COAL AGE

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John M. Carmody
Editor

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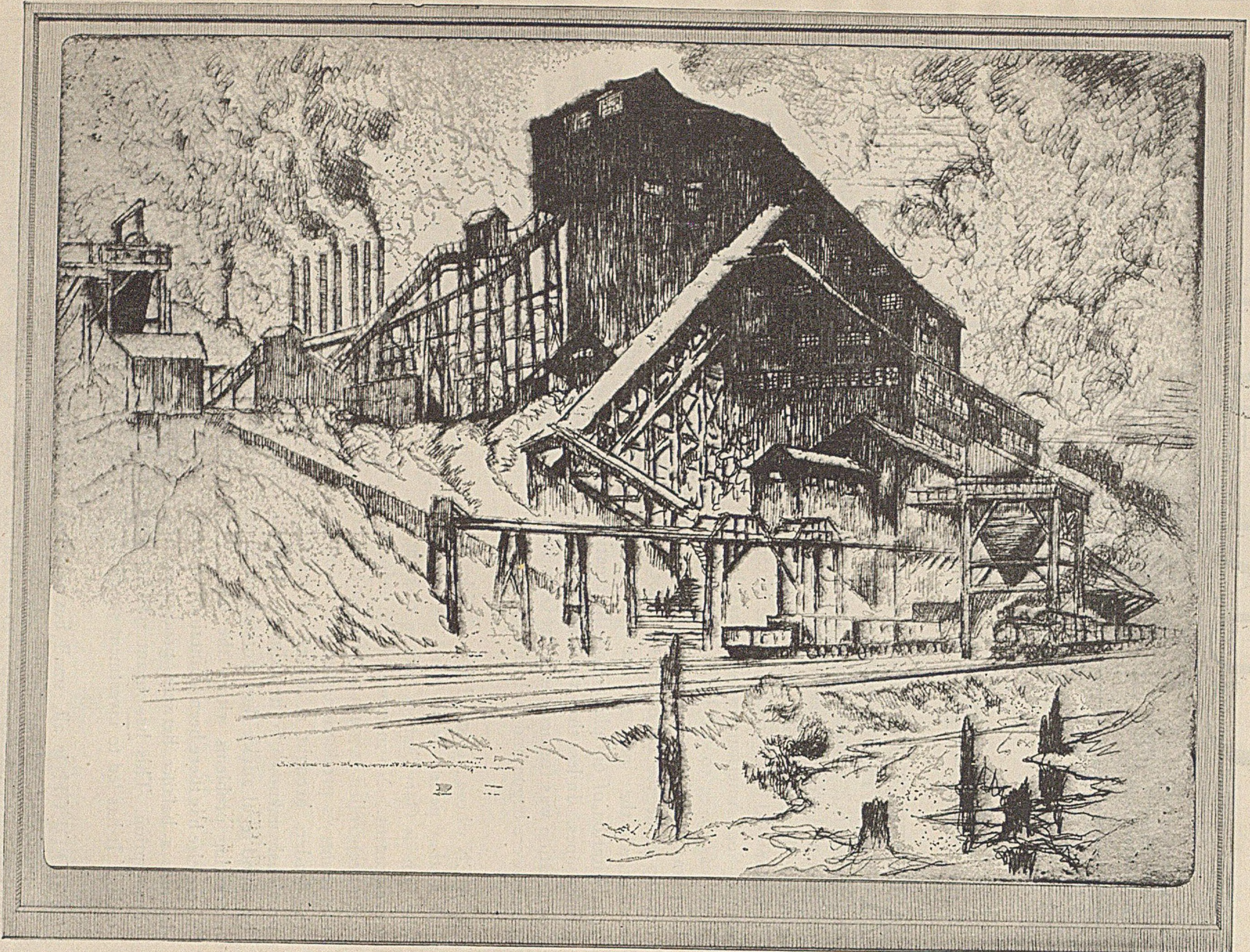
An Approach to STABILITY

A GENERATION ago when Carnegie, Frick and Phipps were laying the foundations of their success and their fortunes, the iron and steel business was more disorganized than even its worst critics would claim for coal today. Out of the bitterest competition American industry has known birth was given to the United States Steel Corporation. Immediately there began to develop a degree of order that not only revitalized the industry but led to the rehabilitation of old plants and the creation of new ones. In less than ten years after the corporation was formed the great Gary steel plants were begun and built out of earnings.

MEN whose industrial life coincides with that period recall what an influence the famous Gary dinners had on this entire development. No member of the informal group controlled as much as fifty per cent of the country's production, yet the vision of the leaders brought a degree of stability previously unknown in the industry. Guided by sound legal advice they worked out their marketing problems within the law. Nowhere else has there been maintained so intelligently a balance between production and consumption. This has meant stability and order. It has led to investment security.

THROUGH it all, small business has prospered. Even in periods of slow demand when the temptation to get all the business going must have been strong, heads were kept cool and prices maintained at a live and let-live level. Many times a price war would have eliminated small competitors. A wiser policy prevailed. In the end they all prospered. Under the leadership of the United States Steel Corporation, not only have plant and equipment been kept abreast of modern scientific enterprise, but provisions for safety and housing have advanced rapidly. A hazardous industry has been made comparatively safe. Housing facilities for employees, unknown a generation ago, have been provided in scores of communities. Modern cities of from 5,000 to 60,000 inhabitants have risen about steel mills. Pension systems and stock ownership plans have been developed and fostered.

THERE is something in this story for the coal industry to think about. Without coal not one ton of steel can be made. Coal is the life blood of industry. It should share in every wave of prosperity. Why does it not do so? Why is coal so frequently sold without profit to those who own it, or mine it, or sell it? It is for those who do it to answer to themselves and to others in the industry who suffer because of this practice. Obviously, scattered effort by too many small units cannot save the industry. It has been tried for years. Organization and co-operation have shown the way in other industries. Why not in the coal industry?



Courtesy Metropolitan Museum of Art.

The Artist Finds Romance in the Preparation of Coal

DISPATCHING *Gets Results*

At Nemacolin

W. H. Gates
Superintendent, Nemacolin Mine, Buckeye Coal Co., Nemacolin, Pa.

Alphonse F. Brosky
Associate Editor, Coal Age

VISITORS at the Nemacolin mine generally like to linger a bit in the underground office of the transportation dispatcher. Here they see a wide-awake young man equipped with the paraphernalia of a telephone operator, seated at a desk, to the left of which, within convenient reach, is a switchboard. He is all business. Spread out before him is a dispatching sheet on which he enters penciled figures with his right hand, and at intervals plugs, with his left hand, connections on the switchboard with one or another of 61 underground telephones, while he listens or talks to someone at the other end of the line.

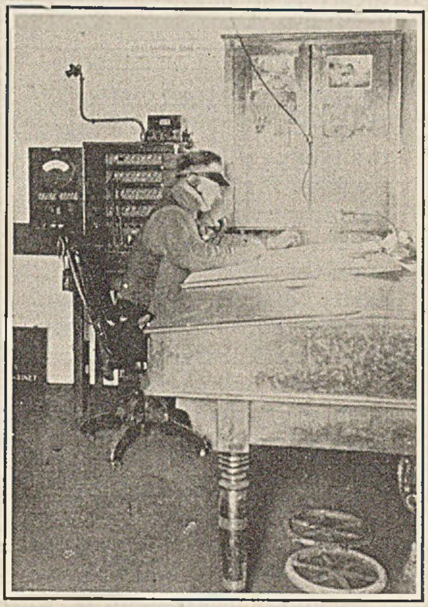
Most visitors express astonishment at the dispatcher's command of accurate information regarding the location and movement of every locomotive, together with the number of empties and loads at various points in the mine. In this he is aided by the tabulated record on the sheet before him, which he keeps balanced up to the minute for ready reference. They marvel at the speed with which he decides questions of dispatching strategy. Standing in the door-way they may have heard one side of a telephone conversation similar to the following:

"Well! Ninety-one? Yes sir! Both finished. [Pause.] Why, Ninety-one has been gone 15 minutes. Ninety has been gone 50 minutes."

INTERPRETED, this conversation is an answer to an assistant foreman who telephoned as to the whereabouts of two gathering locomotives assigned to his section. The dispatcher told him these locomotives had finished up for the day, and exactly when they had ceased hauling.

Again, visitors may have heard this:

"Hello! No, not yet, Andy! No more trips today. What? [The dispatcher pauses and figures up.] Coal 180 and slate 17. [He pauses again as if listening and figures with lightning-like speed.] Delivered 214 empties today."



"Hello! Ninety-One Is Due in 11 Minutes."

Andy, an assistant foreman, wanted to know the record of his section for the day and was enlightened thereon before he had hung up the receiver.

The dispatcher neither wastes breath nor minces words. He gives out information and issues orders in few words with staccato accent. He must function with deliberation for the sake of accuracy, and yet with speed because individuals other than the man to whom he is talking might be waiting to communicate with him. He is compelled to clear his lines promptly not only in preparation for the next incoming call but also to allow himself time for balancing the figures entered on the sheet during his last call.

Nemacolin mine is in a large tract of Pittsburgh seam coal, 96 in. thick, and is now producing about 6,000 tons a day by a concentrated block system of mining. The practice is to require each miner to clean up his face every day. Practically the entire length of the main haulway is double-tracked, as are also the principal flat entries from which room entries are turned. Within a radius of about ½ mile of the hoisting shaft, where traffic congestion would be most likely to occur, grade crossings are eliminated and bridge crossings used. Where tracks cross each other on grade, Nachod automatic block signals showing red, orange and green lights are installed. As already indicated, all haulage is regulated by a dispatcher through an elaborate telephone system.

THERE is no job requiring more constant and alert application to duty at Nemacolin than that of this dispatcher. Since loaded and empty trips for the most part travel over individual tracks, getting the trips to and from the side tracks generally occasions him little worry. It is the proper pro-rating of available empties between various sections of the mine, in order that progress in the clean-up may be kept as nearly uniform as possible, that taxes his resourcefulness. He has no control of the speed with which cars at the faces are made ready for the return trip to the shaft bottom. That responsibility rests entirely with the foreman and his assistants. But he is given the responsibility of promptly replacing loads with empties. Equitable distribution of empties in this mine is vitally necessary because the miner is expected to clean up his place every day.

Statement of the fact that mine car distribution is more or less flexible is not intended to imply that locomotives do not operate on schedule, for they do, so far as is possible. Delays due to various causes are bound to occur. These tend to throw the entire transportation system off balance, in which condition it would stay, were it not for the dispatcher's skill in adjusting it to every change.

Scheduling of trips is, and can be

considered, positive only in so far as it refers to the time of travel from station to station under normal conditions. There are too many variables, at least under present systems of mining, to permit of precise dispatching. All men do not work at the same rate, neither does any one man labor uniformly throughout the hours of the day, nor do conditions remain the same for any appreciable period. This being so, it is a far-fetched notion to expect in a dispatcher a man who will function as a machine by following exact standards or schedules. Conditions affecting his job are ever changing, just as the mine map changes.

EXCEPTION, pointing to the precision of railroad dispatching, might be taken to this argument. The rebuttal is clearly this: On railroads the time allowed for the making up of trains is not standardized. It varies between wide limits as does also the time required for gathering and making up a trip of mine cars. There is, however, a marked difference between railroad and mine transportation, for instance, in the length of the respective hauls. In the former the time during which rolling stock is in use for the transportation of a given cargo is generally so great that an appreciable variation in the time of make-up is largely absorbed and consequently not nearly so outstanding as in mine transportation.

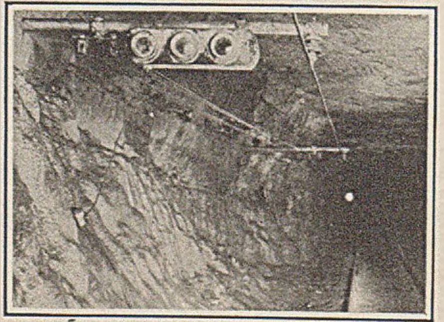
A few important points of attack in working out a successful system of dispatching are: First, to safeguard against causes for avoidable delays; second, to establish limited standards; third, to choose for the dispatching job a quick-thinking man who possesses the further qualifications of a retentive mind, vision and familiarity with the mine workings and the jobs of the men he serves.

THE dispatcher at Nemacolin is a certificated man who has served in many capacities above and below ground. He therefore knows why certain delays occur and how best to meet emergencies. In other words, he can intelligently put himself in the other fellow's shoes. A man should be trained in other branches of mine operation before he goes into training as a dispatcher. The duties on this job should not for a moment be considered as being those of a clerk, for a dispatcher in his field must display as much resourcefulness as must a mine foreman. Certainly he has more decisions to make. The degree of success in dispatching achieved by a coal company is largely dependent upon the type of man chosen to regulate it.

A dispatcher might well be given an opportunity at intervals to visit all sections of the mine and thus acquaint himself with the changes in conditions which are constantly taking place. This thought is based on the belief that the more familiar a dispatcher is with what is going on back at the face the more intelligently will he handle his job.

WHY DISPATCHING?
Dispatching does more than expedite haulage and work at the face. It means keeping such close tab on schedules and performance that "buck-passing" is easily discerned and soon eliminated. Dispatching spots weaknesses in operation and brings them into such prominence that their removal is inevitable.

A qualification he cannot be without is ability to handle men. He must be diplomatic and must command their respect. He cannot succeed in this unless he is patient and cool-headed. The telephone brings him in close contact with the bosses and indirectly with the miners, the level of whose earnings it is within his power to elevate. It is nonsensical to say that the average miner will load so much coal and no more. Give him more cars and his productivity automatically will be increased up to a point considerably higher than that generally thought to be the limit. The miner is disposed to suffer, though reluctantly, a temporary curtailment of high wage-rate work, as through the handling of draw slate, but he will not tolerate long periods of idleness waiting for cars. With this as a reason, he is justified in picking up his dinner pail and starting for the outside. A remedy for this situation is the employment of a dispatcher.



Signals? Yes!

At the Nemacolin mine at the close of a shift, man trips are made up by the dispatcher. Crews on gathering locomotives are instructed to haul back to the shaft, on their way to the motor barn, as many empty cars as are needed to accommodate those miners who have cleaned up their work and are ready to start for the outside. The miners look forward to this service and do what they can to facilitate it. Frequently a miner will walk to a sidetrack, his work completed, and inform the dispatcher either directly or through the sidetrack attendant as to how many men in the vicinity of his place will have cleaned up their places by a certain time, and ask when a man trip will be ready.

Here again, the success of a plan hinges on the dispatcher. If his judgment is good and he manages to provide a sufficient number of empties for the purpose, or exerts himself to accommodate the miners in this way, he wins praise not only for himself but for the company as well.

THERE are other ways in which the dispatcher may function to establish a closer understanding between the miner and the management. At the Nemacolin plant the dispatcher is charged with the duty of directing the distribution of requisitioned supplies. At the close of each shift the assistant bosses make out requisitions for supplies needed in their respective sections. They leave a copy of the requisition with the dispatcher and give the original to the mine foreman who, after acting on it, hands it to the yard master. The dispatcher needs this information for making out his estimate of cars for the next day. The following day the supplies are loaded into cars which are grouped, for greatest convenience in handling, with empty-car trips and then lowered down the slope to the supply track. The slope-bottom attendant borrows from the dispatcher the copies of the requisitions and checks them against the supplies loaded. Then he returns them to the dispatcher in the same order as that of the supply cars. It is then up to the dispatcher to see that the supply cars are correctly routed.

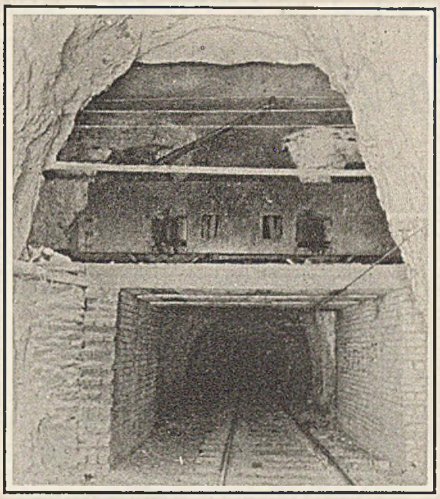
During his visit to Nemacolin the editor talked to a miner of foreign birth who had started work there only a few days before. Asked how he liked the plant, the miner said, "Fine! Never catch-em place like this before. Las night I tell-em boss I need post and ties. Today I get-em on job. Son-uv-a-gun! And lotsa cars, too! Boss he tell me not to make pig of self cause I got-em plenty cars. He tell me to work faster slow. I understand. He want me to get use to diffren way and not kill self at start." Then, with a pleased grin on his face, he added these words with acceleration: "But I work lika hell, anyway, you bet!"

The average distance from the shaft bottom of the sidetracks now in use at Nemacolin is about 1.9 miles. The longest haul is 2½ and the shortest is 1¼ miles. In the territory within a 2-mile radius of the shaft bottom the company has found it economical to make sidetracks small and numerous, establishing them as close to the faces as possible. Coal is gathered by 24 locomotives, most of which are 9-ton cable-reel units provided with permissible features, the remaining units being of the storage battery type. The average day's work per gathering unit is 85 cars or about 250 tons, since the cars used hold 3 tons each. Seven 13-ton locomotives are used to haul the coal from the sidetracks to the shaft bottom.

BEYOND the 2-mile limit the company believes it is desirable to establish large intermediate sidetracks of permanent construction, relaying trips from the temporary sidetracks at the face to the permanent sidetracks by single 13-ton locomotives and from the permanent sidetracks to the shaft bottom by two 13-ton locomotives in tandem.

There are 1,200 mine cars in service in this mine. Without the dispatching system it is calculated that between 1,800 and 2,000 cars would be required for the present production. Each day a reserve of 600 to 800 loads is provided and left standing on the shaft bottom and auxiliary storage tracks for skip operation during the early hours of the following day. If 800 loads are left over, only 400 cars are available for other use. An allowance of about 125 cars is required for slate, supplies and for those that are shopped, leaving 275 empties for the first turn in the morning. These empties, of course, are placed prior to the beginning of the day shift, and any surplus is placed on the sidetracks.

Going in on the first trip in the morning, the main-line locomotives haul a man trip made up of empties turned loose from slate and supply service during the night. On the return trip these locomotives pick up at the auxiliary storage tracks what loads are left on them from the day before.



Bridged Crossing Saves Time, Prevents Collisions

On the first morning trip in, the gathering locomotives travel light. Before the miners are ready for a second car adequate cars have been dumped and placed on the side tracks to meet their needs. Generally the shaft bottom is cleared of standing coal within 2½ hours of the start.

A dispatcher is on duty during the night as well as during the day. Since traffic is light during the night, the duties of the dispatcher serving at this time are more like those of a telephone operator.

The dispatcher uses a daily estimate of the empties each section will need for determining when and where, and also how many, cars should be distributed at various intervals during the day. A preliminary estimate is submitted to the dispatcher by the firebosses who make it up after checking in the workers on their respective sections. The section bosses submit a final estimate upon completing their first morning inspection of the working places. With the dispatching sheet before him, the dispatcher knows at all times how near a section is to clean up and regulates distribution of empties accordingly. His major objective is to have all sections of the mine cleaned up at approximately the same time. When a certain section falls behind its rate of production, he sends extra empties to the side tracks serving it until it is caught up. To do this he may have to curtail the car supply to sections on or ahead of schedule. Ordinarily, he tries to maintain at all times a reserve of 1½ empties for each miner, either on the side track or in trips in motion.

MAIN-LINE traffic is closely regulated by the dispatcher. A block signal and a telephone are installed at every important intersection. The crews on main-line locomotives move from station to station under telephone orders. Under this arrangement the dispatcher is in position to grant priority of movement to trips plying to a section that has fallen behind its production schedule. It also enables him to re-route trips in case of a fall or wreck, perhaps bypassing empties by way of a load track, or loads over an empty track. Further, he is in position quickly to clear any track in case of an emergency.

Where the working places are extensive or the faces are advanced far from the mine opening and a considerable tonnage is being gotten or anticipated, immediate attention should be focused on dispatching of transportation as a means of increasing efficiency. Suffice it to say, dispatching has tremendous possibilities for bringing about better regulation of haulage. Companies that have made it a general practice, and others who are trying it out, realize what can be expected of it.

At Nemacolin it has assisted materially in the effecting of a substantial increase in the average daily output per loader. Simultaneously, it has bettered the general efficiency of the plant. Also it has kept low the number of rolling-stock units in the face of increasing production. One of its most potent influences is the manner in which it serves to bare weak spots in operation. Dispatching also serves another purpose in that it eliminates "buck-passing" by definitely allocating responsibility.

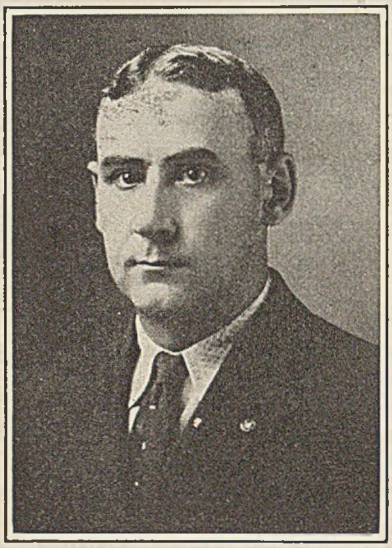
MUCH thought is being given to the dispatching of other allied phases of operation. As dispatching thus far has been confined to haulage, the practical limits and nature of its application to face jobs have not yet been determined. To all appearances, dispatching of face jobs possesses possibilities as wide or wider than those inherent in dispatching of haulage, and development of a technique suited to its requirements is assured for the future. First of all, however, dispatching of haulage must be mastered.

Longwall with Conveyors—

Gives 20 Per Cent More Lump

By J. C. Abram

Superintendent and Mining Engineer
Hooversville Coal Co.
Hooversville, Pa.



J. C. Abram

THOUGH timber costs are high, the compensation of a better product makes longwall advantageous at Mine No. 153 of the Consolidation Coal Co., Van Lear, Ky., where a 1,000-ft. longwall face has been in operation for about a year. As shown by Fig. 1, this long face is laid out in 250x750-ft. blocks. It was originally started as an advancing wall, but this plan for various reasons was abandoned. The five single entries were then driven through the block, and the work proceeded on the retreat.

The Miller Creek or No. 1 seam, which is that worked in this mine, ranges in thickness from 34 to 44 in., the thicker coal being present in the local dips only. The immediate roof is a hard gray shale or slate, and above this is a heavy bed of sandstone, the thickness of gray slate ranging from 2 to 20 ft. and the total thickness of overburden from 240 to 430 ft.

The coal is free from impurities and has pronounced planes of cleavage almost parallel to the long face. The coal is structurally strong and resists crushing to a remarkable degree.

Serving this 1,000-ft. face are four shaking or jigging conveyors, driven by an equal number of 15-hp. electric motors. The conveyors discharge the coal into the mine cars at entries No. 1, 3, 4, and 5 (Fig. 1).

Because the seam is thin, 30 in. of bottom rock had to be lifted on these four entries in order to place the mine car low enough to receive the discharge of the conveyors, and also to provide headroom for the trolley locomotives. The entries were driven 22 ft. wide. Bottom rock was taken 10 ft. in width, leaving a bench on either side, this berm being used for timber storage and giving room in which the longwall machines can cut out.

As indicated in Fig. 2, cribs and props are used as a means of roof control. The crib timber is round and 2 ft. long. Lines of cribs and props are placed alternately parallel to the long face. The cribs are set in their rows on 10-ft. centers, and a round prop is placed between adjacent cribs. The lines of props are set on 3½-ft. centers, 5 ft. behind the center line of the crib rows. When all coal has been loaded into the conveyor, a line of props or cribs is placed within 3 ft. of the solid coal, leaving sufficient clearance for the longwall mining machine to make its undercut.

Four longwall machines are used to serve the 1,000-ft. face. The cutter bar is long enough to give an average 5-ft. undercut. The conveyor line, having pans 10 and 12 ft. long, is placed behind the line props or cribs as indicated in Fig. 3, center *B*.

Up to the present, no attempt has been made to recover crib or prop timber. About 90 per cent of the props at *D*, Fig. 3, were either crushed or broken when the conveyor was moved from between *C* and *D* to *B*. Heavy pressure upon cribs at *C*, Fig. 3, rendered the recovery of these almost impossible by the time the new line of cribs had been placed.

Conveyor movement was accomplished by unbolting the individual sections and moving them to a new location. The conveyor was advanced and the long face undercut by longwall machines at night, the roof being timbered and the coal loaded by a day crew.

Provision was made for the storage of empty cars by placing a solid line of cribbing along both sides of the entries extending back into the goaf. From 10 to 18 cars, averaging 1.7 tons of coal, were hauled per trip.

By leaving the crib timber the roof was protected. As only four major breaks were observed in a period of

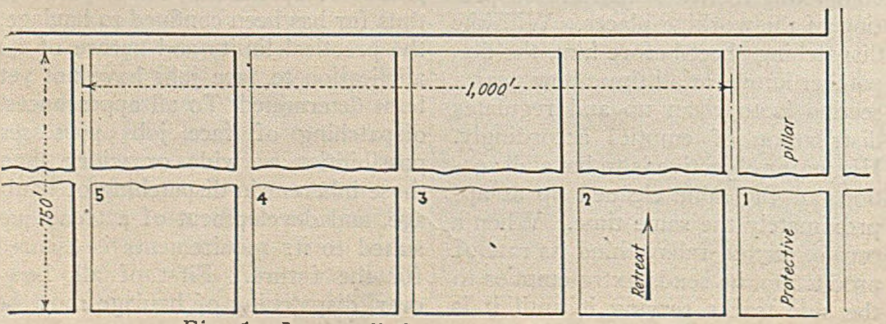


Fig. 1—Longwall System at Van Lear, Ky.

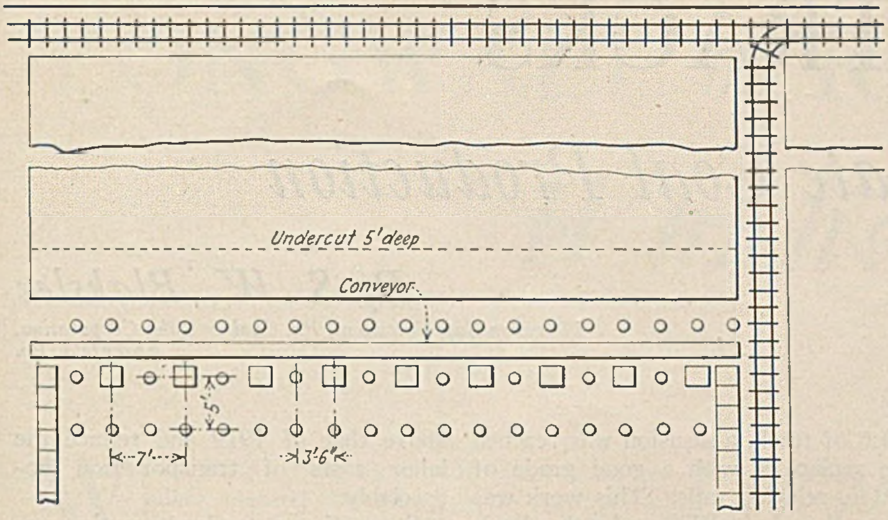


Fig. 2—Face Timbering and Tracks

three months in close proximity to the long face, it may be assumed that the non-recovery of cribs caused the settlement to occur slowly, keeping a continuous or traveling weight upon the coal, thus reducing the labor of mining, and permitting the coal to be taken down without blasting. Sixty per cent of all coal from this long face passed over a 5-in. screen.

No great difficulty has been experienced in keeping the space open between the face of the coal and the conveyors. (See Fig. 3). Breaks in the immediate roof occur with every cut, but are of a shallow nature and easily supported by the cribs and props. After each major break in close proximity to the face, it was observed that the labor of mining or taking down the coal was much more difficult. Other major breaks in the upper strata, than these four mentioned, have occurred so far back in the goaf as to have no apparent effect at the long face.

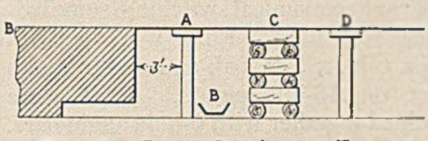


Fig. 3—Cross Section at Face

To the north of the present working, a 1,800-ft. longface is in the development stage. This will be served by nine entries on 225-ft. centers. Some of these entries are being driven with the aid of conveyors and by these means are being extended much more rapidly than those that have been driven without them. As these entries are driven 22 ft. wide and bottom is taken 10 ft. in width, the conveyor is placed upon one of the 6-ft. benches and serves for the discharge of coal only. An angled pan near the point of discharge drops the coal into the mine cars. (See Fig. 4). The bottom rock is loaded without the interposition of any conveyor.

To the majority of mining executives it would appear that the timber cost of this system of mining would be excessive. It is admitted that the timber cost *is* high, but in this connection it must be remembered that 60 per cent of the coal is sold at the top market price. Under ordinary conditions, the shortwall work in this field will produce only 40 per cent of big lump coal. The greater realization, due to an increase of 20 per cent in the quantity of lump coal, more than compensates for the high cost of timber in the long-face system.

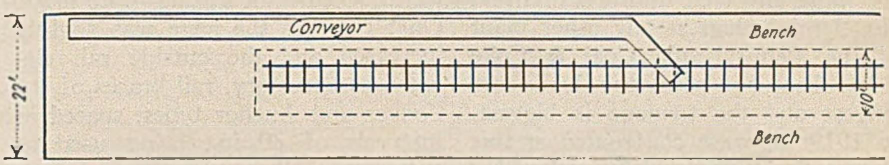
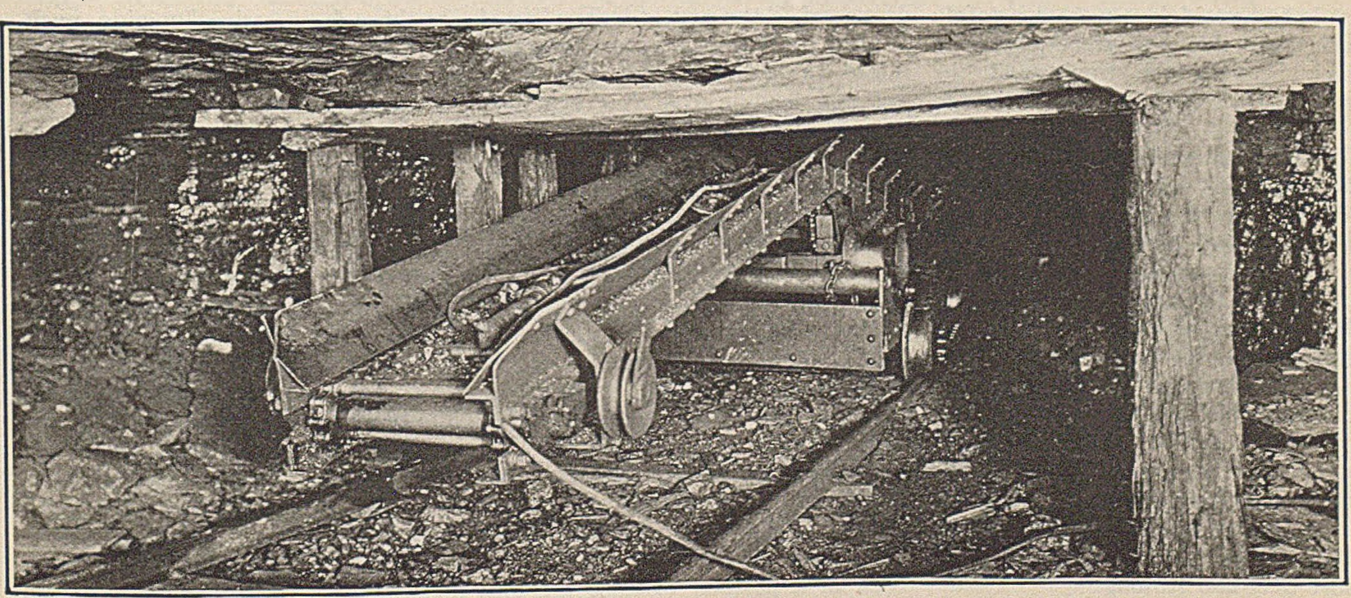


Fig. 4—Driving Entry in Solid with Coal Conveyor on Bench

Experiments have been made with different plans of timbering, but the system described in this article has been found the most satisfactory of any of those tried. The company does not claim to have reached the millennium in longwalling but by the introduction of refinements, it is hoped that success will be attained.



Keeps the Coal Moving from the Face

BETTER TRACKS

Stimulate Coal Production

By S. W. Blakslee

Division Superintendent, Pa. Coal & Coke Corporation, Ehrenfeld, Pa.

HAULAGE requirements of the present day are entirely different from those of the past, since mines are being made larger producers and methods of working are being considerably altered in many instances. Larger locomotives, bigger cars, better track, together with more precise control of trips and distribution of cars at the face, are now required, particularly since mechanical loading has become a practice.

The problems of transportation are more involved at the Ehrenfeld No. 3 mine than at any other plant of the Pennsylvania Coal & Coke Corp. because, here, the hauls are longest and the tonnage is biggest. In 1919 we were confronted at this mine with a diminishing tonnage. Investigation proved conclusively that transportation methods and facilities were largely responsible for this condition. Miners were quitting daily and those left on the job were not being provided with a sufficient number of cars. The cars and locomotives on hand were in fairly good repair and adequate for the production of a much greater tonnage; power supply was sufficient for all needs and yet delays were constantly occurring, due to wreck-producing track between the tipple and the working faces.

THE average haul from face to tipple was 4.2 miles. The mine is divided into three distinct sections and the coal from them passed through a common sidetrack located 1.5 miles from the drift mouth. Double track of comparatively light steel, considering that 13- and 15-ton locomotives ran on it, extended from this main sidetrack to the tipple. The main entry had been driven 35 to 40 years before when more attention was given to drainage than to track tangents, with the result that in 3 miles of track not one tangent was more than 250 ft. long.

As all traffic passed over this section of track, a decision was reached to replace it with a good grade of 70-lb. relaying rails. This work was started early in 1920 under the direction of a former railroad section foreman. Where local swamps did not permit economical switching, some ballast was used. Rails were laid on 6 x 6-in. x 5-ft. oak and chestnut ties set on 18-in. centers. Rails were joined together with 6-hole angle bars, bolts were locked with washers and the joints staggered. All curved rails were jacked—not sprung—into place. On all curves the gage was slightly increased and the outside rail elevated as necessary, rail braces of the Coover and Anchor types, spaced at intervals of 30 in., being used as stiffeners. All of this work was done on the night shifts and Sundays, with the result that no loss of tonnage was suffered.

SINCE the completion of this job a total of 2,400,000 cars of coal and rock has passed over this track. The result has been: (1) Locomotive derailments number but three and in no instance has the track been the cause. (2) Running time of trips has been decreased 28 per cent. (3) The life of locomotive wheels has been increased 40 to 45 per cent. (4) The labor cost of hauling coal has been decreased 40 per cent.

AFTER this job was completed it became evident that the improvement was going to pay big dividends and consequently plans were made to extend 70-lb. track into each section of the mine. Since that time about 20,000 ft. of old, 40-lb., track has been replaced by the heavier "iron," which brought results as good as those derived from improvement of the main haulway. More attention has also been given to tracks in rooms and in butt and panel entries. By these improvements in track we have been in a position to raise the tonnage at this mine about 75 per cent above that of 1919 and reduce the labor costs of transportation appreciably.

Some of our standard practices are listed briefly as follows: All main-line track is laid with 60- or 70-lb. rails; all level panel entries with 40-lb. rails, except where the grade exceeds 3 per cent, when 60- or 70-lb. rails are used; all room entries with 30-lb. rails where the track is level and with 40-lb. rails where the grade exceeds 3 per cent. Lock washers are used on all track except that made up of 16-lb. rails. All switches off main haulage roads are equipped with spring switch-throws. Jump-over switches and home-made frogs and switches have been eliminated and only manufactured room turnouts and switches are installed. Worn frogs are repaired in place by a welding process. All locomotives are equipped with re-railers of the Anchor type, which is also used to serve the purpose of a runaway switch.

A RERAILER is used at each end of main sidetracks, where cars are often derailed when switches are split, or through excessive bumping, pushing, etc. A "frog iron" is used on frogs at main sidetracks and on planes where attendants and rope riders are employed. This is home-made and designed to fit the frog snugly, closing the opening on one side of the point. We have found this device useful in the prevention of wrecks caused through the picking of the frog point by swinging cars. (Both of these devices will be shown in detail in the September issue.)

