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BITUMINOUS COAL NUMBER

Featuring the operations of
THE UNION PACIFIC COAL COMPANY

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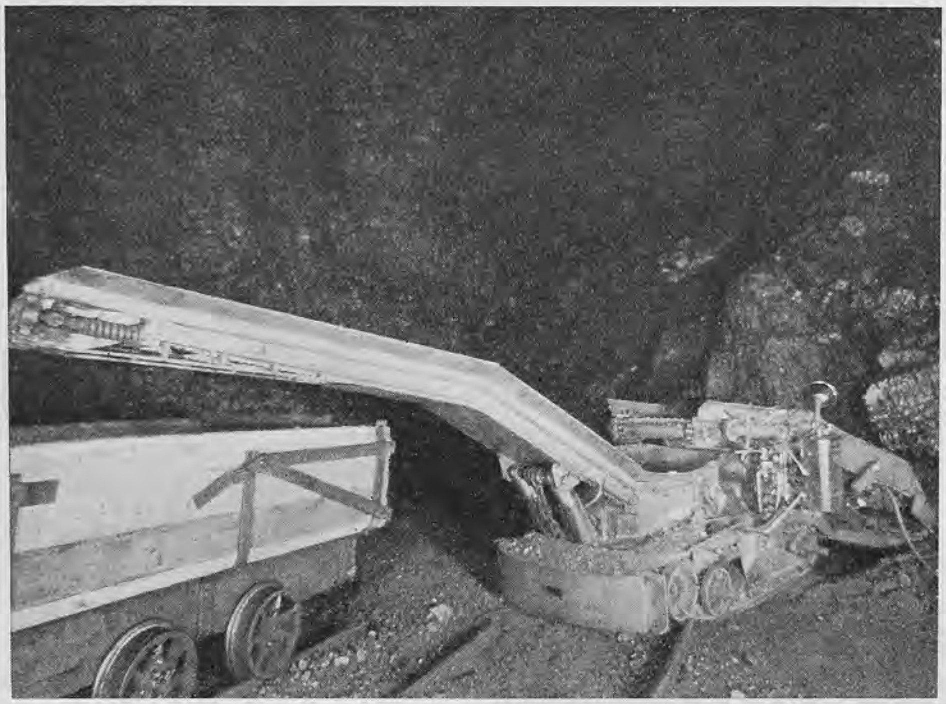
History and Development of MECHANIZ[A]T[ION]

Geology of field—description of mine and seam—early experiments with cutting and loading—present status including shop practice, handling material, and training men for mechanical supervision

THE HANNA coal measures lie entirely in the Tertiary Geological period, the measures containing coal being designated as the Hanna series. This series is composed of alternate layers of sandstone and shales all of which are very weak and not self supporting. The entire field is very badly faulted and in many cases has been subjected to severe folding and horizontal strains. This condition makes the economic mining of these measures very difficult on account of the large amount of rock tunneling required; also the rapid changes of pitch in parts of the basin complicates haulage and mine layout. The coal is lignitic in structure and of comparative weak compressive strength; this coupled with very rapid increase of cover makes the mining of lower measures very troublesome due to bumps and spontaneous combustion. While the middle portion of each seam is comparatively free from sulphur the upper bench in all cases contains free sulphur which causes spontaneous combustion wherever this top measure is broken.

Figure 1 shows a general cross section through the measures now being worked.

The No. 1 seam has been almost entirely worked out in the Hanna Basin and the present workings are now all in the No. 2 seam. This has a thickness of 32 ft. No. 2 mine has been working in this seam since 1889 and is almost worked out. No mechanical loading was ever attempted in this mine. No. 4 mine was opened in 1911 and was laid out for hand operations as no mechanical loading was contemplated at that time. Many millions of tons remain to be mined from this seam, however, and the plans at present are to mine this entire reserve by means of mechanical loaders of various types.



Showing chunks in top coal pile. 5 BU. Joy Loader

MINE LAYOUT AND DESCRIPTION

Figure 2 shows the mine map of No. 4 mine as of December 31, 1928. From April, 1911 to December 31, 1928, there were 4,462,169 tons mined and it will be noted that the present area covered by these workings is very small as compared with this tonnage. This gives one some faint idea of the enormous thickness of the deposit.

No. 4 mine was laid out in accordance with what was at that time considered good mining practice, and, for a standard hand operation of that day was quite satisfactory. Large barriers could not be left with any economy in the hand mining operations as yardage charges were always excessive in this field and

Sullivan cutting machine in pitching place

* Superintendent, Hanna Mines, The Union Pacific Coal Company.

