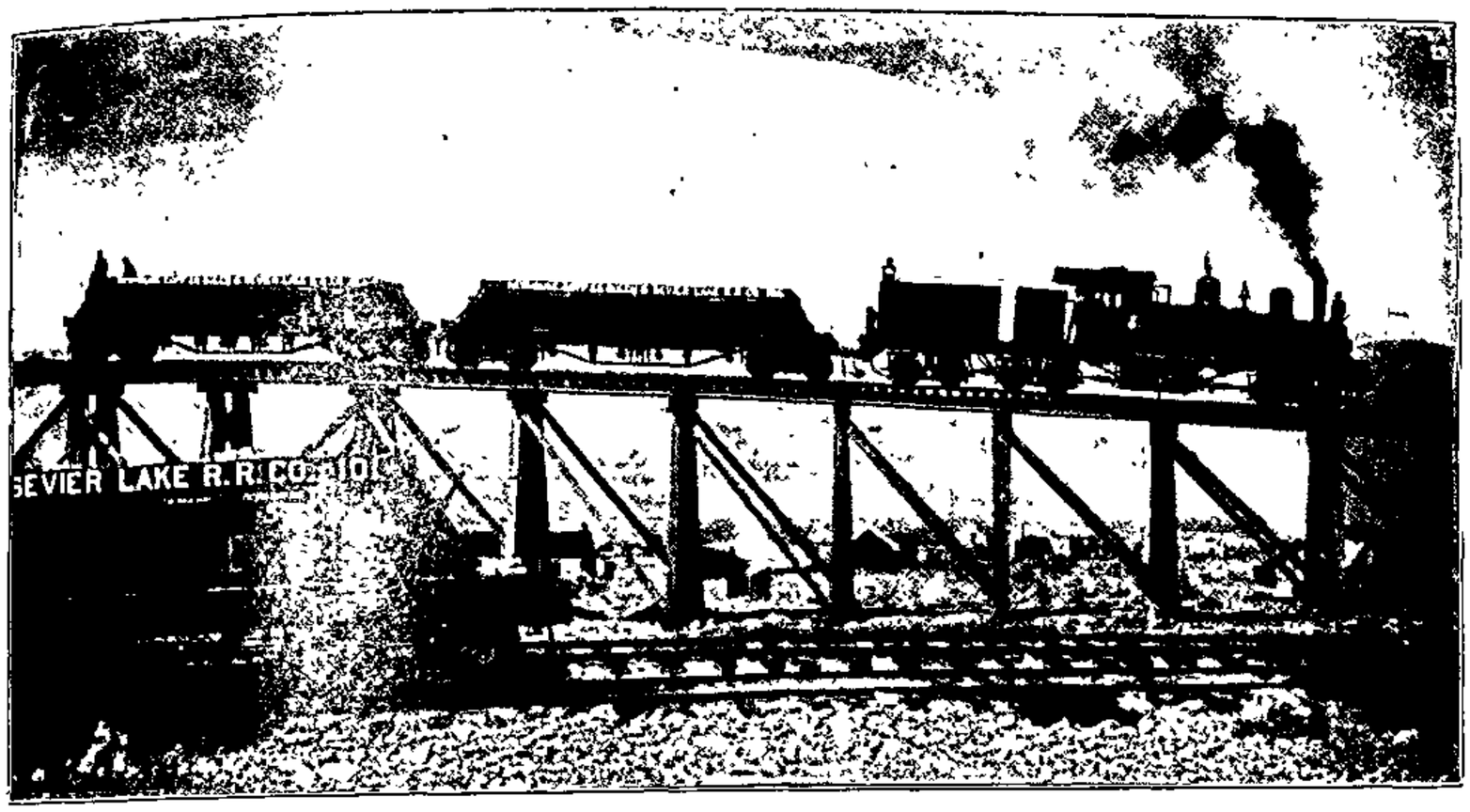
Up to this time nearly all work in the Cactus had been in the nature of tunnel exploration, the mine shaft having reached but a shallow depth. Under the new regime, however, a new three compartment shaft—two compartments for hoisting, and one for manway—was started, and this was sunk to a depth of 615 feet, or to the present tunnel level, with drifts and cross-cuts at intervals of every hundred feet. On the 615 foot level, from the bottom of the shaft, the long working tunnel was started, and work was also begun at its western terminus as well. This tunnel is 6,000 feet in length and has a grade of five inches to every hundred feet, and the car track is of 30-pound steel. The haulage is by means of 50-horse power electric locomotives, and the cars are capable of holding three and half tons each. There are two electric locomotives at the mine.

On each level in the mine immense bodies of ore are blocked out, and these have been cross-cut for distances of from 135 to 200 feet without, in several instances, disclosing both walls of the deposit or lode, and these ore bodies have been drifted upon for a distance of 500 feet on the strike of the vein, thus showing their permanency and continuity. On each level, and from one level to the other, in the footwall, ore chutes have been sunk to the tunnel level and, in the handling of the ore, from the time that the mucker shovels it into the mine car, everything is done mechanically or automatically, from the time that it is dumped into the chutes until it is delivered into the railroad car below the mill. At



Crushing and Loading Station at the Cactus Mine

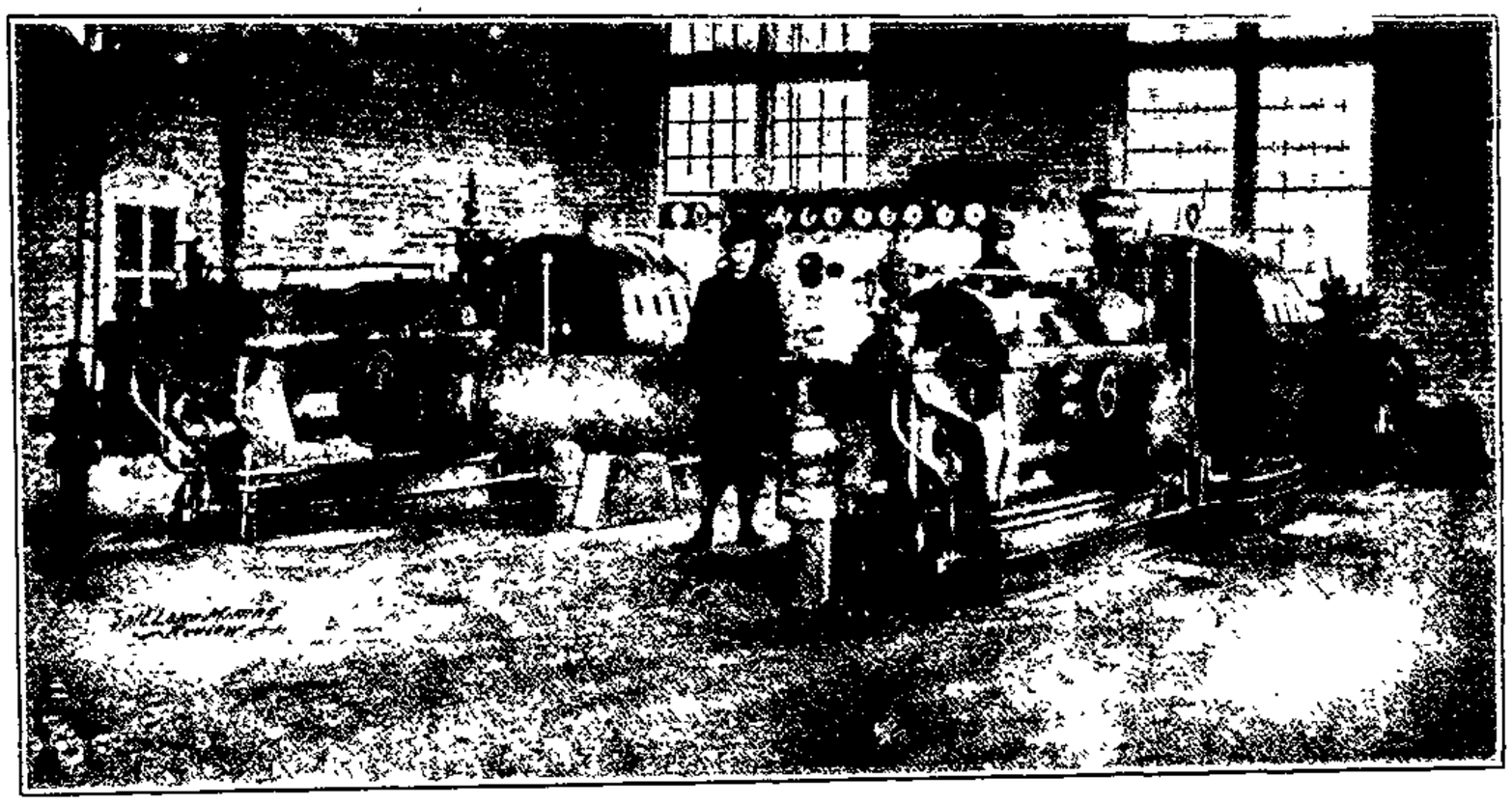
the loading station in the mine the ore passes to the cars of the electric line. A compressed aid gate regulates the discharge,



