COAL AGE

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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

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Geophysical Windows

JUST what may we be privileged to see through the geophysical window? Thus far, resistivity methods have been used successfully to find level beds of coal below glacial drift and to determine bed-rock outcrops of anthracite where the seams do not come to the surface. In Spain, structure has been mapped seismically and coal beds have been discovered by drills spotted where structure thus determined indicated probabilities.

Seams also have been found in this country of which operating concerns theretofore had no knowledge. Such discoveries might be multiplied, for in the anthracite region seams near the surface often spoon out and spoon in, always covered, however, with a mantle of obscuring wash. Moreover, anthracite seams are amazingly prone to split, and one or more of these splits may be entirely undiscovered. When other seams are being stripped, such splits are likely to be covered with spoil, and when so burdened it is doubtful whether they ever will be found even by improved geophysical methods.

But the greatest loss is where the coal seam lies undiscovered in the profundities of the mine. It would seem advisable to institute promptly underground geophysical surveys to find such splits before mining has been abandoned and approach is made impossible. Coal also has been lost where breasts have caved or loose coal has run down the chute so that no one now knows how far the breasts extended or how far the coal above the face of the breast may have broken away. Geophysical surveys in lower or higher beds may enable these forgotten coal areas to be discovered and worked and to determine where counters should be constructed to reach them. In level beds well above tide, geophysical methods may reveal natural water channels by which the mines may be drained after drillholes have been sunk to them.

The geophysical window still is a little murky. It is clearer with some coal and some rock than others; it gives a low range of visibility except with seismic methods, which, though they give distance, do not give definition, and which are effective only with the harder rocks. But in so far as they are effective, geophysical methods should be used. Meanwhile, their technique should be developed.

Silicosis Rackets

INTEREST in silicosis should be aroused in the mining industry, for whenever employees can recover damages for silicosis under the common law there will be some day an enterprising attorney who will profit by that fact, urging on a host of persons who may or may not be affected by that disease that they are victims of an insidious malady which, though it has not hurt them thus far, will eventually end their unhappy lives. Such cases will be tried in the courts before juries that will be sympathetic with men who have to spend their days in the dark mines.

Diagnosis of silicosis is none too certain. A conflict of evidence is almost inevitable, and the jurymen unable to weigh the testimony will be disposed to give the plaintiff a verdict. If, however, this occupational disease is made compensable at reasonable rates and the determination of the issue is allowed to rest with a medical board or commissioners, decisions are less likely to be rendered that will run counter to the facts and bankrupt the com-

panies chosen by the attorney as suitable defendants.

Distressing cases of such action by "ambulance chasers" warn industry to be on its guard and get legislation passed that will assure the workman of proper compensation for damage done and will prevent the payment of blood money to those who have not been injured by the disease. Too often the workman who gets a common-law verdict loses all he makes by payments to lawyers, by court fees and prolonged idleness, for any man who wants to prove total disability is well advised if he quits work, at least from the time of commencing suit. Thereafter, also no one will employ him underground, for, winner or loser of his plea, he has declared himself a silicotic.

Facing Realities

So MUCH EMPHASIS has been placed upon the unemployment problem in the last five years that blind attacks upon the machine as a major or contributing factor in creating that problem too often have fallen upon sympathetic ears. As a result, mention of "labor-saving devices" is almost taboo in polite society and some manufacturers and users of modern equipment which might be placed in that category seem reluctant to advertise their activities. Such an attitude, however, helps neither proper understanding of the situation nor a sound approach to a distressing problem.

In the coal-mining industry, survival depends not upon abandonment of the machine but upon its increasing use. Coal is primarily in competition with the so-called "laborless" fuels. Unless coal prices are on a fair competitive basis, coal will continue to lose business to its rivals, and opportunities for employment in mining will be further and permanently curtailed. Lower production costs are imperative if coal is to maintain or improve its position. That is an inescapable fact.

Costs may be reduced without the machine by the simple expedient of depressing wage levels so far that the advantage oil and gas now have in direct labor charges may be wiped out. Or management may lean more heavily on the machine and so reduce costs while making a higher wage scale supportable. Admittedly that may involve some temporary displacement of workers, but lower costs will open the door to recovery of some of the previous losses to competitive fuels, check further encroachments and thereby ultimately increase the opportunities for additional mine employment. Can there be any doubt as to which is the preferable road?

After You

A LITTLE consideration should convince the public in the mining regions that it would be poor policy to clean up mine pollution too greatly until sewage pollution is removed, for it is acid water that keeps the sewage from putrefaction. The same is true of other industrial wastes, though many of these are not in semi-urban regions, as is the coal industry, and therefore they are not so helpful as that of coal in abating urban nuisances.

But let the coal man not overlook the necessities of the situation; some time he and all other industrialists will have to clean their sloppy water. It is perhaps too much to hope that all will start cleaning together and do it in a quinquennium or even a decade, but it will be done doubtless concurrently and by degrees; and if good judgment is shown by sanitary commissioners and industry it may not be a staggering burden for anyone.

Some mine effluents are not acid now but discharge alkaline waters into acid streams and rivers. It might be well to study why their effluents are alkaline. Perhaps it is due to an operational policy not at all directed to that end—one successful without intention and not helped by a particularly sulphur-free coal. Some of the worst effluents come from mines with coal of low sulphur content.

"Narrow-Minded"

ACCORDING to Senator Norris, father of TVA and apparently eager to sire a MVA (Mississippi Valley Authority), coal men opposing the competition of federal hydroelectric power produced as a byproduct of grandiose schemes of flood and navigation control take "a narrow-minded view of the matter." But what, may it be asked, should the business man do when the government threatens the integrity of his investments, the employment of his workers and eventually asks him to pay the bill? Stand up and cheer?

LOW COST AND SAFETY

+ Keynote of Improvement Program

At Valley Camp's Wheeling Division Mines

By IVAN A. GIVEN
Associate Editor, Coal Age

AS A RESULT of improvements made largely in the past two years, Wheeling division mines of the Valley Camp Coal Co. now take their place in the growing group of operations which have been revised for increased efficiency, lower cost and greater safety. Included in the Wheeling division are the Dartnell and Mobley mines of the Elm Grove Mining Co. of West Virginia, Elm Grove, W. Va., and the Alexander mine of the Glendale Gas Coal Co., Moundsville, W. Va., each rated at 3,000 tons per day of Pittsburgh No. 8 seam coal. All three operations have a long producing history behind them, and the improvement campaign initiated late in 1933 was designed to forestall a lapse into a condition of inefficiency and high cost which, unless proper steps are taken, frequently results at mines where considerable territory has been mined out, where openings have been subject to the normal deterioration of strata and supports for long periods of time, and where hauls, air travel and power-distribution systems have reached considerable lengths.