ATION at HANNA MINES

By O. G. SHARRER *

progress was so slow that where large barriers were left the investment in entry development soon became excessive. Rapidity and cheapness of development now makes it possible to leave almost any reasonable size of barriers and these barriers due to the possibility of concentrating loading machines makes for a very economical operation when the retreat of a mine is started.

Haulage entries were originally laid out to care for comparatively slow haulage from hand loading and have not been suitable for the concentrated haulage necessary from mechanical loading. The plan of mechanical mining has been adopted to these conditions in so far as possible and the information gained will permit the planning of any new operations in such manner as to eliminate practically all of these difficulties.

No. 4 mine workings are cut by three major faults which necessitate the driving of an average of 700 ft. of double tunnel or approximately 1,800 ft. of single rock tunnel to get through them on each entry. This rock work has been very expensive and naturally the plan has been to cut these faults in as few places as possible. In each case a panel has been projected to work out each section of coal between faults and in some cases this has caused the rooms to be very long, in some cases over 1,000 ft. In low coal this would be very uneconomical but in this particular seam this method has worked out as an advantage for machine loading. Our experience to date shows that rooms work best when planned for a depth of from 800 to 1,000 ft.

Early Experiments with Machines of Various Kinds

When this mine was opened in 1911 no attempt had ever been made to undercut this coal by any type of machine and all coal was shot from the solid. This practice was very undesirable from a safety standpoint and also made a very poor quality of coal, particularly from narrow places. No chain machine of that date was successful in cutting pitching coal so that the first attempt to mine this coal was by means of a Radialax post puncher. This machine cut in the top and made a very good job of cutting but was very slow and also was subject to all known kinds of mechanical and electrical failures; this coupled with the fact that the miners did not take kindly to any kind of mining machine made the successful operation of these punchers very difficult. After a long trial period and much grief the machines finally worked well enough to make a fairly good entry driving machine and were worked until they were worn out.

At about this time, 1912, the Sullivan Machinery Company had developed their CE7 machine to a point where they could recommend its use in pitching seams and two machines of this type were purchased. When one sees how easily the coal is undercut today they can have no idea of the difficulties encountered when these machines were introduced. Practically no data was then available as to bit shapes, chain lacing or speed and we had no idea of what type of feed would be necessary to cut this coal. We had no machine runners and runners imported from other fields knew nothing about cutting pitching coal.

We had not the faintest idea of what to expect from these machines and the rank and file of miners were, as usual, opposed to their installation. All in all the introduction of chain machines for undercutting presented a much more difficult problem than the introduction of loading machines at a later date. We learned to operate these machines by tearing them up and rebuilding them until everyone around the plant knew every piece of a Sullivan CE7 by sight and knew just where it went and why. Our own men finally learned how to cut our coal and from then on machine undercutting has given very little trouble; in fact, the cutting has become so simple a step in the entire operation that we are prone to forget that we ever did have any trouble from this source.

When the undercutting of the coal was finally successful the ground was then prepared for the introduction of a loading machine if such machine had at that time been available. However, at that time, 1914-1915, no loading machine was even contemplated for men were plentiful, labor was cheap and tonnages could be maintained easily without recourse to additional machinery.

Changing conditions in 1915 due, in some part, to the World War, caused a labor shortage that made urgent demand for some sort of mechanical aid to production. Much thought and study was given to the possibilities of various coal and rock handling devices but no machine which primarily designated for such service was then available. After a very extended study of the entire subject it was found that the small Thew shovel was apparently the only machine

that had been developed to an extent that would justify its introduction.

Thew shovels were therefore purchased and put to work in 1916 in an experimental way. This shovel could work very easily, as heights of 26 ft. were easily obtainable and the problem of sufficient clearance did not enter into the operation.

No one ever seems to be lucky enough to hit the correct solution of a problem the first time it is attempted and the first attempt to load with the Thew was rather stupid when viewed in the light of our later experience. We could not vision taking a portion of the seam and leaving top coal for the Thew operation, so an attempt was made to take a full face of about 20 ft. and cut and prepare Thew coal the same as for hand loading. Cutting and blasting this face of coal proved to be impossible as the face was so high drilling could not be performed in any safe manner and the cutting machine was under a tremendous handicap as it was quite frequently covered up by the face turning over.

After a very short period of experiment with the full face the Thews were put loading top coal from places where the bottom 7 ft. had been taken out by hand miners. This worked out very well and the Thew operation has been changed very little since that time.