A gang of five men working on the night shift is regularly employed to take care of the track, to attend the drainage and to clean the roadbed on the main haulways. All movements of main haulway locomotives between terminals and main side-tracks are governed or dispatched by telephone.

LONGWALL *or* ROOM—
Which?

By R. Dawson Hall

Engineering Editor, Coal Age
New York City

WHETHER the room-and-pillar method should continue to flourish now that mechanical loaders and face conveying have been introduced is, perhaps, the most hotly debated of all subjects before the mining public. Both sides are ardently zealous for the methods they advocate, but there are many who frankly align themselves with neither, and who are waiting to find who is right, and whether the claims of both are not a little extravagant and only true for certain kinds of roof and certain depths of cover.

It is just as well, therefore, to describe situations as I found them and to leave decision to the reader. But it must be remembered one must always inquire when speaking of longwall or longface, just what kind of longwall or longface is meant, for there are so many intermediate and newly-planned methods (at least they are newly planned in the United States) that lie so equivocally between the two extremes that one cannot safely take any stand as to the right words to use. There is the single-V system, for example. A scraperway is driven up, as narrow as the narrowest of rooms. Then it is widened, and the pillars are drawn back. Surely that is a room-and-pillar working.

But no! Who would attempt to draw back, by ordinary methods such as room-and-pillar operators practice, pillars of such width without leaving cautiously one pillar somewhat behind the other? Here a place 125 ft. wide is drawn at a time. With the two-, three- or four-V systems the width thrown open is even greater. The width may be nearly 400 ft.

Some of the longwall of which we hear, that, for instance, at Indianola, has pillars drawn in steps, each step only 130 ft. wide. Is that longwall? The pillars are perhaps only 30 or, say, 40 ft. wider than was formerly the practice in some regions with room-and-pillar workings.

There are places, however, where blocks 1,000 or even 1,800 ft. long are being drawn, with roads splitting the pillars and serving as passages down which the coal can be trammed. As stated, there are others where the width is only 130 ft.

At the same time there are some places barely 50 ft. wide, yet even these some people are terming longwall. No wonder some are saying that longwall must be defined definitely. With thi sas a preface, it will be well to leave the persons interviewed to speak for themselves.

Foremost among those who have practiced longwall operation is the Valley Smokeless Coal Co., which has been using that system at its No. 3 mine, at Ferndale, near Johnstown, Pa. At that operation, T. M. Dodson has proved that, even with the roof as flexible and difficult to break as it is in the Johnstown field, longwall can, if properly practised, be made an entire success.

"Careful observations," said Mr. Dodson, "have convinced us that at the mine of the Valley Smokeless Coal Co., as elsewhere, the roof does not break down close to the coal pillar. Whatever may be the upper lines of fracture and however much such a fracture may pass over the solid coal, the fact remains that at the edge of the pillar, the rock tends to "cornice out" like a shelf, leaving a space into which a man may crawl and into which many have crawled long after the room or working has caved to the surface.

"This was the conclusion drawn in a report made by R. Y. Williams, who in 1924 was given a roving commission to visit workings in various parts of the country and to report to this company. His opinion was that in workings on the V-system what was needed was not to attempt to support the roof on the weak tips of the pillars, but to widen out the mouths of the V's and to invite falls within the wide openings, keeping the actual

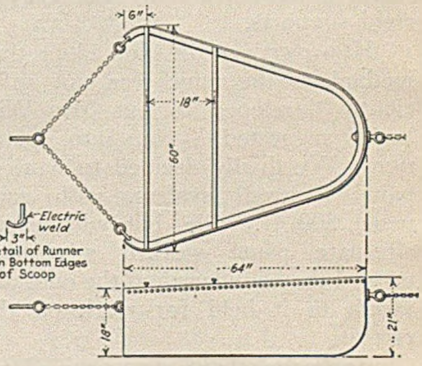


Fig. 2—Small Scoop of P. C. & C. Corp.

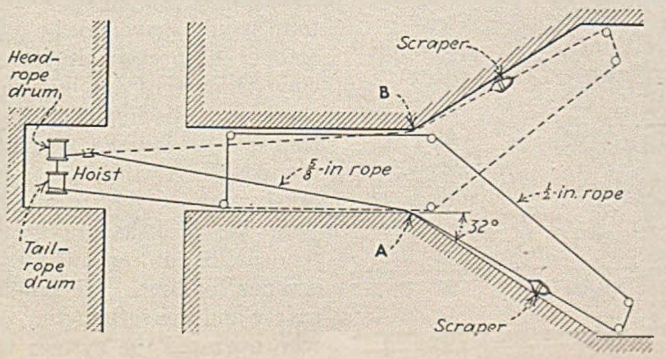


Fig. 1—Method of Operation of Small Scoop, Pennsylvania Coal & Coke Corporation

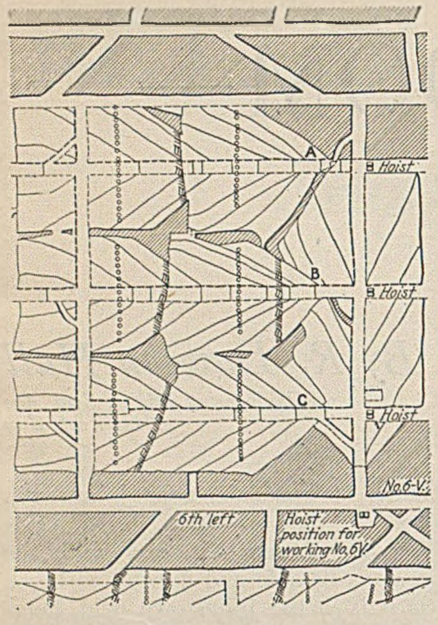


Fig. 3—Original Three-V System, P. C. & C. Corp.

working faces open by the use of rigid supports.

"However, we did not adopt that method as the mine was not sufficiently developed to put Mr. Williams' suggested V-plan into operation. We finally decided to work a panel longwall system, with each panel 300 ft. wide, but with every alternate panel worked advancing toward the boundary and the ones adjacent to it held for work on the retreat.

"The panel that is to be mined retreating has two roads through the center with a 50-ft. pillar between them and it has two other roads so located on either edge that the inby rib of each will be the outby or outside rib of the other panel as its longwall extraction advances.

"Because of the natural tendency of the roof to 'cornice out' from the surrounding ribs, the workmen at the longwall face get protection which, indeed, would be inadequate in itself without artificial support, but which can be made ample by the use of wedge jacks, which provide the roof with rigid support. And let me lay stress on the word 'rigid' for if the support be flexible or yielding there will be downward pressure on the face of the coal. With a rigid support forming itself a fulcrum, the load on the face of the coal is lightened rather than increased. Furthermore, the 'cornice effect' with the aid of cribs makes possible the maintenance of roads, at least for short distances, along the rib on the side of the longwall."

In discussing the relative advantages of longwall and room-and-pillar workings, C. Law Watkins, vice-president and general manager, Pennsylvania Coal & Coke Corporation, said: "It all depends on what you term 'longwall.' If in it is included the single-V system, it can be used with advantage at some of our mines. But a retreating longwall with a long face would require so much timber for its support and so much labor for its installation that it would not pay. Its efficiency in cutting, shooting and loading would be frittered away in the costs of timber and timber erection. In fact it could hardly be operated at all without packwalling.

"The V system, however, is practicable, but really that is hardly even modified longwall. It is merely room-and-pillar work with extremely narrow rooms and wide pillars, worked on an inclined line. The three-V system, as worked at Norton,

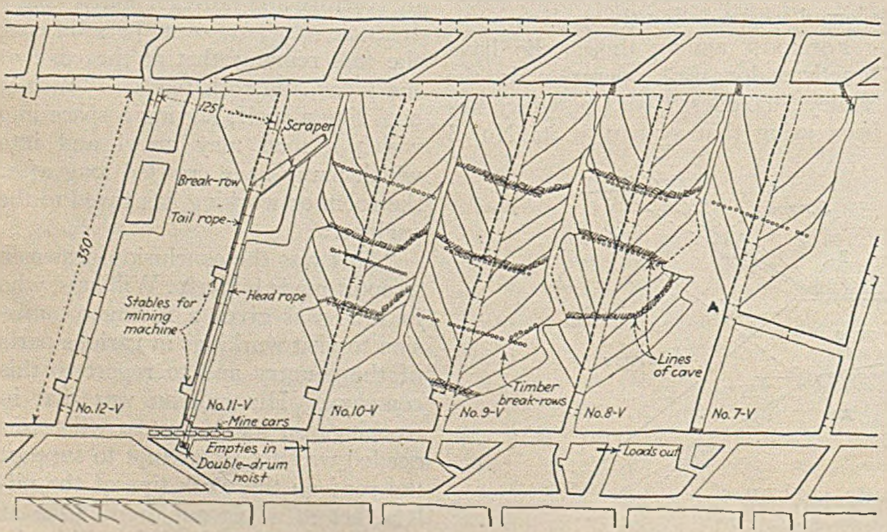


Fig. 4—Single-V Method, P. C. & C. Corp.

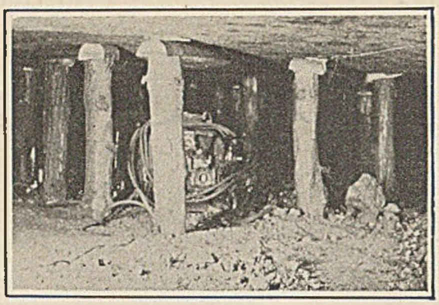


Fig. 5—Where the Line of Props Along the Face Converge at Mines of P. C. & C. Corp.

Va., and later at our mines, has, however, the drawback that synchronization is necessary. The various pillar points between the roadways should be kept in line, and all mining of pillars should be completed at the same time. It sometimes happens that work on a V will have to be delayed, waiting for the roof to fall. This necessitates holding the entire crew in order to finish the delayed V.

"The single-V system in which one room is driven, say, 10 ft. wide and then widened at the face and then backward into the semblance of a V, gives better results as our experience has shown. Pillars are left between the V-shaped rooms but they are thin and do not constitute more than 5 per cent of all the coal. Some additional coal is lost by reason of rolls and clay spars and perhaps in all an 85 per cent recovery is made, but that is as much as was recovered when the ordinary room-and-pillar operation was in use.

"The system has been so successful with us that it has been introduced not only into our Cambria County mines, but into those in Indiana County also. It does not follow, however, that this single-V system should be installed everywhere. Where coal has partings and needs scrupulous cleaning, and where the scraper breaks it, making picking difficult, it is not well to attempt operation in that manner. Where the floor is friable some kind of bottom would have to be put on the scraper to prevent it from bringing clay as part of its burden. Where there are rolls in the floor the condition is even worse. Furthermore, if the coal is friable the scraper may crush it and make its sale difficult."

S. W. Blakslee, division superintendent, is an enthusiast regarding scraper loading. He emphasized its safety and the satisfaction of the men who operated the system which does so much to ease the drudgery of loading. The timber cost also, which

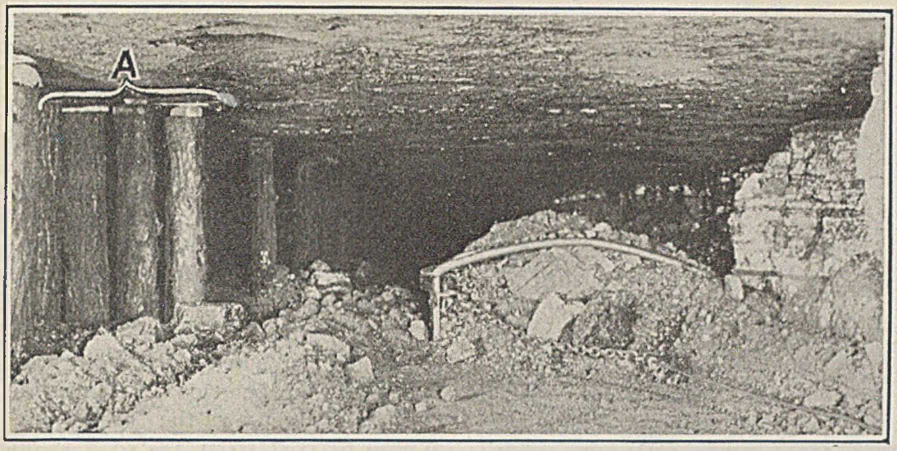


Fig. 6—Loaded Scoop at Face; P. C. & C. Corp. Mine. Four Posts, Indicated by **A**, *Are One End of a Break Row*

in some forms of longface working is discouraging, he said, is only about 4c. per ton higher than with room-and-pillar methods of operation.

He described the method adopted when single V's are used as is now the general practice of his company. "The scraperways or development entries are driven narrow and 325 ft. long on 120-ft. centers. The V's are started right at the aircourse of the heading beyond and then worked retreating toward the loading entry. Yes, the aircourse is allowed to cave with the V but so far the rock has never blocked the air materially.

"Our aim is to keep the face at an angle of about 32 deg. from the scraperway as that makes the lengths of each of the two faces 100 ft. We find we can load one cut from each face or the equivalent of one 200-ft. face every day.

"Here is our system (see Fig. 1). Only a few sheaves and no snatch blocks are required. The full lines represent the path of the ropes when working the right-hand face. In this case one sheave is used on the head-rope and six on the tailrope. The path taken by the rope when loading out of the left-hand face is indicated by the dotted line. The headrope is permitted to run against the corners at *A* and *B*, and the tailrope is carried between the first and second row of timbers.

"Here," Mr. Blakslee remarked,

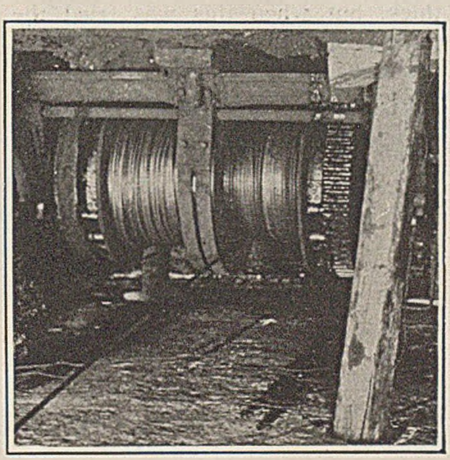


Fig. 7—Double Drum, Friction Type, P. C. & C. Corp. Mine

"is our scraper (see Fig. 2). We have turned in the corners of the side pieces. These rounded corners tend to make the scraper stay out of the loose coal and run in the cleaned path, thus causing less breakage of the coal. A sharp edge would dig into the loose coal at the side of the road and tend to turn the scoop into it, but with the rounded edge the scoop goes ahead and minds its own business. The bottoms of the side plates have curved steel runners to prevent the scraping of the bottom rock.

"The face is timbered at night by the night shift. After every cut a row of 6-in. round posts is set on 4½-ft. centers, 7½ ft. from the face. Every 75 to 80 ft. we set a break-row consisting of two lines of 6-in. posts 18 in. apart with the posts staggered and set on 2-ft. centers.

"After the V has progressed so that the break-row has been extended to the full width of the room or panel and before the ribs have advanced more than 15 ft. from the ends of the break-row, the timbers in the gob back of the row are chopped in order to allow the roof to come down. That usually takes two or three hours and sometimes, as you can see, breaks are not obtained just where we want them (see Fig. 4).

"Every day approximately 168 tons is loaded from the chute at each V. The loading of the two 100-ft. faces of each V is easily completed as a rule in 8 hr., but when it takes longer the men continue at work till all the coal is loaded out ready for the night shift. The men are paid the union scale. (These mines are now shut down like all the union mines in Central Pennsylvania.)

"So successful has been the operation of scrapers as compared with the old hand methods with room-and-pillar that the company has loaded about 600,000 tons of coal in that manner and steadily increased the number of mines thus operated, thereby reducing its operating deficit."

J. F. MacWilliams, electrical engineer, said, "In some of the mines

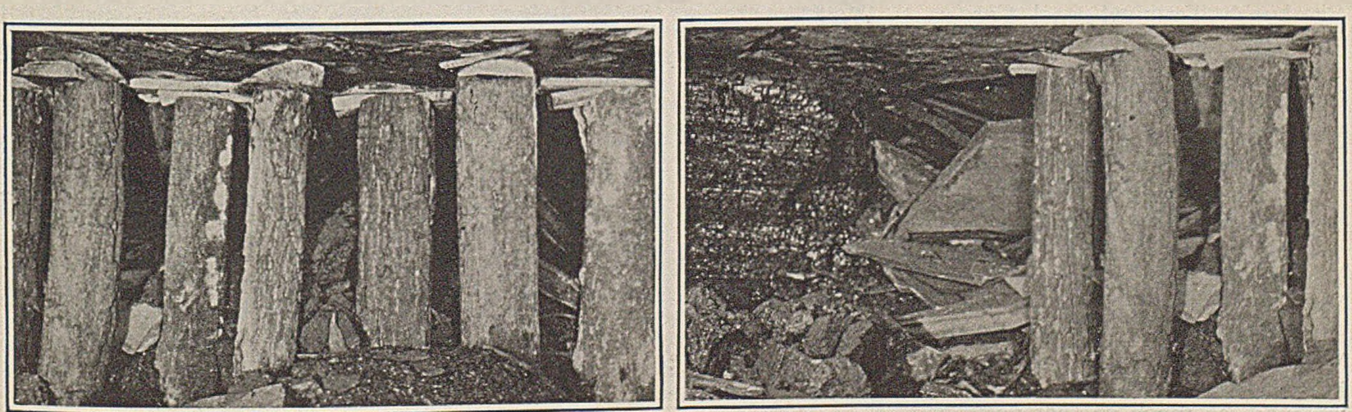


Fig. 8—Break-Row with Cave Behind It on Right, P. C. & C. Corp. Mine

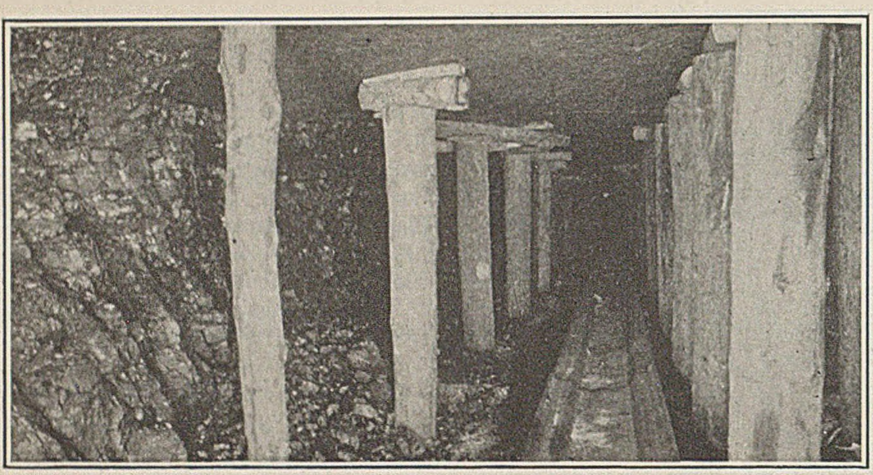


Fig. 9—Shaking Conveyor, Hand-Loading Face, Union Pacific Coal Co., Early Trials

where the Miller seam is being extracted, the regular room-and-pillar system reigns, but mechanism has been introduced to aid in the loading of the coal. Lorain chain conveyors are being used in the roadways. Cross conveyors of the drag-belt type are being made in the shops. They are driven by air-drill motors using compressed air. About 4,000 ft. of these cross conveyors have been constructed. Two compressors have been installed on the surface at Ehrenfeld, and air will be sent into the mine by vertical pipes. The chain conveyors are driven electrically, which is feasible as they are in the entry. However, they will be provided with permissible motors to assure their safety. These conveyors deliver the coal to the entry. When operated continuously they will deliver 24 tons per hour on a level grade."

The quantity of timber used in longface workings, and the cost of setting that timber, have been greatly emphasized by those who have favored the room-and-pillar method of operation. But G. F. Osler, vice-president and general manager of the Pittsburgh Terminal Coal Corporation, on being interviewed, while acknowledging that what was gained in the cost of extraction by longface was lost in expenditures for timbering, nevertheless believed that this method had proved desirable at No. 9 mine, Avella, Pa.

He favored the system, because with it the entire quantity of coal worked had been recovered and because the product was more blocky when thus mined. Eickhoff conveyors were used. True, the roof was bad, so much so that posts had to be set every 6 ft. between the conveyor and the face to maintain the drawslate which was 14 in. thick.

At one time he thought it would be best to let the drawslate down and post under the rash which is 5 ft. thick, but when this was tried the posts pushed up into the rash and the timbering failed of its function. For this reason it was found better to post well and leave the drawslate undisturbed. The posts along the face were relatively so few that they were little in the way of the loaders.

No packwalls were built. A single line of props was placed on 24 to 30 in. centers behind the conveyors. That done, the roof broke without difficulty. The posts were of 8 in. diameter instead of 4 in. as is usual in room-and-pillar workings at that mine. The coal was 5 ft. thick.

At the Arden mine where room-and-pillar methods are used, some old pillars have been withdrawn by Eickhoff conveyors. The use of this method saved money where the coal was thin, because it was not necessary to make height for cars, to lift much fallen rock or to lay track as would have been mandatory had any other kind of equipment been employed. In some cases the conveyors were used to assist in driving places across room pillars near their ends. As soon as the crosscutting was completed, the ends of the pillars were extracted and the coal brought out by conveyors. This proved a profitable experiment.

W. L. Affelder, assistant to the president, Hillman Coal & Coke Co., stated that he believed that the ultimate solution for the economical mining of coal from 3½ to 5 ft. in thickness was to be found in the use of hand-loaded conveyors in room-and-pillar work, rather than in longface methods. His conclusion was based upon results obtained during the past year and a half at one of his company's mines in central Pennsylvania in which a number of Lorain conveyors are in use.

Rooms 35 to 40 ft. wide and 250 ft. in depth are driven on 75-foot centers. Inasmuch as only one main conveyor is used in a butt entry, operations in any butt are limited to advancing or retreating in only one room. The chain pillars between two butt entries are removed by pick work and the coal is loaded by hand into mine cars. The main conveyor, driven by a 15 hp. motor, is carried near the rib side of the room and coal is delivered to it from the advancing room face or from the open end of the retreating rib by a sufficient number of 12-ft. rubber-belt face conveyors, driven by ¾ hp. motors. No coal is recovered from the gob side of a room while retreating.

The conveyors are worked on single shift only, but operation of them on double shift is contemplated. The complete cycle of driving up a room and bringing back a rib re-

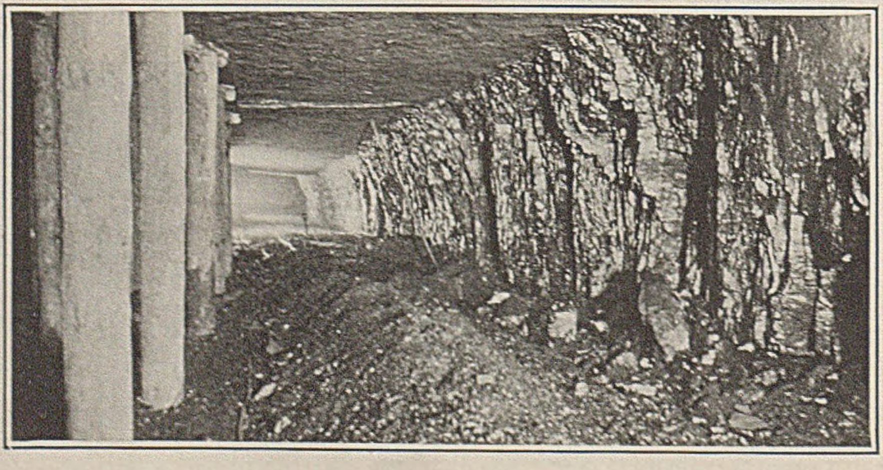


Fig. 10—Awaiting Scraper at U. P. C. Co. Mine

quires about six weeks if the mine is working steadily. The cover over the coal in the sections in which the conveyors are used ranges between 250 and 300 ft. in thickness.

Clarence R. Claghorn, consulting mining engineer of Baltimore, Md., the first man to employ conveyors in coal mining, in this respect preceding both the British and the Germans, in a written communication states: "Through experience I have arrived at some decided impressions as to the conditions under which longwall can be mechanically worked in competition with our customary room-and-pillar system. For instance, except in extremely thin coal or under peculiar roof conditions, I do not think that longwall advancing, with subsidence, can ever be as economical as room-and-pillar with conveyors. I believe that when we come to longwall in this country, as we undoubtedly will in the future, it will be some form of straight-faced longwall, worked on the retreat and with caving."

P. M. Snyder, president, C.C.B. Smokeless Fuel Coal Co., remarked that he is making an experiment in the use of conveyors in the mining of coal from the Pocahontas No. 4 seam which is from 36 to 40 in. thick. He has hopes that his method of operation will be successful with coal of this thickness which is such as not to permit of the use of cars at the working faces without the shooting of bottom or the brushing of top rock. The bottom is of slate and requires heavy shooting, and it is difficult without excessive cost to stow all the rock. Much of it has to be brought to the surface, hauled up to the hill tops and deposited there because the valleys do not supply a suitable place for its dumping.

P. C. Graney, the general manager, and C. E. Bergendahl, chief engineer, described the method that was being adopted. The rooms are driven with a main conveyor—Lorain chain type—placed near one rib, the room being 40 ft. wide and 280 ft. long. The conveyor comes in 6-ft. lengths with occasional 3-ft. sections for use where needed.

The coal is brought to this machine by face belt-conveyors. These are 12 ft. and 20 ft. long. The company finds that the 12-ft. lengths are the easier of the two sizes to handle. The main conveyor can be reversed so that timber can be carried into the working face. At Stotesbury, about 8 in. of rash has to be removed to get to good top, but at Helen mine the roof is free of bone and has excellent characteristics. Timber is set systematically behind the face conveyors as fast as they are moved forward, which is done each time a cut is cleaned up.

Timbers are set 4 ft. apart and in rows on 4-ft. centers. The pillars are mined from their ends, the rooms usually being on 60-ft. centers leaving a 20-ft. pillar, which is brought back as soon as the room is driven up, with exceptions to be noted later. The detail as to the pillar width is not finally settled, but will be fixed by the experience obtained.

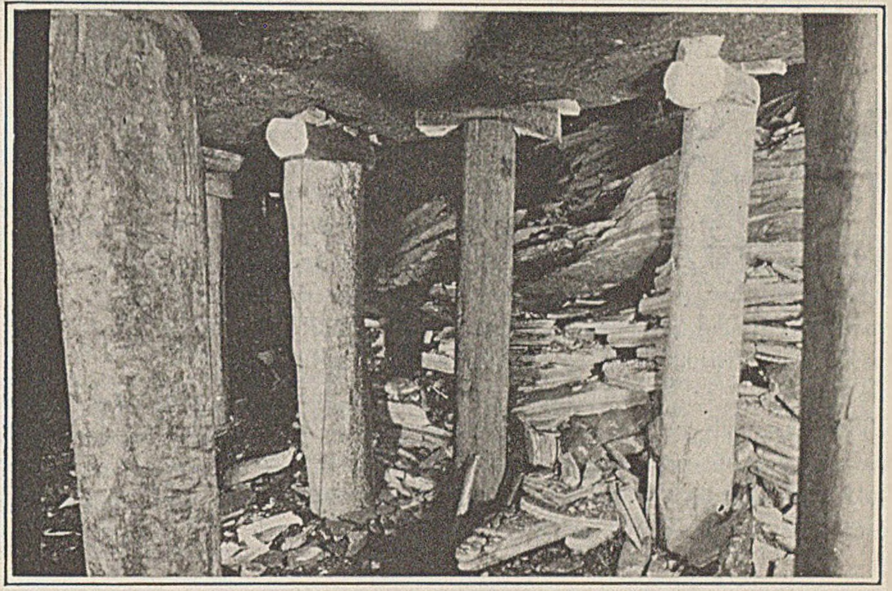


Fig. 11—Break Behind Conveyor Face, Superior Mine, U. P. C. Co.

The cars are pushed into the entry by the locomotive and then spotted under the end of the main conveyor in trips of 15 to 20 by means of small hoists where the grade is adverse. Where the grade is favorable or can be made so, the cars are spotted by gravity, the hoist being the more positive, especially where the cars are heavy as at Stotesbury. Where desirable, the cars are directed from the loading point to the nearest crosscut and into the other headings of the entry. To date, at Helen, eight places have been driven up but no pillars drawn because of proximity to the outcrop, not because the roof was bad. This method was followed to protect the mine against caves which would bring in surface water. At Stotesbury five places in a row have been driven up and the pillars drawn immediately. Fourteen days are consumed in driving and five to six days in coming back with the pillar. The conveyor sections are carried out by the conveyor itself as the pillar retreats. When the pillar is back to the heading stumps, all the sections are already assembled for moving.

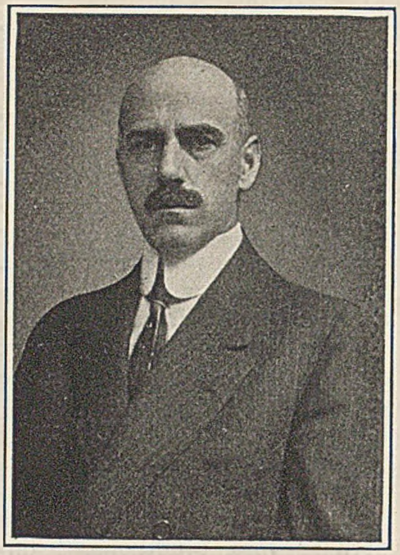
An undercutting machine is kept at the face of the working. Limiting of the activity of the face cutter to a single place is more than compensated by the saving effected in the use of a locomotive. Furthermore, the use of the conveyor has reduced costs by making it unnecessary to lift bottom or shoot top. Six-foot extensions of the conveyor are made in 20 min. From 2½ to 3 cuts are made during each 24 hr.

Rooms are driven by the use of a blower and tubing. Five men including the spotter are employed per shift and two shifts are worked per day.

Mechanization of the loading process means much more than merely buying equipment and putting it to work. It involves, as well, the proper balance of men and machines and the correct application of the equipment to the working method pursued.

The solution of the problem of what system of mining to adopt may be, and probably is, a local one, depending on roof, coal, floor and cover. Today, however, there seem to be few clear indications to guide the individual operator in choosing a system. Every region may have to find a means of overcoming its own inherent difficulties. Almost every coal field in the past has believed itself different and practiced its own peculiar methods. It is true that some differences exist, but too often they are largely imaginary. Once in a while a brave theorist breaks through his environment, boldly transplants a method of mining and meets success.

ANTHRACITE *Awake*



Samuel D. Warriner
Chairman, Anthracite Operators Conference

OF ALL the things that might be said about the anthracite industry the most important thing is that it is not asleep. Enjoying for so many decades an enviable position so far as the ready sale of its product was concerned, it might well have been that the anthracite industry would assume an attitude that everything was all right, that nobody could take its business away from it and that there was really no use worrying. This may be so, and as a matter of fact the industry is not worrying. It is taking an attitude of intelligent concern over the betterment of its product and the protection of its markets.

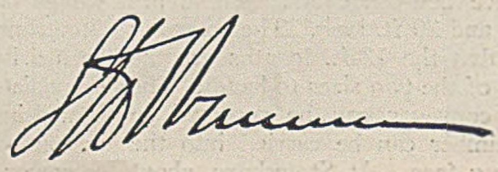
THE most noteworthy thing that it has done is the establishment of Anthracite Coal Service which now has a staff of 69 men located at all strategic points of consumption. At first, the efforts of these men, most of them combustion engineers, were centered upon the large consumer; in combating the efforts of competitors and showing anthracite users how to get the most out of their coal investment. This work is still continued, but latterly we have been rapidly expanding the dealer-service end of our activities. Schools have been opened and more than 500 dealers have been given a course in domestic combustion engineering, which fits them to service any ordinary case. More than 500 men are attending similar classes at the present time. Our effort in this direction has just begun. Response of the dealers in most communities is enthusiastic. The training enables them to correct all ordinary complaints and heating troubles and places them on a footing where they can in most cases prevent the invasion of rival fuels.

Our whole basis of relations with the dealers has been greatly improved in the past year. Monthly meetings are held and problems of mutual interest discussed and in most cases solved to the satisfaction of all concerned. This, it will be recognized at once, represents a great departure from the practices of former times.

IN THE field of research many of our companies are conducting investigations for the purpose of lessening degradation and improving the product in other ways. We have just completed more than a year's investigation of the burning qualities of anthracite under all ordinary conditions in various types of apparatus. This work has been done for us under the direction of Dr. Robert H. Fernald of the University of Pennsylvania.

ANOTHER progressive step has been a system of interchange inspection, under which inspectors of the various companies make unannounced visits to the collieries of all operations in a given district. The reports of these inspectors are then collated at a central office and furnished to all producers. In this way each operator has a chance to check up his own showing with that of other companies. An immediate result of this has been the bringing about of much higher standards of uniformity than prevailed when this system of inspection was put into effect a few months ago.

THE instances I have mentioned are not all-inclusive of things that are going on in the anthracite industry. They are however, I believe, typical of the spirit of the times and of a determination to build upon the inherent advantages of anthracite as a domestic fuel a superstructure of service and to enable our producers and distributors to sell not merely coal but satisfaction to the consuming public.



COAL MINE SAFETY—

A Modern Challenge to the Mine Owner and Executive

By John B. Andrews
Secretary, American Association for Labor Legislation

"THOSE who are responsible for mine management," said a prominent coal mine executive recently, "are in a position to take the lead in mine safety. They know both the human and the practical sides of the problems."

With real appreciation of the community's concern in this matter, he added: "The public is entitled to look confidently to these men to adopt promptly the safety measures that engineering science and mining experience have proved to be practicable and effective." (Address by Eugene McAuliffe, president of the Union Pacific Coal Co., at the twentieth annual meeting of the American Association for Labor Legislation.)

Here is a challenge to the good will and resourcefulness of coal-mine owners and executives. It is a challenge that has grown out of modern conditions of mining and increasing public insistence upon accident prevention. It calls for nothing impractical—simply putting into universal practice the available engineering knowledge of what can and should be done. If this were done, it is, I believe, safe to say that two-thirds of the fatal and serious accidents at the bituminous mines of this country could be prevented.

IT IS recognized that accident prevention in coal mining presents special difficulties. Coal mining is an extremely hazardous occupation. As the mines go deeper, the dangers increase. The cramped working places and passages and the darkness underground present peculiar hazards that are not found in manufacturing industries. In other industries, too, the work places are more nearly permanent and may be made safe once for all, but in the coal mines the work places are shifting. There are indications, however, that these unique difficulties are proving to be an added spur to the ingenuity and professional pride of the mine-safety engineer.

Public opinion is a powerful stimulus to safety work but in the past it has not been focused as sharply upon coal mining as upon factories. This may be due in part to the fact that women and children are found in large numbers in manufacturing, as well as to the fact that coal mines are remote and not so much under the eyes of citizens as are the factories.

IN RECENT years, however, the public has shown a lively interest in the coal industry. This interest is not solely that of the consumer but of the citizen as well. It is concerned with stabilization of the industry and with the prevention of accidents.

Coal-mine operators, no less than the heads of other great and basic industries, have a stake in good "public relations." It has been pointed out frequently at mining conferences that coal mining has not made as great headway with safety as has industry generally. It has been suggested by far-sighted mining men that the coal industry is today, as far as its relations with the public are concerned, in much the same position as the railroads and public utilities were a dozen years ago. What better medium can the coal operators suggest for promoting public understanding than wholehearted co-operation in constructive safety work?

THERE is, or should be, complete mutuality of interest in accident prevention between coal-mine operators and the public. The public is distressed by the human suffering and destitution caused by preventable accidents. So is the humane operator. The public counts the material cost in damaged property and loss of production as a result of mine accidents. So does the operator. The public, through the general adoption of workmen's accident compensation laws, has accepted the principle that the burden of industrial accidents shall be borne in large measure by society as it is passed on in the price of the product. The coal-mine operator is properly expected to fulfill his corresponding obligation to cut down the human and financial cost of accidents —to his company, to society, and to the injured worker and his family— by preventing accidents.