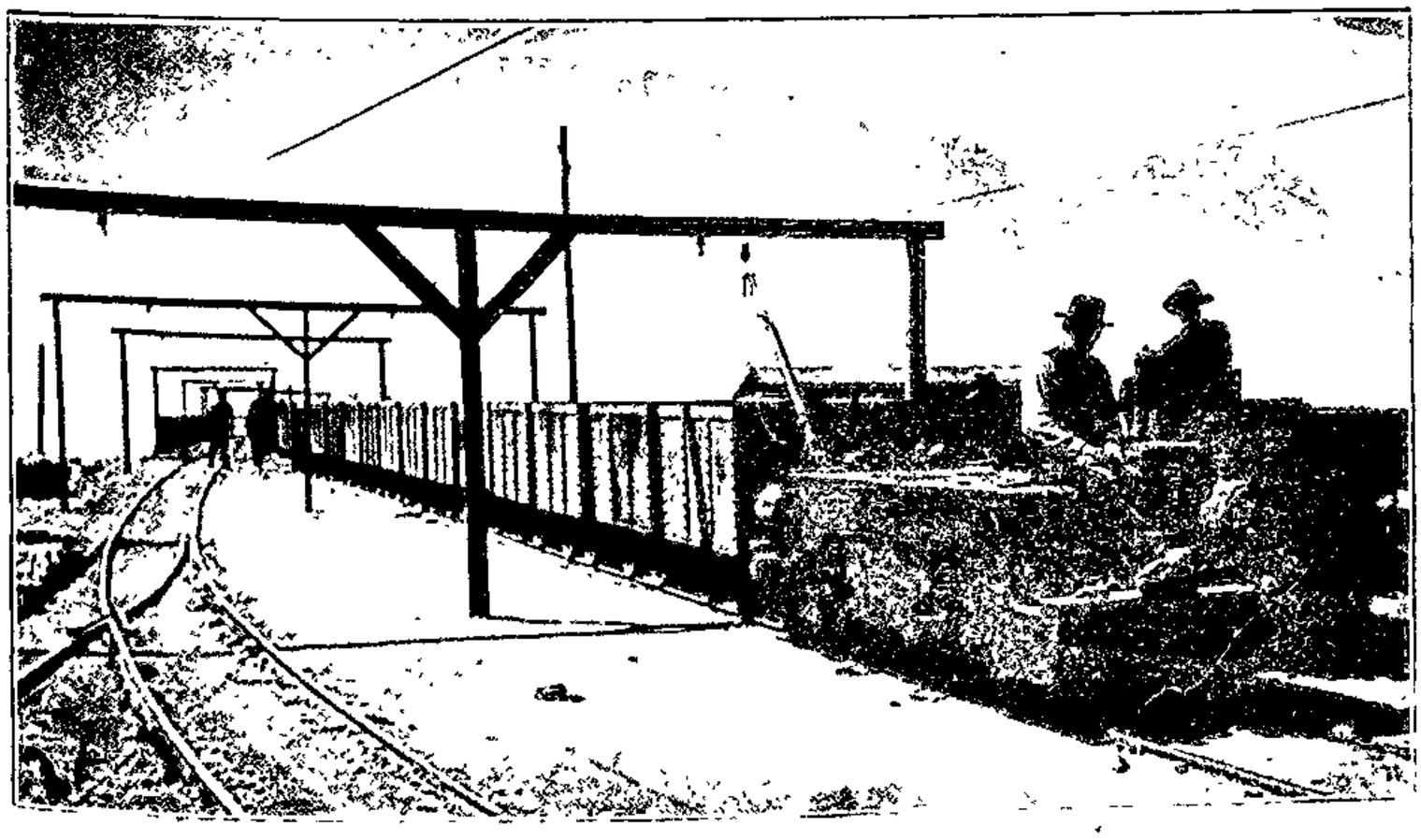
Pushing Loaded Cars to Top of Mill

and the cars, twenty-one in number, are loaded within an incredibly short time. The mine is electrically lighted, and compressed air is used in drilling operations. The pipe-line carrying the compressed air is 13,000 feet in length, from the powerhouse at the mill to the inner mine workings. It is constructed of six and a quarter inch wrought iron pipe, and is substantially laid.

At the tunnel entrance there are several buildings used for various purposes, including a complete sawmill outfit, blacksmith shop and machine shop, electric sub-station, etc., to say nothing of the imposing building where the ore is unloaded from the electric train into ore bins from which the cars of the Newhouse, Copper Gulch & Sevier Lake railroad are loaded. Coming from the tunnel, this train of twenty-one cars reaches the top of the unloading and loading station,



View of Turbine Units and Switchboard



Electric Motor Engine and 21 Cars on the Way into Cactus Mine

or building, over a high trestle. In this top there is an unloading device that is as effective and economical in its operation as it is interesting. This is a car-turner, the idea of which was brought here by General Manager Lafayette Hanchett, and most successfully utilized. This car turner, which was manufactured by Silver Brothers Iron Works company, of Salt Lake City, is a steel and cast iron cylinder fifty feet in length and about six feet in diameter. It rests upon wheels; car tracks extend its entire length, and it is operated by a small compressed air engine. In its utilization seven cars of ore are backed into it; the outer and upper edges of the cars fit into and rest against the triangular nitches fitted into the upper portion of the cylinder. The top of the cylinder is practically open and when all is ready the cylinder is revolved for half its circumference, thus empting the cars almost instantaneously, and, by this unique method, the entire train of twenty-one cars is soon unloaded.

The Newhouse, Copper Gulch & Sevier railroad, connecting mine with mill, is two and four-tenths miles in length. A Shay engine is used as motive power, and this is the only steam operated unit of the Newhouse system. The road has a four per cent grade, and the ore train is composed of four "Gondolas" or standard cars, with a carrying capacity of 80,000 pounds each. At the mill the cars are backed up a long trestle to the top of the plant, where they are mechanically unloaded into the big steel bins mentioned elsewhere in this article.

Power and Mill Equipment.

The power house and contentrating building are under one roof and occupy an area of 150 by 400 feet. The west portion of this immense building is built of heavy structural steel, inclosed with corrugated iron, covered with Ruberoid roofing, and is fireproof. The powerhouse is built of structural steel and brick, with heavy concrete foundations for building, smokestack, trestle work, machinery, etc.

In the power plant equipment and in the distribution and application of the power required in the mill and mine, the management of the company has shown the same progressive policy and practice that characterizes the success of the enterprise as a whole.

As is true with so many mining propositions, they were confronted with the problems of expensive fuel and limited water supply. After going into the subject and considering it from all standpoints as to relative advantages, the generation of

Ore Loading Station in the Mine

electric power in a central station, and its distribution to motors in the mill and for haulage in the mine was adopted. As best suited to meet the requirements of economy, simplicity, and reliability of operation, Westinghouse-Parsons Steam Turbines were adopted for generating the power in the central power plant.

The satisfactory results obtained from this installation amply justify the wisdom of the selection, and it is evident that the Steam Turbine will soon be generally adopted by the mining interests of the west for power transmission work. The Steam Turbine has already supplanted the reciprocating engine throughout the country in many other lines of industry, such as electric traction, lighting, and general industrial power plant work.