First successful loading with Thews started in the latter part of 1916 and the various difficulties of blasting, car service, and maintenance were gradually eliminated. The hardest problem to solve for Thew loading was the proper blasting of the top coal so that the coal would not come down in lumps which the Thew could not handle. This still

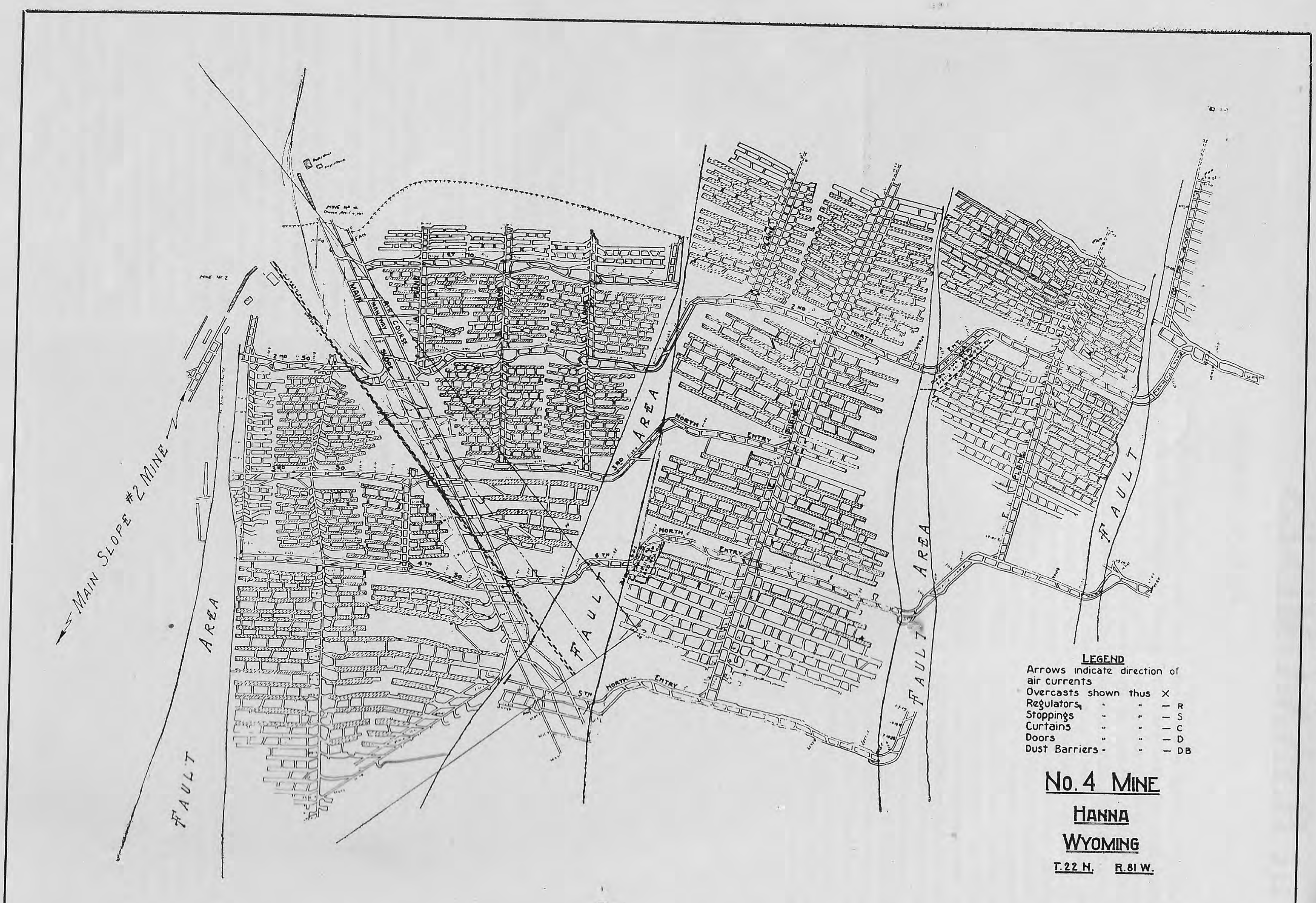

LEGEND
Arrows indicate direction of air currents
Overcasts shown thus X
Regulators " " — R
Stoppings " " — S
Curtains " " — C
Doors " " — D
Dust Barriers " " — DB
No. 4 MINE
HANNA
WYOMING
T. 22 N. R. 81 W.
MAIN SLOPE #2 MINE
FAULT AREA
FAULT
FAULT AREA
FAULT
FAULT AREA
FAULT
FAULT AREA
NORTH ENTRY
NORTH ENTRY
5TH NORTH ENTRY
2ND NORTH
2ND SO.
3RD SO.
4TH SO.
MAIN SLOPE