Thickness of the Pittsburgh No. 8 seam varies from 4½ to 5½ ft. at the Wheeling division mines, and the coal generally is overlaid by the characteristic No. 8 "stone" stratum. Absent in some places, this stone thickens to a maximum of 4 ft. in others. Average thickness is about 15 in. Over the stone and under the main limestone roof is a layer of material of varying nature which, depending on locality, is made up of coal, shale, fireclay and other weak and unconsolidated materials. The stone and other loose material is taken down in mining until a reasonably firm top is reached, but even with this precaution the weakness of the remainder of the material up to the main limestone requires systematic timbering in rooms (p. 197) and frequently causes trouble in entries. The higher temperatures of the summer months are reflected in a material increase in falls due to slacking.

Development is based on the use of main, face and butt, or room, entries, driven at right angles to each other. Main entries consist of four to six headings 10 ft. wide. Six headings, driven in pairs on 35-ft. centers, is the practice where a long air travel is anticipated. Distance between pairs of headings is 70 ft., measured from the centers of adjacent headings. The resulting 60-ft. pillar is cut through every 300 ft. This results in relatively long unbroken pillars, with consequent reduction in air loss. Face entries consist of three headings 10 ft. wide on 40-ft. centers, and are protected by 160-ft. barrier pillars. Butt, or room, headings are driven on 33-ft. centers and are widened to 16 ft. Originally these headings were driven the same width as the others, but investigation has shown that the top can be held as well as in rooms, and the width therefore has been increased to 16 ft. to allow the stone to be gobbed on the side opposite the room necks (Fig. 1), thus saving the expense of taking it to the outside for disposal.

Development of new territory is restricted largely to the winter season, when sufficient entries are driven to take care of the summer lake trade and other business for the rest of the year. Mining progress and other activities in a particular year are summarized in annual operating reports, which give the history of the various mines for the twelve-month period, including track and d.c. distribution maps, and make recommendations for the conduct of future operations. These reports, covering each individual mine, are bound for the use of the various officials and departments and also as a permanent record of progress.

Room entries are turned both ways from face entries, and room necks are turned as the room entries advance. Sixteen rooms, 20 to 24 ft. wide and 255 ft. deep on 30-ft. centers, are worked

Wide room entry, Alexander mine, with gob placed on side opposite room necks

simultaneously from each room entry (Fig. 1). Under this system, miners, service men and supervisors move out of a completed room entry and into the room necks in a new entry as a unit. In some cases, however, the inside eight rooms are started first to cut the number of men moved at one time. In the past, some territories were mined by turning rooms both ways from the room entries, but loss of coal due to caves before the rooms were finished resulted in the adoption of the present system, which has reduced such losses materially. Driving all rooms abreast—a general practice in the Pittsburgh No. 8 field—is necessitated by the character of the roof. Room pillars are left in place, and the stone taken down in mining is piled along each rib, leaving only a roadway in the center.

Operations at the face have been based in the past on the use of shortwall machines with 6- or 6½-ft. cutter bars. Under this system undercutting the place was practically the only major operation performed by the company, the miner assuming all other duties in connection with breaking down, cleaning and loading the coal and caring for the place. Present plans, however, call for the installation of track-mounted cutting and shearing machines throughout, and as a starter a Sullivan 7AU cutter with an 8-ft. cutter bar making a 4-in. kerf has been placed in service at Mobley mine, where it cuts for two room groups of sixteen places each. Standard borod-tipped cutter bits are employed, and the machine is fitted with a 125-gal. water tank and a spray nozzle on the cutter bar to keep down dust. This quantity of water is ample for a day's cutting.

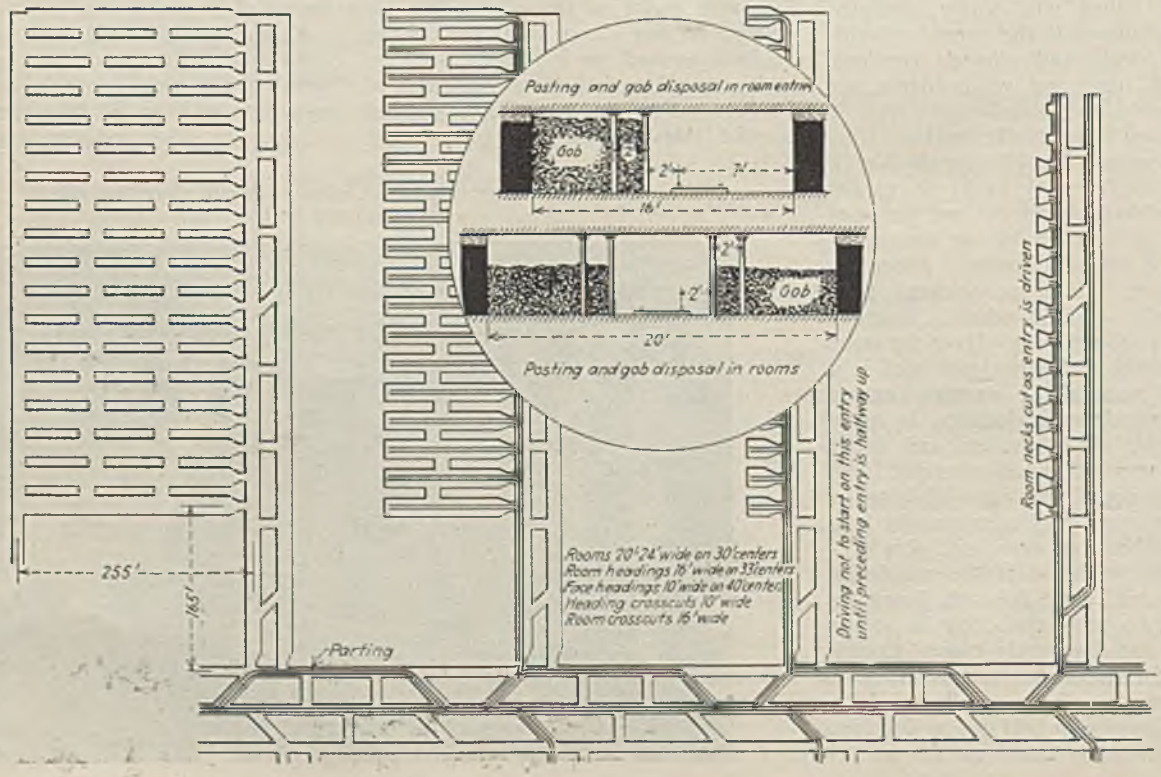
Drilling and shooting at each mine are supervised by a preparation foreman, whose duty is primarily the control of blasting methods to insure the maximum yield of coarse coal. Cleaning of the coal, which starts at the face in Valley Camp's Wheeling division mines, is under the direction of the section foreman, whose only other responsibility is safety. Under this system of allocating responsibility, day men and transportation men are directed by labor and transportation bosses, respectively. Keeping up sights is delegated to two special sight men at each mine. This move was dictated by the fact that orderly development is a vital factor in forestalling roof trouble.

