



Scholars' Mine

[Professional Degree Theses](#)

[Student Theses and Dissertations](#)

1939

The design and equipment of a model coal mine for the Union Pacific Coal Company, Superior, Wyoming

William Thomas Sharp

Follow this and additional works at: https://scholarsmine.mst.edu/professional_theses

 Part of the [Mining Engineering Commons](#)

Department:

Recommended Citation

Sharp, William Thomas, "The design and equipment of a model coal mine for the Union Pacific Coal Company, Superior, Wyoming" (1939). *Professional Degree Theses*. 124.
https://scholarsmine.mst.edu/professional_theses/124

This Thesis - Open Access is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in Professional Degree Theses by an authorized administrator of Scholars' Mine. This work is protected by U. S. Copyright Law. Unauthorized use including reproduction for redistribution requires the permission of the copyright holder. For more information, please contact scholarsmine@mst.edu.

THE DESIGN AND EQUIPMENT OF A MODEL COAL MINE

for

THE UNION PACIFIC COAL COMPANY
SUPERIOR, WYOMING

By

William Thomas Sharp

A

Thesis

submitted to the faculty of the
SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF
MISSOURI

in partial fulfillment of the work required
for the

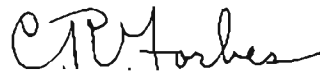
Degree of

Engineer of Mines

Rolla, Mo.

1939

Approved by



Head of Mining Department

TABLE OF CONTENTS

Introduction	1
Geology and Coal Measures	1
Rock Slopes	4
Belts	5
Underground Layouts and Methods of Development	7
Air Shafts	13
Power	13
Tipple	13

LIST OF ILLUSTRATIONS

Belt Line	3
Belt Drive Station	6
7 B. U. Joy Loader	8
Number 7 Car Haul	10
Number 7 Air Shaft	12
Underground Motor Generator Set 14	14
Shaker Screens	15
Tipple	16

BIBLIOGRAPHY

No bibliography; information for thesis was obtained from author's experience and files of Union Pacific Coal Company, at Rock Springs, Wyoming.

INDEX

A		F	
Air Courses	9	Fans	12
Air Shafts	13	Fan House	12*
Azimuth up pitch	4	Feeders	11
Azimuth down slope	4		
B		G	
Belt Construction	5	Generator Sets	13
Belt Drives	6*	Geology	1
Belt Length	4	Grade, Slopes	4
Belt Operation	5	Grade, Partings	11
Bins House Coal	17		
Bins Refuse	17	H	
Booms Loading	17	Haulage	11
		Hoppers	7
C		I	
Capacity	1	Introduction	1
Cars, Coal	11		
Car Hauls	10*	J	
Cleaning Plant	17	Joy Loader	8*
Clark D. O.	17		
Coal Reserves	9	L	
Coal Sizing	13	Lagging	4,* 10
Conveyors Belt	3*	Loaders	9, 11
Conveyor Shaking	9	Location, Mine	1
Cost	1		
Current	13	M	
Cutting Machines	11	Mining Methods	7,9
		Motors Electric	13
D		Motor Generator Set	14
Development Methods	9	Motor Haulage	11
Duck Bills	9		
Dumps	11		
Entries	7		

(*) indicates an illustration

INDEX

P

Partings	11
Percent Recovery	9
Pillars	9
Pitch, Seams	4
Planes	9
Pulleys, Magnetic	13
Pulleys, Snub	5

R

Rails	4
Rooms	9

S

Screens, Shaker	15*
Seams, Coal	2
Slopes, Inside	9
Slopes, Rock	4
Steel, Sets	10*
Sump	4

T

Tables, Picking	13
Tipple	16*
Track	4

(*) indicates an illustration

INTRODUCTION

In order to replace several mines in the Superior field that are near completion, the Union Pacific Coal Company have opened up the new D. O. Clark Mine at Superior, Sweetwater County, Wyoming. They first contemplated opening up the individual seams from the outcroppings. This would have necessitated moving the present camp of Superior several miles west of the present site and building several miles of additional railroad. This plan was abandoned because of the burdensome cost. Then the idea was conceived of driving rock slopes down against the pitch of the various seams. By doing so, they could locate the tipple about two miles from the present site of Superior and it would require only about a mile of additional track. This plan was adopted, and construction was started in the early spring of 1937. Since completion, experts have pronounced this mine one of the model bituminous mines of the nation. Built at a cost of over one million dollars, it is capable of producing 7500 tons of coal per day, when up to capacity.