FIGURE 2

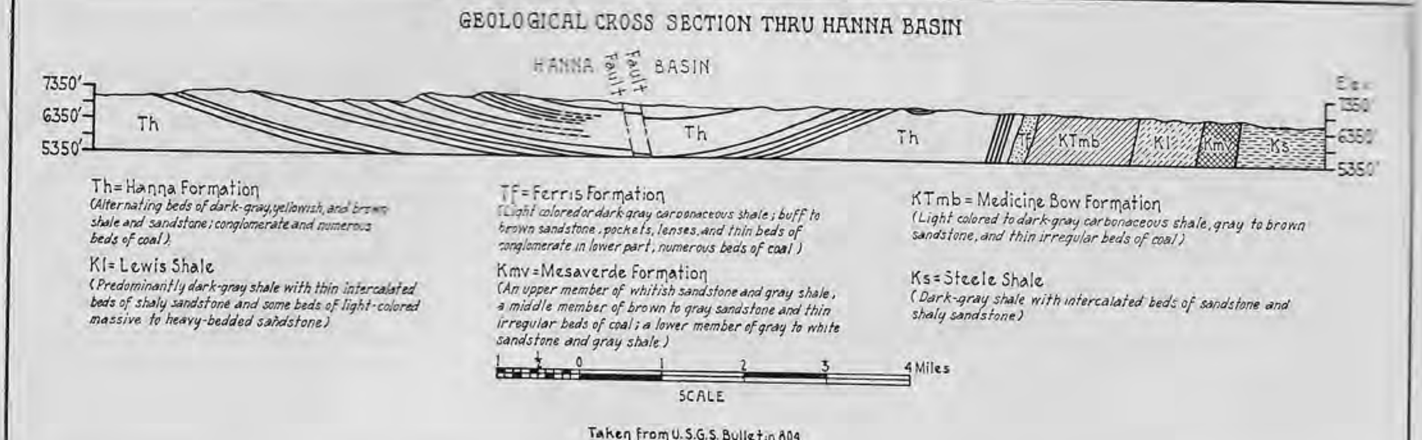


FIGURE 1

presents some difficulty but a careful study of placing of holes and different kinds of powder has cut this source of delay to a negligible factor. When the Thews got underway it was soon found that rooms could not be advanced rapidly enough by hand methods to keep the Thews in continuous operation and a search was started for a machine that would advance the rooms in the bottom bench rapidly enough to keep the Thew shovel in continuous operation. The Joy 5-BU has proved to be the answer to the room driving question and since their installation the Thew shovels have had a continuous supply of coal.

No. 4 mine is now operating at practically 100 percent mechanical loading. The only hand loaded coal being track clean-up and some coal from room necks to allow the Joy to get in the clear of the panel. With the shaking conveyor all of this room neck coal is being loaded mechanically which leaves only the track cleanings to be loaded by hand.

This mine has proven that 100 percent mechanical loading is not only possible but that it is the most economical method by a very large margin. Every kind of place can now be loaded out by some type of machine and at much lower cost than by hand methods.

Shop Practice on Maintenance and Repair

The maintenance and repair of the large amount of machinery needed in a mechanical mine requires a much more elaborate shop equipment than is customary at a hand plant. Loading machines are quite complicated and require high calibre mechanics to repair them. Hanna shops are equipped to handle almost any kind of machine work and in addition have a complete welding shop. Both electric arc and acetylene are used and the tendency is to use electric or acetylene welding to replace all riveting and press fits. Worn parts are built up with the electric arc or remachined to proper fits with a great saving of cost.

The machine shop is in charge of a master mechanic who also has charge of methods and practices in underground repair. The electric shop is in charge of a chief electrician who also directs underground electric repair. All armature winding and motor repair is done in the local shop which requires that it be well equipped to care for the variety of work that must be handled. Electric power is generated locally and the master mechanic has charge of the boiler room and all steam using machinery. The chief electrician has charge of the turbine room and all electric equipment. The master mechanic and chief electrician keep in close touch with the inside mechanical loader foreman so that they are always informed concerning needed repairs.

In almost all cases complete assemblies for the various units are kept in readiness at the main shops and when they are needed underground, the inside loader foreman gets into immediate communication with the main shop and the part needed is sent by truck and gets into the mine with a minimum of delay.

Handling of Material

The carrying of exceptionally high priced repair parts for mechanical loaders runs the material balance up beyond the amount necessary in hand mining. If the material balance is not to get out of line a very careful check must be kept of this department. When a machine is starting out, naturally, one can not tell what repair parts are necessary and the tendency is to carry an excess of repairs. However as the machine works into form it is found that a certain number of parts are subject to failure; these parts must, of course, be carried in stock but only one of each is necessary as replacements can now be obtained in a comparatively short time.