In addition to removing impurities and otherwise exercising care in preparation, the miner is required to distribute bug dust throughout five or six cars, primarily to prevent undue concentrations of fines in certain shipments of mine-run. Clean places underground and clean tipples on the surface are insisted on as real incentives to careful preparation at both places. As a means of checking the efficiency of preparation at the face, fifteen mine cars are selected at random each day and put through the tipple separately to permit careful examination for refuse, bug dust and other evidences of preparation or lack of preparation.

Transportation, because of its vital influence on all other underground operations, has received special attention at Wheeling division mines. Track, rolling stock and power all have been overhauled with an eye to bettering haulage performance. Seventy-five-pound steel now is standard on all main lines, against the weight of 60 lb. formerly used. Face entries and other secondary haulage roads are laid with 45-lb. track, and the old 20-lb. rail employed on room entries and in rooms is being replaced with 30-lb., in anticipation of the use of track-mounted cutters, as well as for its inherently better staying qualities in service.

An innovation in tracklaying methods at Wheeling division mines is the use of 60-lb. cross rails on all new main-line and certain secondary tracks with a relatively long life. Two cross rails are welded across the track at each joint (Fig. 2), the contact surfaces first being cleaned with a portable grinder equipped with a flexible-drive extension. These cross rails hold the track to gage, prevent the rails from turning over, and also serve as bonds. Holding gage and keeping rails upright fall to the spikes in the conventional type of track, but Valley Camp operating officials take the position that ties are primarily a support and that spikes are designed not for the purpose of holding the rails against the stress coming upon them but rather for holding the ties to the rails. Frogs and switches are equipped with cross rails extending clear across the several rails

Fig. 1—General plan of mining for Wheeling division mines, showing method of installing partings on face entries and also timbering and gob-disposal methods in room entries and in rooms



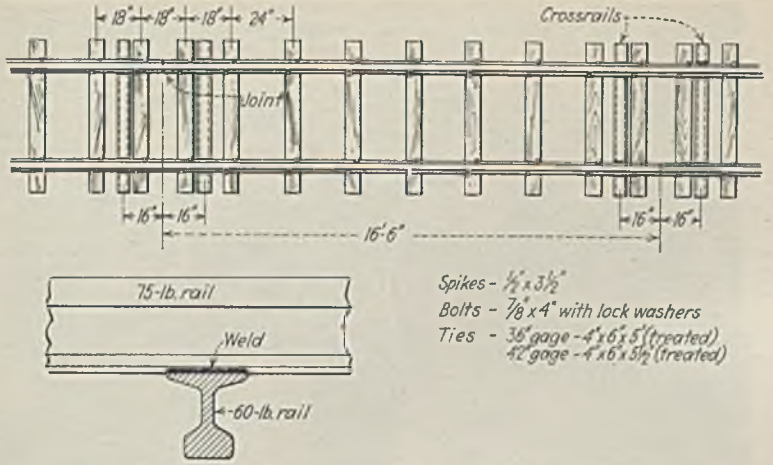


Fig. 2—Method of applying cross rails in building 75-lb. main-line track

at intervals of approximately 3 ft. No wrecks due to rails turning over have been experienced on track laid with cross rails, and the electrical conductivity, tests have shown, is the same as that of track equipped with the conventional bond in good condition.

All track, including main-line, secondary and room-entry track installed in the past two years, has been laid with creosoted ties, including creosoted switch sets for switches. Steel ties are used exclusively in rooms. Main-line ties are 4x6 in.; room-entry ties, 3x5 in. The use of a relatively light tie on main lines is made possible by the adoption of cross rails. To date, creosoted ties have been installed in approximately 50 per cent of the track in the three Wheeling division mines, and a distinct decline in renewals already has been experienced. Life of untreated ties was two to four years, and this type was the cause of many wrecks. Tie plugs are driven in the spike holes of all creosoted ties taken up for relaying to prevent premature destruction.

Cast manganese-steel frogs have been adopted because of greater resistance to wear and breakage. Nos. 4 and 5 frogs are employed on all main-line and sidetrack switches, and curve radius is held to a minimum of 125 ft. on main and secondary tracks, where possible. Track walkers are employed at each mine for the sole purpose of keeping bolts tight and joints tamped up.

To insure reliable motive power, a program of rebuilding locomotives was inaugurated two years ago. This rebuilding includes not only motors and controls, as discussed more fully elsewhere in this article, but also frames, trucks and wheels. Shoes have entirely replaced trolley wheels on all locomotives, and in some instances have allowed trip sizes to be increased by ten cars as a result of the increased pulling power afforded by the greater contact area of the shoe. Reduced controller and resistance maintenance are other benefits that have been experienced since the adoption of the shoe, which was supplemented by a regular trolley-wire lubricating program. The brush system of applying lubricant has been found most satisfactory under conditions at these three mines. With equipment in good condition, the next problem was adequate power. Steps taken to reach this objective are the subject of a separate section of this article.

Plain-bearing wood mine cars with an average capacity of 2 to 2½ tons are used in the Valley Camp Wheeling division mines. To reduce maintenance expense and interruptions to service growing out of mine-car failures, a program of annual inspection of cars has been adopted. Starting at the first of each year, each car —and particularly the running gear—is given a thorough examination. All wheels are removed and washed to eliminate grease and thus facilitate careful inspection for defects before replacement. No wrecks from broken wheels have been reported since this system was inaugurated. Incidentally, a full report on every wreck or derailment occurring on any but room entry or room tracks is required as a means of preventing repetitions.

Wooden mine-car members are painted with Tennessee Eastman Corporation "No-D-K" to check decay. Particular attention is given to treating surfaces in contact with irons and other metal parts, and all bolt holes are swabbed with the treating liquid. Mine-car trucks are now purchased as complete units, with cross members welded between the channels, thus facilitating installation of trucks as a unit and assuring a more rigid running gear.