The electric power generating plant consists of two Westinghouse-Parsons steam turbines direct connected to 400 Kw. Westinghouse turbo-generators which are wound for three phase, 60 cycle, 440 volt, alternating current. One of these units is shown in the accompanying photograph, page 23.

For supplying current to the fields of the turbo-generators, duplicate exciter generator units are used, each of 20 Kw. capacity and sufficient for supplying both turbo-generators simultaneously. One is driven by a Westinghouse Standard high speed engine and the other by a 30 H. P. Westinghouse induction motor.

Both turbines exhaust into a single Worthington surface condenser from which the condensed steam is delivered to a feed water heater by a motor-driven Knowles pump of the valveless triplex type. The condenser cooling water is circulated by an engine-driven Worthington pump of the turbine type which elevates this water to a cooling tower; in this tower the water in descending flows over wooden slats to a settling basin at the bottom during which process it is cooled sufficiently to be ready for circulation again. The cooling tower operates with natural draft, and the condensing apparatus ordinarily maintains a vacuum of 25 to 26 inches corresponding to a true vacum of 27 inches referred to the standard sea level barometric pressure of 30 inches.

These turbines were tested by the purchaser's engineer, and when operating under 150 pounds steam pressure, 27 inch vacuum (referred to 30-inch barometer) and 100 degrees Fahr. superheat, showed the following steam consumption:

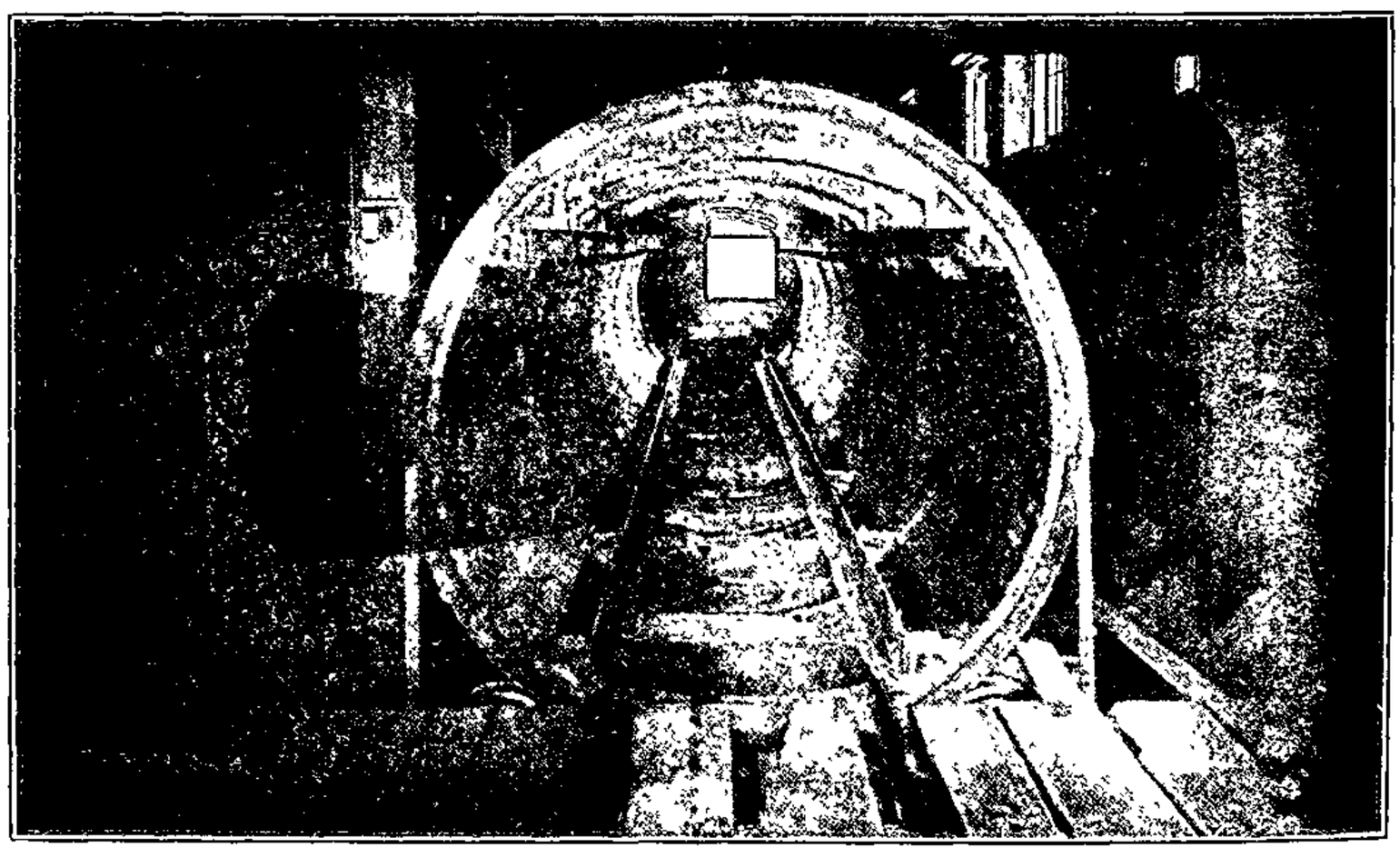
Full load, 14.6 lbs. per electrical horse power per hour.

Three-fourths load, 15.5 lbs. per electrical horse power per hour.

One-half load, 17.2 lbs per electrical horse power per hour.

During these tests the turbines developed 90 per cent overload.

A brief description of the working of the turbine may be of interest. Referring to the accompanying sectional view, page 24, two essential parts may be seen—a rotating and a stationary element, the rotating element supported by flexible bearings, J J, and a stationary hollow casing surrounding this rotor. High pressure steam enters the turbine through the angular port, A, expanding to the right through the various rows of moving and stationary blades. To compensate for the axial thrust the steam presses with equal and opposite force against a frictionless rotating balancing piston, C, mounted upon the same shaft. After passing the first series of blades, the diameter of the turbine is increased to reduce the length of blades necessary and the steam again expands to the right through the second series. As before, the axial thrust is balanced by a second balancing piston, C-1, through the equalizing port, F. Expanding in a similar manner through the last series of blades, the steam finally emerges into the exhaust space, B, with its temperature and pressure completely reduced to that of vacuum maintained in the condenser. Furthermore, the velocity due to expansion of the steam has been abstracted step by step in the various rows of blades, and is kept so low that there is no opportunity for the turbine vanes to wear under the erosion of steam which takes place when high velocities are employed. The two ends of the