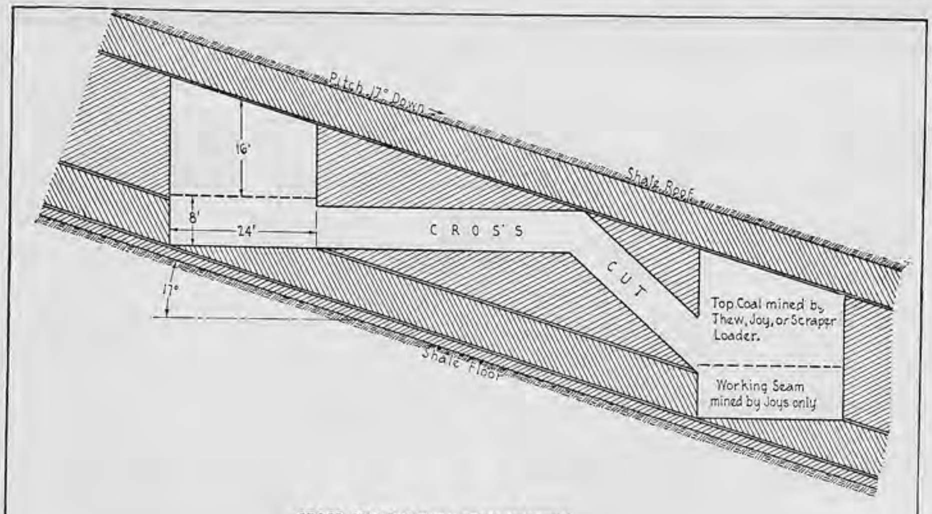
The practice at Hanna mines at the present time is to carry a replacement for each part that breaks frequently, only one part being carried in each case. When this part goes out to the mine the material clerk places another on requisition, this affords protection from delay at all times and does not require a heavy investment in idle material. With proper shop equipment many parts can be reconditioned and made as good as new. The greatest saving in this respect can be made through proper use of electric and acetylene welding.

Material charges are a considerable item in the unit cost of machine units and requires very close attention. The present method of cost accounting shows the material charges for each unit and for each shift. This permits a check on material used every day and prevents the cost from getting seriously out of line.

Training Men for Supervision of Mechanical Loading

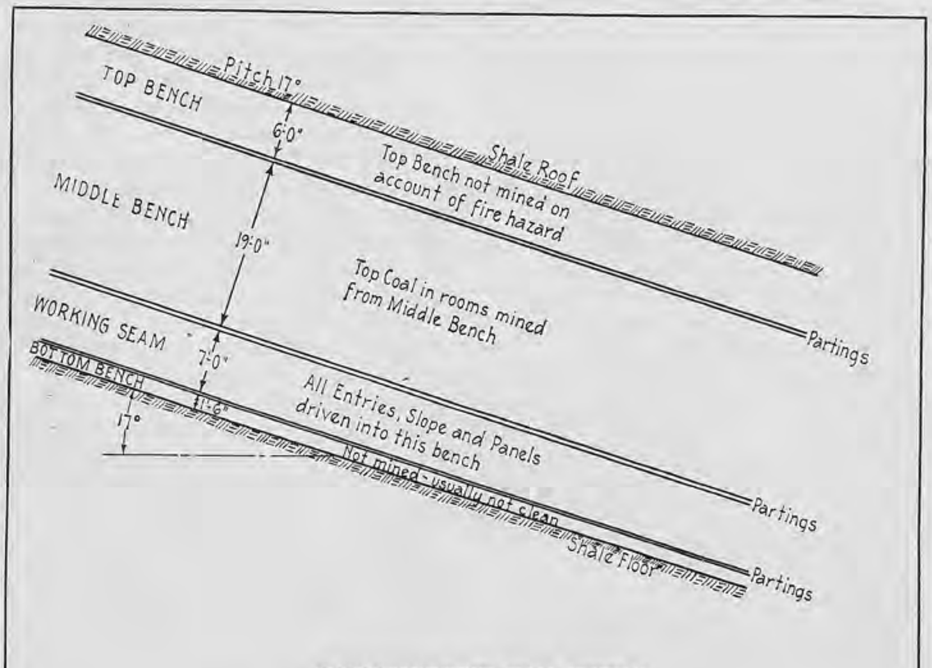
A mechanized mine requires an entirely different kind of supervision than a similar mine operated by hand. In hand operations the supervision consists almost entirely of what one might call personal relations, that is, the contact is with the individual miner, and the official that has the gift of "getting along with men" is almost invariably successful. In a mechanized mine the problem is much more complicated, for while the personal problem is more difficult, in addition, there is the problem of supervising the operation of many machine units.