Evidence of the effect of heavier, better-constructed track and improvements in rolling stock and power supply is afforded by the fact that main-line trip size has been doubled in all cases and the speed of movement greatly increased. At Alexander mine, as an example, trip size has been increased to 50 cars, against the old average of 23 cars. One effect of the heavier track has been a reduction in wave motion in the rail in front of the car, thus cutting down resistance to trip movement.

Single-track main lines with passing tracks at convenient intervals are standard at the three mines with which this article deals. Movement of all trips is controlled by dispatchers with the aid of telephones and signals at sidetracks, passing tracks and junctions. American Mine Door Co. "Electri-Throw" switch throwers with either manual or automatic controls have been installed on major main-line switches to facilitate operation of trips without stops or attendants at switches.

Dispatchers are in sole charge of trip movement, and work primarily from mine maps on the scale of 800 ft. to the inch, on which haulage roads, passing tracks and sidetracks are shown in red. These maps are mounted on wooden bases with isinglass covers, and locomotive position and direction of travel are indicated by ⅛-in. steel pins fitting in holes spotted at the bottom, the entrance and exit to each passway or sidetrack, in both the main

Track-mounted cutter entering a room at Mobley

line and passing or sidetrack between entrances and exits, and at other points where trip movement is controlled. The head of each pin, which bears the number of the haulage unit it represents, is made in the shape of an arrow and is colored to designate the class of unit, as brown for main-line locomotives, silver for secondary haulage units, and black for gathering units. As each locomotive comes to a reporting station, its position and direction are telephoned to the dispatcher, who inserts the corresponding pin in a new hole with the arrow pointing in the direction of travel. The dispatcher also keeps a record of car movement and distribution on the sheet shown in Fig. 3.

To keep gathering travel within a maximum of 1,000 ft., and thereby promote efficiency in this department, a system of "continuous" sidetracks has been adopted (Fig. 1). Under this system, each pair of room entries is provided with a parting, and the arrangement of the various sidetracks is such that in case it should be desirable for trip storage, etc., the individual partings can be connected to form one long sidetrack.

Regular movement of substations to new locations close to the center of working areas, adequate positive and negative circuits and regular inspection of wire and bonds are the major items in the electrification program at Valley Camp's Wheeling division mines. As a general rule, the main d.c. power source is kept not more than one mile from the working face, and in line with this principle, substations have been installed or moved to new locations at all three operations within recent years. At Dartnell, where the original d.c. generating equipment still is in service at the pit mouth, a new 300-kw. substation equipped with a

Main-line junction, Alexander mine. Track is laid with 75-lb. steel and cross rails. An electric switchthrower is installed (right) to operate the switch

Ridgeway motor-generator set has been built 16,000 ft. east of the tipple and directly over the center of the present working territory.

Operating on purchased power, the Dartnell substation supplies direct current at 275 volts to the mine through a 614-ft. borehole. This borehole is 8 in. in diameter and is fitted with three 2-in. and two 1-in. pipes. One 2-in. hole accommodates the positive circuit, which consists of a 1,000,000-circ.mil Parkway cable looped over an old small-diameter sheave wheel and fastened by a clamp. The cable fits snugly in the pipe and installation was facilitated by the use of liquid asphalt, which also assists in maintaining insulation by eliminating air circulation, moisture, etc. Another of the 2-in. holes accommodates a 1,000,000-circ.mil bare stranded return wire, while the third 2-in. hole, which is kept in reserve, is filled with liquid asphalt. The 1-in. holes were designed for signal and telephone wires. One is now used to carry a Bell telephone circuit into the mine, while the other, also filled with liquid asphalt, is in reserve. The substation is full-automatic on the d.c. side.

Both Mobley and Alexander are served by two substations each. One in each case is located at or close to the pit mouth and serves main-haulage units primarily, while the other is moved from time to time to locations over the center of the working sections. At Mobley, the Westinghouse 300-kw. full-automatic substation was recently located at the top of a new air shaft. Underground ducts from the shaft supply a constant current of

Fig. 3—Dispatcher's daily production record sheet

CAR DISPATCHING SHEET

THE VALLEY CAMP COAL CO._____MINE _____SHIFT _____DATE _____DISPATCHER

STANDING FROM PREVIOUS SHIFT

Section

Location	Empties	Loads	Empties In: Trip	Empties In: Total	Empties In: Time	Loads Out: Time	Loads Out: Total	Loads Out: Trip
TOTALS								

Section

Empties In: Trip	Empties In: Total	Empties In: Time	Loads Out: Time	Loads Out: Total	Loads Out: Trip

MAIN LINE TALLY

Empties In: Trip	Empties In: Total	Empties In: Time	Loads Out: Time	Loads Out: Total	Loads Out: Trip

STANDING AT END OF SHIFT

Section

Location	Empties	Loads	Empties In: Trip	Empties In: Total	Empties In: Time	Loads Out: Time	Loads Out: Total	Loads Out: Trip
TOTALS								

Section

Empties In: Trip	Empties In: Total	Empties In: Time	Loads Out: Time	Loads Out: Total	Loads Out: Trip

DELAYS

cooling air to both motor and generator. A similar move also was made at Alexander four years ago, involving location of the 300-kw. motor-generator set at the new 4th St. air shaft. The Alexander unit is similar to the Dartnell unit in that it is automatic on the d.c. side only. All motor-generator sets are equipped with synchronous motors for power-factor correction, and as a result power factor seldom varies much from unity.

Ventilation at Wheeling division mines is based on the use of improved-type force fans to supply air in adequate quantities where and when needed, and reduction in air travel to cut power requirements. In line with these principles, ventilation at Mobley has been characterized by three fan changes in six years. Equipment now consists of an 8-ft. Aerovane fan of the double-stage type operated at present with only one wheel to supply 77,000 c.f.m. at a 1.55-in. water gage with a power consumption of 28 hp. The fan, equipped with a 40-hp. motor, is connected to a new 14x19-ft. timbered shaft, with stairway, 248 ft. deep. Power savings alone are expected to return the cost of the fan in six months and the cost of the entire installation, including the shaft, in five to six years.

Alexander is ventilated with a 7-ft. single-stage Aerovane fan installed with the substation at the 4th St. air shaft four years ago. The fan is driven by a 20-hp. motor and replaced a centrifugal unit equipped with a 75-hp. motor. Volume and water gage were the same in both cases, as follows: volume, 60,000 c.f.m.; water gage, 1½ in. The 4th St. air shaft has a depth of 200 ft. and is a double-compartment shaft with stairway. Plans call for the installation of a hoist and man-and-material cage at the shaft in the future.