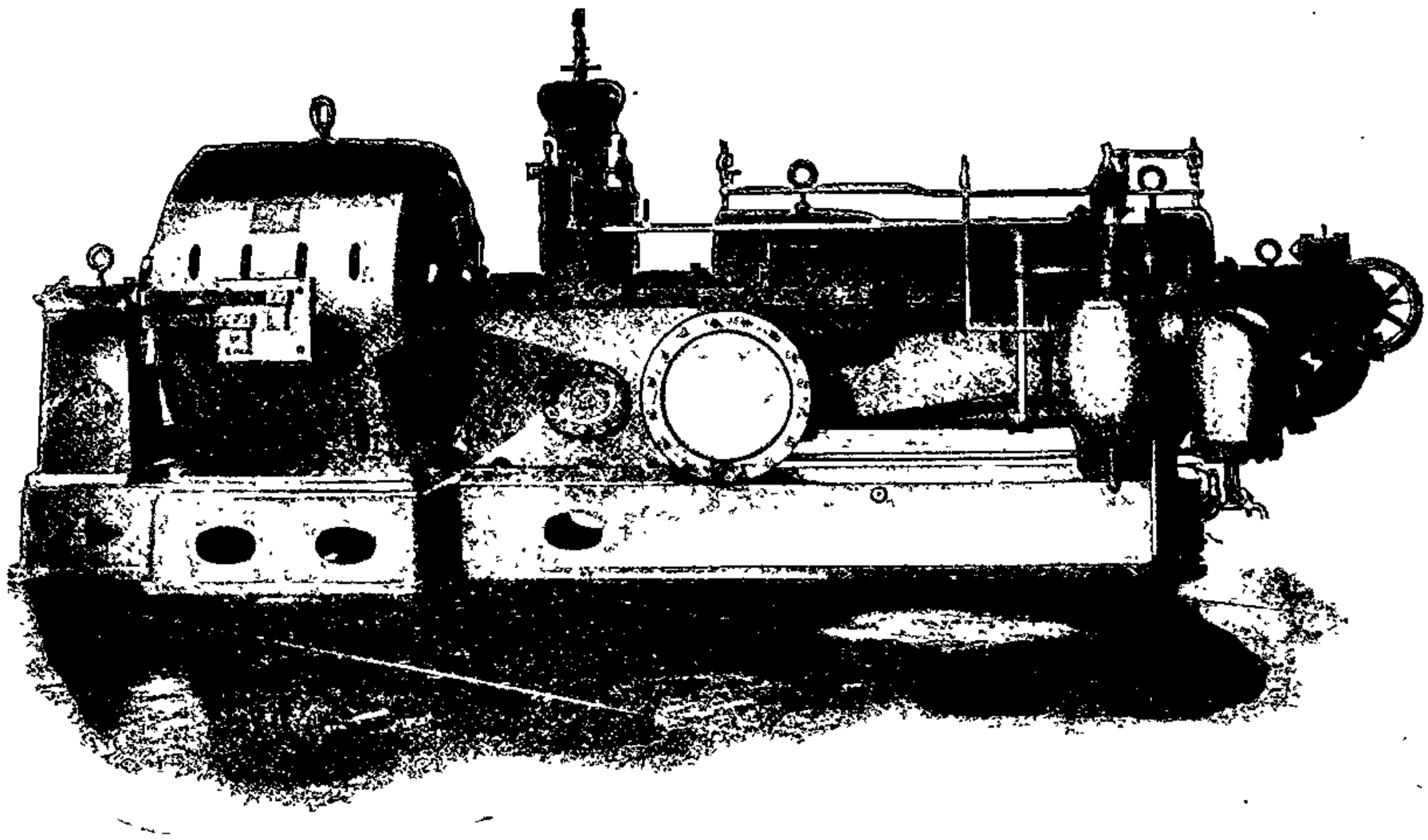


Car Turner at the Mine Loading Station

casing are sealed by frictionless water glands which absolutely prevent air leaking into the condenser or steam leaking out when running non-condensing. An adjustment bearing, H, serves to keep the rotating part of the turbine in precise alignment. Bearings are constantly flushed with oil from a circulating system supplied by a small plunger pump, M, which delivers oil to the bearings at a low pressure, returning through the cooling coil, T, to the reservoir. A sensitive centrifugal governor driven directly from the turbine shaft, as shown, controls the amount of steam delivered to the turbine according to the load.

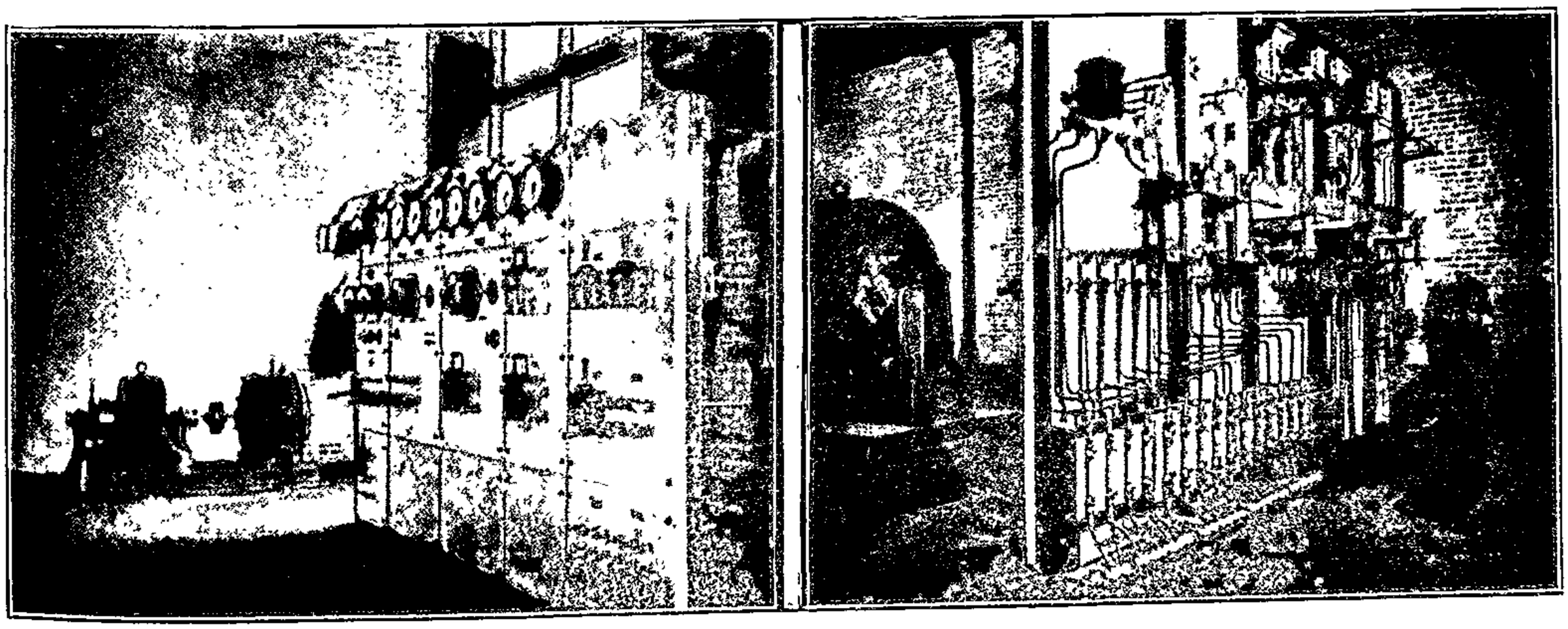
Green Economizer is employed for utilizing the waste heat of the flue gases; this Economizer raises the temperature of the boiler feed water, as it comes from the feed water heater, from 150 degrees to 250 degrees Fahr., for the boilers. The economizer connects with a self-supporting steel stack, eight feet diameter, and 165 feet high. By-pass flues and dampers conduct the gases either through the economizer or direct to the stack as occasion may demand.

As no internal lubrication is used, the condenser steam from the turbines is oil free, and is pumped directly into the feed water heater where the exhaust steam from the feed pumps and the circulating pump heats it to 150 degrees Fahr. This water being distilled eliminates the scale from the economizers and boilers, thus saving the expense of cleaning, and reducing the cost of maintenance of the boilers, and at the same time, the boiler surfaces, being clean, are capable of transmitting the heat from combustion of the fuel to the water contained in the boiler at the highest possible efficiency. As an illustration of the practical results obtained by using the condensed steam from the turbines in the boilers, an inspection of same after months of operation shows that not a particle of scale can be scraped from the lower tubes in the boiler by means of a knife edge.



Westinghouse-Parsons 400 K. W. Steam Turbine Unit

For the operation of the air drills there is installed in the power house one Ingersoll-Sargeant cross-compound, tandem, two stage air compressor, of a capacity of 2,500 cubic feet of free air at sea level. This air is transmitted to the mine at a distance of 13,000 feet, through a six-inch wrought iron tube, where it is distributed in the mine for the operation of air drills and gates at ore chutes. The air is also used for the cylinder used in dumping the ore cars, as previously described.



Front and Rear of Switchboard

The boiler plant consists of three (3) 300 H. P., high pressure Babcock & Wilcox boilers, with internal superheaters, two boilers being of sufficient capacity to carry the load under ordinary operating conditions. A pressure of 150 lbs. gauge is ordinarily carried.

In connection with the boiler plant a

The haulage of the ore from the mine and its crushing preparatory to being transferred to the mill, as well as the operation of the mill in all its departments, is done electrically.