GEOLOGY AND COAL MEASURES

All coal measures in this locality are found in the Mesa Verde formation of the Cretaceous. Each seam

is capped by a soft shale and sandstone. The No. 3 seam is not found in sufficient quantities to mine in this district. The No. 1 seam is found 160 feet below the No. 3, and averages about 7 feet in thickness. One hundred and sixty feet below the No. 1 is the No. $7\frac{1}{2}$ seam, which averages about $5\frac{1}{2}$ feet in thickness. The No. 7 seam is 130 feet below the No. $7\frac{1}{2}$ seam, and runs up to 14 feet in thickness, but will average about 6 feet in thickness. One hundred and seventy-five feet under the No. 7 is the No. 9, or Van Dyke seam, which averages about 6 feet in thickness. The No. 15 seam lies about 165 feet below the Van Dyke and averages about 8 feet in thickness. Ninety feet below the No. 15 lies the No. 19 seam, which has never been worked but from all indications is workable. Later on, prospect drill holes will be put down from the No. 15 seam to prove or disprove the workability of No. 19.

When the No. 7 seam was opened up, it was found to be in three splits. Development work, as far as possible, followed the bottom split. About 800 feet off the slope the first two splits came together. Approximately 300 feet further in, the top split came in to join the other two. Another double split was found in the No. 15 seam. However, these two splits came together about 400 feet



Belt Line

off the slope. Finding of splits in these two seams necessitated change in plans of underground dump stations and partings.

All coal measures in this section lie on a 7-per-cent pitch and a calculated azimuth of $221^{\circ} 18' 30''$ up the pitch.

ROCK SLOPES

The multiple seams are cut by two parallel rock slopes, on 50-foot centers, 2600 feet long. These slopes are driven on an azimuth of $252^{\circ} 18' 30''$ down the slopes. Both are lined with reinforced concrete to a distance of about 100 feet from the portals. The rest of the slopes are lined with steel sets on 5-foot centers, set on reinforced concrete footings, and lagged with 3-inch by 12-inch redwood.

The manway and material slope is 7 feet by 11 feet (inside measurements) on a 17.5-per-cent grade. It has a 42-inch gauge track of 75-pound rails set on the right-hand side of the slope to give clearance for a walkway on the left.