Fan installation and substation after removal to new Mobley air shaft near center of workings

Smaller trolley wire on main entries is now being replaced with 6-0 wire, which, when worn appreciably, is transferred to room entries or other places where demands are not so severe. While feeder requirements are reduced materially by keeping substations close to the center of working areas, ample feeder capacity is installed where load conditions dictate. Return circuits on main lines, as indicated above, are completed through the use of cross rails. Cross rails also are employed on secondary haulage roads where the life warrants their use, but in general stranded copper bonds welded to both rails, with cross bonds at frequent intervals, are employed. Room entries are bonded along the continuous rail opposite the room necks.

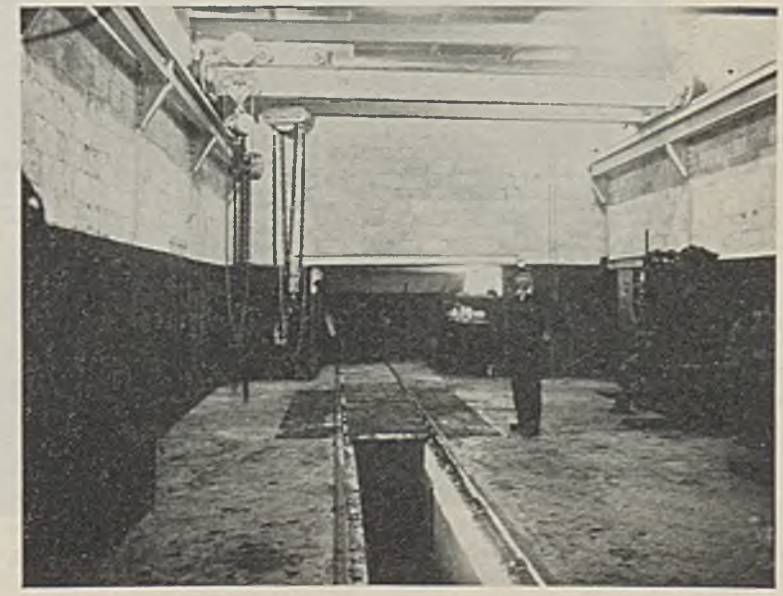
To insure adequate return at all times, the company follows the policy of installing auxiliary return circuits in main, face and room entries. These return circuits are suspended from the rib, and standards call for a minimum of 500,000 circ.-mils on main entries. Face and room-entry circuits consist of 4-0 solid copper wire. Return circuits are tied to the track every 200 to 400 ft. Maintenance of circuits, and particularly returns, is considered as equal in importance to first-class installation, and consequently a full-time power engineer, supplied with the necessary instruments, is employed for the sole purpose of checking the condition of bonds, overhead wire and voltage.

Systematic inspection and overhauling are the keystones of maintenance work at Wheeling division mines. The present program was started off two years ago by a rebuilding project covering locomotives, mining machines and other equipment. In the case of locomotives, rebuilding included building up motor cases and pole pieces; installation of new resistances, controllers, headlights, sideplates, etc.; building up and refinishing of worn axles and shafts; and replacement of plain journal armature bearings by Norma-Hoffman ball and roller bearings.

Building up of motor cases furnished one of the most striking examples of the possible benefits of painstaking maintenance practices. Wear around the journal housings resulted in the past in a large number of armature rewinds growing out of scoring of armatures by pole pieces. Motor cases and pole pieces both were built up by welding and turned to proper clearance and are maintained in this condition. As a result, the number of armature winders to repair the armatures from all the mines of the Valley Camp Coal Co. and subsidiaries has been reduced from seven to two.

Axles and shafts, not only in locomotives but also in other equipment, are built up by welding when worn and then turned to size. High-tensile-strength alloy steels have now largely superseded other types on axle and shaft service. To preserve clearance, locomotive tires