The power is distributed throughout the mill at the pressure of the generating units, i. e., 440 volts. The 440 volts of the main generating station is raised by transformers to 2,200 volts and carried over transmission line 8,000 feet in length, to the sub-station and crushing plant at tunnel entrance to mine.

The crushing plant at the tunnel entrance consists of three 10x20 Blake crushers driven by a 75 H. P., 2,000 volt Westinghouse induction motor.

The sub-station equipment at the tunnel entrance consists of a 75 H. P., 2,000 volt Westinghouse induction motor direct connected to a 56½ Kw., 250 volt D. C. generator. From this motor-generator set the locomotives for mine haulage are operated. The locomotive equipment for the mine consists of two (2) Westinghouse-Baldwin standard mine locomotives, each equipped with two (2) 25 H. P., 250 volt Westinghouse special mining type motors; diameter of driving wheels thirty inches, gauge of track 30-inch.

The following is a list of the Westinghouse induction motors installed:

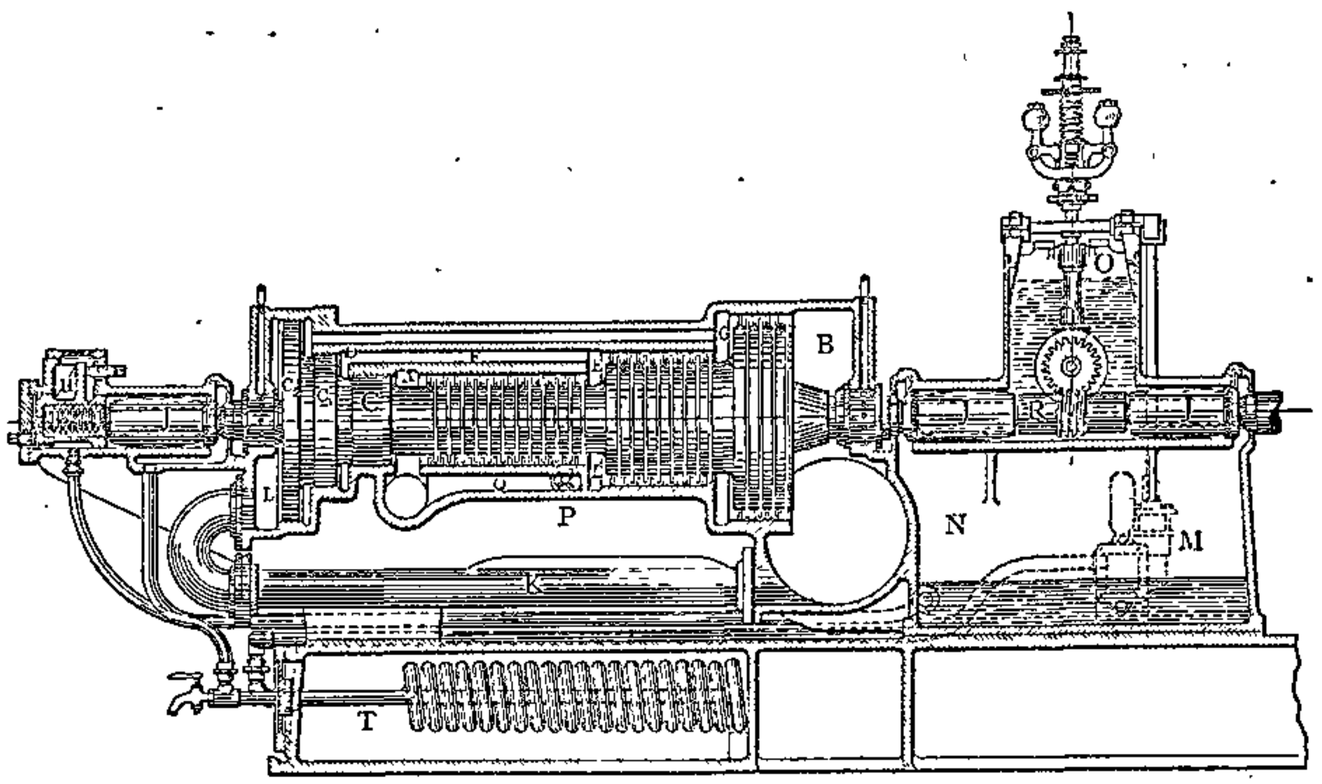
MOTOR DRIVES.
WESTINGHOUSE A. C. INDUCTION TYPE MOTORS.

Size H.P.	No.	Apparatus Operated	Location
75	1	3 10x20 Blake Crushers ..	Mine Entrance
150	2	Crushing Dept. and Jigs	Mill
20	4	Wilfley Concentrators and Slimers	Mill
30	2	Duplicate Centrifugal Slime Pumps.....	Mill
15	1	Sump Pump.....	Mill
15	1	Concentrates Elevator..	Mill
5	3	Concentrates Conveyors	Mill
20	1	Vacuum Pump for Condenser	Powerhouse
15	1	Ammonia Pump for Ice Machine	Ice Plant
3	1	Scraper of Green Economizer	Powerhouse
5	1	Machine Shop.....	Mine Entrance
5	1	Crusher in Assay Office..	Mill

Also one 30 H. P., 220 volt, direct current motor for operating mine hoist.

The mill equipment, in addition to the three 10x20 Blake crushers at the loading station at the mine entrance, embraces the following:

Two 15x36 Holthoff crushing rolls.



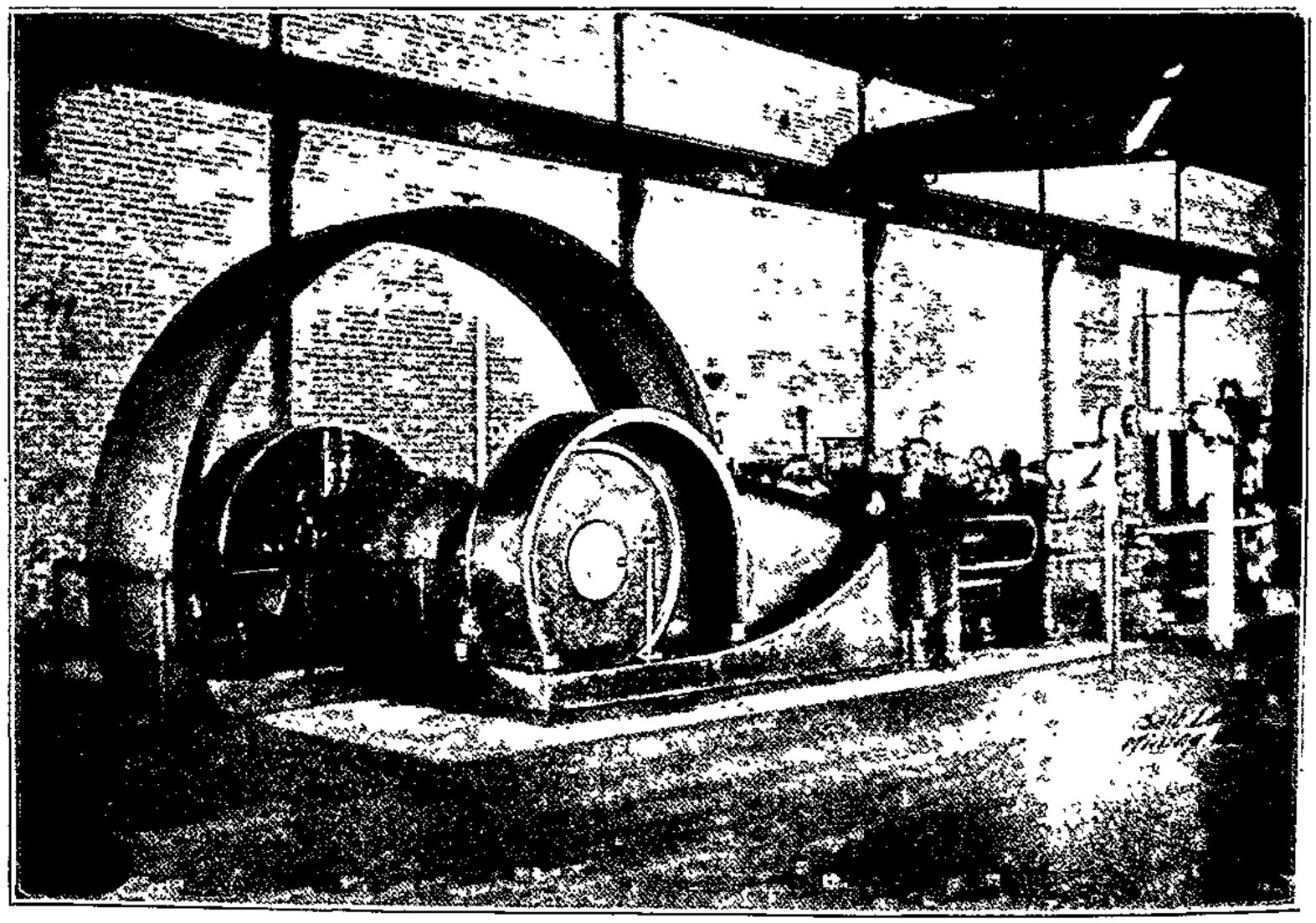
Sectional View of 400 K. W. Westinghouse Turbine