From the public point of view, the coal industry is not adequately meeting its responsibility for accident prevention when it permits 25,000 fatalities in the space of a decade; when— based on man-hours of employment— it kills American coal miners three times as fast as they are killed in Great Britain; when it lags in putting into universal operation well-tested and effective safety devices, such as rock dusting bituminous mines to prevent coal-dust explosions.

PUBLIC interest in coal-mine safety has been greatly stimulated by the shocking series of coal-mine explosions in recent years, and by the present campaign for safeguarding mines with rock dust. As J. E. Jones, safety engineer of the Old Ben Coal Corporation, puts it: "The recent nationwide popularity of rock dusting as a prevention of the propagation of explosions in bituminous coal mines has no parallel in the history of coal mining in the progress of safety."

THE individual burden of suffering and deprivation and blasted lives caused by all industrial catastrophes cannot be measured. There is, however, a cost that falls upon the whole community that is roughly measurable in dollars and cents. This cost includes property loss, charitable relief and accident compensation.

A study made by the American Association for Labor Legislation of the community cost of five recent coal-mine explosions shows $273,500 property loss, $269,295 charitable relief to stricken families, and $1,552,040 workmen's accident - compensation awards. This makes a total for the five explosions of $2,094,835 — an average community cost for each disaster of $418,967. In the past five and one-half years there have been 59 "major" coal-mine explosions in the United States, causing the death of 1,707 miners. In the Castle Gate explosion alone more than 100 of the 172 miners who lost their lives were heads of families, leaving 868 widows and children. The 44 miners who were killed in an explosion in Pennsylvania recently left 175 dependents, of whom 129 were children. Is there not justification for the public's concern over community cost?

COAL-MINE operators and managers are aware of the impressive strides that are being made toward preventing coal-dust explosions. Stimulated and aided by public opinion, coal-mine engineers and progressive mine operators have made splendid contributions to the practical application of the known remedy—rock dusting. When in December, 1922, the American Association for Labor Legislation began its present campaign for the adoption of preventive measures, it was able to secure from official sources the names of less than half a dozen coal companies in the United States and Canada that were using the rock-dust safeguard. Since then, the Association has been publishing in each issue of its quarterly *Review* a "Roll of Honor of Coal Companies Using Rock Dust to Prevent Coal-Dust Explosions." In the current number the list has grown to 214 companies in 17 states and Canada!

FIVE years ago there were no rock-dusting laws in this country. Already six states—Utah, Pennsylvania, Wyoming, West Virginia, Ohio and Indiana—have enacted provisions for rock dusting. Indiana's new rock-dusting law, enacted this year, is based on the "standard bill" prepared as an aid to uniform state legislation. This bill embodies the "standard practices" recommendation of the American Engineering Standards Committee. These recommendations were thus formulated after the most careful consideration by representatives of the following organizations: American Association for Labor Legislation, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Mining Congress, Associated Companies, Coal Mining Institute of America, Mine Inspectors' Institute, National Coal Association, National Safety Council, United States Bureau of Mines, United States Department of Labor. Practical coal-mining men should have no misgivings in supporting this measure for legislative action.

COAL-MINE explosions alone cause from 12 to 15 per cent of the fatalities in the bituminous field—in one year, 1924, nearly one-fourth. If all or nearly all of these deaths can be prevented by rock dusting, does not a heavy responsibility rest somewhere for further loss of life from this cause?

The study of the problem of preventing accidents due to falls of roof and coal, recently undertaken by the Federal Bureau of Mines, is an important step toward providing a practical and scientific remedy for accidents of this kind which deserves co-operation on the part of state mining officials and coal-mine operators. If engineering science succeeds here as well as it has in finding an effective safeguard against coal-dust explosions—and both remedies are given universal application—it will mean putting an end to more than half of our coal-mine fatalities. Surely a goal worthy of our best efforts!

IT IS fair to say, I believe, that the real significance of the action taken at the recent Cincinnati conference on safety standards, in connection with the meeting of the American Mining Congress, lies in the fact that coal-mine operators and managers formally expressed approval of experiments with safety measures now under way under both private and public auspices. In the past the coal-mine owner has been regarded as an intense individualist. He resisted what he called "outside interference." The characteristic isolation of coal camps may have aggravated this attitude which, in industry generally, has long been giving way to a spirit of co-operation. The resolution adopted at Cincinnati, while disappointing to those in the vanguard of safety work, was, as far as it went, a victory for the modern spirit of co-operation over the old individualism.

The standards by which present-day industrial executives are being judged include a proper attitude toward the human side of industry as well as a proper conception of industry's relation to the public. The welfare of employees should be considered as well as the interests of stockholders. In the matter of accident prevention the executive is dealing with more than material interests; he is dealing with the lives and limbs of breadwinners. The testimony of leaders of industry has been overwhelming that effective safety work, as stimulated and aided in recent years by accident-compensation legislation, not only satisfies the humanitarian impulse and promotes better industrial relations but also is "good business."

PROGRESSIVE coal-mine managers, in meeting the modern challenge to accident prevention, are also finding that their interests and the public interest are mutual in the matter of effective safety legislation. Through legislation the public fixes minimum standards below which no operator is permitted to let his safety practices fall. The humane, far-sighted operator is thus protected against the under-cutting of his less scrupulous competitor. Coal-mine safety laws in this country lag woefully behind accepted engineering standards. Many substantial coal companies already have adopted safety measures far in advance of legal requirements. But until adequate and uniform standards are required by all mining states, preventable coal-mine accidents will continue to be a national reproach. Safety work is a paying investment in itself but it cannot always be carried on adequately by the enlightened operator if any of his close competitors remain free to sacrifice safety to greed. To operators and managers who are sincerely desirous of preventing accidents, legislation is therefore an essential protection.

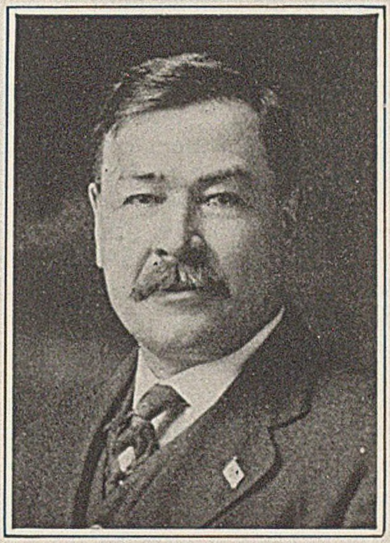
THE modern keynote of coal-mine safety is co-operation—co-operation among mine managers and safety engineers and their organizations and private and public agencies in developing scientific safeguards and perfecting the technique of applying them—co-operation also in bringing about the adoption of uniform minimum standards of safety through legislation that is well-considered and constructive. Co-operation all along the line should appeal to the earnest and public-spirited leadership in the industry as the only means of accomplishing the urgent task of eliminating all preventable coal mine accidents.

DOES LONGWALL PAY?

Is It More Profitable Than Room and Pillar?

By J. J. Rutledge

Chief Mining Engineer State of Maryland Baltimore, Md.



J. J. Rutledge

ANY answer to the questions of my caption must depend on whether longwall is possible at all without pack-walling, and on the length of the longwall face. The question, "If you were putting in conveyors or loaders, would you choose some form of longwall or use room-and-pillar methods?" must be supplemented by other inquiries. Which longwall method? Why would you use it and where?

Before replying to these questions it may be well to instance some observations recently made in the examination of a number of mines where experiments in the use of conveyors were being made in longwall mining—mostly panel longwall. The thickness of the coal seams varied from 1 ft. 7 in. to 9 ft. and the inclination or dip from zero to 70 deg., the coal seams, in some instances, being clean and free from partings, whereas in other cases practically half the cross-section of the seam was composed of shale, binder and other foreign material. The roof varied from hard conglomerate, through hard dark-colored shale, to a fine-grained grey shale, so soft that it could be readily cut by a pocket-knife, and the floor ranged from soft fireclay, a few inches in thickness, to a hard sandstone of unknown depth.

In the mines visited, the results being obtained were good, bad and indifferent. In a few mines packwalls and cribs were being used; in others cribs alone, and in the remainder no attempt was made to support the main roof, which was being broken by props, cribs and jacks, from 12 to 20 ft. from the coal face. In a few mines the roof had broken at the face of the coal and the work was a failure, at least so far as it had progressed.

It may be said in passing that my experience and observations, as far as they have extended, lead to the conclusion that the best system of longwall in this country is the advancing plan as practiced for many years in northern Illinois. In this method of working the weight of the overlying strata is supported by packwalls, the material for which is derived from brushing the shale roof. Formerly all the coal was undercut by hand labor but, to some extent, in recent years, mining machines have been used for that purpose.

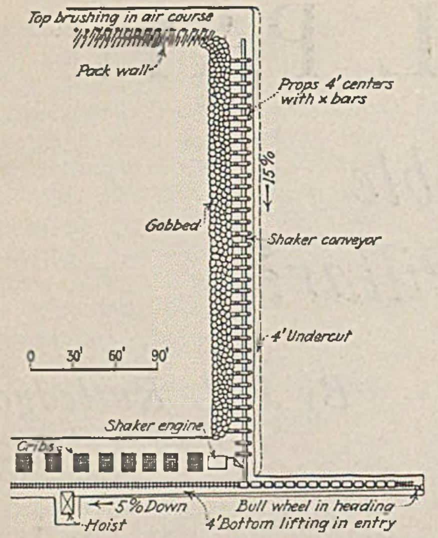
THE basic principle of this method of working, especially when mining by hand, is to so regulate the thickness of the packwalls and the density of the packing between them as to throw a large part of the pressure from the overlying strata on the coal face and thus to make it easier to mine the coal.

The actions consequent on extraction of coal by longwall and other methods can be studied in Bulletin 238, U. S. Bureau of Mines, entitled, "Subsidence Due to Coal Mining in Illinois," which publication gives experimental observations of roof action in the longwall field of the state.

When panel longwall mining is employed, especially when mining machines are used to undercut the coal, and more particularly when the cutting is not made in the clay underlying the seam, but in the coal at floor level, other forces are set in operation. As machines are being used to undercut the coal, there is no advantage in throwing the weight of the overlying strata on the coal face. Indeed, it is essential that this action be avoided and that the pressure of the overlying strata be thrown back from the coal face on the gob so that the roof immediately at the outer edge of the coal face will not be fractured.

NEARLY everyone who has tried panel longwall has found almost uniformly that a disastrous cutting of the roof tends to occur at the face of the coal and that that effect can be avoided only by breaking the roof and relieving the pressure from the overlying strata at some point outby the coal face. Many coal operators so fear this action that they have abandoned the use of panel longwall methods and have resorted to the room-and-pillar method.

CONVEYORS, especially when they are equipped with "duckbills," are peculiarly adapted to the driving of development roadways. After the roadway is completed the "slabbing" of the rib is usually the next step taken. Slabbing is more easily done in room-and-pillar work, but it is usually abortive and results in slipshod mining. A certain quantity of coal is readily and cheaply mined to a limited distance from the conveyor, but if it is desirable to mine beyond that distance the conveyor must be moved or another such unit introduced. In most cases, much coal is lost in the pillars left between the



Longwall for Shaker Conveyor

areas that have been slabbed. Frequently the roof falls because the slabbed area is so large. In its collapse it seriously damages or entirely destroys the conveyors. In panel longwalls, on the other hand, by the use of suitable props and jacks and even of cribs which are capable of being withdrawn, it is possible to break the roof successfully at some distance from the face; in fact, it has been found in a few instances that the poorer the roof the better and more readily it can be caused to break.

With roof thus broken less timber is necessary and the face is kept open. Moreover, the coal produced has a larger percentage of lump.

A visit to a few panel longwall mines is all that is necessary to convince any skeptic of the truth of this statement. Especially is it possible to break the roof when jacks are used. In panel longwall the operations should be performed in sequence—cutting, loading, timbering, moving conveyors, etc.—and, if this sequence of operation is properly observed, the work is a success; one of the greatest advantages of panel longwall is the increased output per loader.

In steeply pitching seams, where the rooms are driven to the rise, room-and-pillar methods are impracticable and conveyors cannot be used successfully. Under these circumstances the only feasible methods are either panel longwall or those in which rooms are driven parallel to the strike of the coal seam. The cost of room turning and road brushing, if the latter is needed, makes the room-and-pillar method undesirable.

Should the seam contain a middle band or be surmounted by a thick drawslate, this material will be more readily and cheaply handled in panel longwall than in room-and-pillar work. A larger and more uniform output per employee can be obtained in panel longwall than with rooms and pillars. Sand jacks or jacks of some other type and straps can be used to better advantage in panel longwall than in the room-and-pillar method. Thus the roof is kept under better control and gives less trouble.

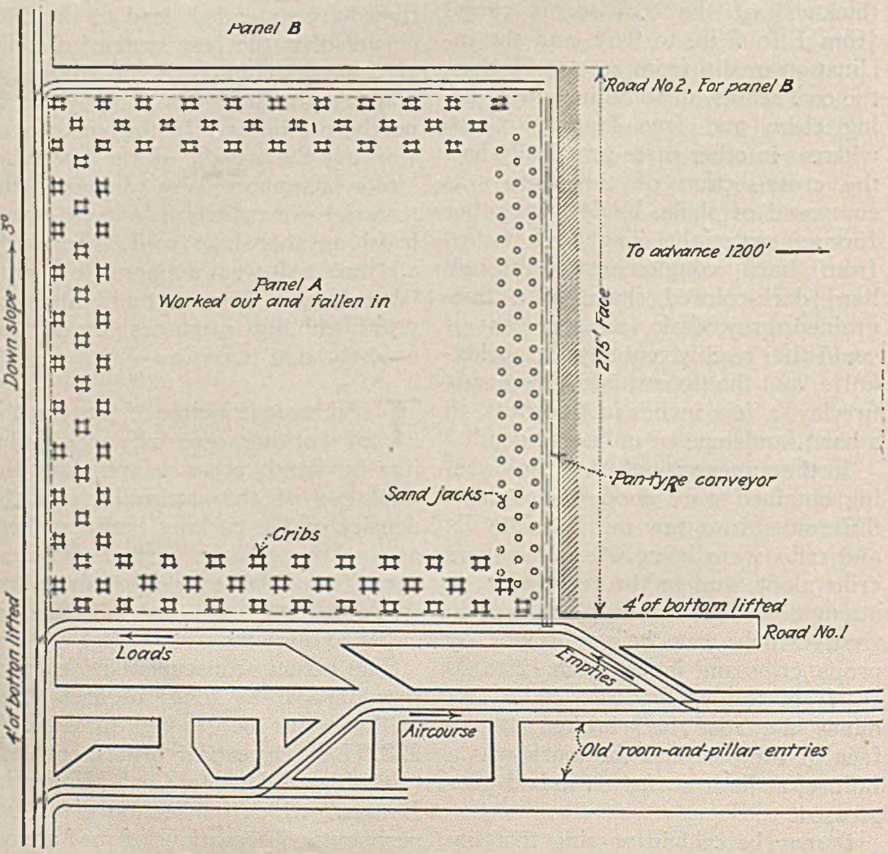
Slabbing has its disadvantages. Wherever the coal is undercut in a clay seam the cuttings must be loaded into mine cars and taken outside the mine workings. Also, when slabbing, all the binder or other foreign matter in the coal seam, together with the drawslate and bottom cuttings must be loaded into cars whereas in panel longwall usually the greater part of such material can be gobbed in the space where the coal has been mined.

My inquiry indicates that the "duckbill" gives better results in room-and-pillar work than in panel longwall, but if the duck-bill is set to work along the panel longwall face loading out the coal "end on" it can be used to advantage. This is an specially good plan wherever the roof is weak. The mine manager is more likely to get a squeeze on the roadway when slabbing than when mining by the panel longwall method.

Lateral conveyors are less effective and more troublesome than main conveyors, and it is usually necessary to use the former when the coal is mined by room-and-pillar methods and conveyors are used. The room-and-pillar method is unsafe both for employees and equipment because the conveyor is not near the solid pillar as in panel longwall work. A squeeze on the entry is more likely to occur when slabbing than when panel longwall is used. Usually a longer face is required in slabbing than with panel longwall. On the other hand, it is probably true that the entries can be worked out more rapidly by room-and-pillar than by ordinary panel longwall.

In the panel longwall method the support of the roof by packwalling, or its fracture, is complete when the conveyor, props, straps or bars are removed, but this is not so when the slabbing method is used. Collapse is long delayed and the pressure continues after the ribs are slabbed. The main trouble with most panel longwall work is that the panel length taken is too long. Beginners in this method of mining usually make this error. The roof is better controlled in panel longwall than in the slabbing method and this is true whether the advancing or retreating plan is used.

When cribs are used the cost of timber in some cases is prohibitive,



System of Longwall Mining with Sand Jacks therefore, the timber must be recovered, or steel timber, if practicable, must be provided and the roof broken and caved. I have seen a 9-ft. seam of coal worked successfully on the advancing longwall method by the use of collapsible cribs which permitted the roof to break a short distance outby the coal face, thus relieving the pressure upon it.

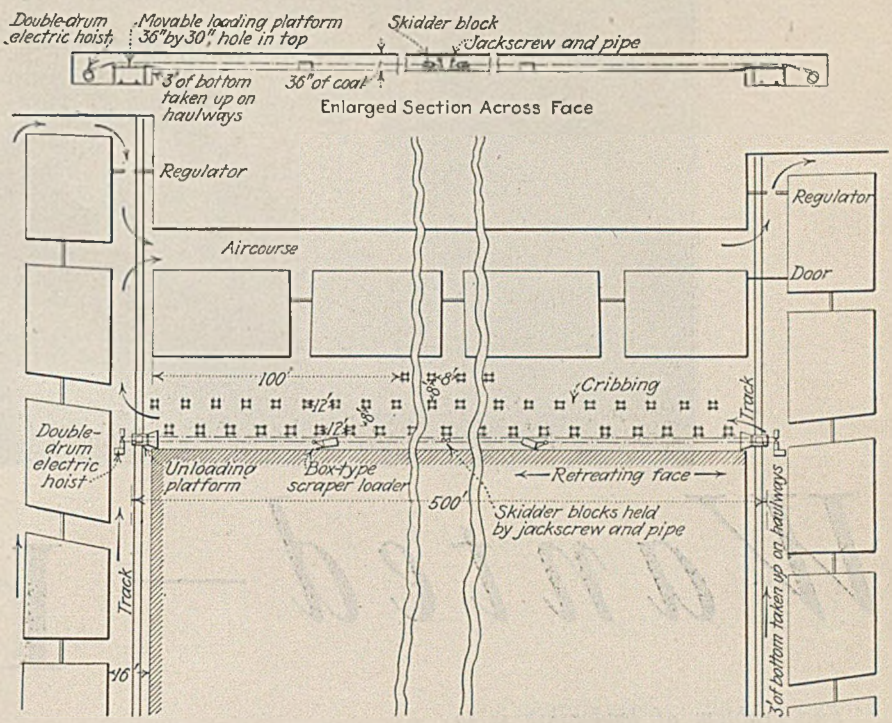
IT is probable that this country will soon have, especially in thicker seams, gob-piling machines such as are used in Germany. These machines will take the place of hand work in building packwalls or in storing gob.

All will agree that the faster the face moves the better the roof stands, and it is my contention that the face can be advanced more rapidly and safely with panel longwall than by slabbing. There is a certain shearing action in the strata immediately overlying the coal and, above the area where the shearing is observable over most longwall work, there is a bending of the strata.

The "first break," in advancing longwall, is usually the worst and occurs immediately outby the shaft pillar. Those who try out panel longwall should expect to experience a reasonable amount of trouble in obtaining the first cave.

NO one will question, it is believed, the statement that panel longwall retreating is less expensive than room-and-pillar mining. The great trouble with panel longwall is usually with timber cribs. These must be left in place or removed with much expense and danger. If they are left in, they frequently act as fulcrums and transfer the pressure of the overlying strata from the gob to the longwall face and cause the roof to cut at the face and perhaps close it entirely. By the use of cribs, which are judiciously placed at various points in the panel longwall face and are removed in due order it is possible to work retreating panel longwall successfully in thin coal seams.

In recent practice, where a shearing cut is made in the longwall face, jacks have been placed in the back of the undercut. This prevents the roof from cutting at the face as the coal is removed. The use of metal straps and tubular steel props will probably reduce the timber cost considerably for, when these are provided, all the timber can be removed and less of it ordinarily will be needed for roof support.



Longwall Mining with Scraper Loading

MY observations show that one great trouble with the panel longwall method, as it is so frequently tried, is that the conveyor chosen has been unsuitable for the work, especially when the chain type of conveyor has been used. The moving of props over chain conveyors is expensive and dangerous. The pan type of conveyor is much more rapidly moved between the props and up to the longwall face than the chain type of conveyor.

In some parts of the country, room turning, yardage and brushing cost so much that coal cannot be mined profitably by room-and-pillar methods. Under these circumstances the methods of working must be changed. This is particularly necessary when labor organizations will grant no relief from onerous working conditions. Likewise, adverse railroad freight rates on coal, which prevent operators of certain fields from competing with those in other fields, can be met only by a change of this kind.

AS a result of the problems consequent on the use of longwall, a new class of professional men has arisen, known as "underground engineers," who have experimental knowledge of the stresses and strains which the strata over coal seams experience when coal is being mined. A new class of miners has been developed, men skilled in underground work with conveyors and comparable to those who have learned to do such excellent work in mines operated by true longwall. Until they have had the needed experience, some problems are sure to arise. Nevertheless I would use the panel longwall method even now and for the following reasons:

(1) It will yield a larger tonnage per foot of advance than the room-and-pillar method.

(2) In many mines it will reduce the number of costly packwalls that have to be built when the true longwall is used, for with panel longwall the roof will be broken permitting the overlying strata to subside at a point some distance outby the coal face.

(3) When packwalls have to be built, it will be possible to dispose of most of the waste material underground in that manner.

(4) Where panel longwall faces are of proper length it will make less brushing of roofs or lifting of bottom necessary than in room-and-pillar workings.

(5) It will reduce the entry driving and trackage necessary in room-and-pillar operation and will increase the output per employee.

Any of these considerations is individually important but when taken together their effects become almost cumulative. Naturally every operator desires cheap coal and panel longwall, when properly planned and executed, would appear to possess large possibilities in this direction. As its use becomes more extensive, effective ways of surmounting its difficulties will doubtless be found.

Wanted— Leaders

"The problem of leadership is to the fore today because of the recognized need in industry, first, of animating those who direct and supervise with a co-operative rather than an autocratic attitude and technique and, second, because of the need of securing in those led a positive and creative motivation. Leadership is the note because of a new outlook on the way in which human power is generated, focused and sustained—an outlook which means an animating spirit on the part alike of leader and led, different from that between "boss" and "underlings," and nearer to that of the captain and members of a football team."

THE words quoted above represent the opening paragraph of an address recently delivered in the capital of the nation. There is at the present moment a call for leadership in the actual conduct of coal mining operations such as never before existed during the life of the industry.

The coal industry is one which is not only overdeveloped and overmanned but is also hopelessly divided along geographical, labor relationship and market lines. The prospects for any integration of the many diverse interests involved are well-nigh hopeless. Therefore, the only practical solution lies in effecting an adjustment of mine capacity to market demand, through some process of selectivity which is possible of automatic application. This can best be secured through a new conception of leadership within the industry, with the capacity and inclination to give this conception life.

The term leadership connotes the ability to lead; leading means that others must follow. As those who lead will always be in the minority, it is only logical to say that great potentialities have always rested with the leader who is capable of inspiring and energizing the majority. What is the character of leadership that has heretofore been employed within the industry? Such has been either speculative or economic—in some cases a combination of both. In many cases the leadership displayed has been of alien and remote character.

> ?
>
> *What can a new and more personal leadership do to stimulate coal mine efficiency?*
>
> READ THIS ARTICLE FOR THE ANSWER

The vital requirement of the coal industry today is harmonious group action, the willingness on the part of man to do his very best toward a certain objective. This objective may best be expressed through a combination of maximum production, of the highest possible quality, at the minimum cost. To secure these three essentials, production, quality and low cost, presupposes the securing in some way by the leader of the support of those whom he leads. In the past it has been possible to obtain a grudging measure of support through economic forces—such as scarcity of employment—or through a wage so low as to make labor inefficiency and waste a matter of secondary importance. The price paid for labor is now so high and the opportunity for securing employment elsewhere is so general as to justify the employer recasting entirely the mining practice previously employed, and likewise the attitude of mind long displayed in coal mine management and leadership.

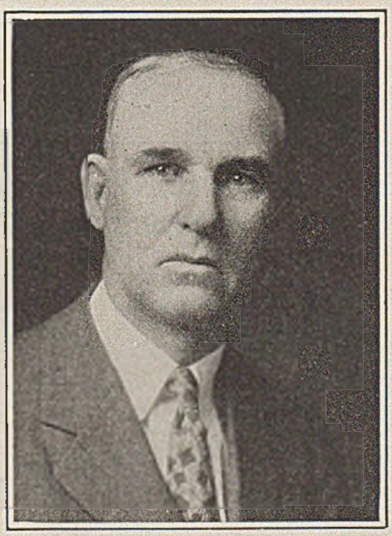
A frank confession is always good for the soul. It is safe to say that the outstanding mistake made by the industry in the past has been that of substituting, in so far as it was possible, a tonnage or other task-rate in the case of one-half of our mine employees, while the remaining one-half was engaged for the purpose of serving the primary producers paid on the task-rate, with the limited leadership displayed very generally directed toward withholding necessary collateral service from the task-paid employees.

# of Men

This process resulted in building up the task-rate to a point sufficient to absorb the employer's failure to render the task-paid employees the service impliedly promised them, with much of the supervisory effort made directed toward restriction rather than production.

The character of leadership in coal-mine management which is now beginning to appear is that which has been tried and proved profitable in other great and successful industries. It is a leadership that substitutes personal contact, friendly guidance and good-will relationship for the theory of "master and man" heretofore employed. The workman no longer approaches his employer haltingly, with uncovered head, but rather with a sense of equality, the result of changed social conditions, the broadening of educational opportunity and the elimination of the specter of privation which in the past assumed the form of unemployment.

I have long thought that the human equation enters too far into the conduct of a coal mining property to admit of the company's principal executive or governing body sitting upon and deciding questions relating to labor relations, mine operation and safety, from what might be called a non-resident or alien position. In substance, I believe that the man in charge of coal-mining property and responsible for its policies should know mining, and should also possess the physical qualifications, the time and the willingness to enter into the very bowels of the situation; this means a first-hand and frequent study of underground conditions. The executive should know his men. Non-resident landlordism occupying, as it



Eugene McAuliffe

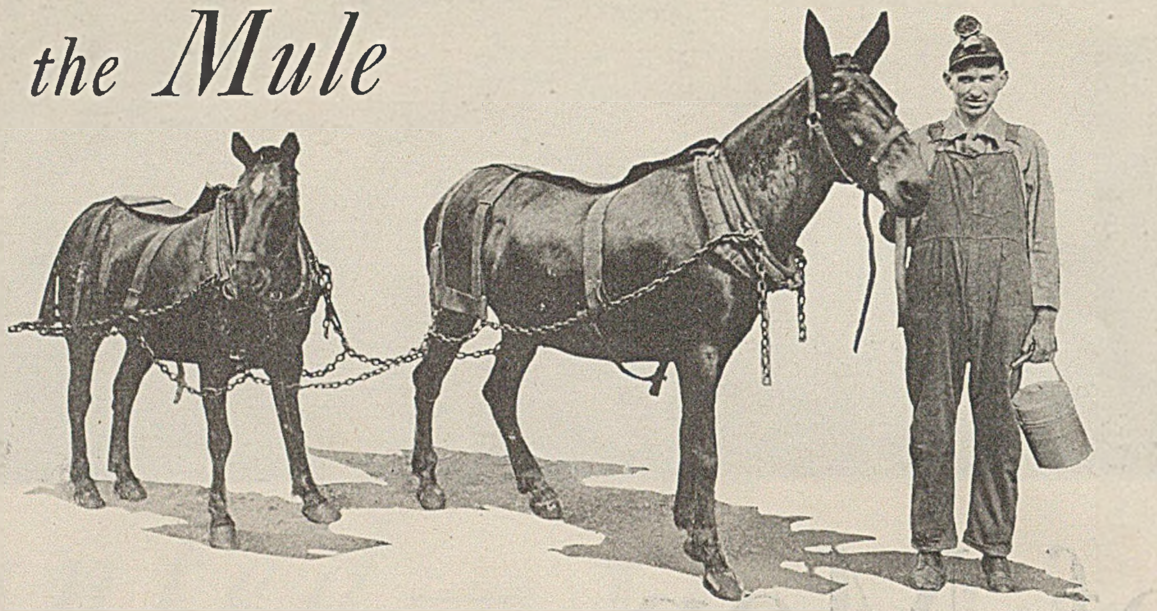
does, a position so detached as to make it impossible to vision the problems involved, has never made a success of any great industry, whether that industry be agriculture, transportation or mining.

The opportunity for expression now open to coal-mine leadership is one unparalleled in the history of the industry. Right leadership will automatically provide the reduction in mine capacity necessary to place coal on a sound commercial basis. This will be accomplished through the working of the selective process before referred to. Such will in turn create a new labor status, with a more skillful and self-respecting body of workers who, enjoying a higher average earning and receiving a just and equitable share of the wealth they create, will strive to produce as much as possible, knowing that the real zone of consumption lies within their ranks.

It is this new quality of leadership that must succeed and take the place of the fragmentary, ultra-vocal guidance which has so long existed. The employers and the labor leaders who have caught the new spirit, who have ceased to think and talk in terms of what happened when the kerosene lamp, the monthly paper, and one suit every two years were the prevailing vogue, are pointing the way—a way blazed by the nation's successful industries, a class within which, with few exceptions, the coal industry no longer stands. It is time to "cast off the lines." There has been too much "churning of the paddle wheels" without headway on the part of so-called coal, industrial and labor leaders.

Eugene McAuliffe

EXIT *the Mule*



By H. O. Rogers

U. S. Bureau of Mines

"H. O. Rogers got his first taste of the coal industry in the offices of the Colorado Fuel and Iron Co. He enlisted in the U. S. Navy during the war and studied economics and statistical methods at George Washington University. He visited many of the coal fields as field agent of the Hammond Coal Commission, in 1922-23, and in 1924-25 was statistician for the Dennison Manufacturing Co. In 1926, he was appointed to his present position in the Economics Branch of the Bureau of Mines under C. P. White."

THE high degree to which mechanization of the bituminous coal mines of the country is being carried is indicated by a statistical study of methods of underground haulage, recently completed by the Bureau of Mines. Of the 7,361 deep mines in operation during 1924, there were 3,585, producing 88 per cent of the output, that reported the use of locomotives of some type underground. The mines not using locomotives, although numbering 3,776, produced only 12 per cent of the output.

A total of 3,377 mines reported one or more electric locomotives, and these mines produced 85.6 per cent of the output.

There were 14,723 locomotives of all types used underground during the year, of which 14,280 were electric, 85 compressed air, 226 gasoline and 132 steam. The total number of animals employed underground was 36,352 and, in addition, there were 649 rope-haulage units.

The information presented herewith was obtained through a question on the Bureau's annual statistical report card for 1924 which was sent to all producers with an annual output of more than 2,000 tons. It covers all mines in operation during the year. In some few cases the operator failed to answer the question, but the information lacking was supplemented by the data relating to haulage appearing in the 1925 edition of "The Coal Catalog," issued by the Keystone Consolidated Publishing Co.

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Information was obtained from 5,703 out of the 7,361 deep mines that operated during 1924. The remaining 1,658 were largely "local commercial" mines with an annual output of less than 2,000 tons. No information was requested regarding the nature of the haulage system installed in these small operations. To make the figures complete, estimates of the number of animals used by these local mines have been included in the totals. As these mines produced only 2.5 per cent of the output, the possible error introduced by the

TABLE I—TOTAL NUMBER OF UNDERGROUND HAULAGE UNITS USED IN SOFT COAL MINES IN 1924

States	Animals	Rope-Haulage Units *a*	Storage-Battery Locomotives With Trolley	Storage-Battery Locomotives Without Trolley	Electric Trolley Locomotives	Compressed Air Locomotives	Gasoline Locomotives *b*	Steam Locomotives *b*	Total Number of Locomotives
Alabama	1,928	56	13	29	305	1	38	8	394
Alaska	21	...	...	...	...	...	...	...	....
Arkansas	317	13	...	2	7	...	4	...	13
California	6	...	...	...	...	...	...	...	....
Colorado	1,703	144	5	20	118	2	2	6	153
Georgia	13	...	...	...	...	...	...	...	....
Idaho	1	...	...	...	...	...	...	...	....
Illinois	4,378	14	85	304	1,153	...	15	6	1,563
Indiana	1,744	...	40	99	345	...	3	13	500
Iowa	979	31	4	2	58	...	2	...	66
Kansas	522	...	13	38	12	...	1	15	79
Kentucky	2,980	7	133	137	1,182	2	6	5	1,465
Maryland	299	2	5	4	76	...	4	1	90
Michigan	95	...	...	5	34	...	...	...	39
Missouri	317	2	2	9	10	...	2	...	23
Montana	271	3	4	3	55	...	1	1	64
Nebraska	1	...	...	...	...	...	...	...	....
New Mexico	449	51	8	2	66	...	2	...	78
North Carolina	6	2	...	...	...	...	...	...	....
North Dakota	173	...	...	...	5	...	2	1	8
Ohio	2,493	10	61	88	631	1	5	...	786
Oklahoma	548	5	1	8	8	...	...	...	17
Oregon	4	...	...	...	...	...	...	...	....
Pennsylvania	8,843	170	176	276	3,559	42	61	36	4,150
South Dakota	16	...	...	...	...	...	...	...	....
Tennessee	649	9	6	12	182	...	26	5	231
Texas	157	2	...	3	10	...	7	1	21
Utah	373	17	9	1	66	...	...	...	76
Virginia	478	3	18	36	460	...	3	9	526
Washington	149	7	4	15	67	...	4	4	94
West Virginia	5,906	12	188	419	3,477	36	38	21	4,179
Wyoming	533	89	4	3	100	1	...	...	108
Total	36,352	649	779	1,515	11,986	85	226	132	14,723

a Does not include rope hoists on main slopes. Data unsatisfactory because of misunderstanding of questionnaire.

b The figures for gasoline and steam locomotives do not include a large number employed exclusively on the surface.

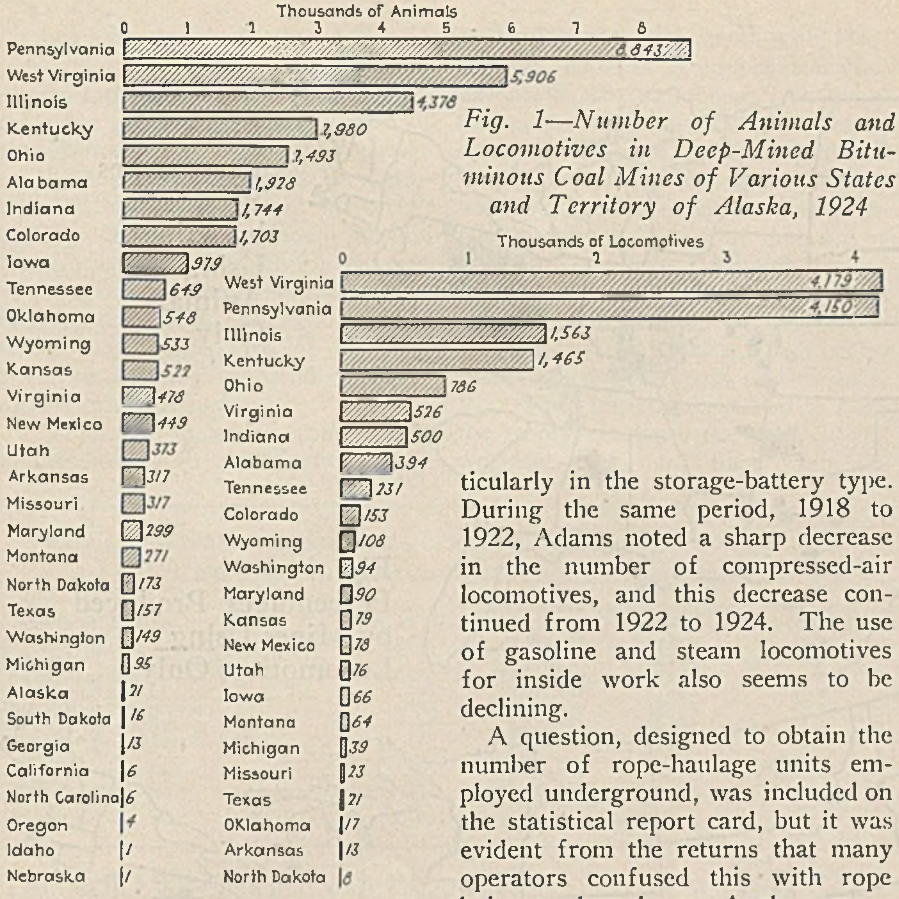


Fig. 1—Number of Animals and Locomotives in Deep-Mined Bituminous Coal Mines of Various States and Territory of Alaska, 1924

estimates is so small as to be practically negligible.