New underground repair shop, Mobley mine



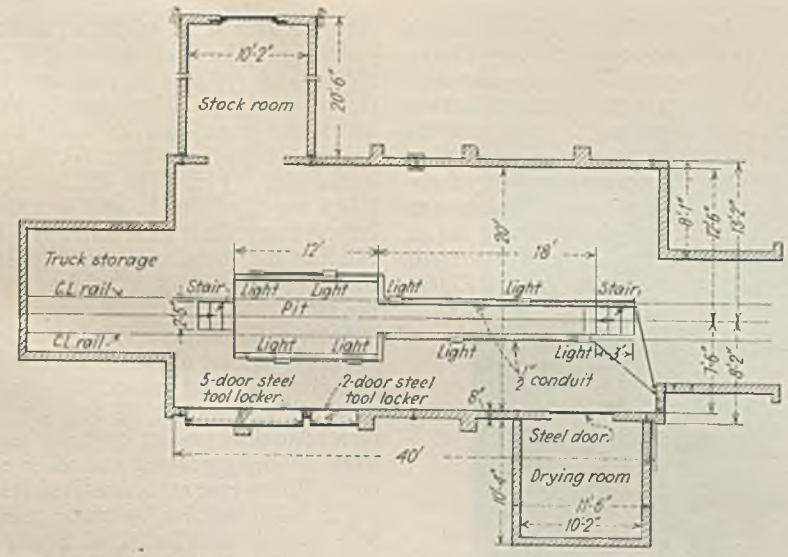


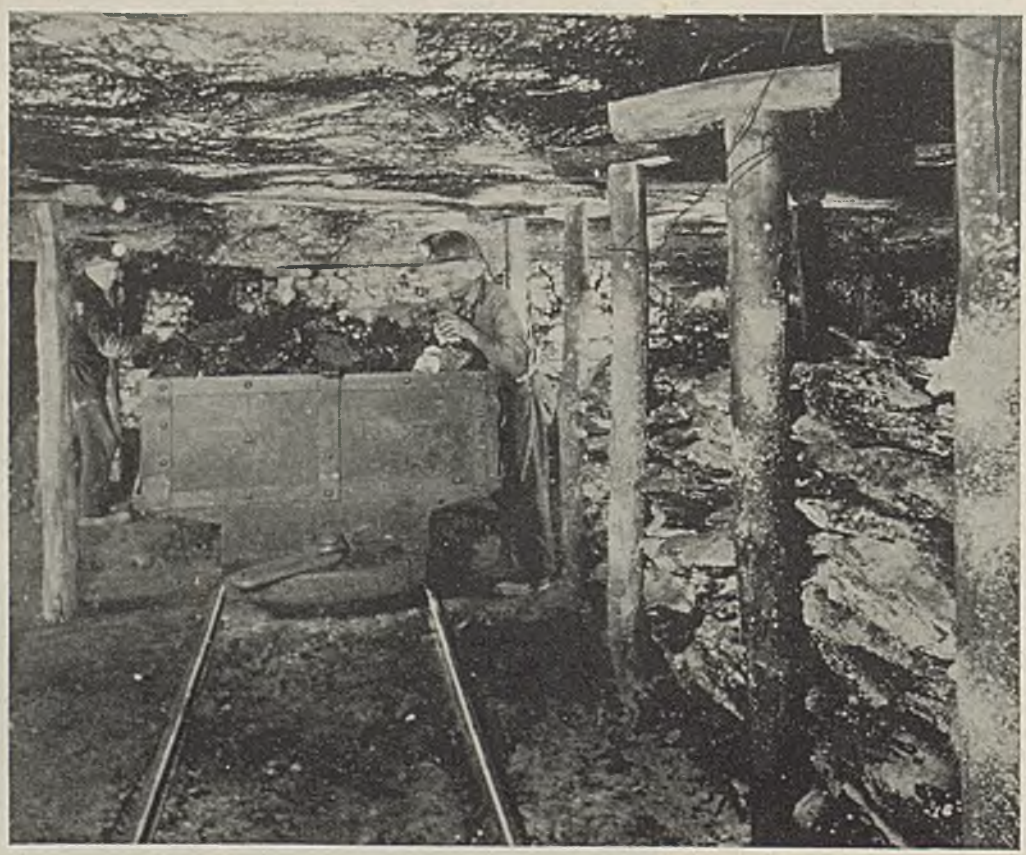
Fig. 4—Plan of underground shop, Mobley mine

are turned once and then discarded, although experiments with banding are being carried out as a means of prolonging tire life. Tire contour also has been changed to eliminate the derailments formerly experienced with new tires, which were purchased with a 30-deg. slope on the treads. As a preliminary, the behavior of a set of 30-deg. slope tires was observed as they were worn down. This observation disclosed that derailments ceased when the slope was reduced to 15 deg., with the result that this limit was adopted as the standard for new tires. Overhauling of locomotives is set off with a coat of battleship-gray paint.

In maintenance, as in other activities, regular inspections are insisted upon as a means of reducing future cash outlays and interference with production. Motormen and machine runners, for example, are required to examine their machines each day and report on their condition. Once each week, each machine is given a more thorough-going inspection in the shop and tightened up. Then approximately every six months, each machine is brought into the shop for a detailed check, including dismantling when necessary for examination, and renewal of worn parts as required.

Heavy repairs, overhauls and rebuilding generally are undertaken by the Elm Grove shops, where complete facilities for such work are maintained. Recently, however, the operating company has undertaken the construction of a complete underground shop capable of handling fairly heavy repairs at each of its mines. Such a shop already has been constructed at Mobley and Alexander mines near the foot of the air shafts.

Fig. 4 is a plan view of the Mobley shop, which includes a pit with side lighting, drying room, stockroom, truck storage and steel tool lockers. Major equipment includes a lathe, planer, drill press and overhead traveling crane with 15,-10- and 5-ton chain blocks. Maximum height of the shop is 14 ft. 7 in., and in excavating prior to construction all loose material was removed up to the solid limestone. Space between the ceiling and the limestone was cribbed with creosoted timbers resting on the ceiling I-beams. Materials of construction included concrete footings, floors and pilasters and cinderblock walls.



Room face at Dartnell mine, showing stone over the coal, posting and gob disposal

Loading machines at Goose Creek discharge into chain-and-flight conveyors which carry the coal to the main belt line extending to the tipple on the surface

CONVEYOR TRANSPORTATION

+ Supplements Mechanical Loading of Coal

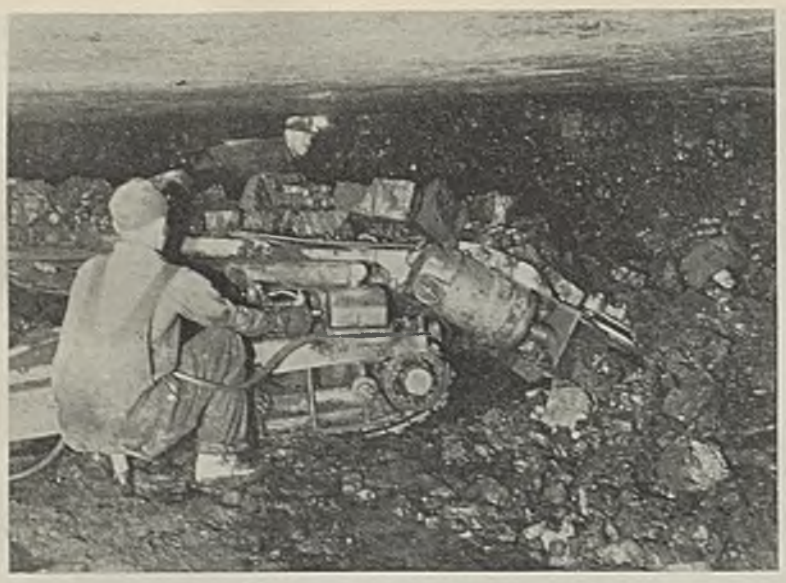
At New Goose Creek Mine

BUILT around belt and chain-and-flight conveyors for transporting coal from loading machines at the face to the tipple, the new Goose Creek mine of the Goose Creek Mining Co., one mile east of Garrett, in Floyd County, Kentucky, represents the translation into reality of proposals for combination loader-conveyor operations made as far back as 1924. With the system in force at Goose Creek, average output per man-shift worked in February was 10.4 tons, including both underground and surface employees and foremen.

The Goose Creek mine was opened in a lease of 500 acres on the Right Fork of Beaver Creek, a tributary of the Big Sandy River, in November, 1935. First coal was shipped on Dec. 1. The No. 1 Elkhorn seam, mined at this point, produces a good grade of domestic coal with an excellent slack for either steam or domestic purposes. As a result of the fairly hard structure of the coal, 5-in. lump percentage averages 29; 5x2-in. egg, 25 per cent; and 2-in. slack, 46 per cent. Thickness of the seam ranges from 36 to 50 in., and banded impurities of a regular nature are absent. The seam is rolling in nature and has a strong sandstone top, except for drawslate in local dips or swags, where the grades may run up to 10 per cent. From the outcrop, thickness of the cover, made up of sandstones and shales, increases to 800 ft.