Two 15x36 style A Gates rolls.
Twenty-eight 2-compartment Hartz jigs.
Thirty-two Wilfley tables.
Eight Wilfley slimers.
Twelve screening trommels.
Four elevators.

The shafting is all equipped with quills and Hill clutch pulleys so that any part of the machinery can be stopped or disconnected independenly, without shutting down other sections.

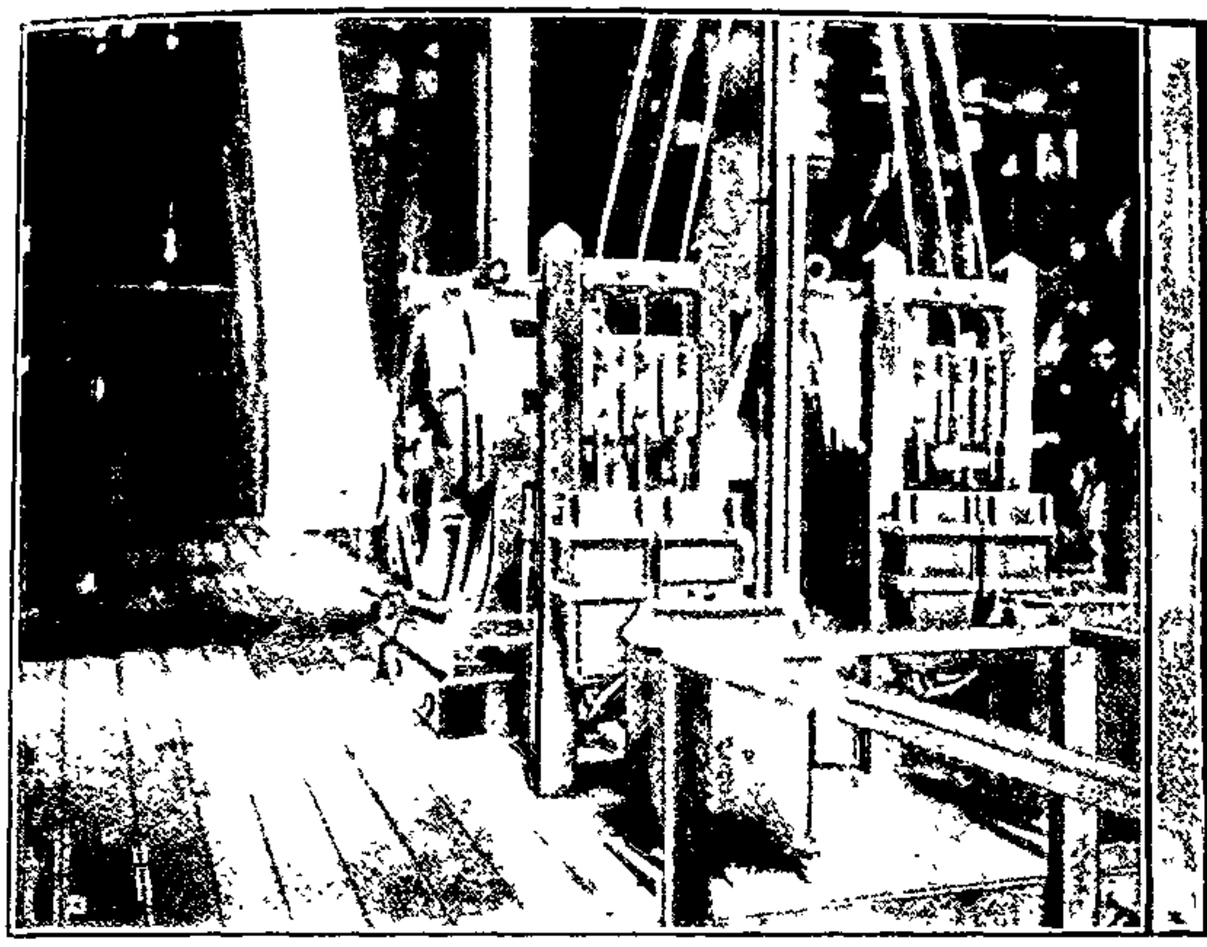
Mill Practice, or Ore Flow.

The ore, as it comes from the mine is dumped automatically at the loading station in ore bins fitted with grizzlies. Such ore as will not pass through the grizzlies run through the chutes into the three Blake crushers where it is made into a product of not exceeding an inch and half in diameter. From the grizzlies and crushers the ore enters storage bins of a holding capacity of 800 tons. Automatically the crushed ore is loaded into the big cars of the Newhouse, Copper Gulch & Sevier Lake R. R. company, and is conveyed to the mill. At the mill the ore is brought up a four per cent incline trestle to the top of the plant, and is dumped into the bins, which have a capacity of 1,000 tons. The bins are constructed of steel and are made exceptionally strong, the mill plan providing for the erection of more bins when occasion requires. The mill is constructed in two sections, or units, which are similar in every respect, and more units may be added at will. The ore is drawn from the bins onto belt conveyors by means of plunger feeders, and from the conveyors delivered to the elevators. There are two elevators in each section of the mill. The belt conveyors deliver the ore product to the dry elevator which takes it to the top of the mill. The elevator is seventy feet high, and the cups are 6x12 inches. From this elevator the ore goes to a fourteen millimeter mesh trommel, and the oversize to 15x36 inch rolls, where it is crushed to about fourteen millimeter size and returned to the elevator. From the fourteen millimeter trommel the undersize goes to a double trommel consisting of a seven and a three and half millimeter screen. The oversize from the seven millimeter screen goes to the No. 1 jigs, and that from the three and a half