The old-time underground official prided himself on his knowledge of human nature and his ability to handle bad roof, gas, etc., but left the handling of any mechanical problems to some other party. He was not particularly interested in machinery and did not consider a knowledge of its operation as being essential to holding down his job. A knowledge of ventilation, gases, etc., is still essential in a modern mine but



CROSS SECTION THRU SEAM ON PITCH
SHOWING POSITIONS OF PANEL ROOMS

FIGURE 3



REPRESENTATIVE CROSS SECTION
OF
NO. 2 SEAM
HANNA, WYO.

FIGURE 4

this knowledge alone is not enough. In addition to the old line mining technique the modern mine official must have a general knowledge of the various machines in his charge. He must be "machine minded" to the extent that he sees his mine in complete relation to the machine and not as a separate unit.

In the first inception of machine loading this situation was understood and the immediate solution of the problem was to allow the old line mine foreman to have charge of the ventilation, safety, personal relation, etc., and the machines were put in charge of another man who had charge of their operation. This was the only solution possible at that time and is true to some extent even now for there are not enough machine-minded foremen to take charge of all mechanical mines.

Any system, however, that leads to a division of authority and responsibility is not proper and can not long survive. A coal mine during the operating shift resembles a ship at sea, the mine foreman taking the rank of captain, and when a ship leaves port the captain has absolute authority over every one on board, even the owner of the vessel having no authority to issue orders. The authority of the mine foreman should be as absolute as that of the ship captain but in order to exercise this authority the foreman must represent the very best of his profession. In order to be able to exercise this absolute authority over all men in his charge the foreman must have a general knowledge of all the various phases of the operation to such extent that he can intelligently direct all of his subordinates. This does not mean that he must be an expert electrician, for instance, but that he should have the general knowledge of electricity that can be acquired by any layman who is interested enough to give the matter some study.

In many cases the older foremen were lukewarm or even actually opposed to machine loading and naturally the new methods could not succeed until they were replaced by men having a different attitude of mind. This led in many cases to the promotion of young men from the ranks of motormen and chain machine runners, these men never having given much thought to the position of foreman. Some of these men have been very successful while others have failed but the experiment as a whole has proven that men who come up through the positions of machine runner, loading machine operator, machine boss, etc., make the best foremen for a mechanical operation. In the past men of this kind were not obtainable but as mechanization grows older there is an ever increasing number of young men who have grown up with machines who are available for official positions. Some success has been attained by taking graduates from the mining schools and training them directly as mine officials, however, in this connection there is no more reason to expect a mining engineer to become a successful official merely because he has a diploma than to expect a good machine runner to be a success. The factors of personality, honesty, and dependability which are so essential in an official are not the product of a college but are traits inherent to the man himself and are just as liable to be the property of a good timberman as of a college graduate.

There are never enough good officials to fill all jobs so it is one of the duties of management to be ever on the alert for possible talent. A man suspected of having ability along this line should be observed very closely and when an opportunity arises should be given a chance in minor capacity. He should not be petted or pampered in any way, in fact, his treatment should be fairly severe in order to find out if he is the type that can stand punishment. When a man gets a (*Continued on page* 127)

just cleaned, load out the rock that has been gobbed, cut, drill, and shoot the face. The Joy is pulled back well above the fall before shooting. Steel ties and 20-lb. steel are used for advance track work, and this is relaid with 40-lb. steel every 75 ft. gained.

In 15 months of operation with two Joys, 1,500 ft. of slope and 1,200 ft. of crosscuts and entry turnouts have been driven. A reduction of 50 percent in the cost has been effected between mechanical operation in this work and hand labor paid on a scale basis. The only difficulty in the maintenance of these machines was found in keeping the clutch on the gathering head in working order. This was remedied by shortening the picks until they barely cleared the edge of the loading head, so they could not catch in the solid face.

As soon as new entries are gained by the progress of the slope, shaking conveyors with duckbills are installed and double-shifted. Four men comprise a conveyor crew in this operation, three men at the face, and one at the loading end. This crew carries out the entire cycle of cutting, drilling, shooting and loading, a certified shot-firer working on each crew. Twenty-eight ft. is an average advance for a double shift in this work.

In the 35-ft. rooms driven up the pitch, the crew consists of five men. A machine man, helper, ratchet man, face man, and a man at the loading end. Assuming a full fall of coal to be at the face, the cycle of operation is as follows: the duckbill is swung over to the right hand side of the room and the loading started. As soon as the right side is cleaned of coal, the machine man and his helper sump in and follow the duckbill across the face, drilling as they cut. When the duckbill reaches the left-hand corner of the room, and the entire face is cleaned up, it is detached from the panline, and pulled back across the face of the room by the mining machine. A 6½ or a 13-ft. pan, as the case may be, is attached to the end of the panline. The cutting machine is pulled back to the right-hand rib of the room out of the way and the line of props extended. The man at the loading station, having prepared the powder and tamping, disconnects all power lines to the face, brings up the powder, and loads, tamps, and shoots the face. The loading process again starts in the right-hand corner of the room. One hundred and eighty tons. for a double shift, is the average in this work, although a record of 270 tons has been made.