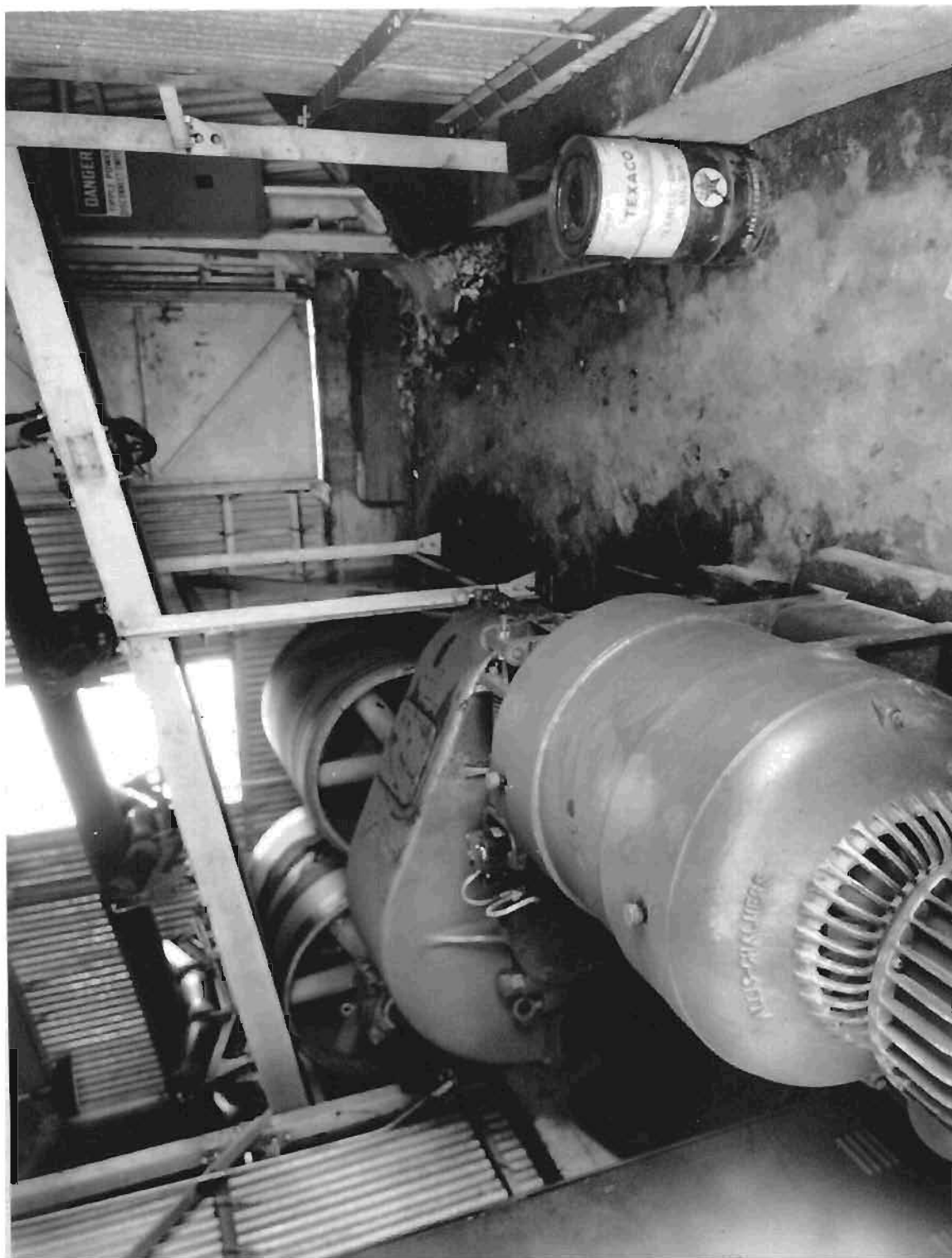
The difference in grades of the two slopes is due to the floor of the four-belt drive and transfer station rooms being on a grade of 1 per cent for a distance of approximately 50 feet each. The two slopes are connected

by 8 feet by 7 feet rock cross-cuts on 225-foot centers. The bottom 30 feet of the slopes are level and are connected by a cross cut to form a sump. These slopes were driven and timbered by the Utah Construction Company.

BELTS

All coal is brought to the surface on four belts that operate in series. Overall length of the complete belt line is approximately one-half mile. Each belt drive is powered by a 125-horse-power, 2300-volt, A.C. motor, and is equipped with an adjustable magnetic starter. The starters are set to make the transition from low to high in twenty-five seconds. A centrifugal governor driven by the head snub pulley on each unit is designed so that no belt can run unless the belt it is delivering to is operating at normal speed. In other words, if any one section of the belt is stopped or retarded, every belt below this one will automatically stop. Each belt is equipped with an automatic thruster brake which operates by spring action and prevents the belt from running back or drifting forward when it is shut down or the power goes off. Solenoid action disengages the brake after the belt is started up again.

The belts are 48 inches wide and are made of 6-ply, 42-ounce duck with a skim coat of rubber between plies.



Belt drive station. Showing motor, speed reducer, thrustor brake, and snub pulleys.

The top coating of rubber is 5/16 inch thick and the bottom coating is 1/16 inch thick. They travel at a speed of 350 feet per minute and are capable of handling 750 tons of coal per hour. Coal is fed to the belt from two 25-ton reinforced concrete hoppers, located at No. 7 and No. 15 seams, by means of reciprocating plate feeders. The top run of the belt travels over troughed rollers on $3\frac{1}{2}$ -foot centers (except at loading points where they are doubled up), with a self-aligning idler every 180 feet. The bottom, or return run, of the belt travels over straight rollers spaced every 14 feet. The belt line and belt drives were manufactured and installed by the Link Belt Company. The belts were manufactured by the Goodrich and United States Rubber Companies.