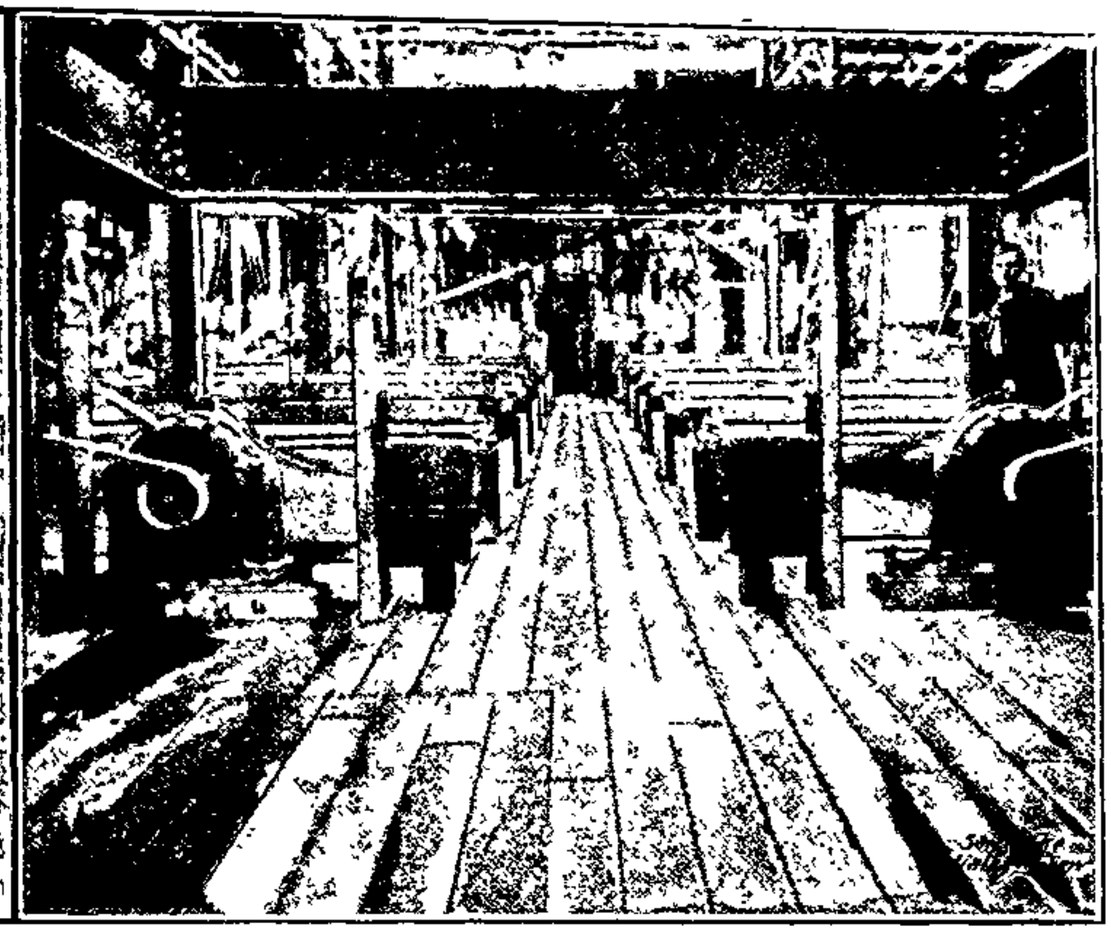


Ingersoll-Sergeant Air Compressor

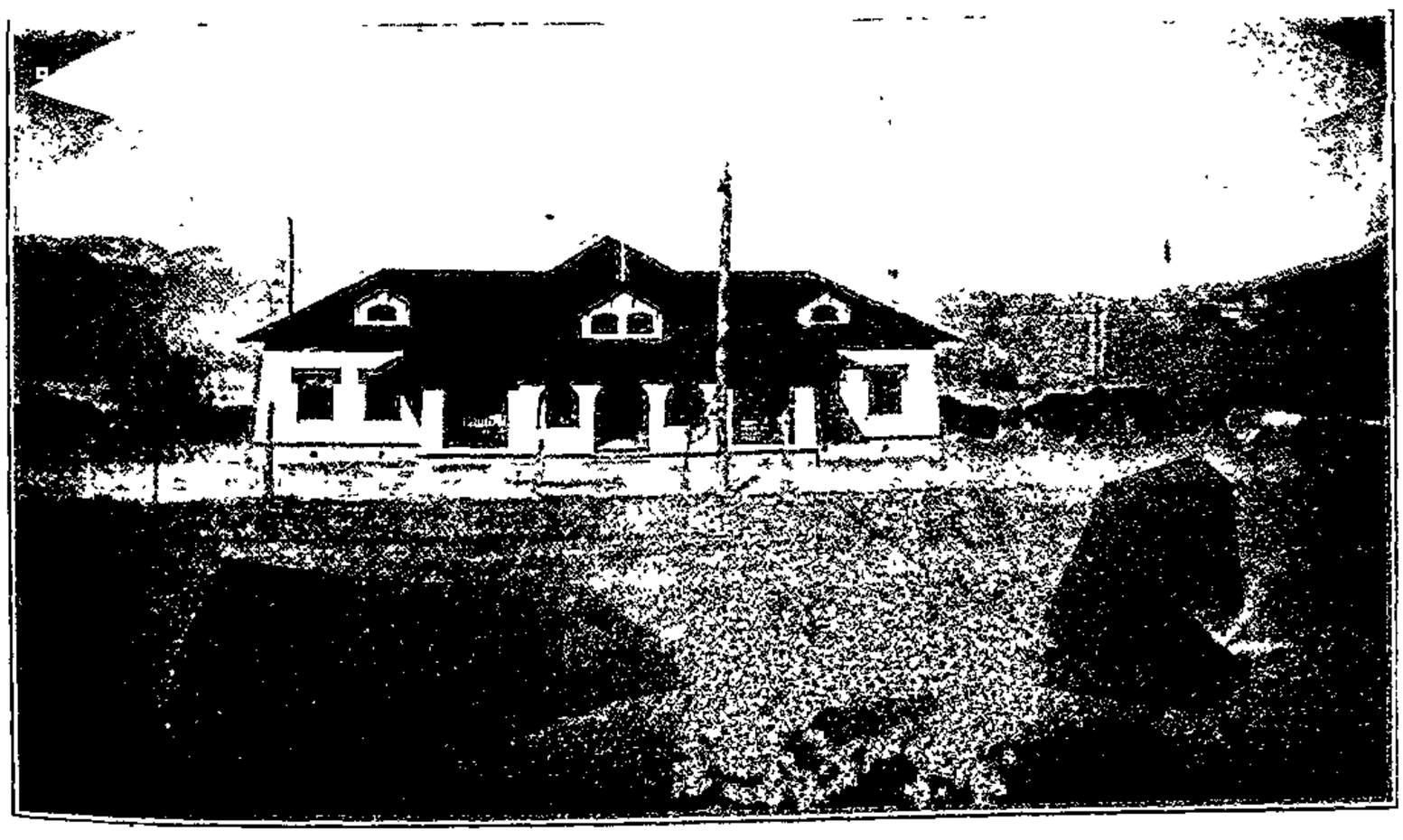
millimeter screen to the No. 2 jigs. The product from the two jigs is taken out through a side discharge. All tailings and hutch products are returned to the wet elevator, consisting of a sixteen inch belt and 6x16 inch cups, which delivers the material to the three and half millimeter trommel, the oversize from this trommel being returned to another set of 15x36 inch rolls for re-crushing, and from jigs to wet elevator, and again to a three and half millimeter screen until all material will pass through a three and half millimeter screen. The undersize from this three and half millimeter screen, and the other trommel already mentioned, is delivered to a ten mesh, No. 20 wire, trommel. The oversize from this trommel goes to No. 3 jigs; the undersize to a 16 mesh, No. 24 wire, trommel, and the oversize from this trommel to the No. 4 jigs. The undersize goes to a system of Calumet water sizers, which are arranged in series. The first compartment of the sizer delivers the coarse material through a 16 mesh screen to a set of jigs running 325 strokes per minute. The next compartment delivers to a set of four Wilfley tables; and the next compartment to another set of four Wilfley tables, and the next compartment to four tables. The overflow from these sizers goes to a system of settling tanks. The settling from these tanks are treated by four tables and the overflow from these settling tanks passes to sump tanks in the bottom of the mill where the slimes system proper begins. The water that flows across the heads of all the tables is also returned to the slimes system in the same manner. From these sump tanks the slimes are pumped to a set of fifteen settling tanks in the upper portion of the mill. These tanks are 8x8 feet and the bottoms are in the form of an inverted cone, being a special design by Mr. Bettles. It is the purpose of these tanks to give the slimes a chance to settle and thicken, when they are drawn off through the bottom of the tanks and delivered to a set of slime tables. All the water in the slimes settling tanks is collected in one tank and used to supply the jigs with water. On the Nos. 3, 4 and 5 jigs the tailings are discharged and sent out of the mill. The product through the first and second jigs is returned through the elevation for re-treating. The middlings from the tables are continually returned to the head of the same table for re-treatment. The product from all the jigs and tables is delivered through a system of shaking launders into push cars, which are elevated and dumped into the concentrates bins. From these bins the railroad cars are loaded, and the concentrates are ready for the market. The overflow from the shaking launders is also dumped back into the slimes system. At the time of the visit of a representative of The Mining Review, the mill was handling about 600 tons of ore daily.