It has ever been the desire, to work out some scheme whereby all the coal, or as much of it as possible, can be extracted at the first mining. For this purpose a long face method has been developed and is being worked successfully. (*See Sketch "A".*) This has also proven advantageous in handling the roof in sections where bad top is encountered. The procedure is as follows:

A 16-ft. plane is driven up the pitch to the breaking entry above, using a Cosco conveyor as in room work. However, the drive is set cornering the longface block to be mined. The duckbill is then pulled down to the bottom of the plane, the 300-ft. face on the right undercut from top to bottom, and props set 3½ ft. from the face, with a 3-in. plank barrier nailed to the prop line opposite that part of the face which is to be shot down. This is done to prevent the coal from scattering amongst the props.

The crew consists of four men on the day shift and two men on the night shift. The day men are the duckbill operator, a timberman, and two face men, whose combined duty it is to load out the coal. The night shift is composed of a machine man and helper, who do the cutting, drilling, shooting, and the deadwork.

About 100 ft. of face at the lower end of the block is then shot down. The duckbill is turned into this and the loading commenced. Usually three loading shifts suffice to clean up the 300-ft. face, about 150 tons being the average daily output. The pans used in driving up the plane are left in convenient positions where they may be readily picked up and used again in the line as it advances up the pitch. The pan line is kept far enough from the face to allow room for the cutting machine to follow up the loading. Pan changes require from 3 to 10 minutes, quick connectors being used. Turns are made by the use of swivels held firmly in place by bridle jacks. A small hoist is set in the breaking entry above for the purpose of pulling up the duckbill when pan changes are necessary. Thus an 80-ft. block is mined with one setting.

While this block is being mined a second conveyor is engaged in driving up the plane in the next adjoining block. When the long face approaches to within about 10 ft. of this plane, it is considered finished, a 10-ft. sacrifice pillar being left to protect the next plane. The first conveyor is then removed and installed two blocks ahead, and the second conveyor starts on the long face off the plane it has just driven.

Thus. mechanical loading has been developed in this mine to a point where a dependable tonnage is maintained, and a substantial saving in cost effected.

MECHANIZATION AT HANNA

(*From page 108*)

a start in a minor official capacity he should be provided with every opportunity to better his education.

The Union Pacific Coal Company has night schools for all employes during the entire winter in which any subject concerning mining can be taken up. These schools are taught by engineers from the chief engineers department and by the operating officials. Frequent staff meetings and meetings of local mine institutes affords every official the opportunity of broadening out his knowledge of mining.

The human side of mining is still the most important and the selection and promotion of officials is a field of almost unlimited possibilities. The mine superintendent who can select and train the proper kind of underground officers need not worry about his machines or his costs for his gang will take care of such things for him.

MECHANIZATION AT ROCK SPRINGS

(*From page 121*)

by the loading point as desired. The tracks on the haulage entries are laid with 20-lb. rails, and 4-ton electric locomotives are used for hauling the coal from the sidings or partings to the slopes.

The tracks on the slopes are laid with 60-lb. rails, and the coal is hauled from the sidings at the slope up the pitch to a landing station by electric hoists, equipped with motors ranging in capacity from 150 to 250 hp. The main haulage entry from the top of the slope to the outside has an inclination of about 1 percent in favor of the loaded trips, and the track is laid with 60-lb. rails. A 15-ton electric locomotive is used for hauling the coal from the landing station to the tipple, a distance of approximately 6,000 ft., 50 pit cars being hauled to the trip, approximating 100 tons per trip. The tipple is of wooden construction, equipped with rotary dump, a three-track shaking screen, and has a capacity of 3,000 tons in eight hours. The pit cars are of the solid body type, of steel construction, capacity 4,500 pounds level full, the track is 36-in. gauge. Slate pickers are employed on the shaking screens and on the railroad cars, and the coal is prepared reasonably free from slate or bone.

The coal seam in the mine referred to is normally 8 ft. in thickness and pitches approximately 8 degrees. The seam is free from bands or impurities, with the exception of a rock band about 18 in. from the roof, which varies in thickness from 1 to 3 in. The roof directly overlying the coal seam is of hard shale, of which is also the floor directly underlying the coal seam. The headings and conveyor ways are driven a height of 6 ft. 6 in. under the rock band, and when the blocks and pillars are won the 18 in. of top coal is recovered. The working places are dry, and the amount of water encountered is not more than sufficient to keep workings in a damp condition.