The haulage equipment of stripping pits, of which 225 were in operation in 1924, and such equipment of deep mines as is used only on the surface, are not included in the statistics.

Table I shows, by states, the number of underground haulage units in use in bituminous coal mines in 1924. It will be seen that the mine mule is still widely employed, but the number of animals of all kinds underground is a small factor in the demand for work animals, for the total number of horses and mules in the country is about 24,000,000. Included in the 36,352 mine animals are a few dogs used in small mines working thin coal.

Of special interest in connection with Table I is the rise of the electric locomotive and the decline of other types. According to W. W. Adams *(Kinds of Haulage and Cutting Machines in Coal Mines, U. S. Bureau of Mines Serial No. 2352, Reports of Investigations, May, 1922)* the number of storage-battery locomotives in use increased more than 300 per cent from 1918 to 1922, and the number of trolley locomotives increased 23 per cent. From 1922, the last year covered by Adams' study, to 1924, there was a further large increase in both types, but particularly in the storage-battery type. During the same period, 1918 to 1922, Adams noted a sharp decrease in the number of compressed-air locomotives, and this decrease continued from 1922 to 1924. The use of gasoline and steam locomotives for inside work also seems to be declining.

A question, designed to obtain the number of rope-haulage units employed underground, was included on the statistical report card, but it was evident from the returns that many operators confused this with rope hoists used on slopes. As the purpose of this study was to determine the system of underground haulage used to transport the coal from the working face to the shaft or slope, or to the drift mouth, rope units employed in hoisting were clearly beyond the scope of the present analysis. In editing the returns every effort was made to eliminate rope units such as described above, and the resulting figures are presented in Table I as the best now available. The total number of rope-haulage units shown —649—is probably less than the number actually in use.

It has, therefore, not seemed worth while to separate the rope-haulage mines in the subsequent analysis and in Tables III to VI, the mines have been classified in three groups only: (1) those using animals but no locomotives; (2) those using locomotives but no animals; and (3) those using a combination of locomotives and animals. All three groups, it will be understood, contain a small number of mines also using rope haulage.

The figures on number of units employed underground as given in Table I do not give a true idea of the relative importance of the various methods of haulage. What is really important is the proportion of the total output handled by each method. Table III shows that 12 per cent of the output came from mines using animals only; 34.1 per cent from mines using locomotives only, and something over half—53.9 per cent—from mines using both locomotives and animals. Tables IV and V give the details by states and Fig. 3 shows the same data in graphic form.

The percentage of deep-mined coal produced in 1924 by mines using animals only is shown by counties in Fig. 3. From this diagram it will be seen that animals constitute the chief means of underground motive power in the tier of states from Iowa to Texas. Mines using animals exclusively (or animals and ropes) accounted for 77.1 per cent of the deep-mined coal produced in Missouri, 77.0 per cent in Oklahoma, 75.0 per cent in Arkansas and 70.8 per cent in Texas while in Iowa and Kansas about 50 per cent of the production came from mines of this class. Natural conditions in this area have not favored mechanization.

In 1924 the 1,512 bitu-

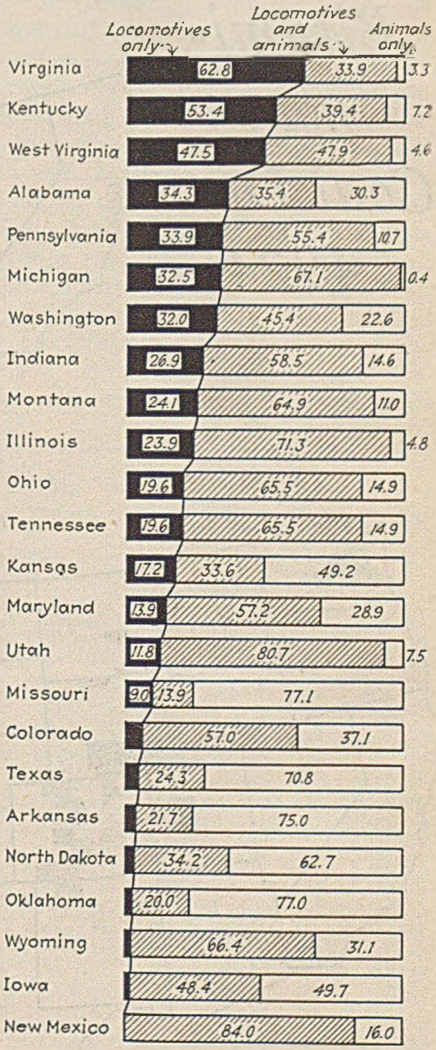


Fig. 2—Percentage of Total Deep-Mined Coal Produced in 1924 by Method of Underground Haulage Employed

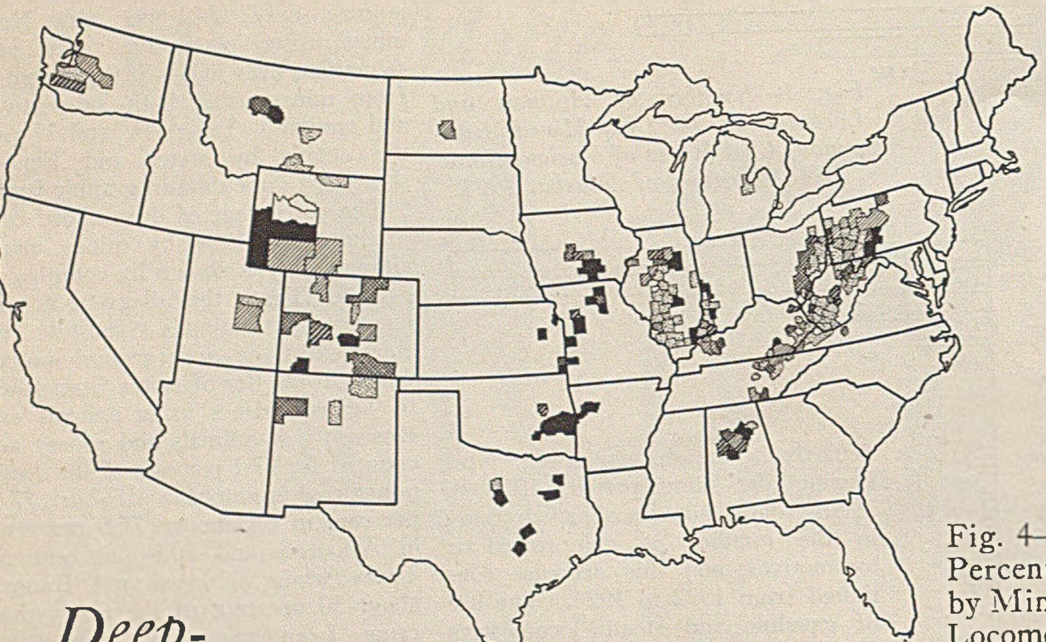
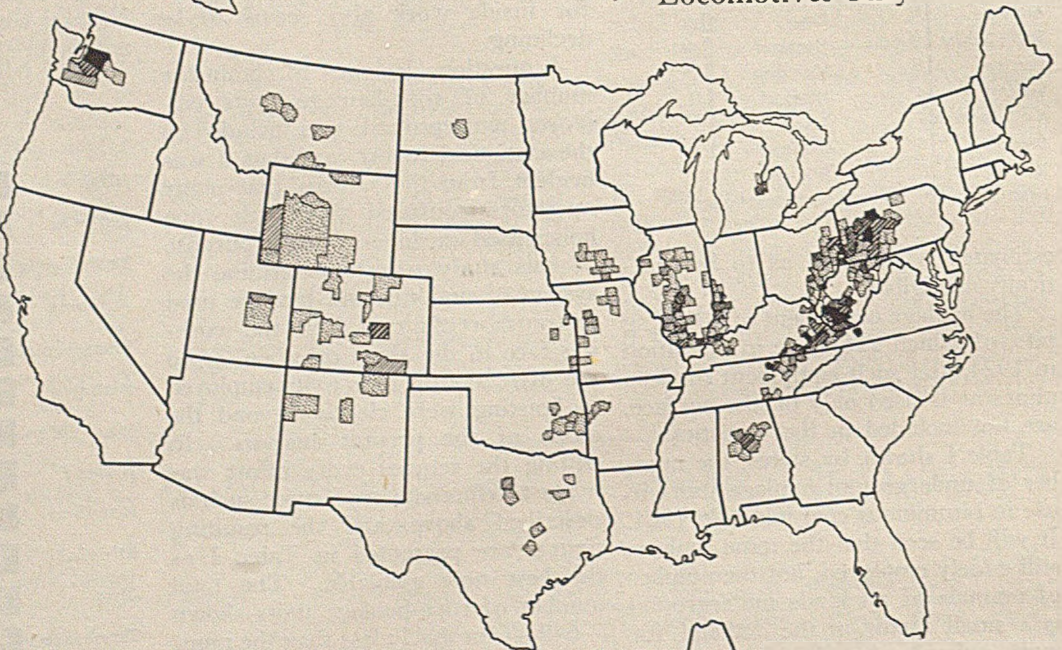


Fig. 3—
Percentages
Produced
by Mines
Using
Animals
Only

Deep-Mined Bituminous Coal Data 1924

Fig. 4—
Percentages Produced
by Mines Using
Locomotives Only



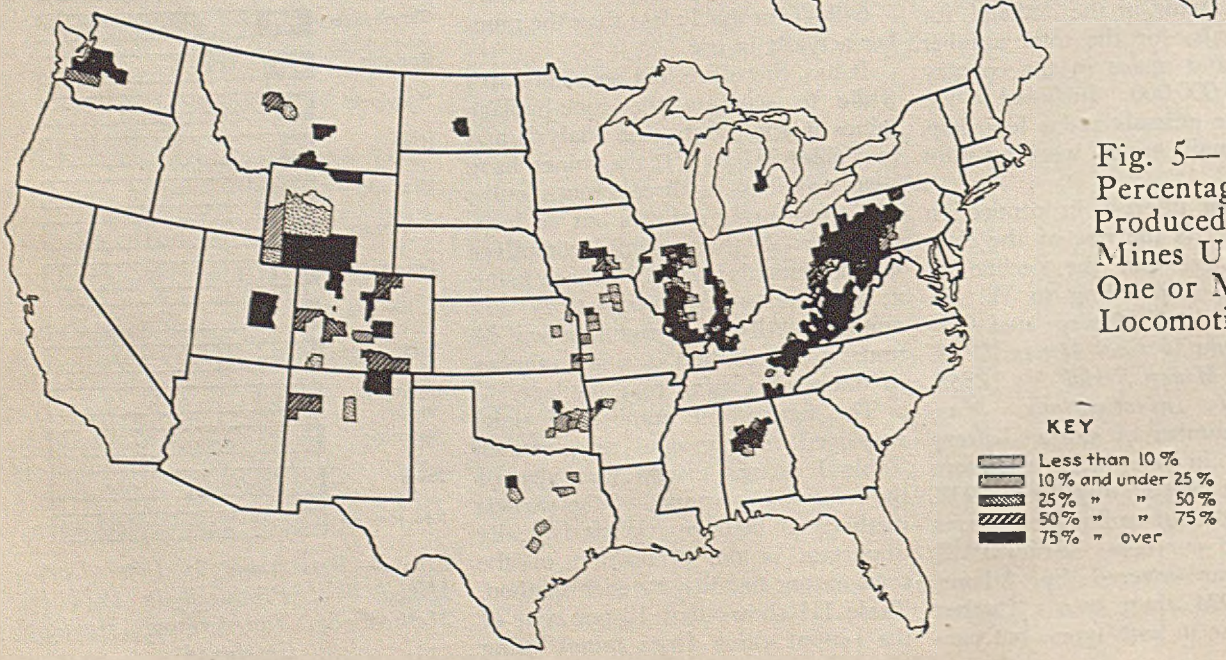


Fig. 5—
Percentages
Produced by
Mines Using
One or More
Locomotives

minous mines producing more than 34 per cent of the deep-mined coal employed locomotives only. Fig. 4 indicates the geographical distribution of these mines by showing the percentage of the total output which they contributed in each important producing county. The counties shown in solid black are those in which 75 per cent of the tonnage came from mines using locomotives only, and counties in which such mines are of less importance are shown in graduations of diminishing density.

The extent to which animals can be dispensed with and the entire work of haulage be performed with locomotives, depends upon physical conditions, as already shown. In many mines, working thin coal, gathering locomotives have been introduced simply because mules could not be used in the rooms and entries without excessive lifting of bottom or brushing of top. Elimination of mules further depends upon local practice with respect to hand tramming or pushing of cars, which is also related to the thickness of the seam. Where the miner is expected to push the empty car from the entry to the working face, and then push the loaded car back from face to entry, the task laid upon the haulage system proper is greatly simplified. Districts where this is the rule may show a high percentage of mines using locomotives only, because the miner is actually doing work which in other districts would be done by mules or by a special gathering locomotive. Some of the geographical variations in Fig. 4 are thus explained.

Subject to this qualification, the black or heavily shaded areas of the map are those where mechanization of haulage has been carried farthest. The rapidly growing Middle Appalachian region leads in the percentage produced by mines using locomotives only. Virginia came first in 1924 with 62 per cent (see also Fig. 3). Following in order were Kentucky and West Virginia, where 53.4 per cent and 47.5 per cent of the tonnage respectively was produced in mines using no animals underground.

The percentage of deep-mined coal produced in mines using one or more locomotives underground is shown graphically in Fig. 5. It must be noted that this map also includes the mines using locomotives exclusively as well as those employing a combination of locomotives and animals. The mines included in these two groups accounted for 88 per cent of the country's output during the year in question or 1924.

Heretofore, comparison has been made between animal haulage and locomotive haulage. It remains to

Table II—Number and Production of Bituminous Coal Mines in 1924 Classified According to Method of Haulage Used

Method of Haulage	No. of Mines	Production (Net Tons)	Average Output per Mine	Per Cent of Deep-Mined Coal
Animals only	3,616	47,237,062	13,063	10.1
Rope only	14	196,761	14,054	0.1
Locomotives only	1,472	154,214,737	104,765	32.8
Animals and rope	146	8,976,659	61,484	1.9
Animals and locomotives	1,951	235,194,999	120,551	50.0
Rope and locomotives	40	6,072,193	151,805	1.3
Animals, rope and locomotives	122	18,187,673	149,079	3.8
Total deep mined coal	7,361	470,080,084	63,861	100.0
Stripping operations	225	13,606,454	60,473	.....
Grand total	7,586	483,686,538	63,761	.....

Table III—Number and Production of Bituminous Coal Mines in 1924, Classified According to the Three Major Methods of Haulage Employed

Method of Haulage	Number of Mines	Production (Net Tons)	Average per Mine	Per Cent of Deep-Mined Production
Animals only (or animals and rope) (a)	3,776	56,410,482	14,939	12.0
Locomotives only (including 40 mines also using ropes)	1,512	160,286,930	106,010	34.1
Locomotives and animals (including 122 mines also using ropes)	2,073	253,382,672	122,230	53.9
Total deep-mined coal	7,361	470,080,084	63,861	100.0
Stripping operations	225	13,606,454	60,473	.....
Grand total	7,586	483,686,538	63,760	.....

(a) Includes 14 mines producing 196,761 tons that reported no means of haulage other than ropes.

Table IV—Number and Production of Bituminous Coal Mines in 1924, Classified by Methods of Underground Haulage Used by States

State	Animals Only (including a few mines also using ropes)				Locomotives Only (including a few mines also using ropes)				Locomotives and Animals (including a few mines also using ropes)					Strip Operations		Total All Mines	
	No. of Mines	No. of Animals	No. of Rope Units	Production (Net Tons)	No. of Mines	No. of Locomotives	No. of Rope Units	Production (Net Tons)	No. of Mines	No. of Animals	No. of Locomotives	No. of Rope Units	Production (Net Tons)	No. of Mines	Production (Net Tons)	No. of Mines	Production (Net Tons)
Alabama	138	1,153	31	5,688,782	36	199	14	6,439,958	56	775	195	11	6,631,363	8	370,081	238	19,130,184
Alaska	8	21	...	99,663	...	...	...	....	...	...	...	...	....	...	....	8	99,663
Arkansas	66	302	12	1,089,215	5	10	...	41,282	5	15	3	1	97,699	10	223,307	86	1,451,503
Colorado	175	753	83	3,877,309	9	21	7	618,973	47	950	132	54	5,947,816	...	....	231	10,444,098
Georgia	2	13	...	9,290	...	...	...	....	...	...	...	...	....	...	65,657	2	74,947
Illinois	234	1,008	12	3,196,859	36	543	...	15,749,210	201	3,370	1,020	2	47,081,352	17	2,295,860	488	68,323,281
Indiana	115	506	...	2,772,485	29	236	...	5,096,032	77	1,238	264	...	11,100,507	27	2,511,189	248	21,480,213
Iowa	228	614	31	2,715,190	2	4	...	105,842	26	365	62	...	2,647,418	...	....	256	5,468,450
Kansas	177	380	...	1,697,971	6	39	...	594,066	19	142	40	...	1,160,622	26	795,074	228	4,247,733
Kentucky	254	929	...	3,175,701	224	893	2	23,416,838	169	2,051	572	5	17,253,810	13	1,300,855	660	45,147,204
Maryland	56	152	...	616,535	12	33	...	296,374	25	147	57	2	1,220,794	...	....	93	2,133,703
Michigan	1	1	...	3,500	2	11	...	269,764	6	94	28	...	557,756	...	....	9	831,020
Missouri	96	278	2	1,158,306	6	14	...	135,175	6	39	9	...	207,699	19	979,700	127	2,480,880
Montana	51	86	1	298,379	3	24	2	653,403	13	185	40	...	1,760,211	1	193,372	68	2,905,365
New Mexico	24	59	11	445,520	...	...	...	....	18	390	78	40	2,340,543	...	....	42	2,786,063
North Carolina	2	6	2	57,094	...	...	...	....	...	...	...	...	....	...	....	2	57,094
North Dakota	115	144	...	480,561	1	1	...	23,684	3	29	7	...	262,098	13	434,184	132	1,200,527
Ohio	417	828	3	4,101,785	76	315	2	5,410,312	207	1,665	471	5	18,094,227	50	2,866,683	750	30,473,007
Oklahoma	72	409	5	1,553,042	1	3	...	60,000	9	139	14	...	404,464	12	312,109	94	2,329,615
Pennsylvania	1,005	2,989	39	13,875,785	558	2,160	62	43,975,626	535	5,854	1,990	69	71,879,544	24	902,818	2,122	130,633,773
South Dakota	16	16	...	12,043	...	...	...	....	...	...	...	...	....	...	....	16	12,043
Tennessee	72	241	2	678,904	13	71	...	893,122	54	408	160	7	2,984,529	...	....	139	4,556,555
Texas	35	116	1	733,406	2	10	...	51,006	6	41	11	1	251,482	1	111,117	44	1,147,011
Utah	17	63	1	338,067	2	13	1	527,936	20	310	63	15	3,622,154	...	....	39	4,488,157
Virginia	40	132	1	354,177	45	348	...	6,715,879	30	346	178	2	3,623,408	...	....	115	10,693,464
Washington	36	82	3	598,855	11	44	1	850,041	11	67	50	3	1,204,771	...	....	58	2,653,667
West Virginia	280	1,054	3	4,663,222	431	2,256	8	48,189,884	505	4,852	1,923	1	48,565,343	4	244,448	1,220	101,662,897
Wyoming	35	223	10	2,101,883	2	7	...	172,523	25	310	101	79	4,483,062	...	....	62	6,757,468
Other States (a)	9	12	...	16,953	...	...	...	....	...	...	...	...	....	...	....	9	16,953
Total	3,776	12,570	253	56,410,482	1,512	7,255	99	160,286,930	2,073	23,782	7,468	297	253,382,672	225	13,606,454	7,586	483,686,538

(a) Includes California, Idaho, Nebraska and Oregon.

Table V—Per Cent of Deep-Mined Coal Produced in 1914 by the Three Major Methods of Haulage Employed

States	Animals Only (Including a Few Mines Also Using Ropes) Per Cent	Locomotives Only (Including a Few Mines Also Using Ropes) Per Cent	Locomotives and Animals (Including a Few Mines Also Using Ropes) Per Cent
Alabama	30.3	34.3	35.4
Alaska	100.0	....	....
Arkansas	75.0	3.3	21.7
California	100.0	....	....
Colorado	37.1	5.9	57.0
Georgia	100.0	....	....
Illinois	4.8	23.9	71.3
Indiana	14.6	26.9	58.5
Iowa	49.7	1.9	48.4
Kansas	49.2	17.2	33.6
Kentucky	7.2	53.4	39.4
Maryland	28.9	13.9	57.2
Michigan	0.4	32.5	67.1
Missouri	77.1	9.0	13.9
Montana	11.0	24.1	64.9
New Mexico	16.0	....	84.0
North Dakota	62.7	3.1	34.2
Ohio	14.9	19.6	65.5
Oklahoma	77.0	3.0	20.0
Oregon	100.0	....	....
Pennsylvania	10.7	33.9	55.4
Tennessee	14.9	19.6	65.5
Texas	70.8	4.9	24.3
Utah	7.5	11.8	80.7
Virginia	3.3	62.8	33.9
Washington	22.6	32.0	45.4
West Virginia	4.6	47.5	47.9
Wyoming	31.1	2.5	66.4
Other States	100.0	....	....
Total	12.0	34.1	53.9

consider electric haulage as contrasted with all other types.

It will be seen from Table I that electric locomotives far outnumbered all others and that out of 14,280 electric locomotives, 11,986 were of the trolley type. How many of these were fitted with crab reels or conductor-cable reels, the figures do not show. The trolley locomotive is less mobile than certain other types, because it cannot leave the trolley wire and bonded rails for any great distance even when equipped with cable reel, but it is more widely used than all other types combined.

As has been previously noted, storage-battery locomotives have been rapidly gaining in favor in recent years. From 1918 to 1924 the use of this type has increased at a rate far in excess of that of the trolley type, but the number still remains far below that of the trolley locomotive. Storage-battery locomotives are primarily used for gathering purposes, and when they are made explosion-proof, they are particularly well adapted for operation in gaseous mines where the use of the trolley type is dangerous. The storage-battery locomotive has also been employed to some extent on main haulageways but when used exclusively for this service is less efficient than the trolley locomotive.

Combination storage-battery and trolley locomotives are also coming into use, 779 being employed underground in 1924. They are of particular advantage where the workings are scattered.

Table VI in conjunction with Fig. 6 gives the percentage of deep-mined coal produced by mines using one or more electric locomotives. As will be seen from this table, over 85 per cent of the deep-mined coal produced in 1924 came from mines where electric haulage is used to some extent.

Table VI—Production and Percentage of Deep-Mined Coal Produced in 1924 by Mines Using Electric Locomotives

States	Mines Using One or More Electric Locomotives: No. of Mines	No. of Electric Locomotives, All Types	Production (Net Tons)	Per Cent of Production	Mines Using No Electric Locomotives: No. of Mines	Production (Net Tons)	Per Cent of Production	Total Deep Mines: No. of Mines	Production (Net Tons)
Alabama	59	347	11,919,285	63.5	171	6,840,818	36.5	230	18,760,103
Alaska	....	....	....	....	8	99,663	100.	8	99,663
Arkansas	9	9	138,981	11.3	67	1,089,215	88.7	76	1,228,196
California	....	....	....	....	6	1,425	100.	6	1,425
Colorado	51	143	6,469,461	61.9	180	3,974,637	38.1	231	10,444,098
Illinois	232	1,542	62,620,071	94.8	239	3,407,350	5.2	471	66,027,421
Indiana	105	484	15,846,879	83.5	116	3,122,145	16.5	221	18,969,024
Iowa	28	64	2,830,912	51.8	228	2,637,538	48.2	256	5,468,450
Kansas	25	63	1,691,875	49.0	177	1,760,784	51.0	202	3,452,659
Kentucky	374	1,452	40,041,675	91.3	273	3,804,674	8.7	647	43,846,349
Maryland	31	85	1,381,149	64.7	62	752,554	35.3	93	2,133,703
Michigan	8	39	827,520	99.6	1	3,500	0.4	9	831,020
Missouri	10	21	332,970	22.2	98	1,168,210	77.8	108	1,501,180
Montana	15	62	2,409,949	88.8	52	302,044	11.2	67	2,711,993
New Mexico	10	76	2,277,467	81.7	32	508,596	18.3	42	2,786,063
North Dakota	2	5	238,063	31.1	117	528,280	68.9	119	766,343
Ohio	284	780	23,545,538	85.3	416	4,060,786	14.7	700	27,606,324
Oklahoma	9	17	464,464	23.0	73	1,553,042	77.0	82	2,017,506
Pennsylvania	1,047	4,011	113,087,561	87.2	1,051	16,643,394	12.8	2,098	129,730,955
South Dakota	....	....	....	....	16	12,043	100.	16	12,043
Tennessee	46	200	2,515,631	55.2	93	2,040,924	44.8	139	4,556,555
Texas	4	13	115,634	11.2	39	920,260	88.8	43	1,035,894
Utah	21	76	4,197,600	93.5	18	290,557	6.5	39	4,488,157
Virginia	71	514	10,209,198	95.5	44	484,266	4.5	115	10,693,464
Washington	18	86	1,756,800	66.2	40	896,867	33.8	58	2,653,667
West Virginia	891	4,084	92,945,773	91.6	325	8,472,676	8.4	1,216	101,418,449
Wyoming	27	107	4,655,585	68.9	35	2,101,883	31.1	62	6,757,468
Other States (a)	....	....	....	....	7	81,912	100.	7	81,912
	3,377	14,280	402,520,041	85.6	3,984	67,560,043	14.4	7,361	470,080,084

(a) Includes Georgia, Idaho, Nebraska, North Carolina, and Oregon.

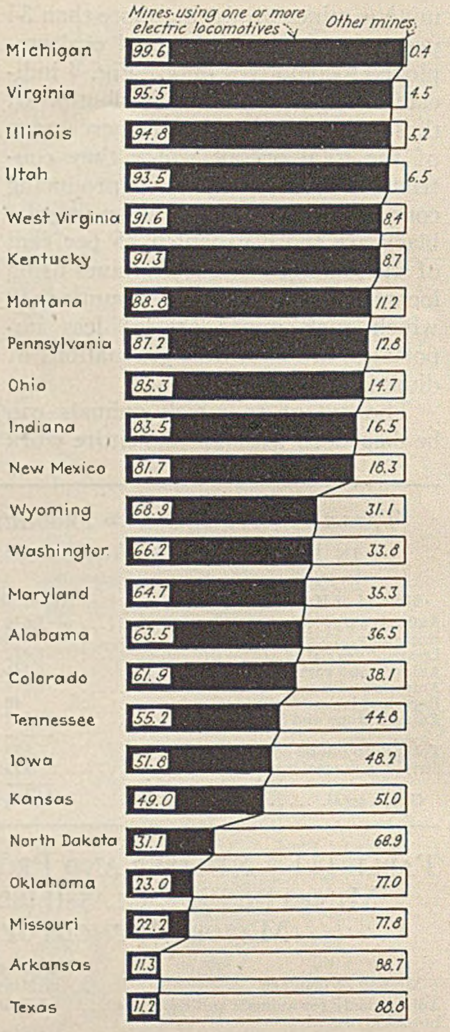


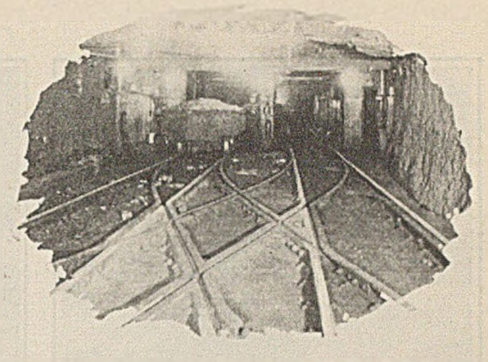
Fig. 6—Percentage of Deep-Mined Coal Produced in 1924 by Mines Using One or More Electric Locomotives Underground

Although steam locomotives were the type first used in underground haulage, comparatively few remain in service at present. They are, however, still widely used on the surface and in stripping operations. In 1924 there were 226 gasoline locomotives employed underground in bituminous coal mines. This type of motor is used to some extent in almost all parts of the country as indicated by Table I. Its advantages are great mobility and low initial investment. Its disadvantages are the fire hazard and the poisonous nature of its exhaust.

There were also 85 compressed-air locomotives in service underground in 1924, but the use of this type was confined almost entirely to Pennsylvania and West Virginia.

Thus the mule is disappearing from the mines just as the horse is vanishing from the country's highways. His place is being taken chiefly by the much faster and more efficient electric locomotive.

MINE TRACK—
Construction Methods for Anthracite or Bituminous



A Real Job

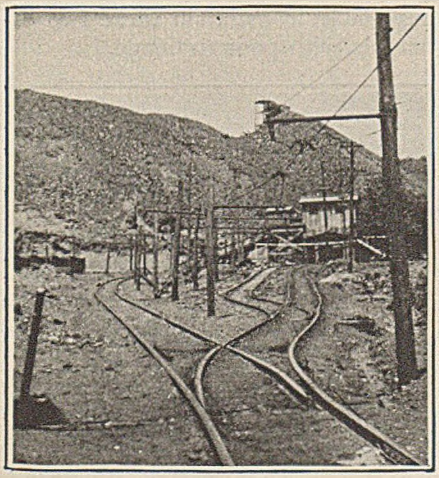
By F. C. Hohn
Consulting Mining Engineer
Pottsville, Pa.

NEVER in the history of the mining industry was speed a more important factor in mine transportation. This is due to the present high cost of production and to market conditions. With adequate signal and track facilities, slopes and planes can be operated at rope speeds of from 1,200 to 1,500 ft. per minute, and motor hauls at 10 to 12 miles per hour, as safely and efficiently as at the lower speeds of 600 ft. per minute and 6 to 8 miles per hour when tracks and dispatching systems are poor. This reduces transportation costs nearly 50 per cent.

Double-tracking slopes and planes, with balanced hoists, also results in large savings in cost and time. This is especially true where cars are discharged in a rotary dump without uncoupling from the rope and where, with the proper track- and switching-layouts, they can be efficiently hauled at high rope speeds from intermediate levels off the slopes or planes. Track facilities, especially at shaft landings and the foot or head of slopes and planes, are too often determined by first cost rather than by the hoisting cycle or the number of cars to be handled. Disregard of the two latter factors often occasions a blockade at the throats of the transportation system, fixes haulage costs and limits production. To balance, short delays that occur in the respective operating units and not interrupt production, the capacity of terminal tracks at these important points should be equal to at least one hour's tonnage.

On single-track motor hauls, and even on long mule hauls, where two or more motors or teams are employed, a block-signal system, similar in design to that in use on electric railways and manually operated by the crews, speeds up trip movements. To clear the trips quickly on this class of haulage, ample passing-track and terminal facilities are necessary. The signal system, especially on motor hauls operating at 10 to 12 miles per hour (850 to 1,000 ft. per minute), makes possible the movement of capacity loads from point of origin to delivery points without any set-offs. When it is considered that at least three minutes are required to set-off and pick up a trip having 2,500 to 3,000 feet of straight running, the time lost in changing power at intermediate stations will more than offset any delays at meeting points.

Good track is essential to the speeding-up of any haulage system and must be constructed with reference to the kind of rolling stock and the nature of the service required. For high-speed slopes and planes, 160-lb. rails should be used with 6 x 8-in. ties and No. 6 turnouts; on ordinary motor hauls using 7- to 15-ton motors, 40-lb. rails laid on 5 x 7-in. ties, and No. 4 turnouts give excellent results; and for motors weighing 15 tons or more, 60-lb. rails and No. 6 turnouts are recommended. Tracks that are poorly constructed and maintained contribute more to transportation delays than any other cause—not to mention the increased maintenance cost and the wear and tear on the rolling stock.



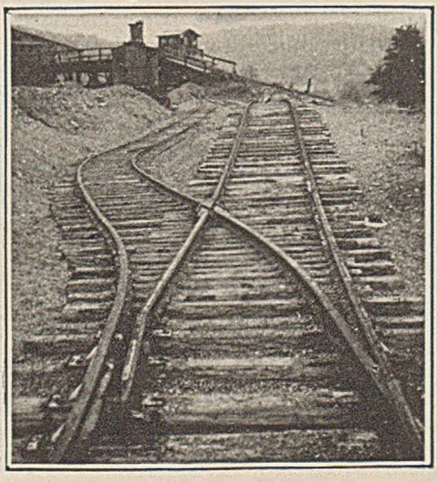


Fig. 1—Which Will Last Longer?

The three track essentials that guarantee efficient operation are alignment, surfacing and properly-designed turnouts. Yet, in mine-track construction and maintenance, these frequently are given the least consideration as shown at the left of Fig. 1. This view is of a typical mine track leading to a rotary dump and indicates the common practice in construction and maintenance using riveted-plate frogs and old-style split switches. At the right in Fig. 1 is shown a similar track, properly constructed and maintained, that not only will give efficient service at a minimum cost for upkeep but an absolute guarantee of the free movement of trips. This track is constructed of 40-lb. A.S.C.E.-section rails, angle-bar rail joints; ¾-in. track bolts with Harvey grip-threads and recess nuts, ½ x 4½-in. track spikes, 5-in. pole ties of good timber with a minimum face of 5 in., No. 4 turnouts with 5-ft. heavy-duty split switches, manganese cast-steel Graham-flanged frogs, parallel-throw switchstands and cinder ballast. The turnouts are designed in accordance

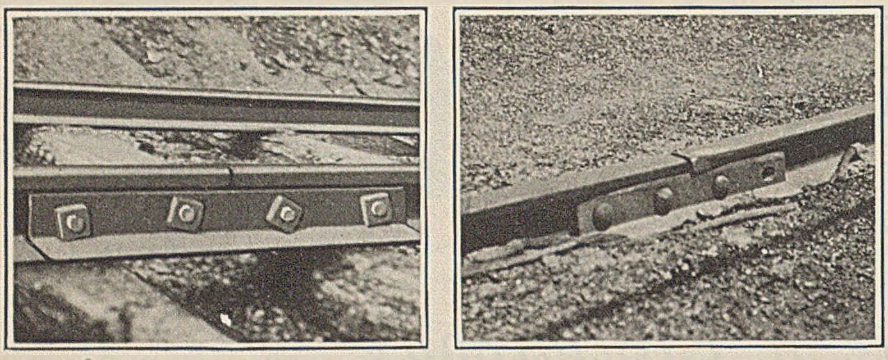


Fig. 2—Correct and Faulty Rail Joints

with A.M.C. standards. This type of track easily can be installed complete in place for $1.50 per lineal foot and a turnout, including labor and material, for $72.50.

The advantages of this type of construction are: (1) The ball of the rails is kept dry and clean, thus securing maximum tractive effort from the motive power and the free running of cars; (2) rail flanges are kept clear of acid-laden materials, thereby eliminating unnecessary corrosion; (3) track is held in uniform line and surface; (4) track is left open for inspection and repairs, which reduces maintenance costs; (5) more room for the spillage of coal, without blocking the track or interfering with traffic, is allowed; and (6) the necessary drainage is provided.

Rails commonly used in the mines have A.S.C.E. sections designed for ball wear and stiffness. The majority of mine-rail failures are due to corrosion of the base and, therefore, the A.R.A. section rail, type B, having a heavy thick flange to combat corrosion, is an ideal mine-rail section. The angle-bar rail joints, fastened with Harvey grip-thread track bolts and recess nuts are of sufficient strength to hold the ends of the rails firmly in position at all times. This type of thread and nut will not loosen, and with two ties supporting the joint (as shown at the left of Fig. 2), joint troubles are eliminated. At the right of Fig. 2 is shown the old-style bolt which is impossible to keep tight without constant attention. The illustration clearly indicates what happens to the rail to say nothing of the equipment that pounds over it. This condition is not uncommonly found in mine tracks.