UNDERGROUND LAY-OUTS AND METHODS OF DEVELOPMENT

Since there are only two dump stations in the mine-- one at No. 7 and one at No. 15 seam--coal from the other seams must be handled at these stations. At the present time, only three seams are being developed: Nos. 7, 9 and 15; coal from No. 9 is taken down the manway and material slope to No. 15 and dumped there. As soon as the inside slope in No. 9 is driven far enough down the pitch, a motor road or slope will be driven through the rock to the No. 15 parting in order to expedite the handling of coal from No. 9. In the same manner, coal from the No. 1 and No. $7\frac{1}{2}$ seams will be handled through the No. 7 seam.



7 B. U. Joy Loader

In this early stage of development only four entries are being driven in each seam: a haulage way and a manway, with a return air course on each side. Inside slopes will be driven off the haulage ways up and down the pitch. These are known as planes. The 4-entry system will be carried out in these planes. At 350-foot intervals down these planes, double entries on each side will be turned off. These entries will be driven to the boundary line of the block of coal; then the retreat will be started by driving rooms up the pitch, 30 feet wide, with 30-foot pillars between. When a room is 300 feet up the pitch, the pillar will be mined and the room caved. Also the chain pillars between the two entries will be mined as the retreat progresses. Two conveyors are commonly used in one pair of entries, the outside shaker going up the pitch while the inside shaker is mining the pillar between the completed room and the caved area. This system of slopes is usually on 3000-foot centers. Slopes in the different seams are always placed over each other, when possible, with a 200-foot barrier pillar left on each side, and will be driven up the pitch to the outcropping to insure better air conditions. At the present time this new mine has about seventy-one million tons of coal reserves laid out for it. Approximately 85 per cent of this will be recovered.

Development work is being done with 25-horse-power Goodman shaking conveyors with Goodman duck bills, 5 B.U.



Car haul number seven seam--also showing
steel sets and Redwood lagging.

and 7 B.U. Joy loaders. Coal is either cut with 35-B and 35 BB short-wall Jeffrey cutting machines or Jeffrey arc Wall machine. Cars used to service these mechanical loaders are 4-ton, all-steel cars. When loaded, they are picked up by an 8-ton electric haulage locomotive and taken to the 40-car partings. There they travel down a .5-per-cent grade, where they are picked up by the car feeder which feeds them across a flat grade to the scale where they are disconnected one by one, weighed, and rolled down a 1-per-cent grade into a Card revolving dump on a .75-per-cent grade that is superimposed over the 25-ton hopper. The car is dumped and continues on a .75-per-cent grade until it clears the dump; there it strikes a steeper grade, where it picks up enough speed to make the kick back. From here it is picked up by the car haul and pulled up a 10-per-cent grade. There each incoming car pushes the string of cars down a .5-per-cent grade to the entrance of the 40-car partings, where it is picked up and taken back to the mechanical loader.

These 40-car partings are timbered with 20-foot steel sets on 4-foot centers and lagged with redwood. They are wide enough to accommodate two tracks, one for empties and one for loads. Due to the reverse grades of the two tracks, there is a grade separation of about three feet at the entrance of the partings.



Number seven fan house with head frame

AIR SHAFTS

Air shafts (12 by 16) have been sunk to the No. 7 and the No. 15 seams. Double-stage Jeffrey aerovane fans furnish the ventilation--a 9-foot-diameter fan for No. 7 and tributary seams, and a 10-foot-diameter fan for No. 15 and tributary seams.