MECHANICAL Operation at Hanna Mines

By J. V. McClelland *

Descriptions of operations with large electric shovel, mechanical loaders, rock shovels, scrapers and conveyors—Mechanical loading on 100 percent basis—Slope driving in heavy pitch and thick coal—Description of drainage and ventilation

THE Union Pacific Coal Company's Hanna mines are located adjacent to the town of Hanna, Wyo., which is on the main line of the Union Pacific Railroad about 135 miles west of Cheyenne.

Mechanical loading in the Hanna No. 4 mine dates from January, 1916, at which time the first Thew shovel was put into operation. Another unit of similar type was installed in July, 1917, and during 1918 two more shovels of the same make were introduced. Two of these loaders are still in operation. The Thew shovel is an electric driven machine of the swinging boom type similar to those used in strip pit mining or railroad grading work. Since these shovels require a minimum of 15 ft. overhead clearance their use in underground mining is prohibitive in ordinary mining operations. Only the very unusual conditions of roof and height of coal prevailing in the Hanna mines, when the seam is 32 ft. thick, makes their use possible.

Results obtained with Thew loaders showed that mechanical loading could be carried on successfully in the Hanna mines providing the proper type of equipment could be obtained. To carry out this policy of mechanizing the mines two Joy loading machines of the 4-BU type were installed during 1923. Results obtained with these machines led to the installing of more of the same type during the years 1924 and 1925 until 12 of these loaders were in operation. These machines were only partly satisfactory as they were not built heavy enough to withstand the hard usage to which they were subjected. The 5-BU type of Joy loader was introduced in 1928, and were so far superior to the smaller type that the number of machines was increased until at present there are seven of these in operation. The 5-BU type is of heavier construction, and is better adapted to Hanna conditions.

In line with the Union Pacific Coal Company's policy of mechanization it became necessary to install some type of loading machine suitable for entry driving. To this end an Eickhoff shaking conveyor was installed in 1927. This conveyor was equipped with a "Duck-Bill" at the front end to eliminate shoveling on the pans. This "Duck-Bill" was designed by the Rock Springs Loader Co., and has proven very satisfactory. About 90 percent of the coal is loaded without shoveling by using the "Duck-Bill" and swivel pan arrangement. At present there are two of these units in operation and are used for driving panel planes to the raise on a pitch of from 12° to 15°. Experience shows that the shaking conveyor is capable of advancing these planes about 400 ft. with one setting of the drive. As these conveyors advance up the pitch some means of handling the coal from the end of the conveyor must be provided. In order to avoid installing hoists to supply cars to the conveyor a very practical auxiliary conveyor has been built by the resident master mechanic. This is a "button conveyor" with a series of "buttons" each two inches in diameter and two inches long fastened on a ⅝-in. steel hoisting rope. This runs in a 16 gage galvanized iron trough. The drive for this conveyor is a small hoist with a grooved sprocket riveted on the drum driven by a 20-hp. motor. The shaking conveyor discharges into a bin through which the button rope passes, thus conveying the coal to the loading station on the entry at the foot of the panel. The present "button conveyor" is about 1,400 ft. long, and has proven a very efficient installation.

In order to determine the loading machine best adapted to Hanna conditions a type of scraper loader was introduced in 1926. The motive power for the scraper is derived from a double drum hoist manufactured to Union Pacific Coal Company specifications by the Vulcan Iron Works, of Denver, Colo. Two types of scrapers are used, one of the open end box type of company manufacture, and another of the Sauerman "Crescent" type. The use of scrapers is limited at Hanna to the loading of what is known locally as "top-coal." This top seam is about 19 ft. in thickness and is removed by second mining. The operation of scrapers is not continuous at the present time, but are used only when maximum production is required.

Another type of loading machine, known as the Butler shovel, is also used in Hanna No. 4 mine. This is an air-driven machine and was adapted from the metal mines for rock work. The presence of a series of faults in the Hanna seam necessitates the driving of rock tunnels at fairly regular intervals, hence the need for a machine of this type. Air is supplied by Sullivan compressors, Type WK, size 10 in. by 10 in., installed at locations convenient to the operations of the shovel. The machines are well adapted to the work, have low maintenance cost and are an economy on account of labor saving. No attempt has been made to load coal with this machine, as the supplying of air is not convenient for any extensive operations.

Mechanical loading is now on practically a 100 percent basis. The only coal loaded by hand coming from room necks being opened up for Joy loaders. At the present time the No. 4 mine is producing 1,700 tons of coal per eight-hour shift, the average production per unit being: Thew shovels, 200 tons; Joy loaders, 215 tons; and shaking conveyors, 55 tons. In the use of shaking conveyors for development work it is of more importance to obtain yardage than high tonnage. The scraper loaders when

* General Inside Foreman, The Union Pacific Coal Company.