Purchase of mine ties is usually made only on the basis of price, no consideration being given to wearing qualities or maintenance costs. The ordinary 5-ft. tie, costing from 23 to 26c., has an average life of from one and a half to two years and a maintenance cost of 62c. per year. The 5 x 7-in. x 5½-ft., and the 6 x 8-in. x 6-ft. mine ties manufactured from good, sound, white or rock oak make equally good tie timbers (with bark removed), have a service life of from five to six years, cost approximately 23½c. per tie per year to maintain and reduce costs of surfacing and lining. With smaller ties it is almost impossible satisfactorily to maintain these important factors.

Treating mine ties will effect a saving of about 11c. per tie per year and, including tie plates, will require an additional investment of $1.07. It may become necessary in a few years, because of the scarcity of good decay-resisting timbers, such as white oak, rock oak, catalpa, chestnut, locust, cherry, black walnut, mulberry and heart yellow pine, to treat mine ties. This will make possible the use of a large variety of cheaper timbers of less decay-resisting qualities, such as beech, birch, hard maple, red oak, black oak, gum, elm, hickory, hackberry, sycamore, sap Southern yellow pine, Western yellow pine or loblolly pine.

The 40-lb. No. 4 turnout, shown at the right of Fig. 1, was purchased complete, including switch, switch stand, frog and closure rails, for less than the old-type riveted-plate frogs, pin latches, guard rails and makeshift switch throws can be purchased or made. The latter costs about $90.00 complete in place, has a service life of two or three years and requires almost constant repairs and attention. On the other hand, the new type of turnout, having a service life of 10 to 15 years and low maintenance charges, costs but $72.50 as previously indicated.

The heavy-duty split switches are designed in accordance with the best railroad practices and are fully plated and braced. Manganese cast-steel Graham-flanged frogs, such as shown at the left of Fig. 3, are ideal for mine use as they are durable, safe, low in cost, ride easily and wear long. Taking all things into consideration, frogs of this type cost no more to install than those made from riveted plate. The flange feature is especially desirable where loose-wheeled mine cars are used. These cannot be guided over the point of the frog in safety with a guard rail on the opposite side. The flange-bearing feature also relieves pound on the wing rail such as results with a riveted-plate frog. An example of the latter is shown at the right of Fig. 3.

Guard rails are always a source of trouble and cannot be securely fastened to the running rail on light rail sections. This is because the web, unless cast-steel or riveted-plate types of guard rails are used, is not high enough for flange clearances above the fish plates or other fastenings. Guard rails of the types just mentioned cost practically as much as flange frogs to install. To maintain the line, surface track must be constructed on a well-drained roadbed and the ties uniformly tamped with good cinder or rock ballast. It is impossible to maintain these two essentials with poor drainage.

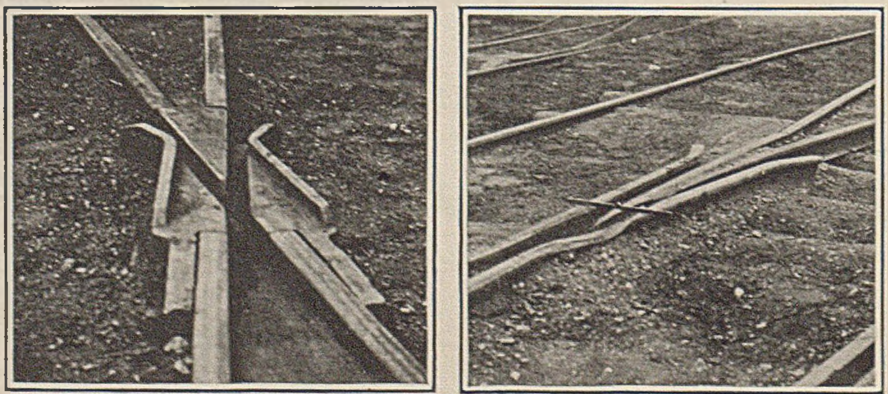


Fig. 3—Which Would You Choose?

Persistent HAULAGE *Adjustment Overcomes Distance*

By Charles Enzian

Mining Engineer, Berwind-White Coal Mining Co., Windber, Pa.

GENERAL mine operation can be no more efficient than its haulage. Recognizing that this is so, the Berwind-White Coal Mining Co., operating in the Windber district of Pennsylvania, has always attempted to provide as good a system of mine transportation as tried methods, and existing equipment, would permit. A number of its mines have been in operation for many years so that the hauls are now beyond the average in length. The foresight of the early managements in establishing, from the beginning, facilities for double-track haulage has enabled the present organization to continue the running of these mines on an economical basis.

Charles Enzian

In earlier years these mines produced at a rate as great as, or greater than, that of the present day, though facilities at hand were such that haulage was necessarily slow; but in those days the working faces were comparatively close to the openings. As the faces advanced further and further from daylight, the managements found it imperative constantly to improve the haulage system in order that the mines committed to their care would continue to produce at an established rate. This being the case, the haulage methods now employed at the mines of this company cannot be considered as revolutionary but as evolutionary. Heavy track and large locomotives—two of them rated at 35 tons—are in service; but similar equipment has been in use for quite a few years at these mines.

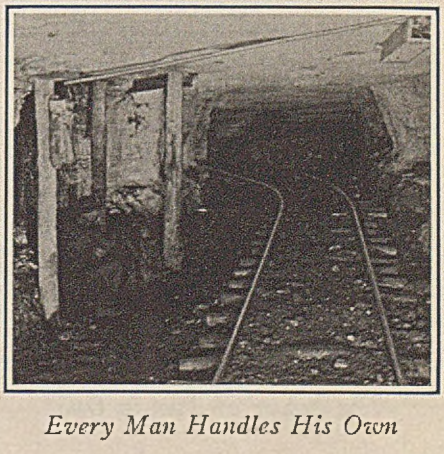
More recent changes have been the replacing of practically all old, plain-bearing wooden cars with steel cars equipped with roller bearings, and the substitution of room hoists for gathering locomotives. Thin coal and heavy grades and a desire otherwise to improve efficiency influenced the decision to make these last changes.

The mines of this company are working in the Lower Kittanning seam in the Wilmore basin, which dips about 2½ per cent in a generally northeast direction. This seam is known locally as the Miller; it varies from 3 to 4 and averages about 3½ ft. in thickness. The floor is of fireclay and in it occur numerous rolls or horsebacks. These frequently intrude into the coal so that the seam in places is reduced to a thickness of only several inches and the floor plane, consequently, is decidedly wavy. The roof consists of shale or sandy-shale, and overlying this is a firm sandrock. From this description of conditions characteristic to the seam, it is apparent that haulage is an outstanding element in the problem of maintaining high production efficiency at these mines.

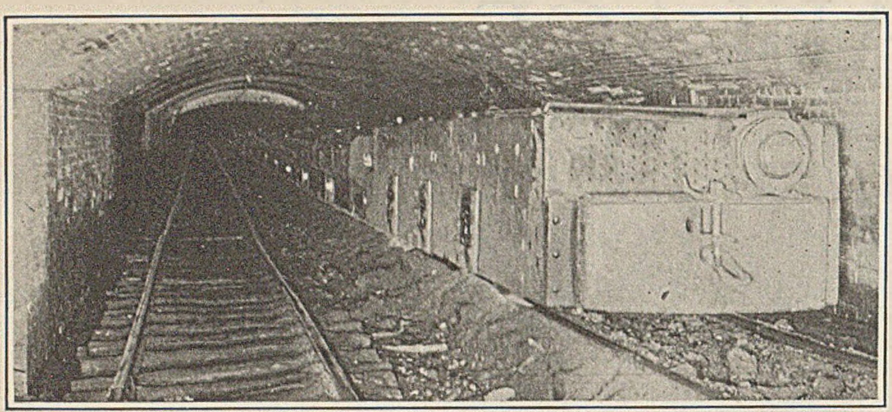
All of the mines under discussion, except one shaft operation, are worked from the outcrop and developed on the room-and-panel heading system, full retreating. The main headings in these mines extend from 3 to 5 miles in a straight line. Panel headings are generally about 3,500 ft. long, but some of them have been driven 6,500 ft.

The general practice where the roof is good is to double-track the main haulage roads and where the roof is poor to lay only one track in each of the two main intake headings. Grades vary from 1 to 5 per cent against loaded trips on the main headings and from 1 to about 13 per cent on the panel headings, although grades as high as 20 per cent have been encountered for comparatively short distances. In all main- and panel-haulage entries, considerable top and bottom grading is necessary to meet the requirements of heavy and, necessarily, speedy traffic. The clearance over the rail in main and panel headings is 6 ft. and in room headings it is 5½ ft. Since the floor is wavy, a rather elaborate plan of ditching and pumping from local dips is necessary to insure proper drainage of the haulage roads, a practice highly essential in minimizing maintenance and operating expense.

Haulage tracks are made up of 12-, 20-, 30-, 40-, 50- and 70-lb. rails, the total trackage amounting to 260 miles, 45 per cent of which consists of 50- and 70-lb. rail track. The heaviest rails are of A.S.C.E. section, rest on tie plates and are fastened with splice bars and standard spikes. They are laid on 5 x 7-in. x 5½-ft. sawed ties of green hardwood. Where the haulage roadbed lies on a grade and ample drainage is insured, ordinary mine refuse is used for ballast. In wet places and where drainage is slow, burnt slate-dump



Every Man Handles His Own

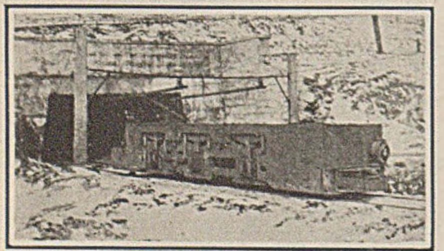


The Reason Why

slag or boiler-house ashes are used for ballast. All tracks, crossovers and curves, are aligned in accordance with standards and grades established by the engineering department. The construction of this type of track is invariably done by a special crew of men under the direction of a proficient foreman. This crew divides its time among all the mines, devoting its attention to the construction and repair of track and to general improvements and maintenance of haulage roads. Where roof conditions are unusually severe, special roof supports are constructed of steel I-beams on brick walls and lagged with steel and brick. The 50-lb. rails and those of smaller section are laid by the local mine-track and repair crews. In this work the same care is exercised in grading, alignment, construction and ballasting as is employed on the 70-lb. track except that no tie plates are used.

Track maintenance must be considered an important item in successful mine transportation. Regular crews are employed at each mine, whose sole duty is to keep all haulage roads clear and in good physical condition. The custom at all of these mines is to keep one man constantly so engaged in each panel during the day and a crew on the haulage roads at night.

Transportation in these mines is entirely mechanical, trolley motors and room hoists being employed exclusively. Of the former, 118 are in use, two-thirds of which are 13- to 35-ton types. The locomotives used may be classified in three groups, namely, main, lateral and gathering. The last classification of locomotives has been almost entirely replaced by room hoists. Main haulage locomotives constitute approximately 25 per cent of the total number employed; in proportion to their tractive power they however represent a considerably larger percentage. These units haul from 20 to 60 cars per trip and run between the tipple and sidetracks located in the entrance to the principal panel headings. Trips for the lateral haulage locomotives are made up on the room headings and are hauled to their respective sidetracks. Generally a sidetrack is provided in each panel heading, but as mining in the room heading retreats one sidetrack may serve two or more panel stubs. The locomotives used for this work vary from 6 to 13 tons and haul from 5 to 20 cars per trip, depending upon the grades.

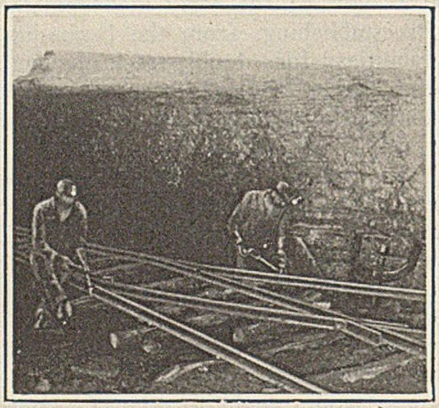


The Power of Two in One

There are 850 room hoists in service. These are of several different makes and vary from 1½ to 15 hp. They are equipped with clutch drums and brakes, and accommodate from 300 to 600 ft. of ⅜- or ½-in. steel rope. This system of serving the miners with cars eliminates much brushing of roof or floor lifting, especially in sections where rolls are encountered or where the seam is abnormally thin. It further provides an individual service to each miner, enabling him to change cars at the face at his own convenience, or to suit working conditions. Two or three empties are spotted at a time near the room mouth. While the tonnage hauled by the hoists is comparatively small, it nevertheless has been found economically sound practice to install them where the room track grade exceeds 2 per cent either in favor of the loads or empties.

In the five largest mines of this company nearly 4,400 steel cars of 2-tons capacity each, equipped with roller bearings, are in use. The installation of these new mine cars did not entirely entail a monetary loss in old cars for those in good condition were either sold or transferred to the company's mines of smaller output and shorter hauls. The expense of operating the new cars is only a fraction of that incident to operating the old, and to this saving may be added many intangible advantages.

Each of these cars yields from 1.5 to 2.7 tons per day, the average being approximately 1.8 tons. This apparently low yield per car can best be explained by stating that in one of the larger mines, which produces 2,500 tons daily, the average length of run of the main haul locomotives is 4.83 miles or 9.66 miles for the round trip; that the average haul per ton of coal is 4.99 miles; and that



The Demand—Good Track or None

the ton-miles, including motors and cars, per ton of output is 9.27. It is interesting to note that the daily duty of the main haul locomotives at this time, taking into consideration the weight of the locomotives and cars hauled, is about 260,940 ton-miles. Four haulage locomotives, one 20-, two 24- and one 35-ton type, perform this duty.

Time studies and graphs are made periodically as a means of checking the performance of haulage locomotives. These studies assist in the rearranging of equipment or schedule of operations and adjusting to changing conditions. They are particularly valuable for determining the transportation needs when daily production is altered. Every mine should consider seriously the adoption of this practice.

PRODUCTION TIME STUDIES
Increase Output

By Jerome C. White

Production Engineer, Pittsburgh Coal Co., Pittsburgh, Pa.

MECHANICAL mining, that is, cutting or loading coal by machines, is a phase of the industry in which manufacturing conditions are closely approached. In this method of mining there are opportunities for mass production, for the making of time studies as a basis for standardized operations and for the planning and scheduling of work for increased output. Mechanical mining lends itself to this type of management because its operations are mostly repetitive and standards once set for a particular mine are not likely to vary greatly within reasonable time limits.

Five things must be considered in doing work: (a) With what tools or machines shall it be performed? (b) how shall it be done? (c) what factors are unavoidable? (d) how much to allow for them, and (e) how to use all of the remaining time for maximum production. After the variables have been found, a standard production time is set. In order that a common basis or terminology be used, let us call all natural cause factors that hinder production *variables;* and those elements causing loss of production which are within control of the management, *delays.* Time study then becomes a tool of management that may be used to get rid of idle machine hours.

In studying an operating problem it should be broken into all its separate elements for detailed study and analysis. The method used is time study by a stop watch. Fig. 1 is an example of how far it is possible to go toward finding out what the actual operations are. Though the detail in this example is quite refined, natural conditions made operations difficult. In another mine the operation

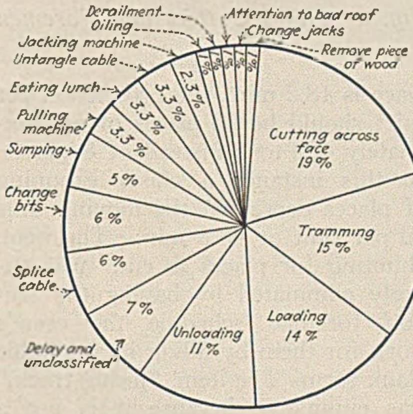


Fig. 1—Where the Time Goes

of cutting a place would be expressed as: Preparing to cut, 1.10 min.; cutting, 4.0 min.; and preparing to leave, 1.10 min., the place being cut in 6.2 min.

The idea of making a study of the minute details is to find what factors enter into operations and to what extent they control production. The thought is: If conditions are to be bettered in order to increase output, what is the length of time necessary to do it? There is one sound way of determining these factors and that is experience. However, to make the knowledge thus gained available to others for study and analysis, the actual details of performance must be methodically observed and recorded. This is generally admitted to be true even though there are different opinions as to the value of the methods actually used to achieve this result.

If work involving a series of operations be observed during an adequate period of time, certain recurring elements will so often inject themselves into the completed job (or cycle) that their frequency and causes may be ascertained with accuracy. For this reason a series of time studies covering an adequate period of time to take care of variables, representing a sufficient number of completed operations (cycles) when recorded, may be used to set workable standards of operation. Of course, conditions change; headings and rooms advance, and there are falls of slate or roof; clay veins, etc., occur. However, the degree of these changes of natural or operating conditions may be reduced to an almost mathematical accuracy. Unavoidable (variable) factors causing loss of production may be segregated from avoidable factors (delays). The object of time study is, therefore, to find what are the existing conditions and to what extent they can be controlled. They can be controlled only after it is known what they are. The record thus obtained is to be used as a guide to the management in bettering conditions and in improving and maintaining equipment so as to obtain the most from the "machine and payroll dollar."

Table I shows the distribution of

TABLE I—ACTUAL OBSERVED TIME AND REVISED SCHEDULES FOR COAL CUTTING

Item No.	Operation	Observed Time (Actual) Minutes	Percentage of Total	Built-up on Standard Time Minutes	Percentage of Total		
1	Cutting coal. Includes time fror . arrival at switch until return	188.03	55.43	408.00	85.00	Tota places cut......	8
2	Moving (tramming)........	97.00	28.63	48.50	10.01	Type of machine......	Top cutter
3	Hunting places to cut........	7.08	2.08	......	......	Method of payment...	Day wages
4	Changing bits, oiling and inspecting........	20.00	5.94	20.00	4.17	Average width of room	18 ft.
5	Taking sights........	3.50	1.04	3.50	.75		
6	Fixing track........	23.30	6.88	......	......		
		338.91	100.00	480.00	99.93		

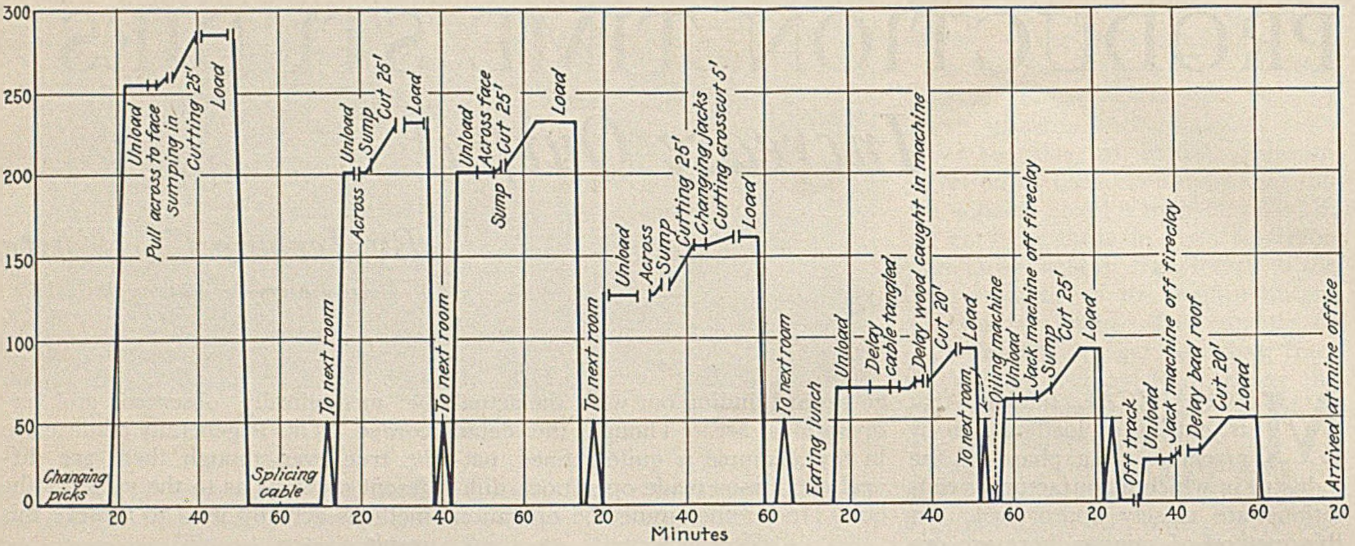


Fig. 2—Helps Cutters and Foremen

a cutting crew's time for a shift as observed. As an example of how a standard production may be built up from unit times based upon what reasonably good operating conditions should be, Fig. 1 and Table I may be used. The actual production in Table I was 8 places or 160 tons, showing that an average of 23.5 min. per place was maintained. The time study of each place showed some delays which accounts for the difference of 4.8 min. between the average maintained and 18.2 min. shown in Fig. 1. However, 20 min. per place may be allowed as a basis upon which to build a standard production, and the standard distribution of time would be made up as follows: Cutting 408 min.; moving time 48.5 min.; changing bits, oiling, greasing, etc., 20.0 min.; taking sights 3.5 min. for a total of 480 min. for the 8-hr. shift. Based upon this time at an allowance of 20 min. per place, which is ample to take care of many small delays because the actual cutting time per place is 18.2 min., the production per shift should be 20 places or approximately 400 tons instead of 8 places. In this instance a closer grouping of places decreased the moving time 50 per cent or 48.5 min. The item, "hunting for places to cut," was entirely eliminated by having the section foreman schedule the crew's work for them by filling in a suitable blank form. The item, "fixing track," was eliminated because it is not a cutter's work to lay tracks.

At another mine using the same type of cutting machine, where the work had been planned in advance, based upon previous experience and studies, a production of 30 places, approximately 600 tons, was maintained. In the latter place, however, the grades were not so steep nor was the roof as bad as in the mine where Table I was obtained. But the point is, the production standards were based upon existing conditions.

In a large organization the results of time studies may be charted to visualize the conditions. The charts shown in Figs. 2 and 3 represent studies made of a shortwall cutting machine operating in the Lower Freeport bed of Cambria County, Pennsylvania. The curves were made by J. F. MacWilliams, electrical engineer of the Pennsylvania Coal & Coke Corp., from data on a machine and crew selected at random.

The chart in Fig. 2 covers 5 hr. of working time. Seven rooms, varying in width from 20 to 25 ft. and one 5-ft. crosscut, were undercut, aggregating a total of 170 ft. of face. The rooms were on a common entry and their depth in feet ranged as follows: 250, 200, 200, 125, 70, 60, and 25. Though this chart does not represent an average for operation of shortwall machines it does indicate the nature of delays likely to be encountered.

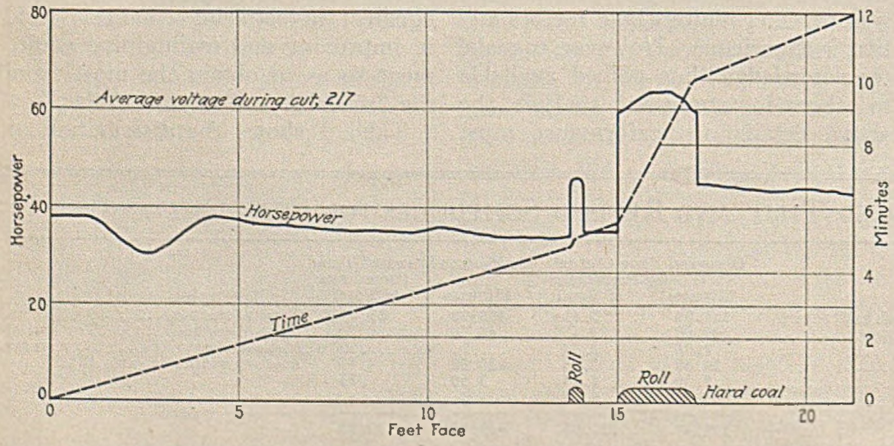


Fig. 3—Test of 50 Hp. Shortwall Cutter with 36-In. Feed

The purpose of time study is to find the quickest way in which work can be done in fairness to the worker, and to formulate a standard time and procedure. It is not the entire purpose of time study to speed up the worker, but to study operations for sources of waste and to help management make conditions possible for a high production. There is a danger to be guarded against in the making of time studies when conditions are not standard. "Standard" times based on variables are worthless. That is why the preliminary time study is necessary to find out those conditions that are obviously bad and operations that are poorly carried on. In such cases statistics or percentages of time reductions will be interesting though probably meaning little. It is the constant improvement of good work that counts.

Are COSTS *Important?* *If so,* BUDGET *Them*

By Horace G. Crockett

Engineering Partner, Scovell, Wellington & Co., New York City

BEYOND question the actual cost of mining coal bears small relation to its selling price. Perhaps this is the reason that systematic cost accounting has never been extensively undertaken by the coal industry. For although many coal operators believe that they have and utilize an efficient cost accounting system, few of these are comparable with the systems employed by manufacturers.

Mines produce only one product. The necessity for details and refinements in cost accounting are, therefore, not apparent. Total expenditures divided by the number of tons produced gives the cost per ton. To many operators this seems adequate.

Manufacturers have long recognized that the chief value of any cost system lies in the control of manufacturing expense. In many industries cost of production has as little relation to selling price as it has in coal mining, yet complete cost accounting systems have been adopted. These give the executives a wealth of information which may be effectively used in management. The indications are that similar methods could be employed in coal mining with equally beneficial results.

BUDGETING means forecasting the sum to be expended during some specific time period. Some allege that such a forecast cannot be made because production is always uncertain. Should the attempt be made to forecast not only production but sales and price, it would be asserted that these are matters of even greater uncertainty and that such a forecast could not possibly be made with accuracy. It is wise, however, to plan ahead as far as possible and to have some idea of what the result of a year's or a month's operation ought to be.

Admitting that future production and sales cannot be forecast, it is nevertheless perfectly possible to assume two or three volumes of production and make a reasonable budget for each. In this manner a fairly accurate idea of what results ought to be can be had. In setting up such a budget normal production should be taken as a base and other volumes of output scaled up or down from this starting point. Each component item of total expense must, of course, be studied and considered separately.

A standard cost is established by dividing a normal expense by a normal output. It is entirely possible, therefore, to set up a standard outlay per ton, and to determine what it should cost to produce coal under any given conditions. Once standards have been set it is a simple matter to check actual costs against them.

FOR the individual operator it is certainly highly advantageous to be able to determine approximately what the results of a year's business should be. Although such a forecast will probably be inaccurate the first year, it may become extremely reliable in a short time. The hazards and uncertainties of coal mining cannot be foretold. Consequently, it is important that everything definitely known or that can be foreseen shall be reduced to measureable terms. Thus, should accidents occur, their effect will have been somewhat discounted.

Setting a budget is not a job to be performed at a desk miles away from the mine. Those who incur expense and are held responsible therefor must be considered. It is only after careful analysis of all available information that such budgets may be logically set. When people have been tactfully consulted they take keen interest in results; they are anxious to justify their own opinions.

But perhaps the greatest advantage accruing to the individual operator is indirect—the ability to compare costs with those of other mines. This is particularly advantageous to those who control several operations. If comparisons are based on so-called actual cost alone they are of little benefit. A certain operation may be less expensive in one mine than in another, yet the higher cost operation may be the more efficient. The proper procedure is to compare the standard cost for each individual operation in each mine and the margin by which this component expense deviates from the standard set.

IT IS not within the province of this article to discuss cost accounting in detail. Once general principles have been established, the only question remaining is selection of the specific items that need consideration. A budget should be set up and standard costs established. An operator who controls many mines will logically go into greater detail than one whose interests are small. Even the smaller operators, however, will probably refine their accounting methods when the subject warrants closer study.

All the difficulties confronting a budget system are encountered in its establishment. In actual operation it becomes an ordinary accounting system setting forth expenses in such detail as the operator considers essential. It is in the comparison of actual results with standards that the great advantage lies.

PROBABLY no single activity in which the coal-mining industry could engage would be more profitable eventually than a general improvement in cost-keeping methods. The budget, however, is no panacea. It will not settle labor troubles, avert competition nor prevent an operator from making mistakes or using poor judgment. It will, however, provide much valuable information useful in settling arguments with labor or with governmental agencies. It would certainly make competition more intelligent and place a useful implement within the manager's grasp.

COAL AGE

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JOHN M. CARMODY, *Editor*

NEW YORK, AUGUST, 1927

Use of "Rash" as Ballast For Roadbeds Is Undesirable

Too often is the loose coaly slate of the roof, known as rash or rashings, used for ballast in mine roadways. It is a better material for that purpose than slate, when viewed solely as ballast, because, if it has a large percentage of coal, it does not act like clay even after the small quantity of shale in it has changed to that material. After disintegration it still drains fairly and allows the air that would be imprisoned by clay to escape which is an advantage. But its large percentage of coal increases the danger in case of an explosion. The floor becomes fuel for the spreading flame.

But where there is much water it has a costly disadvantage. Coal of all kinds contains sulphide of iron and when water and air are present the iron sulphide forms sulphuric acid. Where conditions favor the speedy passage of water from the roadbed, little damage is done but in swags, or depressions in the roadway, the water becomes highly acid, damaging the rails, pipes, and pumps. Sometimes, therefore, the use of the right kind of ballast would give the pumps a longer life.

It might be well in all mines to give careful thought to the question of the source of the water's acidity and to correct the conditions that favor that acidification. Wherever water is allowed to lie in contact with coal it cannot fail to become impregnated with acid. One cure is to get it out of the mine as rapidly as possible. The use of limestone as ballast is also worthy of consideration.

Commerce Commission in a Dilemma

With the filing of tariffs by the Southern railroads on July 27 and 28 reducing rates on lake cargo coal 20c. per net ton, the bitter fight for control of the tonnage to the Northwest enters a new phase and the Interstate Commerce Commission is faced with an unenviable dilemma. If the Commission, which has been the center of a political storm since its original decision two years ago, permits the Southern rates to become effective, it consents to the practical nullification of the benefits of its order directing a 20c. cut from the Pittsburgh, Cambridge and Ohio No. 8 fields. If it suspends the Southern rates, it will be charged with denying the Northwest the advantage of lower fuel costs.

There is only one thing of which the Commission can be sure. Whatever action it takes will cause a wave of protest and intensify the political atmosphere with which the controversy has been surrounded. On the other hand, the Southern lines have improved their standing with the operators on their rails—even if the Commission, as many believe, suspends the rates and makes a definite finding upon the question of relationship between transportation charges from the Northern and the Southern fields. The finding, it will be recalled, the Commission declined to incorporate in its order of last May.

In the meantime, this controversy, which assumed a virulent form seventeen years ago, will continue with unabated fury. Energy which should be employed in working out modern merchandising programs will be consumed in seeking rate readjustments. The Northwestern buyer will be encouraged to think more of price than of quality and service. Admittedly this business, which has averaged over 25,000,000 tons per annum in recent years, is a prize to tempt any producing field. Yet, in the long run, no producing district can hope for stability if rates are to be continuously in issue. The prospect under such conditions is one of confusion worse confounded.

District Heating Gives Coal a Chance to Displace Oil

To many it will come as a surprise that district heating has so wide a spread and so many installations as it actually has. Strange it will seem also that these plants are found in such relatively small towns as have seen fit to build them. A list, on its face incomplete for New York City itself is lacking, contains no less than 140 towns, two with two installations. The towns in many cases have well below 10,000 inhabitants. They are mostly in the Middle West. New England, so far as the list shows, has few of them, though Massachusetts has three and Connecticut one.

District heating has not had a rapid growth, probably because too few availed themselves of its advantages when it was installed. Had more adopted it the losses of distribution and the costs of building and maintaining steam lines would have been less. In fact, as with every public utility, the more who accept its service, the lower the cost to every one and the more general consequently becomes its acceptance. In any public service nothing succeeds like success.

As against the menace of oil, district heating comes as a benefaction to the coal industry. It promises a use for fine coal to the anthracite operators and as a further market for bituminous-coal producers. The oil furnace may make soot and spread an odor of oil. Steam heat has none of those advantages. With an oil-heating furnace there is sure to be more or less noise of combustion, but with steam heat none penetrates beyond the furnace room.

As for heat regulation, district heating may be made even more sensitive than an oil-burning furnace, for the moment the steam is turned on the heat is available whereas with any furnace there is delay till increased combustion affords the necessary steam.

An oil-burner installation costs with tank from $450 to $1,200, but the company that supplies steam heat to a household can truthfully say that it will cost the consumer nothing to install and nothing to maintain except such as the piping system will demand, which is, of course, no more than with coal or oil-heating. That is a distinct advantage in merchandizing this convenience.

Pictures have been shown of the master of the house sitting tranquilly down by his oil furnace or playing billiards in his furnace room. The noise and the smell of the furnace might repel him, also the appearance of his heating equipment, but with purchased steam there will be no smell, no noise, no furnace and with more modern houses there will doubtless be no exposed piping.

In fact is it too much to hope that purchased steam may be, not a luxury like oil, but a less expensive convenience, though the relatively wasteful plants and improper distribution of earlier days may at the present time present a somewhat different conclusion.

Why could not the pipes be used in summer to carry refrigerated air to the houses and other buildings desiring that service? The air would have to be extremely cold and be mixed with other air at street temperature before being circulated for ventilation.

Where Drillers Lose Water, Mines May Do Likewise

It might be of value to ascertain at what horizons drillers in any region lose water in drilling, because this would indicate the possibility of draining the mines by sinking a hole to that level. The commercial possibilities of such records have not been sensed. They may have a real value and should be kept for the benefit of the mining industry. Water that descends to a lower level and issues from the ground far away from a mining region is disposed of forever. In some regions the water drained from one mine finds access to another and has to be pumped a second time. Records made available to mining engineers would unquestionably lead to worth-while results.

Good Roads a Factor in National Prosperity

More than a billion and a half dollars was spent in the nited States for road building and maintenance during the fiscal year ended in June, 1925, according to a study just completed by the National Industrial Conference Board. Whereas less than 20 years ago expenditures for road building were still a negligible item in governmental finance, our present annual road bill amounts to more than one-sixth of the entire public budget, and is exceeded only by our governmental expenditures for education and protection.

The development of the country's roads during the past quarter-century closely reflects the revolution in the field of transportation brought about by the automobile and its rapidly extended adoption as a means of carrying goods as well as passengers. About 1,000,000 miles of highways have been built since 1904, when the total roadway mileage in the United States amounted to 2,151,379, only a small proportion of which was surfaced, traffic consisting principally of short distance market hauling and a few venturesome bicyclists. During the next five years, less than 50,000 additional miles of roadway were built, but between 1909 and 1914 the advent of the automobile made itself felt, 250,000 miles of new roads being added. In the next seven years, although they include the war years when state and local government budgets were held down to the minimum, 500,000 miles of new roads were added.

The immense volume of long-distance motor traffic that has developed during the past ten years, however, also has increased the necessity of a well-linked highway system, connecting important centers and fed by the smaller market roads radiating from local centers into surrounding rural territory.

The state governments in 1925 had become so active in the field of highway building and maintenance that they raised more than 37 per cent of all highway revenue, while the local governments raised only little over half of the total. The federal government meanwhile had interested itself to the extent of contributing about 10 per cent of the total. Nearly half, or 49.5 per cent, of all highway bonds floated in 1925 were issued by state governments.

The coal industry is affected by this development directly and indirectly. A large tonnage of coal is used in the manufacture of cement. Trucking between mines is facilitated. Living conditions for miners and their families are greatly improved and their range of pleasure greatly widened by good roads. Good roads make possible consolidated schools serving scattered mining communities through bus transportation. This is all to the good and justifies the interest operators have taken in the movement even when they have paid dearly in higher taxes.

The BOSSES *Talk it Over*

Can You Schedule Development?

"STILL thinking about that tipple job, Jim?", asked Mac as he opened the drawer of his desk and produced pipe, tobacco and matches.

The super waited until Mac lit up and seated himself comfortably, then replied: "That's the least of my worries right now. The Big Boss tells me the company just landed a contract that will run through the winter. He has it figured out that our quota will require us to run along at 2,500 tons until spring. The bad part of it is the price don't give us much to go on."

"Well, Jim, we can do it without much trouble for a while. We've been gettin' the tonnage from the hill since we got more power to 'er, but she'll peter out before long. You know I wanted to push right ahead with those entries on the West Main when orders came to stop them. We better start 'em goin' again right away or we'll be out of luck. That's the beauty of working the rooms on the retreat. You have development ahead and something to fall back on in an emergency, as in this case. If it wasn't so serious, I'd laugh about it. The company might have known that we would need more coal pretty soon and kind of planned ahead. It's the same old story, year after year. All of us ought to wise up."