Natural conditions made for a compact arrangement of the surface plant with a minimum of construction. The seam occurs at approximately tipple height, and has been exposed for about a mile along Beaver Creek by a newly constructed highway. It was only necessary to build a light steel bridge 100 ft. long to carry the outer end of the main belt conveyor from the mine portal over to a small three-track shaker-screen tipple located over the tracks of the Beaver Creek branch of the Chesapeake & Ohio Ry. The portal is directly over the highway and is just far enough above it to give adequate traffic clearance under the conveyor bridge. The tipple is equipped to prepare and load lump (over a loading boom), egg and slack.

The coal area embraced in the lease is roughly rectangular in shape, thus simplifying the problem of projecting the main conveyorways for transportation. The major portion of the tonnage will be brought out through the Main North entry (Fig. 1), which connects with the Main entry at a point approximately 250 ft. inside the portal. The Main entry also serves as a room entry, and operations at present consist of advancing the two headings making up the entry and working rooms to the right. When all of the coal to the right of the Main entry is worked, either by long



Loading coal in a room at Goose Creek

Room conveyor discharging onto main belt

rooms or a combination of subsidiary entry and rooms, room conveyors, loaders and other equipment will be transferred to the left side of the Main entry, and rooms on this side worked out down to the Main North entry. Succeeding room entries will parallel the Main entry, and, as in the case of the Main, rooms will be worked out on the right on the advance to the eastern boundary and rooms on the left will be mined on the retreat. Coal from the loading units will be carried on a belt down the room (or East) entries to another belt on the Main North, which in turn will discharge onto the Main entry belt leading to the tipple.

The general plan of driving headings and working rooms at Goose Creek is shown in Fig. 2. Headings are driven 25 ft. wide on 60-ft. centers. The main belt is laid in the center of the right-hand heading, and a track is projected in the left-hand heading, or aircourse, for supplies and also as a return circuit from the d.c. equipment in use. This track will be extended from time to time as the headings advance and, contrariwise, will be shortened in a similar manner as the rooms are worked out on the retreat. Present standards call for a room width of 40 ft., a depth of 500 ft. and centers of 70 ft. Wider rooms and the use of face conveyors were contemplated when the mine was opened, but experience showed that adjusting the loaders to keep the discharge ends of the tail conveyors over the face conveyors involved too much jockeying for position, with consequent loss of time. With a width of 40 ft. and the conveyor in the center of the room, the loaders can easily reach either corner of a place and the problem of keeping the loader discharge over the room conveyor is greatly simplified.

Rooms are necked approximately 15 ft. wide, and opposite each room neck a crosscut is driven through the heading pillar to make an outlet for the corresponding room on the opposite side, which is driven in each case on the same center line. Necks on the heading, or right, side of the entry are driven by the loading machine on the advance to make them ready to receive the loading head and initial sections of the room conveyors. Crosscuts between rooms are driven from both sides.

Rooms at present are worked in pairs, and the equipment for such a pair consists of one Joy, Jr., loading machine, one shortwall mining machine with 7-ft. cutter bar, one portable drill (kept with the cutting machine), and two Joy chain-and-flight conveyors made up of 6-ft. sections, or pans. Conveyors are laid in the centers of the rooms, and the loader, cutter and drill alternate between the two places, traveling through the crosscuts. With loading completed in a place the cycle of operations begins with cleaning up loose coal, squaring up the face and scrapping the bottom left by the cutter. Two men take care of this work as well as conveyor extension and any other tasks which may require attention. Upon completion of the clean-up and scrapping activities, the place is undercut and drilled by the machine crew, which also loads and shoots the shotholes located at the top of the cut and spaced 8 to 10 ft. apart. Pellet powder is employed for blasting. With the coal shot down, the place is ready for the loading machine.

Substantially the same system is followed in the headings, where crosscuts and room necks, in addition to the heading faces, provide sufficient coal to keep the loading unit busy. Two chain-and-flight units and a cross conveyor, also of the chain-and-flight type, are employed to carry the coal back to the main belt, which is extended every 200 to 300 ft. With the roof conditions at Goose Creek, slabbing of room pillars to increase recovery is possible and already has been done. On the basis of preliminary experience, plans have been laid for including this activity in the regular mining routine, using hand

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"Coming events cast their shadows before"—at least in the case of the new Goose Creek loader-conveyor mine. With the growth of interest in the possibility of continuous transportation of coal from the working face to the tipple by means of conveyors, engineers in the early days of the mobile loader foresaw the eventual incorporation of machines of this type in the conveyor set-up. While the interval between proposal and adoption covered more than a decade, the principles of a loader-conveyor operation were outlined in the Jan 24, 1924, issue of *Coal Age* by Walter M. Dake, then engineer associated with Sanford E. Thompson in making a report on "Underground Management in Bituminous Mines" for the U. S. Coal Commission. Operations at Goose Creek represent translation of these principles into reality in substantially their original form.

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loaders for this work, although it is possible to do it with the loading machines. To reach the pillars, the room conveyors are swung over to the side of the place. Otherwise, no change is made in conveyor position or operation.

Main belt conveyors (Joy-M. & C.) consist of 26-in. Goodyear five-ply belts carried on stands 12 ft. long. Spacing of the loaded idlers is 4 ft., or three per stand; return-idler spacing is 12 ft. Weight of a 12-ft. stand with idlers is 377 lb. Over-all height of the conveyor is 19 in., and its rated capacity is 175 tons per hour. The main belt now in use is driven by a 20-hp. motor located at the tipple. Main chain-and-flight conveyors in rooms and headings, consisting of head, or drive sections, weighing 2,419 lb. each with motors; tail sections, 178 lb. each; and 6-ft. intermediate sections, 156 lb. each (with chain and flights per section, 104 lb. each), are driven by 15-hp. motors. Chain-and-flight cross conveyors are driven by 5-hp. motors. Cutting machines are driven by 50-hp. motors and the loading machines by five 4-hp. motors.

Conveyors operate on 440-volt alternating current. The main circuit to these machines consists of a Trenchlay cable made up of three No. 2 conductors. Loaders, cutters, drills, gathering pumps, etc., are powered with direct current supplied by a 150-kw. motor-generator set feeding 275 volts to a 500,000-circ.mil rubber-covered feeder. The supply track, which will be double-bonded, will serve as the return. Starting and stopping of individual chain-and-flight conveyors is controlled by starters and pushbuttons mounted on the driving units. The main conveyor is started and stopped at the tipple. A telephone system will permit coordination of conveyor operation.