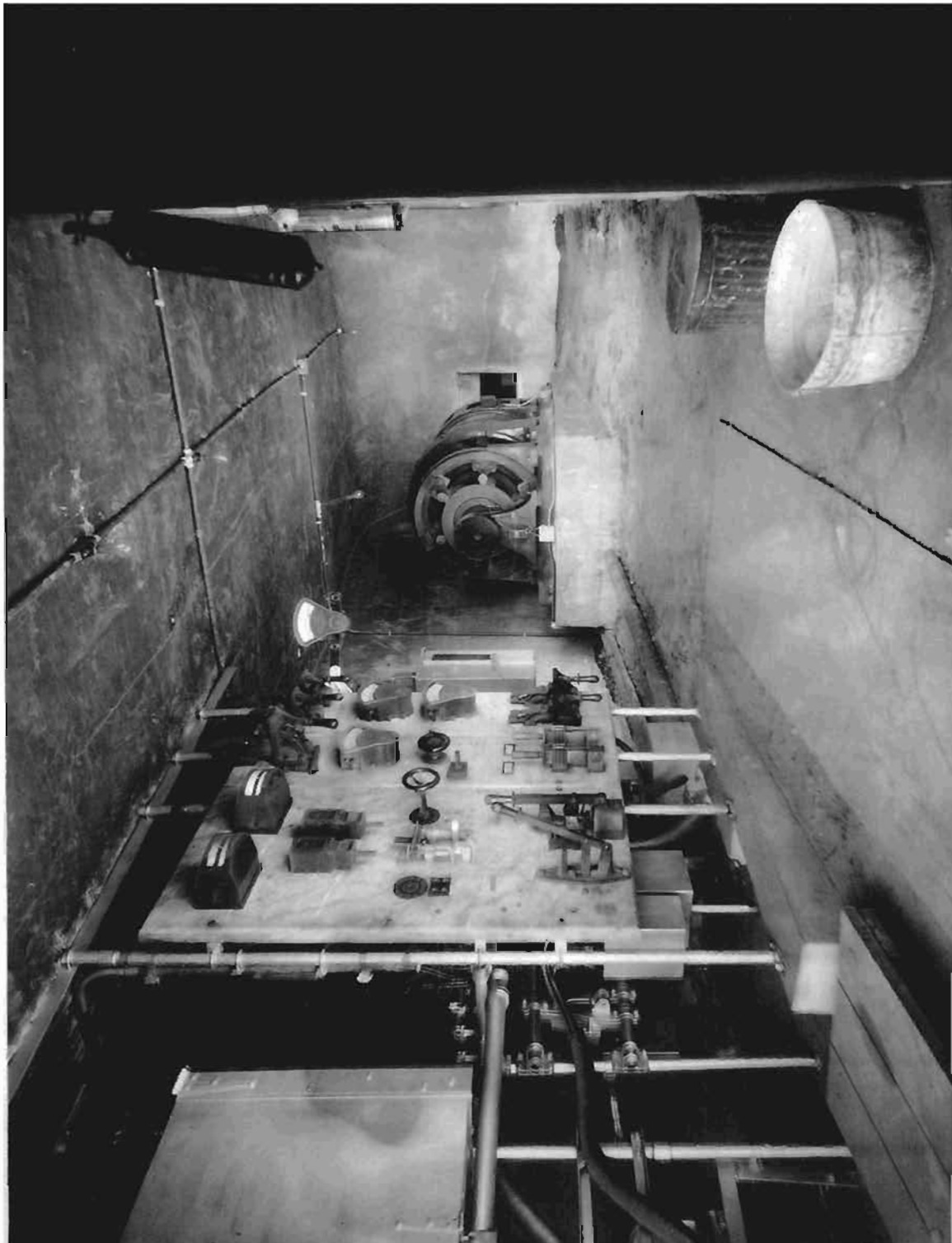
POWER

Thirty-three thousand A.C. current is delivered to a bank of transformers near the mine entrance from the central power plant in Rock Springs, Wyoming. Here it is stepped down to 2300 volts before it is taken underground. Conveyor drives used the 2300-volt, A.C. current.