"It is serious, Mac, and we've got to act now—work up a plan of some kind. What's yours?"

"I've already had my say, Jim; you heard it a minute ago."

"I realize how you feel about it, Mac, but the company doesn't see it that way. Now they want to start up those West Main entries, as you suggest, but they also want us to turn rooms on the go and cut down production from the hill as tonnage from this new work picks up. They say the cost of coal from the hill is too high and that it will be lower for coal coming from the West Main—shorter haul and all that goes with it."

"That's the trouble, Jim, they look at costs from a close-up. If they see a piece of coal that looks cheap they say 'Take that' and let the future take care of itself. Here I'm trying to clean up the old stuff and concentrate the workings. They want to dig all over the lot. Then they wonder why our costs are high. It's the same old story all over again."

What is your plan for regulating development?

Does it pay to spread development for the sake of immediate cheap coal regardless of long-time results?

Should the super go ahead as directed or should he work out a plan on paper with the chief engineer to show the general manager the mistakes of the proposed method?

Can a balance between entries of working areas and those being driven for future use be maintained?

All mining men are urged to discuss these questions
Letters accepted will be paid for

This Is What Shorty and Mac Started

Bosses Should Know Their Stuff

IN "The Bosses Talk It Over" you have started a discussion that will give us many different views. I was in Shorty's shoes as assistant electrician, electrician, and chief electrician for a period of twelve years, and in Mac's shoes for eight years; so I think I know exactly how both feel.

Speaking from my experience, I would say there is no one solution to the problem, but that different combinations of bosses and electricians call for individual treatment. For example, in one case Mac is a first-class mine boss in so far as actual knowledge of mining and the handling of men are concerned, but all he knows about electricity is that the wire will shock you, that the motors stop when there is a short, or that the "juice" is off when the lights go out.

Let us suppose Shorty knows his "onions" and that to him poorly bonded track means poor power, slow haulage, and "burn-outs"; that small feeders mean the same thing; that Old Ironsides would not have burned out if Mac had let him have men and bonds to make a good return and had spent the money for the necessary feeders instead of kidding himself that he was cutting costs by not doing so. In a combination of that kind Shorty ought to be given full authority over the entire electrical department, reporting to the superintendent only.

In the second combination, Mack is still the A-No. 1 mine boss. Before he was the boss he was electrician and had made a study of electricity just as intensively as he had for his papers. He knows how many circ.mils of copper is necessary for a feeder; also which is cheaper in a particular instance, a loss of twenty volts, a mile of 4/0 wire or a 1,000,000 circ.mil feeder He knows whether Old Ironsides can be kept running the rest of the shift and if it can be permanently repaired after quitting time. In this instance Shorty is a good repair man, but if you asked him to figure the drop in the Main-North feeder with, say, four locomotives and four machines running, and to give you figures on the amount of copper to be added to bring the drop in voltage down to, say, ten volts, he would think you were giving him a problem in calculus. The chances are he would ask what in the Sam Hill you thought he was anyway. In this situation Mac ought to be in full charge and Shorty take orders from him.

In another combination, Mac and Shorty might both know their "stuff." Mac is the boss, because he has the knack of handling men. That is why he is the boss. Shorty cannot get along with men, but he is a first-class electrician. In that event Shorty ought to take his orders from Mac, and any grievances between Shorty and his men should be left to the jurisdiction of Mac.

In another combination, where the company has a number of mines, and employs a chief electrician over them all and a chief at each mine with assistants under him, the full authority rests with the chief, and each chief at each mine must answer directly to him. In this case the mine boss should not have any authority over the electrical department except in a co-operative way, such as calling the chief's attention to something that is being neglected. The authority over the electrical help and equipment should rest with the chief of the electrical department.

The best combination exists where the mine boss has had electrical experience, and understands the fun Shorty has at times. Shorty is the kind who appreciates the little helps Mac gives him in his rounds, such as bridging out a broken grid in an open rheostat or keeping Old Ironsides running. When they meet, Mac says, "Shorty that 'blankety blank' rheostat in No. 10 looks bad to me. You ought to give it the once-over when you get time," or "Shorty that motor on No. 4 pump has a broken spring on a brush holder and is firing pretty bad," Perhaps he knows Shorty is cut pretty close, though a new feeder has to go up, and asks him how much more help he needs. Or Shorty comes outside from the face and says, "Mac, Old Timer, that switch in No. 3R—10 WW is not in line and the No. 6 motor is off the track several times a day; you ought to look that over."

This is the ideal combination, each the boss over his own department but co-operating with all departments. These combinations are not fictitious. They are actual; I have worked through them in the past twenty years, and the last combination is the best. THOMAS JAMES,

Mine Mgr. Mine No. 3.
Knox Consolidated Coal Co.,
Vincennes, Ind.

Topic for September

SAFETY

Does spending on safety save money?

Should it start from the top?

How should it be handled?

Get the Tonnage; Give the Orders

WHERE an inside superintendent is employed, he should be allowed to give orders providing he keeps the foreman well informed as to what he is doing. Where the foreman is the only high mine official stationed underground, he alone should direct the workers. He is the man the superintendent looks to for the tonnage. If he isn't competent to give orders he is not fit to be mine foreman.

J. W. DAVIS.
General Mine Foreman.
The Gauley Mt. Coal Co.,
West Virginia.

Intelligent Organization Prevents Confusion

UNLESS a foreman's responsibility is definitely fixed, its limits known both to himself and his entire organization, and his authority within those limits unquestioned, he cannot function with satisfaction either to himself or his employers. A spirited foreman, competent in his line, in an organization where every man's duties are properly fixed, will neither require nor permit orders to be given by another except functionally or in an advisory manner.

The superintendent will, perhaps, divide his force somewhat like this: The mine foreman will be in charge of all underground operations; he will have an assistant in charge of each section competent to supervise all labor sent into that section for any purpose other than those continuous phases of maintenance or operation which are specifically delegated to others; there will be an inside electrician or master mechanic in charge of maintenance; there will be a man in charge of haulage and there will be other foremen in charge of such classes of work as the needs may indicate. Each of these will receive general instructions from the mine foreman and issue detailed instructions to the men under him, each knowing where his authority ends and the other fellow's takes up, and each will consult with the mine foreman and each other. On the surface similar tactics will be followed.

All this is apropos Shorty and Mac and Too Many Bosses. It may not be too many bosses but too much Boss. From the general manager to the section boss, too much bossing is worse than not enough. If a man is competent to do his work let him know what is expected of him and let him do it. He will. LANGELOTH HILL.

Pennsylvania.

Superiority Complex Is the Great Divide

IN the case of Shorty and Mac, what is the trouble? Something is holding them apart. What is it? Is it lack of ability to organize or of knowledge of the benefits to be derived from working together? Maybe it is a superiority complex.

Did you ever, as mine foreman, hold a conference with the superintendent to decide on something that the electrician should do and how he should do it, only to find on giving the order that he had a much better plan? I have. And why shouldn't he? He is a specialist in his line. The foreman and the superintendent have duties so varied that they cannot specialize in each department in their charge. So why would it not be a good thing to call in the electrician when his work is being discussed? It isn't a secret, and he is usually a high-grade fellow with some valuable suggestions to make. But most of all he will know that he is an appreciated members of the organization. That will go a long way toward making him a thinker as well as a worker, which is most desirable.

We as officials too often dismiss the fellow under us with the supposition that there is no use talking to him about his work because he doesn't think. Is it true that he doesn't think, or do we by a superior attitude close the avenues of expression to him? As officials, we must step out of that superiority complex and charge the other fellow with a share of the thinking.

When the mine official assumes the attitude that he knows a little and each man in his charge knows a little, and starts organizing his working forces on that principle, directions will be handed down in an orderly manner, and neither the electrician nor anybody else will be struggling in cross currents of uncertainty. ROY NOTTER.
Pennsylvania.

The Old Army Game Cause of Trouble

DISCUSSION such as that between Shorty and Mac is an anachronism in this age of supposedly keen competition in coal production. To be sure, it is not unusual to be confronted with the spectacle of mine superintendents and mine managers engaged in the scarcely-inspiring old army game of Shuttelcock and Battledore in exercising their jealously-guarded prerogatives. A well-regulated coal mine does not operate that way.

Let us assume for the moment that we have a coal mine with four sections, averaging two miles between bottom and inside parting, and four road-motors hauling the coal to the bottom. A trip of twenty cars averaging two tons of coal to the car, the motor making a round-trip every thirty minutes, will take care of a 2,500-ton hoist.

The gathering motors get the miners to their working places by starting time. Everything is ready to start work when the whistle blows. As the road-motor leaves the bottom, the switcher calls the section to which the motor is headed that it is on its way with twenty empties at such and such a time. Fifteen minutes later that motor should be headed toward the bottom with twenty loads, which information is 'phoned from the inside parting to the bottom switcher. An accurate check is kept all day long on every section.

A delay of a few minutes without news of the motor's location will find a trouble-shooter headed that way to learn the reason for the delay and ready for almost any emergency. Why should Old Ironsides be inside stuck on a hill from 10:15 till nearly noon without help? Why did not the trip-rider go to the nearest telephone? Where was the dispatcher or switcher? Wasn't it possible to route the first motor out in the direction of the B. O. motor and bring it to the shop for repairs, while the three remaining motors take care of the extra section among them to preclude the possibility of the miners in this section going home?

To return to the superintendent-mine manager problem. If ever two positions demanded unity of purpose and resolution, these positions do.

The major problems of coal-getting, the arrangement for, and installation of, expensive equipment and every strategic move to better the coal-getting, should be thoroughly probed. Constructive methods that point to economic betterment should be applied no matter from whom the idea came. It is a pathetic sight to watch a superintendent wallow around on something of which he knows nothing, yet wishes to appear that he does.

The mine manager should have absolute control of the mine, electrical as well as the other departments of underground operation. Superintendent, mine manager and electrical chief should get together every evening to discuss the happenings of the day, and plan the next day's program. Changes that apply exclusively to the top equipment should be discussed between superintendent and electrician; changes that apply to both top and bottom should be agreed upon by all three.

The superintendent should never order electrical or any other work to be done underground except through, and after discussion with, the mine manager. Any deviation from this course is quickly noticed by employees. The mine manager's position and the respect that should animate those detailed to carry out his orders will be appreciably affected. The practical operation underground should be left entirely to the mine manager who in conjunction with the chief electrician, shall so arrange the work as to maintain the maximum efficiency. No coal mine is operated by one man, and when the mine manager and chief electrician have demonstrated their ability to successfully carry out the scheduled program, they should be left to exercise their ability without interference.

And so it should be with coal mining. Given a coal mine with equipment consistent with the tonnage expected; enough supplies to keep each department on its toes; a capable superintendent, mine manager and chief electrician who will function smoothly, and the cost sheet will tell the story as entrancingly as any "best seller" ever did. Hell's bells will be joy bells, and goats will be in the pasture where they belong. ALEXANDER BENNETT.
Illinois.

THE first thing that caught my attention was the foreman's statement that *he* was mining 2,500 tons in one shift for the company. Individual effort counts for little and only small companies with inefficient management tolerate it. The argument between Mac and Shorty was entirely out of line. The feeder line in 10 East would have been up when needed if the management had been efficient.

Each department of mining should come under a separate head, the electrician under the power and mechanical, the mine foreman under the operating, and the outside foreman under a department to be called Allied Operation, each department to have a standard rate of efficiency, and all departments to be under a general manager and a counsel who know enough about mining to judge efficiency. HUGH SNYDER.
West Virginia.

A Vicious System

I AM certainly sorry for both Mac and Shorty—not particularly on account of the trouble they are having in the incident referred to, but because they are working under such a vicious system. The super doesn't seem to know what he really wants done (or if he does, he is taking a poor way of doing it). I would try to get a definite understanding between my various foremen, electricians and myself. I would want my foreman to understand that he was boss, even over the electrician, to the extent that he was the judge of which of two jobs was the more necessary to help him at that particular time. Had I, as super, found out on my inspection trip that the wiring on the West Main was in need of repair I should have called Mac's attention to it, with the suggestion that he have it fixed at once. Then he himself would have sent the electrician there that morning and when his haulage motor stopped he would have known where the electrician was. Then he could have put him on the job at once and the motor would have been put back in service without much delay.

On the other hand, we hire an electrician because of his skill and knowledge and his ability to hold his position depends largely on his ability to keep our cutting machines, motors and other machinery on the go. After calling his attention to a job, I do not myself try to tell him just exactly how to do it, nor do I permit my foreman to dictate to him just how to do the job. I feel that both the foreman and myself have enough other duties to attend to, without having to detail each job through the electrician's shop. He and his crew are to be judged by the results they get, rather than just how they get them.

I have always let it be felt that in any case I expected the foreman to use his authority when it is impossible to get in touch with me concerning any matter that may arise on which he has no definite instructions. Afterwards, if I feel that he has made an error, I find the best way to prevent its re-occurring is to point out to him what I should have done under the circumstances, by discussing the matter fully to bring out his own ideas and mine on the subject. Usually such a talk evolves a method of procedure, that will apply many times afterwards in similar circumstances. IVAN L. ELY.
Superintendent.
The Cabin Creek Consolidated Coal Co., Acme, Kanawha Co., W. Va.

Lack of Co-operation All Along the Line

THE incident referred to is one that is frequently met in the operation of a coal mine, and is not caused by "Too many Bosses" but is due to the lack of co-operation between them, beginning with the general manager and extending to the foreman of the least degree.

I would settle the argument in this way: First—Give the superintendent full authority over the entire property.

Second—Have the superintendent delegate to his mine foreman the necessary authority to operate the mine successfully, which in my opinion would give him full control inside of the mine, making him responsible to the superintendent for results. In that case the superintendent would give instructions to his mine foreman and he in turn would instruct his assistants. Had the superintendent instructed Mac what he wanted done, Mac would have instructed Shorty what to do, and would have known where Shorty was and when the main-haul motor stalled on the hill he would have gotten Shorty on the job without delay.

The responsibility of the general management in matters of this kind should be to so organize the official family that there would be no overlapping of authority in the different departments.

JOHN MARLAND.
General Superintendent.
King, Harlan Co., Kentucky.

I DO not hold either Mac or Shorty responsible for the failure of the mine haulage locomotive on the grade in Old No. 3 mine, but I do place the blame on the shoulders of the superintendent, since it seems that he lacked the organizing ability. There is no question but that the foreman should have had charge of all underground employees. If this system had been in force at this mine, Mac would have known the whereabouts of Shorty and immediately set him to work on the locomotive or to clear the haulway for another

locomotive. If there is not sufficient work for Shorty underground to keep him busily employed, the superintendent and Mac should get together and work out a system that would enable Mac to know the whereabouts of Shorty while the mine is in operation. C. T. GRIMM,
General Superintendent.
Buckhannon River Coal Co.,
Adrian, W. Va.

Employ Competent Electrician Is Best Method

EIGHTEEN years as mine electrician and four years as mine foreman makes me feel like helping Mac and Shorty straighten out their difficulty. As a foreman I have found the best system is to employ the most competent electrician obtainable at the pay set by your company. Hold from him much of the detail work and allow him time to travel the mine as does the foreman. He will then keep a close check on the condition of his equipment and guide his assistants in their work to the best advantage. Have a place where the foreman, assistant foremen, motormen, machine runners and the superintendent can leave a note stating what they may have seen that needs attention. The electrician will read them all and if he is a competent man he will know which job needs attention first and check each off his list as it is done. In turn, he will always leave a note on his door stating which section of the mine he is in. His slate may never be clean, for he may be short-handed or short of material. If you have made note of a certain piece of work to be done, don't expect to see it attended to the next day, for there may be on the "board" two or three jobs of more importance.

MAT SEESE.
First Grade Mine Foreman.
Cairnbrook, Pa.

NO! The superintendent, being the responsible head, has the authority and right to give instructions to any employee, but if he decides to give personal instructions to any one other than the foreman, it should be done openly and above board and not to the exclusion of those responsible for producing results. If Mac had known that Shorty was working on wire in the West Main, he could, and undoubtedly would, have gotten him on the job immediately to repair the stalled locomotive. The situation indicates an utter lack of co-operation and team work between the mine superintendent and the foreman.

EDWARD BOTTOMLEY.
Wyoming.

NO, this is not a case of too many bosses but rather of too few of the right caliber. Mac, Shorty and the super have their counterparts at many mines. Having had twenty years' experience in official capacities at mines, I have seen this little scenario acted and re-acted time and again. The attitude of the actors is fairly representative of no small number of our mine executives at both small and large operations. This argument will not be settled by pointing out a solution. Our hope lies in a radical change offering education and training early in life to enable men to strike a true balance in dealing with and managing others. It is not at all difficult for the thoroughly trained manager to see and understand the crux of the matter in dispute. The superintendent should possess a certificate of competency showing a higher degree of knowledge of mining than that of the foreman. He might be called inside manager and be given full control of all underground work. Distribution of authority should be about as follows: The manager should hold himself responsible for the output of coal. He should make the mine foreman responsible to him for the general condition of the mine and conduct of the employees under his charge. The master mechanic and electrician should be responsible for their separate divisions of the work and the men under their charge. With the management properly organized, Shorty, Mac and the master mechanic would all take orders from the inside manager and be glad to do so. I. M. A. LITTLEMAN.
Pennsylvania.

Too Many Orders Gum the Works

THE mine electrician or master mechanic of a modern mine producing 2,500 tons per day has charge of a very important department that does not function properly when he is deluged with cross-orders from the superintendent and mine foreman. He should so thoroughly understand the relative importance of the different phases of his work that definite orders from the superintendent would be unnecessary.

Briefly summed up, his duty is to keep all electrical and mechanical equipment in such good repair that no interruption in the flow of coal from the working face to railroad car can be charged to its failure. If he commands sufficient help and material, information regarding future and immediate needs of the mine, regardless of its source, should be all that is necessary to minimize time lost on account of electrical failures.

The superintendent should see that all department heads are well qualified and have the necessary tools and supplies. If interference with production is not to occur, the super's orders must come through the foreman. No valuable time would have been lost through the argument between Shorty and Mac if the superintendent had suggested to Shorty that the "wiring on West Main" be fixed as soon as such repairs could be made without interfering with important work.

The general manager can prevent the recurrence of such arguments by insisting that the superintendent settle them the right way. A superintendent should see his own mistakes and profit by them as well as by the mistakes of others. In this way he will build up an organization that will co-operate to the company's advantage.

This observation is based on several years' practical experience as mine foreman and superintendent. LAN DLADY.
Kentucky.

WHY did this motor stall? Did Mac really know, and was this a daily occurrence? Was the motor too small for the grade, was the motorman overloading it, or was the voltage too low? Who should have known these things? The mine foreman, of course. What would the super say? Well— he could only say that Mac had used poor judgment because he had no facts. This "probable" stuff will get him nowhere. Knowing the motor was stalled, Mac should have gone to the spot immediately and found out what the trouble was. Then he would have had the right dope and could have taken the matter up with the super. Mac must not forget the super shall be the adviser. He should have invited the super underground to see for himself. It might have been necessary to put in bigger motors or grade the hill. Things of this character require the super's opinion, and the sooner he knows about them the better. Having the facts, the super is prepared to talk to his superiors about improvements.

MATHEW LEWIS.
Windber, Pa.

FROM the point of discipline, Shorty was right in obeying the super's orders, but to accord with good management the super should have relayed his orders down the line. Only when safety of the mine is threatened, is the superintendent at all justified in issuing orders direct. The foreman should know his personnel and how every phase of the work is being conducted. Oftentimes a slight re-arrangement cuts the day's output several hundred tons. I am a firm believer in "all boss or no boss." Foremen who will work on no other condition are rated highest and are easiest to follow.

H. T. WALTON.
Wolfpit, Ky.

Base Division of Authority On Power Costs

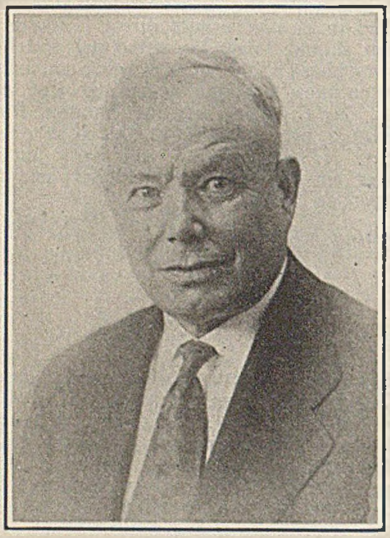
A MINE foreman should take orders from the superintendent. If a division of authority is necessary, it should be based on the control of power costs. The general management should see that cost sheets showing expenditures for power and electrical supplies are kept separate from those giving mining costs. The mine foreman and the electrician should receive copies of these each week. If Shorty had been responsible for the cost of power, he would have suggested a limit to the size of trip Old Ironsides be allowed to haul uphill. Neither would Shorty have let 10 East get in such bad condition for lack of feeders.

My experience has been, where the electrician is bossed by the mine foreman, that bonds and feeders get attention only when repair and power bills have amounted to more than the cost of maintaining feeders and bonds or when the daily tonnage declines. An electrician can measure savings with precision instruments, which give him a chance to show what he can do. A mine foreman should welcome such a division of responsibility, since problems in labor, actual mining, ventilation and safety alone keep him hustling. A. PLODDER.
Mine Electrician.
West Virginia.

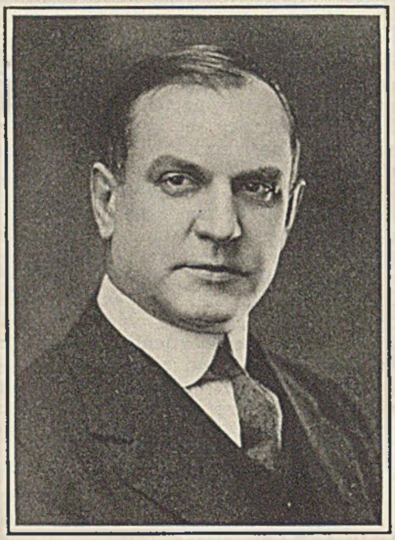
HOW could Mac be the real foreman of the mine if he did not even know that Shorty was fixing the wiring on the West Main? Is Shorty a fellow who goes out of his way to meet the superintendent and dodge the mine foreman? And what business has the super telling Shorty to fix the West Main wiring? The super should be big enough to tell him that orders governing this work must come only from the foreman. Mac is not fitted for his job if the super doesn't have enough confidence in him to leave the bossing job in his hands. When the superintendent of our mine goes underground, I, as foreman, go with him. As we go through the workings we talk in detail of what should be done. Sometimes we argue, but generally we part with a clearer understanding of our problems. His orders are my orders, then, and my word is never disputed. And when I need Shorty I know where to find him.

B. DURACINE.
Canada.

WORD *from the* FIELD



Thomas Moses



Thomas Dawson

Coal Co. Head Named By Steel Corporation

Directors of the United States Steel Corporation, meeting at Pittsburgh, Pa., July 23, elected Thomas Moses, of Danville, Ill., president of all the coal subsidiaries of the corporation. The companies affected include the United States Fuel Co., H. C. Frick Coke Co., United States Coal & Coke Co., National Mining Co. and the Hostetter Connellsville Coke Co. Mr. Moses succeeds Walter H. Clingerman, who died June 13. For the past twelve years Mr. Moses has been general superintendent of the United States Fuel Co.

Thomas Dawson, of Mount Carmel, Pa., was made vice-president of the H. C. Frick Coke Co. He will continue as chief engineer, however.

Mr. Moses, who was born in Audenried, Pa., 57 years ago, began his career in the coal industry as a rock picker in an Illinois mine at the age of twelve. Later he was a mule driver. He rose steadily, serving two terms as secretary of the Illinois Mining Board and for a time as a state mine inspector. He became superintendent of the Bunsen Coal Co. in 1910 and five years later was made general superintendent of the company, the name of which was changed soon after to the United States Fuel Co.

That the man who will tackle what has been described as the biggest coal-mining job in the world—in which he will be called upon to direct the labors of 40,000 men — possesses a striking personality is attested by the fact that when his friends decided to welcome him back home last week when the train arrived from Pittsburgh, Danville virtually closed up till "Tom" got in.

"I'm terribly conscious of the grave responsibilities of my new position, even though I haven't had time to think much about them yet," says Mr. Moses. "I was elected president of corporation after corporation so quickly that I don't even know the names of them all.

"I'm president of three railroads, coal-carrying roads in Pennsylvania, and don't even know the names of them. I'm president of three water companies in Pennsylvania, but what their names are I don't know. The seven coal companies are scattered—four in Pennsylvania, one in West Virginia, one in Kentucky, and the United States Fuel Company of Illinois and Indiana."

Although his business headquarters will be in Pittsburgh, Mr. Moses will retain his residence in Danville. "My position will require lots of traveling and I might just as well retain my home in Danville, where everybody is a friend."

Mr. Dawson, also, is a Pennsylvanian, having been born at Mount Carmel. He entered the employ of the Frick company in 1901 as a draftsman and has served successively as division engineer, assistant chief engineer and as chief engineer.

Southern Railroads Reduce Lake Rates 20c. To Meet Cut in Northern Fields

Railroads serving Southern mines have countered the decision of the Interstate Commerce Commission ordering a reduction of 20c. in lake cargo rates from the Pittsburgh, Cambridge and Ohio No. 8 districts by making the same cut in rates from mines in the Virginias, eastern Kentucky and Tennessee. Tariffs carrying the lower rates were filed with the commission July 27 by the Chesapeake & Ohio, Norfolk & Western and Louisville & Nashville railroads to go into effect Aug. 28, or eighteen days after the date specified for the reductions from the Northern fields to become effective by order of the Commerce Commission.

By special permission of the commission, the Baltimore & Ohio R.R. filed tariffs July 25, to become effective on Aug. 10, reducing rates from the Fairmont district 10c.; from the Connellsville field, 16c., and from the Pittsburgh field and all Ohio districts, 20c.

When the order of the Interstate Commerce Commission in *Lake Cargo Coal Rates, 1925,* was promulgated last May, reducing rates from the Northern fields after the original decision in this proceeding had rejected a tentative opinion calling for drastic re-adjustments and had declined to disturb the then existing rate situation, there was a storm of protest from the Southern producers.

An announcement was made by the Southern carriers about a month ago that they would make a 10c. cut, but this was not satisfactory to the shippers on those lines and was withdrawn after many protests had been made by the public and the coal operators of the Southern states. A large gathering of these interests met executives of the Southern roads at White Sulphur Springs, W. Va., and voiced opposition to any action but a cut equal to that accorded the Northern fields.

In voluntarily meeting the full cut of the Northern carriers the Southern lines have placed the Interstate Commerce Commission in a dilemma. If after passing on the proposed tariffs it approves them it will upset the advantage given the Northern fields. If it denies the application of the Southern carriers, it will face possible protest from consumers in the Northwestern states.

Coal Mine Accidents Cause 156 Deaths in June; Rate for Six Months Lower

Fatalities in coal mines from accidents in June totaled 156, according to information furnished by state mine officials to the U. S. Bureau of Mines. Forty-nine of the accidents were at the anthracite mines in Pennsylvania; the remaining 107 were at bituminous coal mines in various states. As the output of coal during the month was 43,884,000 tons, the fatality rate per million tons was 3.55, as compared with 3.36 in June a year ago.

The rates for anthracite and bituminous mines separately were 6.75 for the former and 2.92 for the latter, the corresponding rates for June last year being 5.37 and 2.93, respectively. Coal output during June included 36,627,000 tons of bituminous and 7,257,000 tons of anthracite.

Records covering accidents during the first half of 1927 show a loss of 1,162 lives, as against 1,191 during the corresponding months of 1926. These figures represent fatality rates of 3.66 and 3.92, respectively, per million tons of coal produced, thus indicating a reduction of 7 per cent in the frequency of fatal accidents during the present year. The fatality rate for bituminous mines alone was 3.23 per million tons, based on 894 accidents and a 6-months' production of 276,627,000 tons.

The 6 months' fatality rate of 3.23 for bituminous mines indicates a reduction of 14 per cent from the death rate of 3.78 for the first six months of 1926. For anthracite mines alone the returns for the first half of 1927 showed 268 fatalities and indicated a fatality rate of 6.55 per million tons as compared with 4.96 for the same period last year.

The month of June, 1927, was free from major disasters—that is, accidents causing the death of five or more men. Thus far in 1927 seven major disasters have occurred with an aggregate loss of 140 lives. During the first half of 1926 there were eight major disasters, resulting in 194 deaths. Fatality rates based exclusively on these disasters were 0.639 in 1926 and 0.441 in 1927, a reduction of 31 per cent in the present year.

A comparison of the principal causes of accidents during the first six months of 1927 with the corresponding record for 1926 shows that in 1927 the death rates have been lowered for falls of roof and coal, for haulage accidents, and for explosions of gas and dust. The rates for explosives and electricity are somewhat higher than the corresponding rates last year. Comparative rates per million tons are as follows:

	Year 1926	Jan.-June 1926	Jan.-June 1927
All causes	3.790	3.921	3.660
Falls of roof and coal	1.829	1.876	1.716
Haulage	0.650	0.658	0.573
Gas or dust explosions:			
Local explosions	0.111	0.138	0.148
Major explosions	0.525	0.639	0.419
Explosives	0.145	0.129	0.202
Electricity	0.143	0.122	0.151

Launch Sales Promotion On Smokeless

To give impetus to a sales promotion movement in behalf of the entire West Virginia smokeless area the Raleigh *Register*, Beckley, W. Va., issued a "Smokeless Coal Edition" of 50 pages on July 21.

In a three-column box on the first page the editors point out that "the weakness of the smokeless coal industry has always lain in its failure to adopt modern merchandising methods—methods compatible with the superior quality of the coal in heat units. . . . While other industries with a superior commodity to offer the public have devoted prodigious efforts and money to the selling end—to the development of a stable market—smokeless coal operators, by and large, have devoted themselves intensively to production, allowing the market to take care of itself."

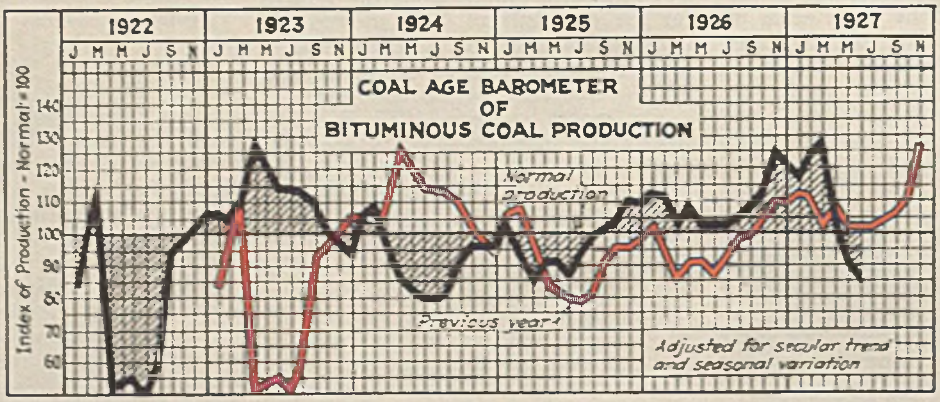
This situation, the editors of the *Register* maintain, should be reversed. The higher quality coals from this district, they declare, should command a profitable market at all times—not merely when lower grade coals are not available. "Intelligent sales promotion," it is stated, "is the touchstone that will do the work, as those operators who have gone in for that sort of thing to some extent can testify. Those few who have thus developed an assured market are not so much at the mercy of the fluctuations of production in other coal mining fields."

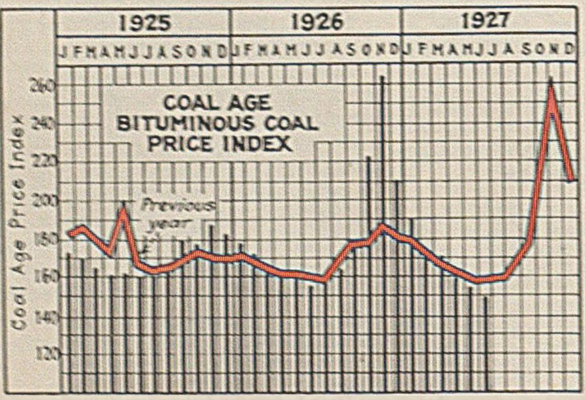
Coal-Mine Fatalities During June, 1927, by Causes and States

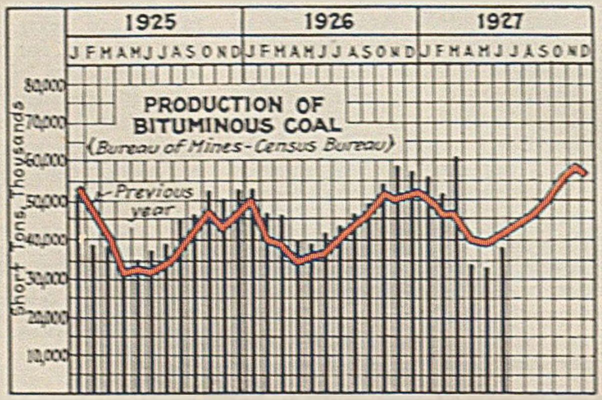
(Compiled by Bureau of Mines and published by *Coal Age*)

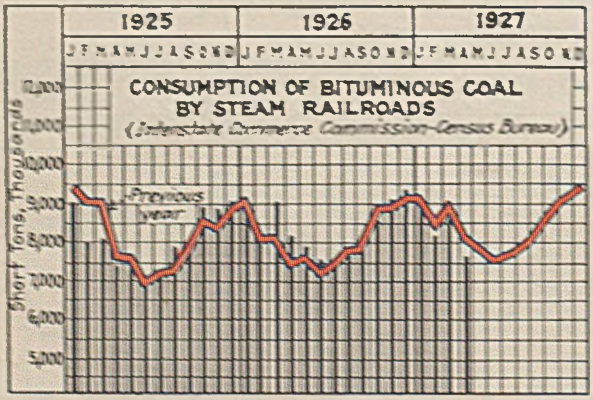
State	Underground												Shaft					Surface							Total by States	
	Falls of roof (coal, rock, etc.)	Falls of face or pillar coal.	Mine cars and locomotives.	Explosions of gas or coal dust.	Explosives.	Suffocation from mine gases.	Electricity.	Animals.	Mining machines.	Mine fires (burned, suffocated, etc.).	Other causes.	Total.	Falling down shafts or slopes.	Objects falling down shafts or slopes.	Cage, skip or bucket.	Other causes.	Total.	Mine cars and mine locomotives.	Electricity.	Machinery.	Boiler-explosions or bursting steam pipes	Railway cars and locomotives.	Other causes.	Total.	1927	1926
Alabama	3			1								4													4	2
Alaska																									0	0
Arkansas	1											1													1	0
Colorado	1	1										2			1		1								3	6
Illinois																									0	12
Indiana	1				1							2													2	1
Iowa																									0	0
Kansas					1							1													1	5
Kentucky	2		2								1	5													5	15
Maryland		1										1													1	1
Michigan																									0	0
Missouri																									0	0
Montana			1				1					2													2	0
New Mexico	3											3													3	0
North Dakota																									0	0
Ohio				1	2							3													3	9
Oklahoma	1		1									2													2	2
Pennsylvania (bituminous)	15		2		4		2					23							2				2	4	27	27
South Dakota																									0	0
Tennessee																									0	1
Texas																									0	0
Utah	1											1													1	3
Virginia							1					1													1	4
Washington							1					1													1	0
West Virginia	22	7	8	3	1		1		1		1	44						1	1				2	4	48	42
Wyoming		1		1								2													2	2
Total (bituminous)	50	10	14	6	9		6		1		2	98			1		1	1	3				4	8	107	132
Pennsylvania (anthracite)	25	3	3	5	6	2	1				2	47						1	1					2	49	47
Total, June, 1927	75	13	17	11	15	2	7		1		4	145			1		1	2	4				4	10	156	
Total, June, 1926	84	8	31	12	9	1	10	1	4		5	165						1	2				3	6	171	179

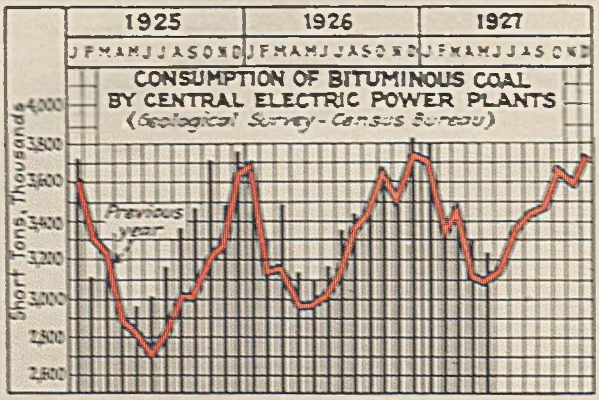
Indicators of Activities in the Coal Industry

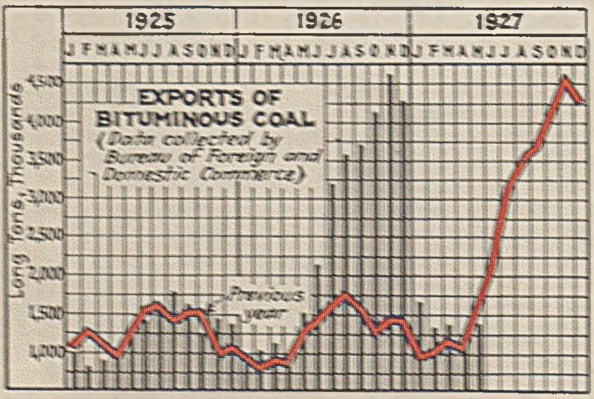


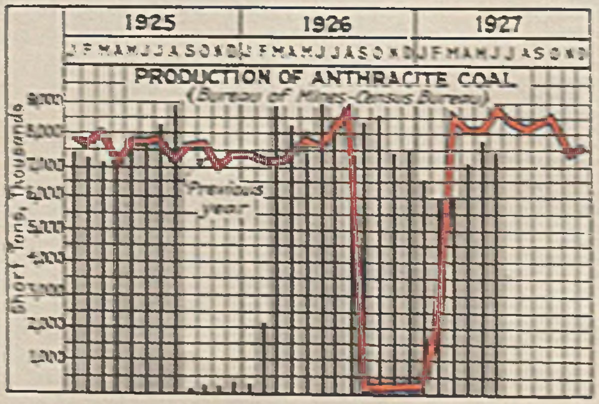












MARKETS *in Review*

ALTHOUGH general conditions in the bituminous coal markets of the United States were erratic last month, greater evidence of consumer interest was manifest in the Middle West. Western Kentucky coals held the center of the stage and railroad buying was responsible for their headline position. It remains for this month, however, to establish whether the upturn presaged a real improvement which would spread out over the coal fields generally or a flurry which would disappear as quickly as some others have vanished.