Two 150 H.P. Motors, Driving Jigs and Trommels



Two 25 H.P. Motors, Driving Tables

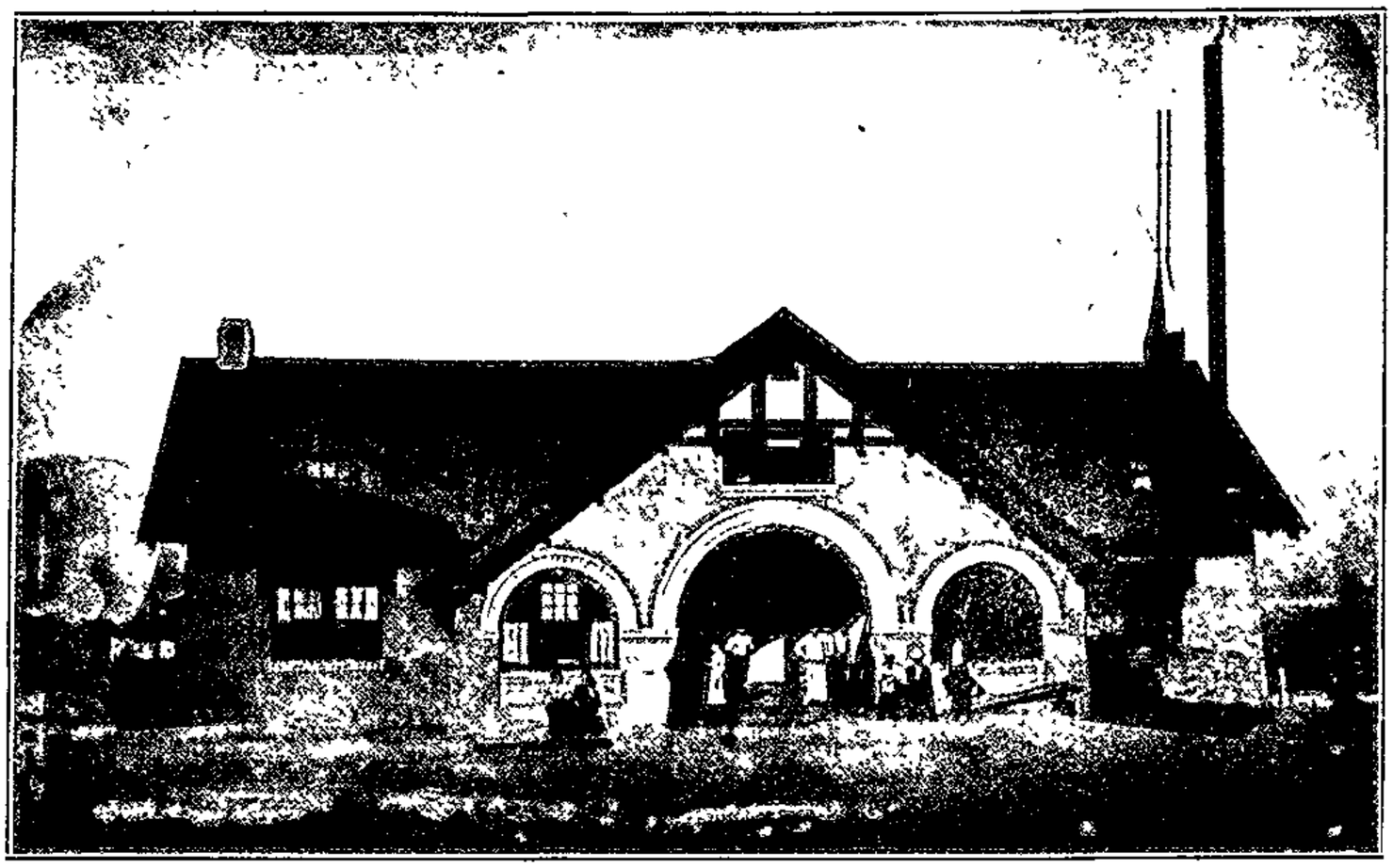


Cactus Club Building

The Newhouse Water System.

Realizing the urgent necessity of an ample water supply for his Cactus enterprise, Mr. Newhouse was soon able to secure this much-needed commodity by the purchase of the Wah Wah springs, eight miles west of the present town of Newhouse, being the only available water supply in that section of the country. To bring this water from the springs to the mill-site a pipe-line 44,000 feet in length from reservoir to reservoir, was laid, twelve and fourteen inch steel pipe being used. In addition, at Wah Wah, 20,000 feet of wood pipe is used in collecting the water from the several springs and conveying it to the reservoir on the west side of the valley. Through the main pipeline the water is delivered by gravity to the reservoir above the mill, at the rate of 1,075 gallons per minute. This reservoir, which

is located several hundred feet east of the mill, and at an elevation equal to the top



Dining House of the Cactus Inn

of the mill, has a capacity of 3,000,000 gallons and from it pipes deliver the water to the mill and also to the town of Newhouse, under pressure, for boiler, mill, fire and domestic purposes.

In speaking of the Newhouse water system, it might be well to state, in this connection, that the equipment of the Newhouse works includes an ice-manufacturing plant, and that the various departments of mine and mill are supplied with this needed article, for the use of employes, while the inhabitants of the town are able to secure ice at a price not above that at which it is retailed in Salt Lake City.

The Town of Newhouse.

While the days of miracles have been relegated to the dim and misty past, there has been an almost miraculous change, within a brief period, in the desert plateau just below where Copper gulch debouches into the Wah Wah valley. Here, but two or

Partial View of the Town of Newhouse

three years ago, the desert reigned supreme, and, but for the wickiup of some wandering Indian or the scurry of a jack-rabbit, was void of life. A few years ago, in order to reach the mines of Copper gulch, by conveyance, it was necessary to drive from Frisco, by a circuitous route, a distance of ten or twelve miles. But now, owing to the enterprise of Mr. Newhouse, backed by his ample capital, the San Pedro, Los Angeles & Salt Lake Railroad company has extended its Frisco branch to the mouth of Copper gulch, the new line being seven miles in length, and at its terminus, almost as by magic, a thrifty and attractive little town has sprung into existence, and which, from the incoming train, looks to the traveler like an oasis on the desert.

The town, proper, is laid out in regular order, and with the mammoth mill building flanking it on the east, and with the commodious Club House and boarding houses, makes an imposing appearance.

Mr. Newhouse has taken most commendable pride and interest in the building of the town which bears his name. Within its environments there are over fifty neat and cosy cottages, containing from four to six rooms each. These are all modern and are constructed of cement, with shingled roofs, which are painted, and each residence

View of Newhouse Mill from the Northwest

is piped for water supplied from the pipeline, and is electrically lighted. These are occupied by the employes of the company, having families.

The Cactus Club building is one of the most attractive structures in the new town. It is of the bungalow type, and its beauty is enhanced by the fine little park, with its green lawns, which lies in front of it. In the Cactus Club there is a reading room, a billiard room, a reception room, and a bar. The membership includes the business men of the town, mine and mill superintendents, and all employes of the company who are eligible, and who are elected by ballot; the object of the club being to promote good fellowship and to provide a place of repose and entertainment for its members and their friends.

The Cactus Inn is another imposing structure. In fact, the Inn embraces two build-

ings, one of which is employed as a boarding house, and the other for lodging, and the Inn provides for the comfort of about 300 men daily, most of the employes of the company making this their home; the Inn being under the management and supervision of mine host, Charles Matthews, itself, which has more the appearance of suburban residences near a large city than anything that can be found in many of the old-time mining districts of the west.

In the preparation of this article The Mining Review acknowledges courtesies from the following gentlemen of the New-

Indian Wickiup, formerly on Site of Newhouse Mill—"Before and After"

whose every effort and aim is to give comfort and satisfaction to his patrons.

North of the townsite there are several temporary structures and a number of tents, some of which are occupied by transients, and this portion of the town looks more like a typical mining camp than does the town

house Mines and Smelters' staff:

Mr. Samuel Newhouse, president.

Mr. Lafayette Hanchette, general manager.

Mr. A. J. Bettles, metallurgist and mill manager.

Mr. R. F. Moser, mechanical engineer.