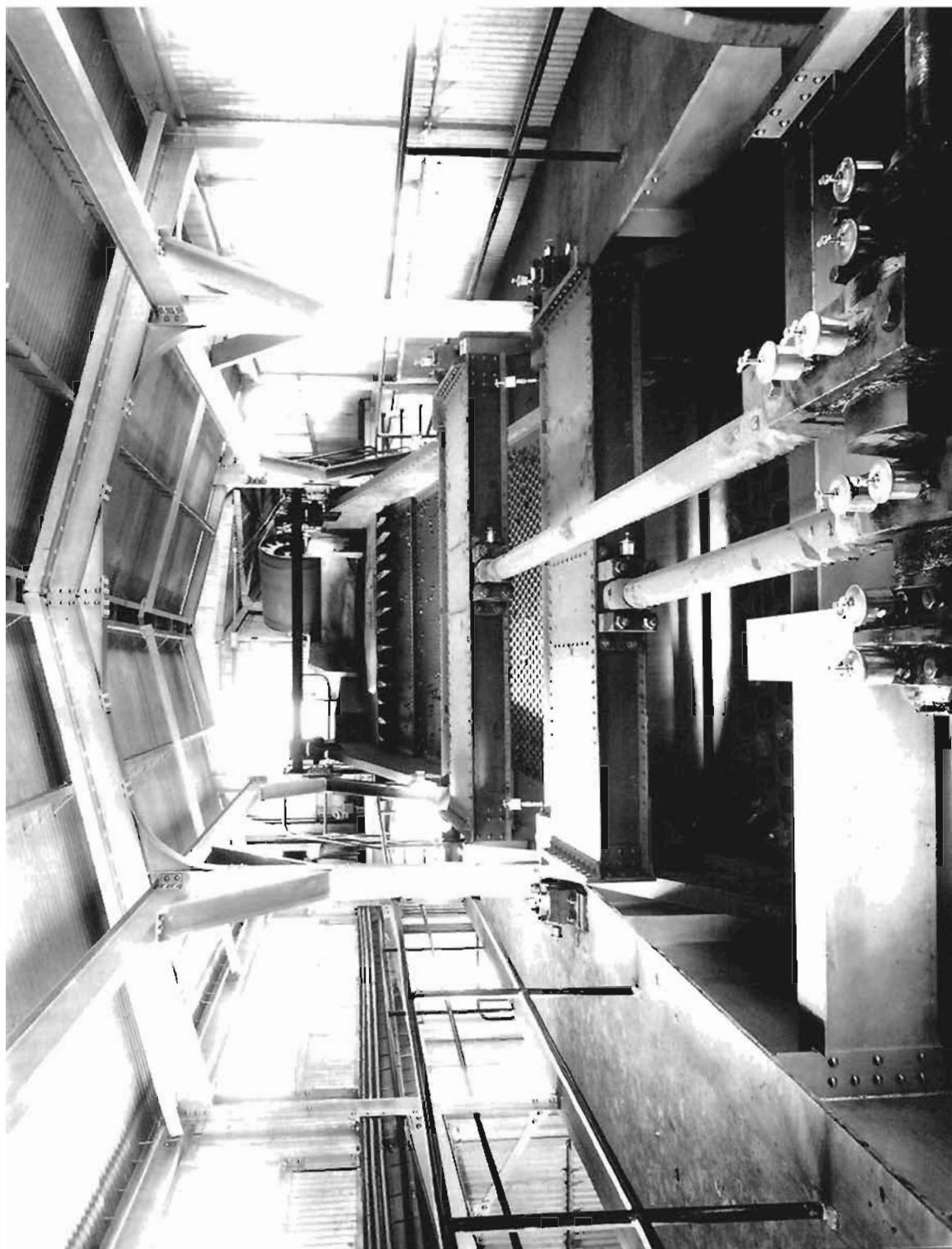
A motor generator set located in the No. 7 seam converts this into 250-volt, D.C. current for cutting machines, haulage motors, shakers, drills and pumps. Most of the tippie machinery operates on 220-volt, A.C. current.