Early in July railroad buying strengthened spot prices on western Kentucky mine-run in the Chicago market. Following this there was a gradual tightening in prices in Louisville, while Chicago levels showed little change. In the third week of the month, however, additional railroad buying resulted in increases all along the line. First felt at Chicago, in a few days the advances reacted in Kentucky, raising block from \$1.65@\$2 to \$2.25@\$2.50; mine-run from \$1.50@\$1.60 to \$2@\$2.25 and screenings from \$1.50@\$1.75 to \$2 @\$2.25.

THIS BUYING suggests, of course, that uneven distribution of stockpiles may yet play an important part in the final decision in the wage controversy which so far seems to have defied efforts at a friendly solution by the operators and the leaders of the United Mine Workers. Stocks as of June 1 were estimated by the National Association of Purchasing Agents at 66,510,000 tons—a decline of 5,778,000 tons in one month. During May, in other words, industrial consumption was 783,000 tons less than in April, but 611,000 tons more was used out of stockpiles.

DURING June the bituminous mines of the country produced 36,627,000 tons, as compared with 35,395,000 tons in May. Figures for the first three weeks of July indicate that the output last month closely approximated the June total. The June-July increases over May output more than offset the additional draft upon storage made in May. Barring some unrevealed changes in the rate of consumption, therefore, industrial stocks on Aug. 1 may be estimated at between 55,000,000 and 56,000,000 tons.

IN ANTHRACITE the outstanding feature the past month has been the manner in which the steam sizes, particularly No. 1 buckwheat, has gained in strength with the falling off in production due to the dearth of orders for domestic sizes. At New York, where this activity has been most marked, independent quotations have risen from \$2.25@\$2.50 per gross ton to \$3@\$3.25. Other sizes, except birdseye, have been stimulated, but in a lesser degree.

The past month has been a hard one for the sale of the large coal. Egg probably has fared better than any other domestic size, with stove second. Pea has been the weakest. It is felt, however, that by mid-August there will be more life to the market because many retail distributors and household consumers will want to put in stocks before the 25c. increase scheduled for Sept. 1.

THE LAKE TRADE in bituminous still is active, although there was a gradual contraction of shipments during July. Nevertheless total dumpings to July 25 were over 4,300,000 tons ahead of last season and operators at the Head of the Lakes were beginning to wonder where they would store all the coal en route. In view of early season developments, however, the Duluth-Superior docks were confident that the Northwest would take 10,000,000 tons this year. On the anthracite side of the trade, predictions were made that the total would be cut from 1,000,000 to 700,000 tons.

Generally speaking, seaboard bituminous markets were sluggish last month. New York had a few days' spurt and then dropped back. There were little signs of activity at Philadelphia or Baltimore. The suspension of union operations in central Pennsylvania left no deep impress on the trade. The New England market held promises of improvement which were not fulfilled, although some recovery was registered in low-volatile coal toward the end of the month.

SOUTHEASTERN markets were spotty, but the situation at both Cincinnati and Louisville was stronger at the close of the month than at the beginning. Aside from the sharp upturn in western Kentucky coal, however, the measure of improvement was small. Eastern Kentucky and southern West Virginia slack were backward throughout the entire period. Birmingham showed no signs of revival until the end of July and even these indications were somewhat offset by curtailment in contract shipments.

Neither Cleveland nor Columbus was particularly active. Competition in the Pittsburgh district was keen and western Pennsylvania producers were compelled to quietly shade list figures at times to keep business from going to northern West Virginia. Inquiries increased in Buffalo and toward the end of the month some of these inquiries were translated into orders, but most of the business was placed directly with the mines.

EASTERN COALS had hard sledding in the Middle Western markets. As August drew near there was more interest shown in the future by Illinois and Iowa retailers. On the whole, industrial inquiry also was somewhat broader and this was reflected in an advance in prices on Fifth Vein Indiana screenings. To many in the Southwest the development of demand for summer storage coals was disappointing. Colorado and Utah complained that business was not up to expectations; mines in those states averaged only about 50 per cent running time or less.

June exports—the latest month for which figures are available—fell behind last year, when the repercussions of the British strike were beginning to be felt. Except in the case of anthracite, however, the foreign movement was ahead of May. During June there were 1,694,044 gross tons of bituminous coal, 303,951 tons of anthracite and 58,837 tons of coke exported. Canada took 1,514,415 tons of bituminous coal, 302,025 tons of anthracite and 55,502 tons of coke.

AVERAGE PRICES of bituminous coal changed little until the last week in July. *Coal Age* Index of spot bituminous prices was 152 on July 5, 150 on July 13 and July 20 and 155 on July 27. The corresponding weighted average prices were \$1.84, \$1.82 and \$1.88. The sharp increase on July 27 was due to the jump in western Kentucky quotations at Chicago and Louisville. As stated in a preceding paragraph, railroad buying furnished this stimulus.

The Connellsville beehive coke market was quiet throughout the month. Less business was closed on contract and the prevailing price for third-quarter deliveries was \$3.25. Spot prices were firmer, not because of increased demand but because the ovens found no profit in forcing sales. Domestic trade in byproduct coke throughout the country was not brisk.

OPERATING IDEAS *from* Production, Electrical *and* Mechanical Men

If you have a practical idea, a short cut method, or a new wrinkle in operating or maintaining a machine, here's the place to shout about it! *Coal Age* will pay you for your time and trouble and for the help it will be to other coal operators.

* * *

Depending on its possible value to the shop or operating departments (which look to *Coal Age* for new ideas from the field), and upon our ability to publish it in these columns, we will pay from $5.00 up for each idea.

* * *

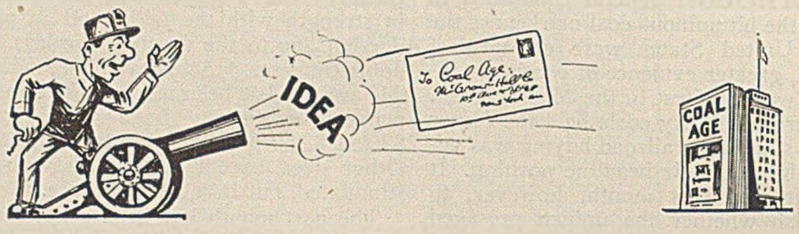
Here's your opportunity not only to win the recognition of your own officials for using your wits to lick a job, and to cash in on it, but also to exchange your ideas with others. For through this department of *Coal Age* others will contribute ideas which will be worth a lot to you.

* * *

So go to it and give this clearing house of ideas a chance to record your progressiveness.

* * *

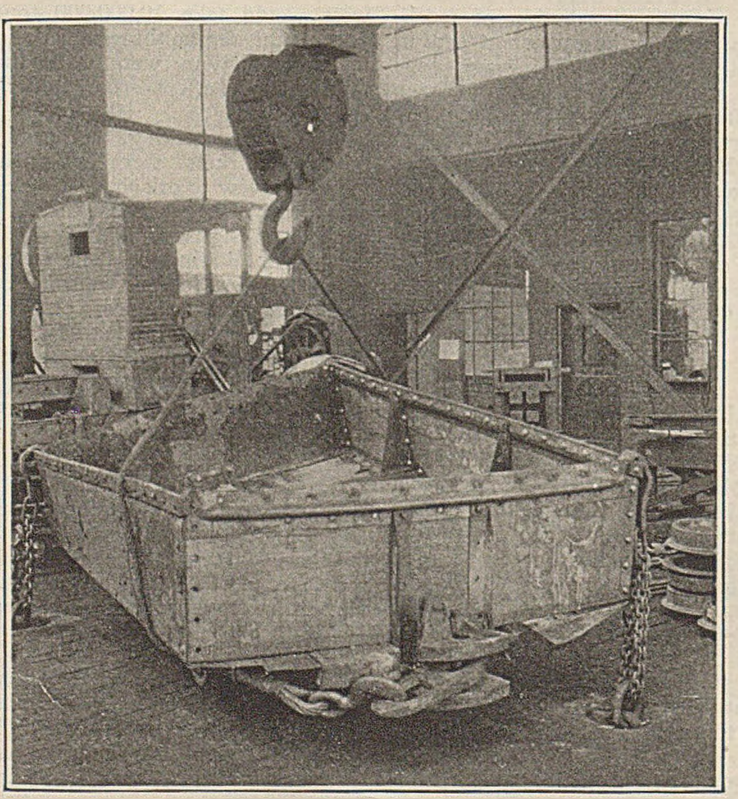
Make your story short and snappy. We'll edit it if necessary. Don't stop to make finished drawings if illustrations are needed. Simple sketches will do. Our draftsmen will follow your ideas.



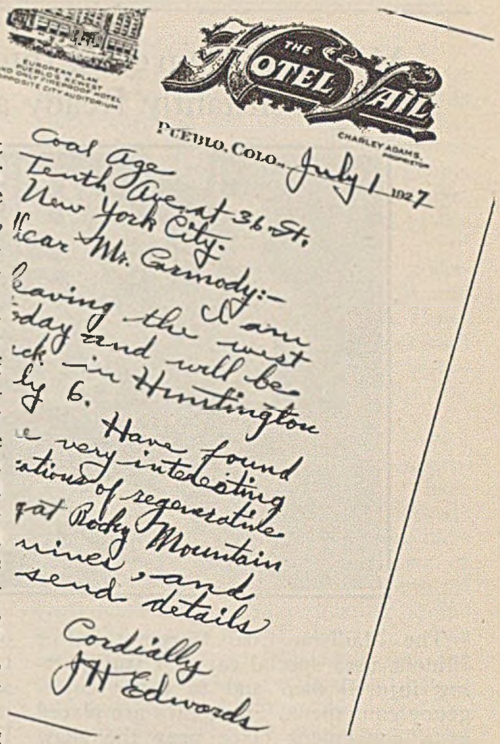
Warped Mine Car Is Pulled Back Into Shape By Ten-Ton Trolley-Type Crane

It is not necessary to tear down completely, or even partially disassemble, a steel mine car that has been warped as the result of a wreck merely in order to straighten it. At the Nemacolin mine of the Buckeye Coal Co., Nemacolin, Pa., cars in need of straightening are taken into the shops and put through the adjusting process here illustrated.

A 10-ton trolley-type crane lifts the car from the track and lowers it to the floor in a space allocated for the work. The position of the car is so fixed that the two high corners, which invariably are diagonally opposite, lie in line with two anchor rings embedded in concrete in the floor. Each of these corners is rigidly held by a hook fastened to an adjustable chain. A 1-in. wire rope is slung under the two low corners, the ends being hooked to the drawheads, and suspended from the crane block. The crane is then caused to exert a pull sufficient to spring the low corners into normal position. This job is completed in a few minutes.



Regenerative Braking Doubles Life of Ropes In Rocky Mountain Mines


THE HOTEL VAIL
EUROPEAN PLAN
PUEBLO'S NEWEST AND ONLY FIREPROOF HOTEL
OPPOSITE CITY AUDITORIUM
CHARLEY ADAMS, PROPRIETOR
PUEBLO, COLO., July 1 1927
Coal Age
Tenth Ave. at 36 St.
New York City.
...ear Mr. Carmody:—
...eaving the I am
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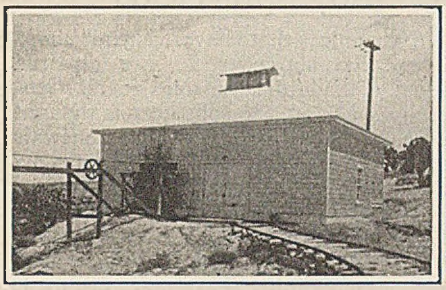
...ly 6. — in Huntington
Have found
... very interesting
...ations of regenerative
... at Rocky Mountain
...mines, and
send details
Cordially
J H Edwards

There is no doubt but that braking by regeneration is a method which involves little if any wear on the equipment. Consequently, renewals of friction surfaces are reduced to a minimum and some useful energy is furnished to the power system. It would seem reasonable, therefore, to use this method wherever possible.

Rough terrain and pitching seams are reasons for the use of many gravity planes and slope hoists in the Rocky Mountain coal fields. These installations afford excellent opportunities for regenerative braking and a number of companies have utilized this method.



Sweetwater Hoist House

At the King No. 1 mine of the United States Fuel Co., Hiawatha, Utah, the introduction of regenerative braking on an incline machine has practically doubled the life of ropes which cost $5,000 to $6,500 each. The incline on which this rope is used is 5,800 ft. long, has an average grade of 12 per cent and a maximum grade of 20 per cent. Trips of 17 cars, averaging 4.1 tons per car, are handled in balance by a gravity incline machine, having tandem wheels fitted with Walker differential rings.

Originally the machine was equipped with a 75-hp. motor which was used only for starting. In order to secure smooth braking and resultant increased rope life, this motor was replaced in 1925 by a 500-hp. 2,200-volt alternating-current motor of the wound-rotor type. Operation is as if the motor was driving instead of braking. All resistance is cut out of the motor circuit when the controller is on the operating point and the speed is automatically held to a few per cent above synchronous. This results in an average rope speed of 900 ft. per min.

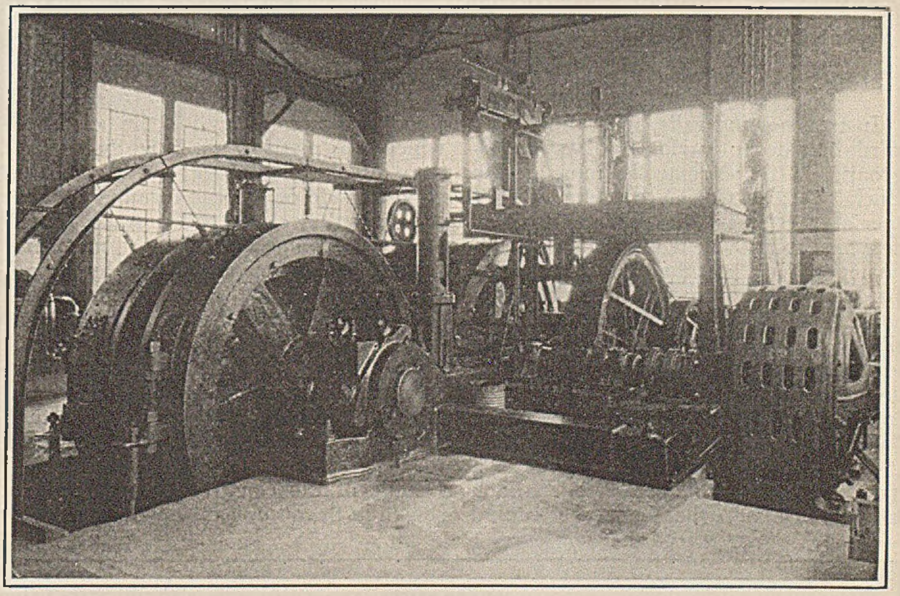
When the descending trips were being governed by the mechanical brakes of the incline machine, 400,000 tons was considered good rope service. Since the introduction of electric braking, a life of 750.000 tons has been obtained. This increased life is due to the elimination of the jerking which was inherent with the form of mechanical brakes used. Power returned to the line amounts to approximately one kw.-hr. per ton of coal handled. The amount is recorded each month by a watt-hour meter connected permanently in the motor circuit. Readings for two months, selected at random, show 39,100 kw.-hr. and 38,400 kw.-hr. for mine productions of 29,200 tons and 36,500 tons.

At Quealey, Wyo., is another interesting application of regenerative braking. This is at the Sweetwater mine of the Gunn-Quealey Coal Co. Here a 440-hp., 2,200-volt slip-ring induction motor hoists the mine output by single-rope haulage up a 3,000-ft. incline that has a pitch of 8 to 10 per cent. The loaded trips, consisting of 14 cars, each averaging 2 tons, are hoisted at a rope speed of 1,250 ft. per min., but the empties are lowered at 1,400 ft. per min. This increased speed, greater by 12 per cent, is secured by operating the motor on or near the third running point—that is, with the last two sections of the resistance in the rotor circuit.

Holding the motor to a safe lowering speed is entirely in the hands of the hoistman and he depends upon an electric tachometer for rope speed indication. This tachometer consists of a magneto belted to the drum shaft, delivering current to a voltmeter calibrated in feet per minute and mounted near the trip position indicator.

A different method of protection against overspeed is in use at a mine of the Colorado Fuel & Iron Co., near Walsenburg, Col. Here a flyball governor, which is driven from the hoist drum, automatically disconnects the motor from the line and sets the mechanical brake in event that the operator allows the descending trip to go above a safe speed for the motor windings. In this case, also, resistance is left in the rotor circuit to permit the desired lowering speed.

These installations are those which I chanced to see at Rocky Mountain mines. Conversations with prominent coal-mine electrical engineers of the West, including D. C. McKeehan of the Union Pacific Coal Co., F. B. Thomas of the Victor American Fuel Co., and G. S. Thompson of the Colorado Fuel & Iron Co., indicated that these companies use regenerative braking on many of their slope-hoist installations.



Hoist at King Mine No. 1

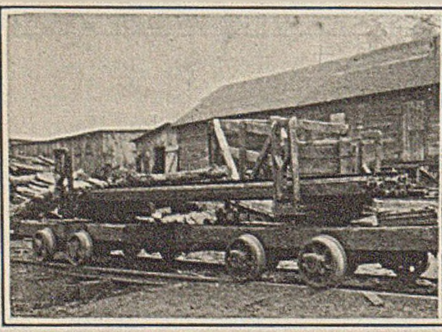
Mine Car Converted Into Ambulance Is Kept Constantly Ready at Shaft Bottom

The Madison Coal Corporation, of Illinois, uses special cars for transporting injured men and to carry emergency equipment. These cars are placed at a convenient place near the shaft bottom and, when the call is received, they are hooked to a mine locomotive and rushed to the scene of the accident. The equipment carried on them is as follows: One pump jack, one steel bar, one copper bar, six copper hammers, two hand axes, two sledgehammers, two saws, two pipe wrenches, 20 lb. of mixed nails, two pairs of wire cutters, one life line, one stretcher, one rubber blanket and one woolen blanket. The stretcher rests on chains and therefore does not receive the jar that results from traveling over uneven track. The box for the blankets is seen in the bottom of the car.

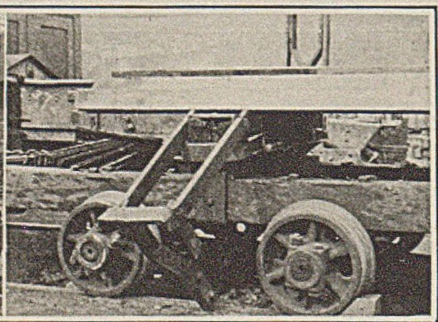
New Mine Rail Carrier Is Designed Primarily For Safety and Convenience

In transporting rails, from the supply yard outside to various points underground, at the Nemacolin mine of the Buckeye Coal Co., Nemacolin, Pa., a special carrier is used which has been designed to provide a maximum of convenience with a minimum of danger. On each of two trucks in tandem is a bolster that is held to a supporting cross-sill by a king pin and is therefore free to swing in a horizontal plane. With this arrangement the load of rails can be taken around curves without "working."

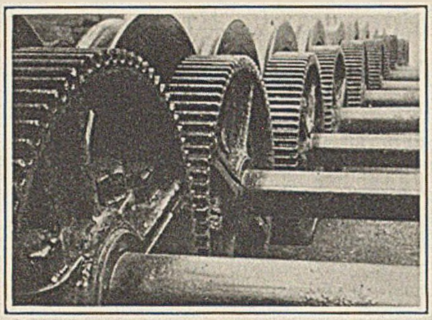
On the ends of each bolster is a hinged stake held by a latch. Each latch is bent into the shape of a capital J that embraces the end of the bolster to which it is pinned by a hinge bolt. The stem of the J-member extends to the opposite side of the car forming a hand lever for the release of the stake. Each stake is composed of two members which are fastened together by hinge rivets. When the stakes are released they swing outward, opening up like a jack knife, and the legs fold inward until the foot of them rests on or near the track rail. The rails being transported may then be slid off the bolster, down the sloping stakes and dropped to the ground in the clear of the track. Details of the construction are plainly shown in the accompanying illustrations.



Loaded Carrier



Ready to Unload



Ready for Service

"Loose Wheels" Curtailed By Split Gears

Companies that have central shops where locomotive trucks are repaired usually standardize on solid gears. Generally speaking, the split gear is thought of as the one for use where renewals are made in the mine and perhaps by any "jack leg" mechanic.

The practice of the Island Creek Coal Co., of Holden, W. Va., is exactly contrary. Although it has a complete central shop and all truck repairs are made there, split gears are the standard.

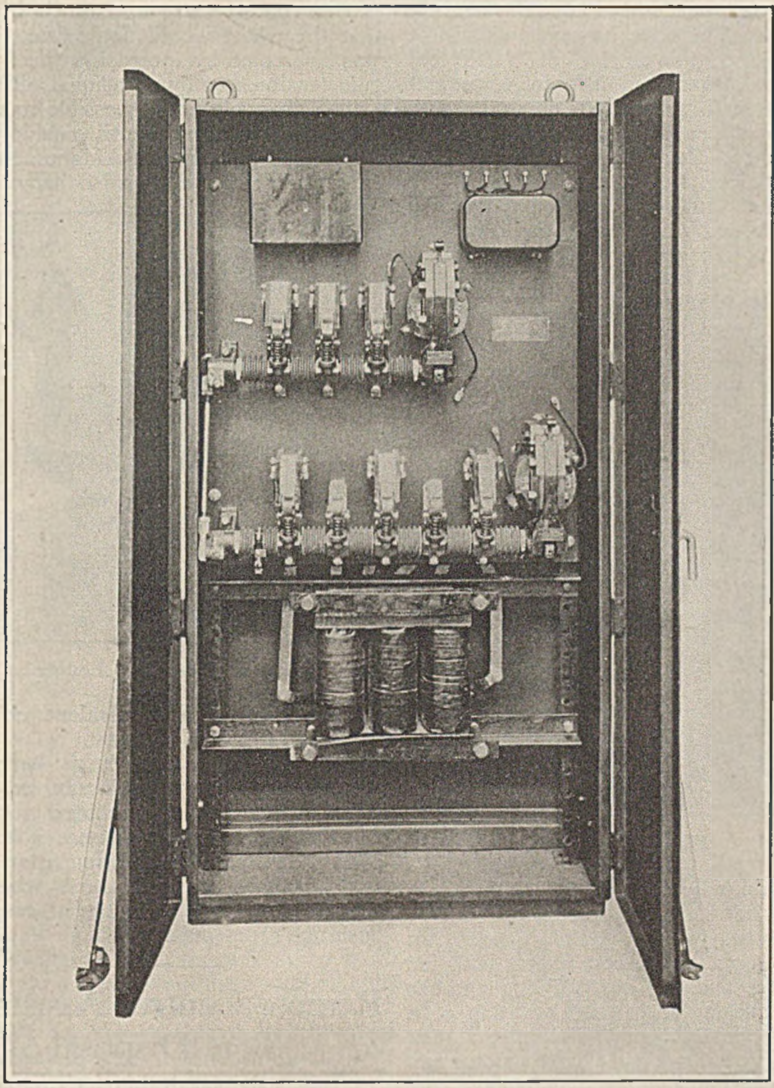
Split gears are used due to the fact that L. D. Thompson, chief electrician of inside equipment, is certain that the troubles from loose gears (caused by being the split type) have been fewer than would be the troubles from loose wheels if solid gears were standard. If the solid type were used, a wheel would have to be pressed off and back onto the axle in order to make a renewal. Because the wheel would have a looser fit after a removal, Mr. Thompson claims that cases of loose wheels would show up in service.

Although the company operates 123 locomotives and these gathered and hauled 7,000,000 tons of coal last year, fewer than six cases of loose gears became evident. These caused no loss of tonnage because they were detected in the early stage and the trucks replaced with spares which are kept on hand in each mine.

This success with split gears is due to the fact that all are applied in the central shop and that the work is done by a man who has this as one of his special jobs. The key is made a thousandth of an inch or so wider than the seat and keyway. The half of the gear which contains the keyway is then hammered onto the axle, forcing the key into place. The latter must fit so tightly that the half of the gear will not fall off the axle if the truck is rolled.

The next step is to apply and bolt the other half of the gear. Shims are placed in the bore if the gear does not "make up" to the axle before the rims come together. The bolts are tightened cold and the nuts spot welded. Finally the ends of the key are upset with a heavy punch or drift.

Automatic Remote Control Reduces Operating Costs for Many Companies



Automatic Starting Compensator

Most coal mine managements today realize that the elimination of man power, in so far as possible, is highly desirable if costs are to be reduced. This realization, says J. W. Wightman, electrical engineer of Cincinnati, Ohio, has placed remote or automatic control of electrical machinery in a prominent position as it makes possible the partial or entire elimination of manual operation not only in starting but also in attendance of motor equipment.

Fortunately, the substitution of remote control for hand starting is, in the majority of instance, a comparatively simple and cheap process.

Occasionally, when remote control is substituted for hand control, a more complicated problem presents itself.

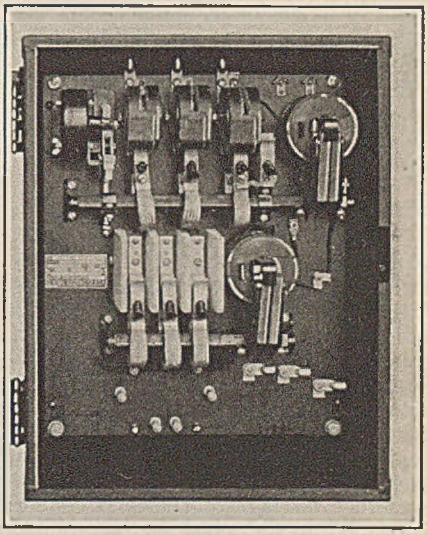
Recently, the Fordson Coal Co., one of the largest producers in its district, desired to change one of its main ventilating fans from hand to remote control. The fan operated at a remote point and supplied air through a shaft in the center of the property. This fan was required to operate at three different speeds: Low speed at night or at those times when only a few men were at work; normal speed during normal or day operation; and emergency speed in the event of fire or other disaster.

Three possible applications of motors with remote control were considered: A multi-speed squirrel-cage motor with an automatic compensator and a pole-changing switch for four combinations of poles; a brush-shifting motor with remote control; and a slip-ring motor similarly controlled. The problem was considered from three different aspects: First cost; power consumption at various speeds based on the time of operation at each speed; and ease of speed variation to meet the increased or decreased demand for air as necessitated by the changing conditions in the mine.

The multi-speed, squirrel-cage type of motor was quickly eliminated, as the speed required for day work and that required at night were not in the proper ratios to that required in an emergency. Furthermore, changes in the air requirements might necessitate changing of the day and night speeds at any time.

The brush-shifting motor made possible any speed from full to one-third, and its efficiency curve was excellent. However, the comparative first cost was high for the particular size required—approximately twice that of the slip-ring motor with its control.

Choice of the proper remote control for the slip-ring motor application presented still another problem. Three types of remote control were considered: A full magnetic push-button type, having a comparatively small number of speeds; motor-operated drum control with push-button and indicating lamp; and a combination of the two. The last type was chosen because it provided a comparatively large number of speeds, and also because it met the speed requirements. This control equipment consists of a magnetic panel with line and accelerating contactors arranged to start and accelerate the motor to a speed provided by the setting of the drum controller. A push-button station was mounted some distance from the fan and control. It comprises a start-stop button of the snap-switch type, fast and slow buttons to operate the pilot motor on the drum controller to speed up or slow down the fan, and indicating lamps to show if the motor was running and the position of the drum controller.

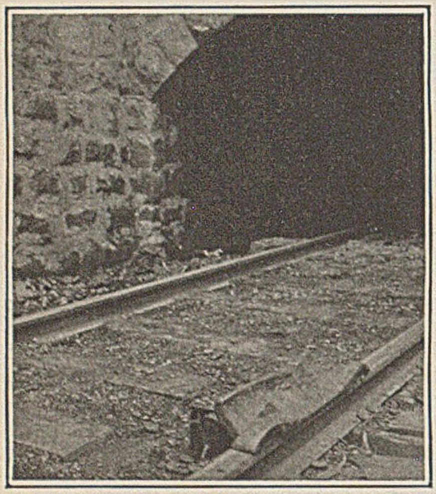


Automatic Control Panel

After the motor has once been started and the speed has been adjusted to give the desired flow of air, if the power fails the motor will automatically restart on the return of power, and will accelerate to the speed at which it had been running before the shutdown.

Derail Failure Shows Need for Testing

The accompanying photograph was made within a few minutes after a 6-ton battery locomotive had accidentally run over the derail. Neither truck of the locomotive was thrown from the track. The derail is of the two-direction hinged type and its function is to prevent

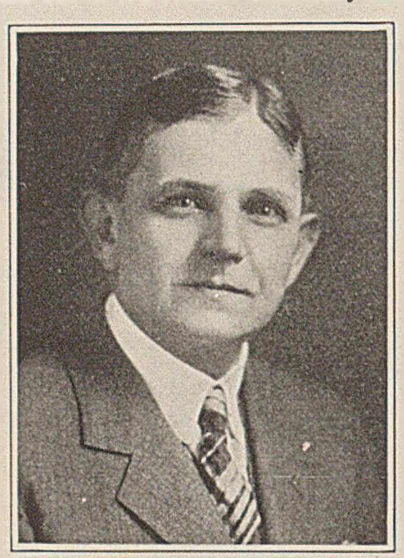


They Don't Always Work

equipment, normally standing on a side-track outside, from entering this opening which is a man haul and down grade from the entrance. Few would doubt the ability of a standard type of derail to "wreck" equipment, but this instance indicates that even so simple a device as this should be tested occasionally.

Fit the Job to the Man To Get Results

There is no one, no matter what his station in life, who does not possess some good qualities that are worth developing, says Harry C. Howes, general manager of the Happy Coal Co., Happy, Ky. It is largely up to the foreman to develop these qualities in his men, but to do this he must possess them himself. In other words, what is in the boss is reflected in the men who work under his direction. If he is wasteful and throws spikes, bolts and fishplates in the gob, the men under him are apt to do likewise. On the other hand, if whenever he finds a spike, a bolt, a fishplate or anything else of value, he picks it up and carries it to where it belongs, the men under him will soon begin doing the same thing. If the boss drinks on Saturday nights and Sundays, his men in all probability will drink also. If he gambles, his men are likely to gamble too. The manner of handling labor is largely responsible for the success or failure of an operation. In the first place the work should be planned in advance by the foreman and so systematized that each employee knows just what he is to do. There must be sufficient discipline to carry on the work efficiently in a systematic manner. The boss, however, should be a judge of human nature. Different methods of handling different employees may have to be used to obtain results. One employee may have to be handled altogether differently from another. In all instances, though, the boss should be kind but firm—promises should rarely be made, but when made should be carried out to the letter. Too many fore-



Harry C. Howes

men habitually make promises that they cannot fulfill.

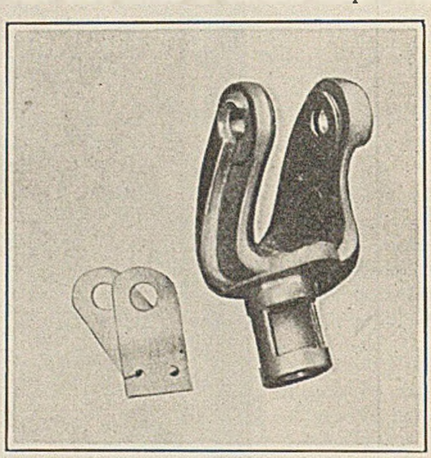
Knowing where to place men, in order to obtain the best results both for the man and the company, is another important factor in the operation of a mine. The boss may discharge a man because he is not an efficient motorman and does not keep up the haulage, yet the man may be good on track. It seems to me that if an employee is not successful at one job he should be given a chance at another before being discharged, unless, of course, there is some other good reason for dismissing him.

Contact-Spring Harps Prolong Wheel Life

When the Island Creek Coal Co. started to use 20-ton locomotives, as well as two 13-ton locomotive in tandem, the trolley wheels on those in the 250-volt mines gave much trouble. Graphite bushings did well to last over a day, and the wheels more than two days. So far as the officials were aware there was available at the time no commercial type of harp which answered their requirements of service and cost, so they proceeded to solve the problem themselves.

Copper contact springs of various sizes and degrees of stiffness were riveted to the harp so as to press against the wheel hubs. It was found that springs of sufficient stiffness to make proper contact caused so much friction that the wheel would not rotate. This was overcome by increasing the trolley pole tension and by occasional oiling.

The change made it possible to use a wheel for weeks and until outside wear limited the usefulness. Manufacturers were then asked to furnish harps with



Makes Them Last Longer

contact springs of equivalent characteristics.

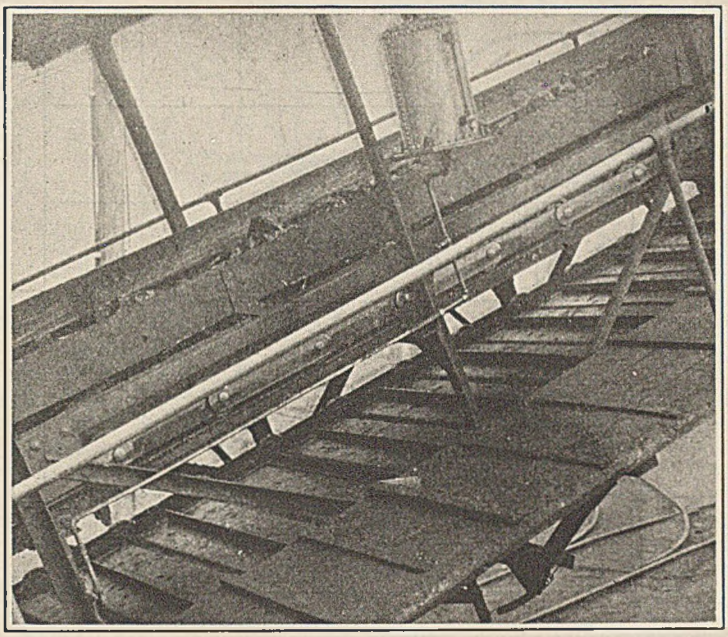
On each side of the harp there are two copper springs, each $\frac{3}{32}$x$1\frac{1}{4}$x$2\frac{1}{2}$ in. Extra springs are purchased for renewals. The present practice is to put a drop of oil on each spring after each trip of about two miles. A wheel is worn out without a change of graphite bushings or springs.