TIPPLE

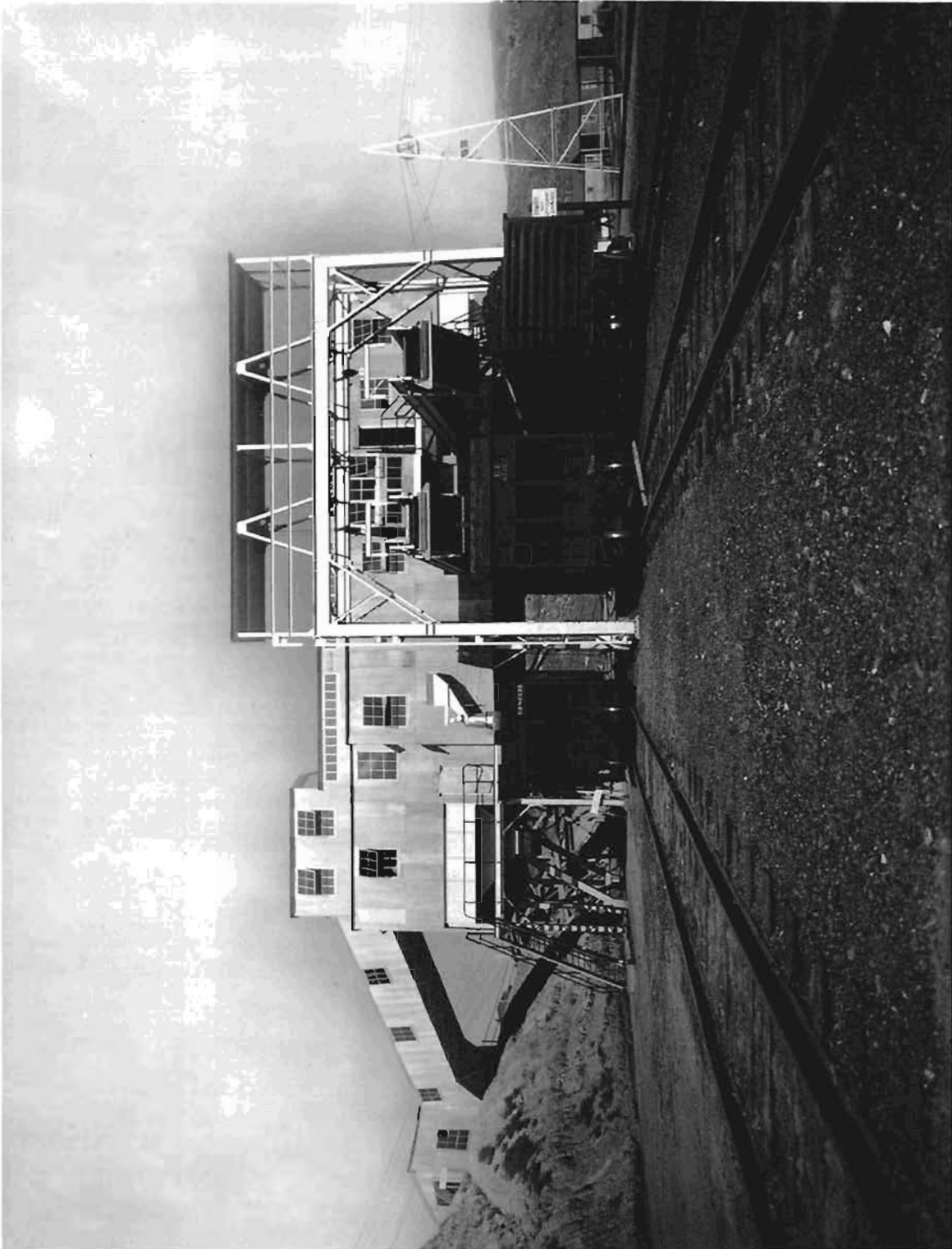
The conveyor belt dumping coal from the mine discharges over a 5-ton Dings magnetic pulley in order to remove tramp iron. The coal is screened over vibrating shaker screens into four sizes (minus 1-inch slack, $2\frac{1}{2}$ -inch by 1-inch nut, 6-inch by $2\frac{1}{2}$ -inch egg, and plus 6-inch lump). The coal passes from the screens over reciprocating picking tables. The slack can be loaded either separately or split, and part of it dropped



Motor Generator set room located underground in number seven seam



Shaker screens in top Galley of tippel
Magnetic pulley in background



D. O. Clark Mine tipple. Belt Galley on left.

into the mixing conveyor. Egg and nut are loaded over the same loading boom. Half of the lump is usually diverted onto a flight conveyor that takes it to the house coal bin; the remainder goes out on a separate boom. Usually, mine-run coal is desired for railroad use. In this case, all picking tables empty on to a mixing conveyor and are loaded over the lump boom. Refuse conveyors run along the floor and empty into a refuse bin at the end of the tipple. This is a 3-track tipple of reinforced concrete and steel, designed by Union Pacific engineers exclusively for railroad fuel, and constructed by the Allen and Garcia Company.

It can be truly said that Union Pacific officials have taken every reasonable step both toward safety and efficiency in operation of this mine. For years, it will stand as a fitting tribute to the present Union Pacific officials, as well as a memorial to Mr. D. O. Clark, first Executive Head of the Union Pacific Coal Company properties.