Remote Control Assists in Slate Disposal

There are many applications of remote control to slate dumps, according to J. W. Wightman of Cincinnati, Ohio. In such installations the slate bucket is filled, hoisted, dumped and returned automatically. This not only cuts costs below old hand methods but also, in many cases, simplifies the slate disposal problem by dumping in a remote location. Thus, valuable space near the tipple site is available which, with the old hand-dumping arrangement, was used for the slate bank. Motors applied to this service are stopped and reversed by remotely located limit switches, and the control used is very similar to that designed for skip-hoist applications.

Although the automatic substation is not an industrial control product, it is closely related to types of industrial control and plays a large part in cost reduction. About 75 per cent of all substations installed at the present time are of the full-automatic type, which not only eliminates attendance but also gives better and more satisfactory operation.

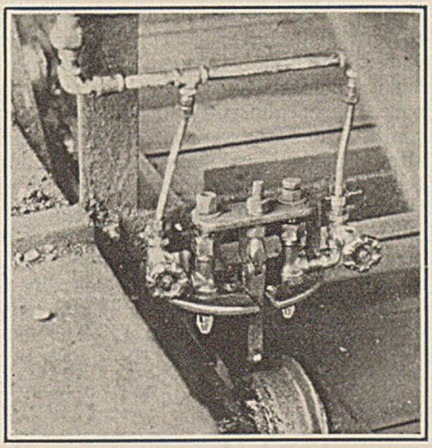
Oiler Comprising Small Pump Automatically Aids Conveyor Lubrication



Reservoir Mounted on Conveyor

Because coal is transported to the tipple by apron or pan conveyors at nine of the Island Creek Coal Co.'s mines, lubrication of these conveyors has been given close attention. It was found by experience that lubrication is the chief factor influencing maintenance cost, but the officials were never satisfied with the common methods of applying the lubricant.

Pouring oil onto the wheels by hand was expensive from every standpoint, and not satisfactory as to results. Not always did the oil hit the right place and therefore some of the wheels often suffered for want of lubrication. W. A. Hunt, of Holden, W. Va., general superintendent of the mines, finally perfected an automatic oiler which has revolutionized conveyor lubrication so far as the Island Creek mines are concerned.



Close-Up of Lubrication

This oiler consists of a small double-cylinder single-acting pump which shoots a few drops of oil on each side of the wheels as they pass. On the upward or suction stroke the pistons are moved by action of the conveyor wheel against a lift rod having a small roller on the end. After the center of the wheel has passed under the roller, a joint in the lift rod allows this rod to kick forward. This action, in turn, allows a spring to force a quick return of the pistons on the discharge stroke. The result is the ejection of oil at exactly the right time and on the desired spot.

The amount of oil ejected can be varied through practical limits by adjustment of valves in the oil lines feeding each cylinder. While the conveyor is in regular use the pump can be stopped by swinging the lift rod out of the guide slot and turning the rod to one side. It can be started again by dropping the lift rod back into normal position.

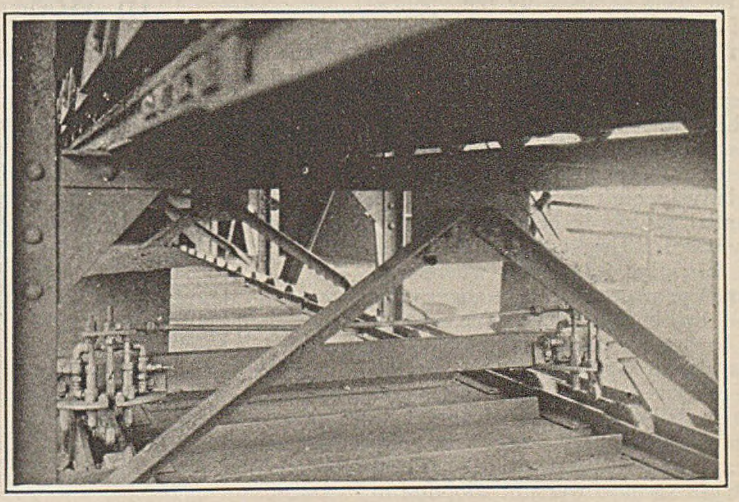
Two of the double-cylinder pumps are required for each conveyor and both are supplied by gravity from a common oil reservoir. Forty of these Hunt lubricators are now in use at the Island Creek mines. The first of these was installed over two years ago. Loading booms and other tipple conveyors of the link-and-wheel type are included among those which are equipped with the system.

Mr. Hunt has been granted patents covering the lubricator and has made arrangements to market the device.

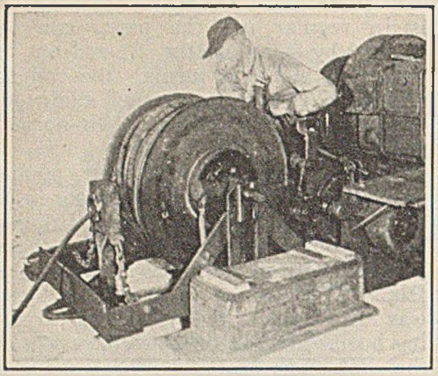
Operator Is Protected by Spooling Device

When spooling of the cable on cutting machines, compressors and other portable equipment is done by hand there is always danger of the operative's hand or clothing being caught somewhere in the reel. He is practically compelled to expose himself to this danger if no mechanical arrangement is provided for doing the job.

At the Nemacolin mine of the Buckeye Coal Co., Nemacolin, Pa., the cable is fed to the reel by manual operation of a simple spooling device. A longitudinal shaft of 1½-in. diameter is mounted on the frame of the machine under the reel. Fixed to this shaft at the tail end of the machine is a steel radius arm of strap steel that envelops a porcelain eye, through which the cable is threaded. At the other end of the shaft is fixed a lever which is controlled by the operative from his seat, revolving the shaft and consequently swinging the radius arm in a slight arc across the reel. The travel of this arm is arrested by two chains. By this means the cable is fed evenly



Friction Fighters at Work

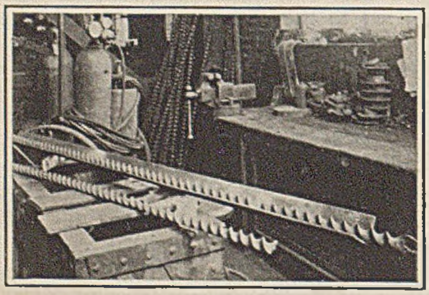


Protects Operator

to the reel with convenience and safety to the operator. Because of the simplicity of construction and attachment, and by reason of its low cost and effectiveness in operation, this device should have wide application.

Welding Lengthens Life Of Coal Augers

When the end of any coal auger used in the mine of the Buckeye Coal Co., Nemacolin, Pa., has been worn to the extent that it no longer meets the minimum requirements as to length, a piece from a discarded auger is welded to it. The auger and the piece to be added are

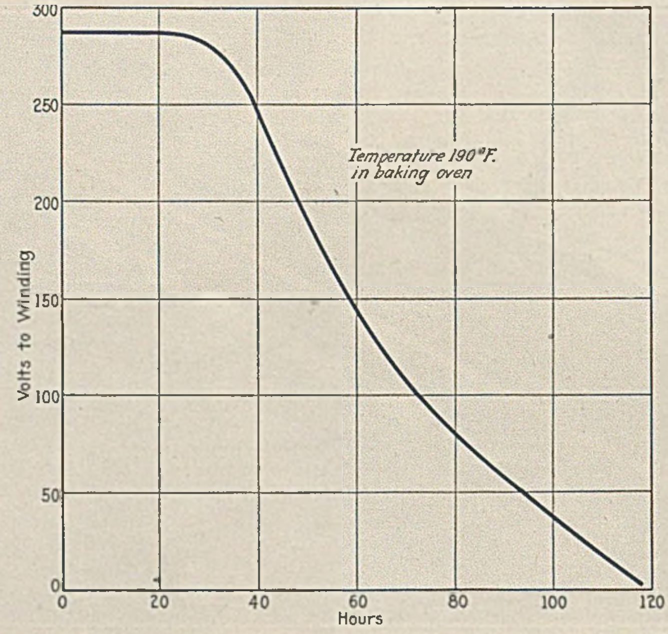


Re-Pointed in 10 Minutes

lined up and matched in a 2- or 3-in. angle section which serves as a trough. Here the weld is made by the application of an oxy-acetylene flame on either carbon steel or bronze steel welding rods. The weld is neatly made and therefore no time is consumed in smoothing it.

This job is prepared and completed in about ten minutes. In consideration of the relatively high cost of drill steel a substantial saving is being effected by this practice. Day men do the drilling at this mine. At plants where contract men provide their own augers and do the drilling, a reasonable charge could be set for the repair job. The miners would appreciate the service, since otherwise they must buy new augers periodically. The advantage to the company lies in the fact that holes are less often "drilled short." These advantages seem to warrant adoption of the idea at every mine.

Efficient Drying of Water-Soaked Motors Cannot Be Effected in Short Time

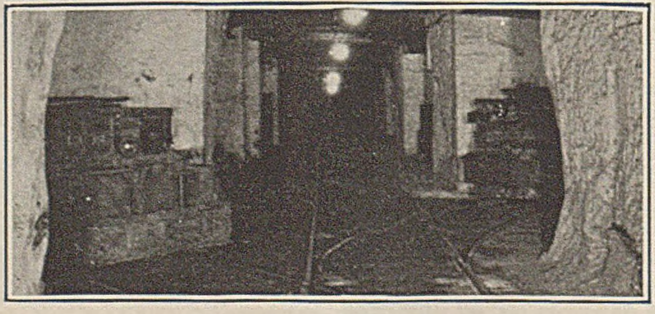


The voltage test for insulation is one of the best methods of checking the drying-out process during oven-baking of motors that have been submerged in water. Although the insulation of most small motors that have been so immersed can generally be restored to a condition closely approximating normal after 8 or 10 hours baking at about 200 deg. F., Carl Lee, electrical engineer of the Peabody Coal Co., Chicago, Ill., does not think that large motors can be dried out and show any appreciable reduction in the voltage test for insulation in so short a time. The accompanying curve, taken on a 150 hp., 440-volt a.c. motor that had been submerged in mine water for about two months, indicates that even after baking for more than 24 hours at 190 deg. F., the insulation was practically useless. Not until the motor had been baked for nearly 120 hours at the given temperature did the insulation become normal.

It is, therefore, apparent that, at least in the case of large motors that have been submerged, it should not be concluded that the insulation is destroyed or the baking oven improperly ventilated if the voltage test does not give a normal reading within a few hours—four or five days may be required.

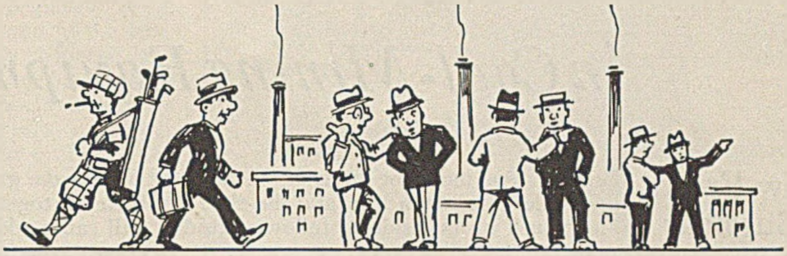
Each Locomotive Allotted Individual Stall In Modern Underground Barn

The layout and construction of underground motor barns are not modern in principle unless an individual stall is provided for each locomotive. The main track is always clear so that any one of the locomotives may be run in or out at will. This barn, which consists of ten stalls, is in the Harmar mine of the Consumers Mining Co., at Harmarville, Pa.



Stabled in Separate Rooms

Among the Manufacturers



The American Rolling Mill Co. recently acquired the property, plants, business and patents of the Columbia Steel Co. and the Forged Steel Wheel Co. at Butler, Pa., and Elyria, Ohio. These properties add another complete manufacturing unit, from pig iron through to finished product, to ARMCO's producing forces. The Columbia Steel Co. has worked out, at Butler, Pa., a continuous strip mill to produce sheets in strip form up to 36 in. in width, employing both a hot- and a cold-rolled process in the plan of manufacture. The Forged Steel Wheel Co. has a capacity of some 10,000 tons per month of forged steel wheels.

* * *

The Power Specialty Co. and the Wheeler Condenser & Engineering Co., having combined assets of approximately $12,000,000, were consolidated recently under the name of the Foster Wheeler Corporation. No changes are contemplated in products, which include superheaters, economizers, water-cooled furnaces, air heaters, tube stills, unit coal pulverizers, condensers, pumps, cooling towers, feed-water heaters, evaporators, fractionating equipment and heat exchangers.

* * *

In order to provide better sales and service facilities for its customers in northern New Jersey and certain adjacent counties of New York State, Ingersoll-Rand Co. has opened a branch office at 236 High St., Newark, N. J.

* * *

The General Electric Co. has entered the custom molding business, according to a recent announcement by E. O. Shreve, manager of the industrial department of the company. The product will be marketed under the trade name "Textolite Moulded."

* * *

The Westinghouse Electric & Manufacturing Co. has introduced types SB and SKB distribution transformers for industrial application. They are designed and constructed to operate under severe conditions in the matter of vibration and handling. Mines and oil fields are two important applications.

In connection with the development of a new thermostatic steam trap, Warren Webster & Co., Camden, N. J., have made market studies that indicate the breadth and value of what they call "the process steam market." The company declares that this field is so large and varied that it ranks with the low- and high-pressure fields and justifies designation as the third great field for steam.

* * *

The T. J. Lane Equipment Co., Springfield, Ohio, has been appointed agent in central Ohio territory for the complete line of the Lakewood Engineering Co. Mr. Lane has been in the equipment business in this location for the last fifteen years. In the southern Ohio district the Mechanical Supplies Co., Cincinnati, has been appointed a new agent and will handle the Lakewood line there as well as in adjacent Kentucky counties. This company, which has been serving the industrial as well as the contracting field in this territory for more than ten years, is now opening a construction machinery department in addition to its regular supply business. J. B. Miller is president and has charge of sales for the last-named company.

* * *

The Lincoln Electric Co. announces that the Missouri district office has been moved from 1808 Railway Exchange Building, St. Louis, to 1003 Davidson Building, Kansas City. Robert Notvest is in charge. A branch office also has been established at 220 Nicholas Building, Toledo, Ohio, A. H. Homrighaus, formerly in charge of the Missouri district, has been transferred to Toledo in charge of the district.

* * *

Directors of the Bucyrus Co. at a meeting in South Milwaukee, Wis., and those of the Erie Steam Shovel Co. at a meeting in Erie, Pa., on July 20 approved the plan for merging the two properties. Stockholders have been asked to deposit the stock of each company, and when sufficient deposits have been made a new company is to be organized, probably under the name of the Bucyrus-Erie Co., to take over the assets of the old concerns.

Trade Literature

General Electric Co., Schenectady, N. Y., has issued the following publications: GEA-743, illustrating and describing its CR3202 drum controllers for two- or-three phase slip-ring induction motors. GEA-780, solenoid-operated air circuit breakers. GEA-754, semi-automatic reduced voltage starters for synchronous motors. GEA-765, CR7006-D20 magnetic switch.

Sullivan Machinery Co., Chicago, Ill., has published bulletin No. 79-G, illustrating and describing its light Ironclad coal cutter, class "CE-10".

Mine Safety Appliances Co., Pittsburgh, Pa., has issued the following two bulletins: The new McCaa 2-hr. oxygen breathing apparatus, enabling wearer to work two hours in dangerous quantities of gas, smoke or where deficiencies in oxygen may exist. H-H inhalator for combating monoxide gas.

The American Rolling Mill Co., Middletown, Ohio, in its booklet "Armco Ingot Iron" gives the history and service of this iron.

Link-Belt Co., Chicago, Ill. Belt Conveyor Data Book No. 615, comprising 144 pp., contains a wealth of engineering data on the design, construction and operation of belt conveyors handling all sorts of materials under a variety of operating conditions. Included in this book is a description of the anti-friction idler equipped with Timken roller thrust bearings.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued a 32-pp. book, S.P. 1774, entitled Baldwin-Westinghouse Mine and Industrial Electric Locomotives, containing performance, characteristics, electrical and mechanical equipment data and dimensions of 25 different types of trolley, storage-battery and combination locomotives for mine and industrial plants. Selection of Electrical Equipment for Larry Cars is the title of a 4-pp. leaflet, L.20319, containing a general description of a larry car.

Stephens-Adamson Mfg. Co., Aurora, Ill., has issued a four-page folder illustrating and describing its JES variable speed transmission, which receives high power at high speeds and delivers it at lower speeds for the direct operation of machinery equipment to which the unit may be attached.

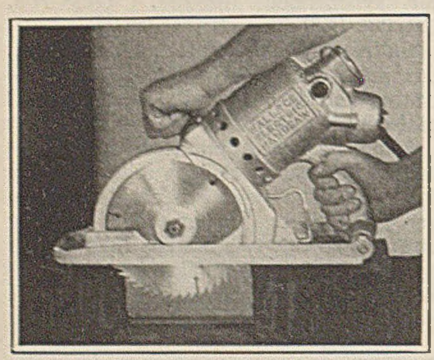
WHAT'S NEW

in Coal-Mining Equipment

Electric Handsaw Freed From Danger Bugbear

Like every other electric tool, the electric handsaw has gone through several stages of development. From a crude beginning this latest portable electric machine has been developed by J. D. Wallace & Co., 134 S. California Ave., Chicago, Ill., until it is now claimed to be efficient, powerful, foolproof and, above all, safe.

A universal type of motor makes it possible to use this handsaw on either



A Safe Saw

alternating or direct current of any frequency. Maximum efficiency is said to have been secured by connecting the motor direct to the saw spindle. The saw is so designed that the motor cannot be overloaded by putting in a larger saw-blade than the power unit is intended to handle.

The method of guarding the saw is claimed to be particularly ingenious. The guard is locked in a position which covers the blade at all points. When the operator wishes to cut, he simply releases the safety guard by means of a trigger conveniently placed near the grip. After the cut is finished and the saw is lifted from the work, the safety guard or shoe automatically drops and locks in position, covering the blade, and will not open again until released by the trigger. When the machine is in use, the blade is covered at all points above the point of work.

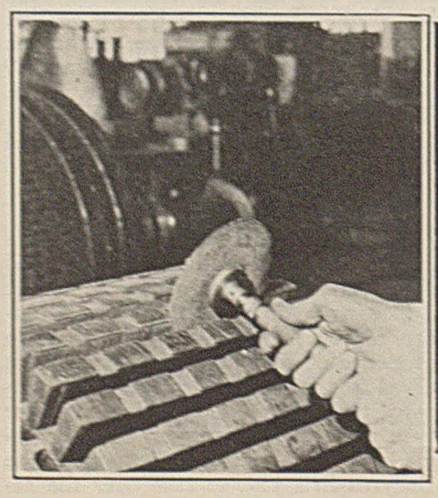
In use, the electric handsaw is said to be both compact and convenient. One handle is of the type found on an ordinary handsaw, the other the same as that used in guiding a handplane. Both are close to the point of work, insuring accuracy and ease of operation. A splitter follows the saw blade, drops into the cut, and helps to guide the machine. An indicator in front makes it possible to follow a line, and the shoe is machined on one side to follow a guide rail.

With the depth gage which is provided, the saw can be set to cut accurately to any predetermined depth. A standard 8-in. round-hole blade is used. Ball bearings are used throughout—all of the same size and of standard make. Gears run in grease, quietly and without overheating.

This saw is said to have a wide variety of applications. Carpenters and builders use it to cut concrete forms, rafters, joists, studding, sheathing, flooring, sash, doors, and stair stringers. Many save handling costs by using it to cut lumber on the pile. Manufacturers are adopting it in their shipping rooms for opening crates, making new boxes, and reclaiming old stock. One firm uses it with a dado head to remove old addresses from packing cases. House carpenters and maintenance men also find many uses for it, as do the railroads and railroad equipment manufacturers.

Slot Cleaning Machine Is Fast Worker

A slot-cleaning outfit, recently announced by the Martindale Electric Co., Cleveland, Ohio, is said to offer the ideal method of removing old insulation from the slots when rewinding armatures. Cleaning these slots in the old manner with file and chisel consumes much time and leaves the sides of the slots rough which may chafe the insulation when the coils are tamped into the slot. If a chisel is used to remove



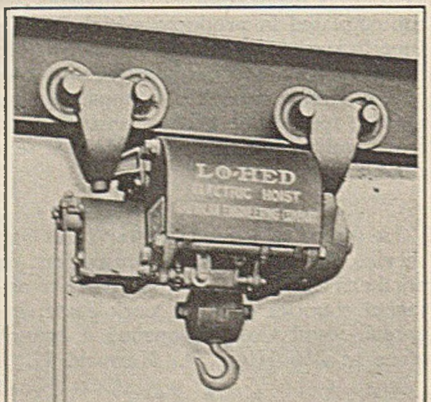
Speedy Slot-Cleaner

burns from grounds, the laminations are battered together to some extent. This will cause eddy currents and thereby increase armature heating.

This new device is claimed to save 75 per cent of the time and labor ordinarily required to clean up an old armature, removes burns easily and leaves the slots smooth. It also quickly removes old solder from the riser slots and, with the addition of a fibre stiffener between the discs, burrs that will turn a file can be easily ground off. The flexible non-breakable discs eliminate all danger to the operator. The outfit is said to have many other uses.

Trolley Hoist Requires Little Headroom

To meet the need for a means of handling and conveying materials under minimum headroom conditions, the American Engineering Co., Philadelphia, has added to its line of Lo-Hed hoists a motor-trolley electric monorail hoist that operates in 15½ in. headroom. It is built in ½- and 1-ton sizes and is

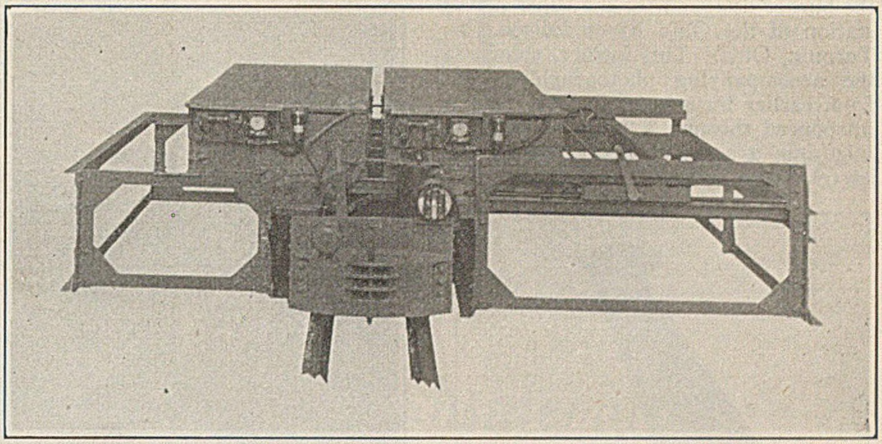


Not Much Headroom Needed

similar in construction to the standard Class A Lo-Hed hoist except that it is mounted on an 8-wheel trolley that reduces the headroom required by more than 5 inches.

The hoist is made for operation with alternating-current at 20 ft. per min. or direct current at 20 to 40 ft. per min., and a special high-speed hoist provides for operation at 40 ft. per min. with alternating current, and 40 to 80 ft. per min. with direct current. The standard height of lift is 20 ft. but, when required, a lift of 25 ft. can be provided. The motors are fitted with ball bearings and are fully inclosed. Remote control of both hoist and trolley motors can be provided.

The hoist is designed to travel around curves of short radius and to shift easily over switches, roller bearings being used on the gear shafts and in the trolley wheels. The drive between the motor and drum is by means of spur gears running in oil. Grease lubrication is provided on all bearings not automatically lubricated by the oil bath. The unit is also equipped with lowering and holding brakes and a positive-acting upper limit device.



Charged Battery Partly on Locomotive. Discharged Battery Half-Way Off

Battery-Changing Device Is Time Saver

The battery-changing station, recently announced by the Atlas Car and Manufacturing Co., Cleveland, Ohio, is a device for removing a discharged storage battery from a locomotive and quickly substituting a charged battery. It is claimed that the entire change can be accomplished by the locomotive operator, unassisted, in less than five minutes without moving the chassis of the locomotive during the operation. Therefore, with the aid of this machine and an extra battery, practically continuous service can be secured from a storage battery locomotive.

It is desirable or advantageous to use an extra battery in connection with a battery-changing station under the following conditions: When it is desired to double-shift a locomotive having chassis capacity sufficient for only one shift; when clearances or operating conditions prohibit the use of a locomotive with a battery large enough to work a complete shift; or when it is not desirable to charge a battery at night—then two batteries can be employed and worked on alternate days or alternate shifts.

As indicated in the illustration, the operation of the device is simple. The locomotive, under its own power, is brought into position at the station and U-shaped rods—which serve to hold the battery box securely in place when on the locomotive—are lifted and dropped into receptacles provided in the corners of the battery boxes. Thus, a rigid connection is formed between the battery on the rack and the one on the locomotive. The hooks on the carriage are then engaged with the nearest battery box and, by turning the hand crank, the operator can move both batteries in the proper direction to install the charged battery on the locomotive.

The hand crank is mounted on a light carriage and is suitably geared by cut spur gearing to pinions which engage with racks placed along each end of the frame. Consequently, the power required is small and even the heaviest battery can be moved with little physical effort and in a surprisingly short time—it is said that the change can be accomplished easily in less than five minutes.

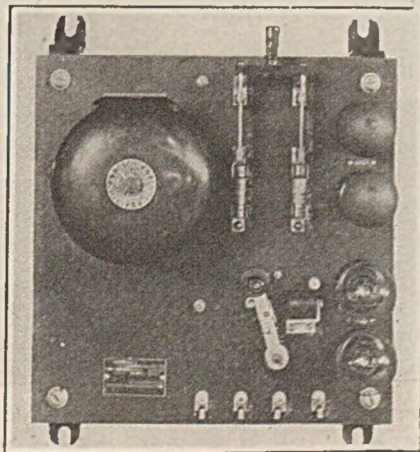
Each alternate change requires that the batteries be moved in the opposite direction and this is done by simply reversing the direction of rotation of the hand crank. The carriage, being geared to its frame, can either push or pull as the conditions require.

If it is desired to expose the chassis for lubrication, inspection or repairs, the battery can be removed with this machine without bringing the other battery into position. This feature, it is said, makes the device a very desirable auxiliary equipment for any locomotive having the battery placed above, and covering, the major part of the chassis.

This equipment does not require that the chassis be moved during the battery-changing operation and so does not necessitate the use of any electrical cables, plugs or similar devices. The battery boxes are mounted on rollers and, as has already been pointed out, the actual operation of changing batteries requires little effort. The changes required on the locomotive chassis to allow the use of this battery-changing station are said to be slight and generally can be added to existing locomotives without much difficulty.

Distinctive Signal Panel Has Gong and Lamp

A signal panel, designed for use in pump installations—especially in buildings—as a warning signal for the purpose of calling an attendant in case of danger from overflow or emptying of the tank, has recently been announced by the General Electric Co. The panel is governed by one or two float switches.



Uses Light and Sound

With this panel an audible signal sounds immediately when either the predetermined high or low level of water is reached. The gong can be silenced by the attendant upon his arrival, and the silencing switch does not have to be manually reset after the float switch takes a normal position. "High" and "low" signal lamps are provided, either of which lights when the predetermined level has been reached and remains lit until the float takes a normal position.

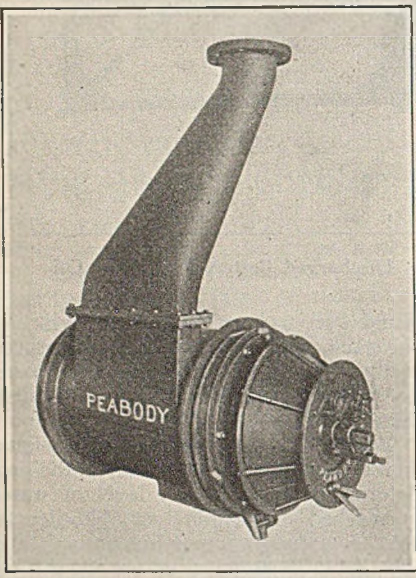
It is said that the panel can be used for a one-level signal by omitting the float switch for the other level. It is also claimed that the device can be used on pressure systems although, when single-pole float- or pressure-switches are used, it is necessary to add a relay in place of the other pole.

Equitable Distribution Stamps Coal Burner

It is recognized that the limiting factor in the rate of steam generation in any boiler is the rate of combustion within the furnace. Ultra-rapid burning of pulverized coal appeared to open the way to extraordinary combustion performances until practical experience disclosed another limiting factor—namely, the inability to provide sufficient burners to fire the coal at normal draft pressures. The physical limitations of boiler-front dimensions definitely limit the number of possible burner openings.

In this latter connection, reference is made to burners (and their dimensions) of the best forced-draft type—those in which the coal-carrying air is given a properly turbulent whirling motion by introducing the secondary air through a slant-waved air register. When the number of burners that can be applied to a boiler is limited, it is necessary to design a burner that will satisfactorily meet the requirements.

Apparently the Peabody Engineering Corporation, 110 East 42nd St., New York City, has solved the problem with the burner designed for the super-power station of the Ohio River Edison Co., Toronto, Ohio. This burner, shown in the accompanying photograph, differs from earlier burners in that the coal is introduced through a large rectangular inlet into a screw-thread-vaned burner barrel. This interior arrangement gives



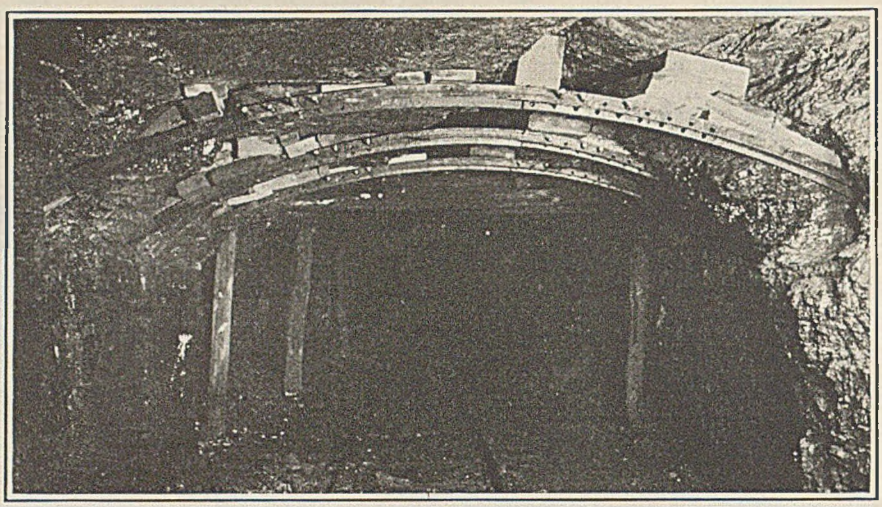
A Better Burner

the coal an even distribution into the blast of combined primary and secondary air whirling through the barrel or body of the burner. Viewed through a peep-hole, the flame from this burner shows no stratification and no dark streaks which would indicate a spotty distribution of the powdered coal.

Performance tests at the Toronto, Ohio, plant, it is reported, indicate that coal was burned at the rate of 5,000 lb. per burner per hour with six burners operating on one boiler, and at the rate of 6,000 lb. per burner per hour when the number of burners was reduced to four. This is much superior to the best previous performance. It is also notable in that the CO_2 reading measured 16 per cent which indicates that the air supply was so exactly gaged that all the coal was completely burned and no heat lost through incomplete combustion.

The steam output has reached a peak load of 325,000 lb. per hour, which is 445 per cent of the manufacturer's capacity rating for the 2,200 hp. boilers installed at this station. Notable, from the practical operating viewpoint, was the fact that there was no slag formed during the test. With proper combustion, slag removal should be easy.

This burner, it is claimed, can be used with any unit pulverizer or any type of feeder from a bin system of powdered coal storage. It should make possible increase of boiler plant capacities without change in boiler equipment.



One-Man Roof Is Permanent

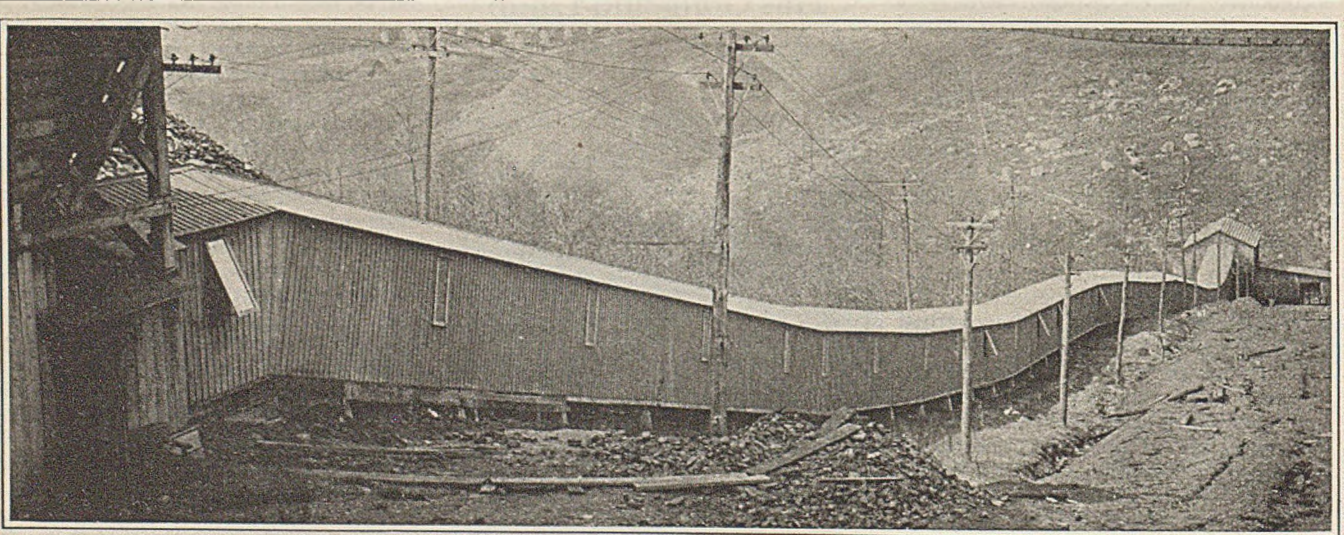
Iron-Arch Roof Supports Are Permanent

As permanent timbering the M-S-A adjustable roof supports, manufactured by the Mine Safety Appliances Co., Pittsburgh, Pa., are said to be most efficient. The supports consist of three pieces of channel iron, "nested," pinned together—and all bent to a 20-foot radius to form an arch, adjustable to varying widths of entries from 8 to 14 feet.

One man can erect a set in place, wedging in blocks to make the roof safe. No shearing of the ribs or cleaning along the roadways to obtain clearance is necessary. Being adjustable, this roof support saves the time ordinarily required to measure up and cut steel or wood timbers.

To avoid operating delays, bad roofs are taken down as soon as possible and the place permanently timbered. These supports can be spaced according to the weight of the roofs and, if needed, lagging can be added to cover the roof supports and provide a strong arch. Or, if desired, the roof between supports can be gunited.

These supports are said to be easily recoverable when on the retreat—the rib is slabbed off to free one end and the roof support is withdrawn.



Corrosion-Resisting Housing Materials Decrease Maintenance Costs

This conveyor shed, built of copper-bearing galvanized-steel sheets manufactured by the Blaw-Knox Co., Pittsburgh, was recently erected by the Reitz Coal Co., Windber, Pa. It is 10 ft. wide, 8 ft. high and 661 ft. long. Since its erection, inquiries have been received for similar sheds, 1,100 and 1,400 ft. long. The Blaw-Knox Co. always carries a large supply of these sheets in stock. They can be obtained in various sizes for the building of portable homes, garages, buildings, sheds, etc.