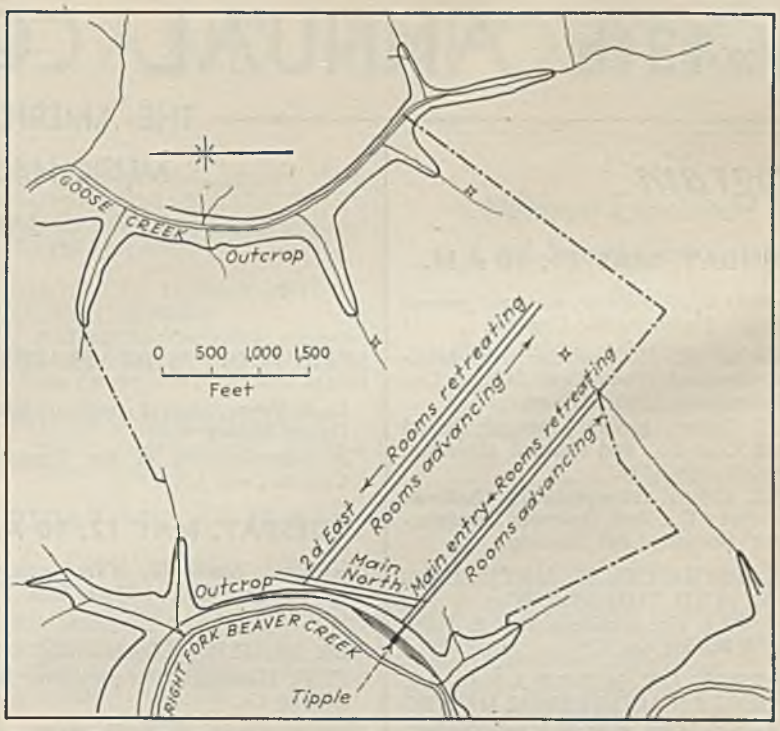
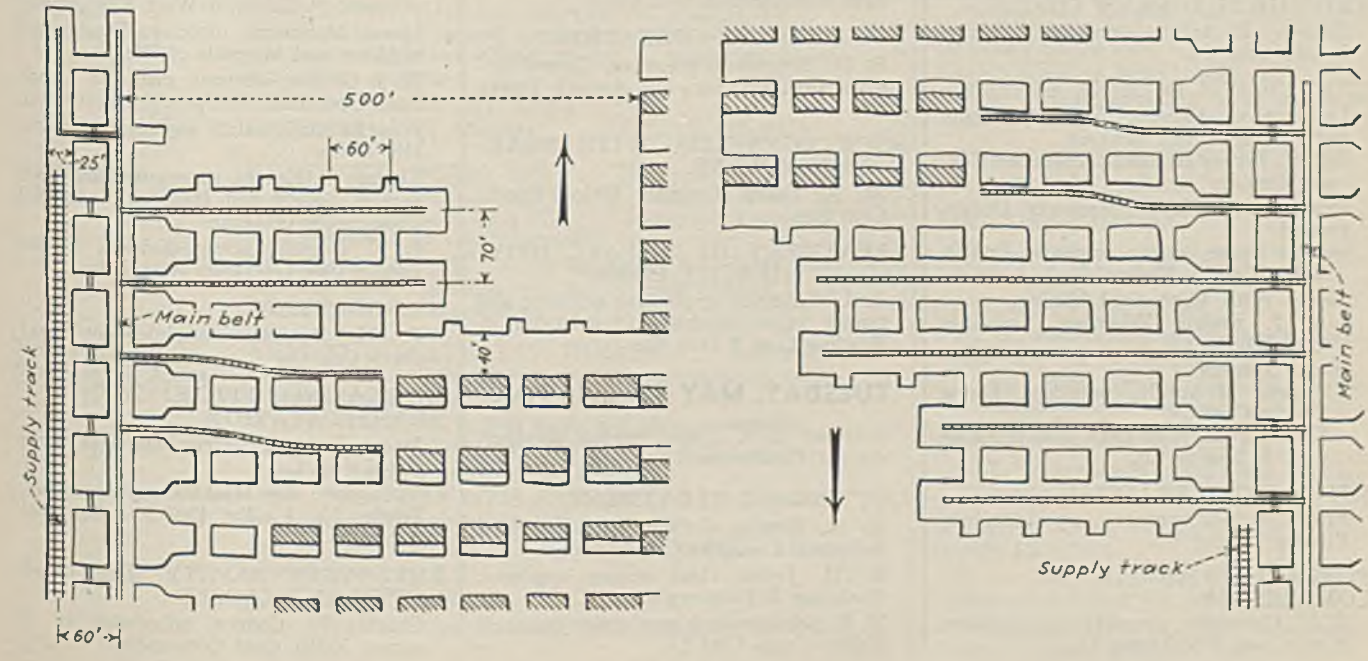


Fig. 1—Goose Creek property map, showing projected method of development

With the two loading units now in operation, the standard mine force per shift is: two loader operators, two helpers, four machinemen, four panmen, one electrician, two tipplemen and one foreman. One blacksmith is employed on the day shift only, making the total force for two shifts of operation 33 men. Panmen, in particular, are available for any other necessary work underground and any member of the mine force can be shifted to other than his regular task when required.

In February of this year, an average of 30 men were employed per day of two shifts. In that month, when operations were hampered somewhat by car shortages and one loading unit went on a part-time basis, the mine loaded 5,000 tons of coal in sixteen days of two shifts each, making the average output per man-shift 10.4 tons, including foremen and outside employees. Power consumption was 12,600 kw.-hr., including consumption by tipple motors rated at 11½ hp., or 2.52 kw.-hr. per ton of coal shipped. The demand peak in February (15-minute basis) was 90 kw.

Fig. 2—Left, advancing entry and mining rooms on the heading side, with one loading unit in the entry and the other driving rooms; right, two loading units working rooms on the retreat on the aircourse side of the entry



»»»13th ANNUAL COAL MINING

THE AMERICAN MINING CONGRESS

MUSIC HALL, CINCINNATI, OHIO

MAY 11-15, 1936

Program

MONDAY, MAY 11, 10 A.M.

Chairman: I. N. Bayless, assistant general manager, Union Pacific Coal Co.

Introducing—E. J. Newbaker, vice-president, Berwind-White Coal Mining Co., and chairman, Coal Division.

R. E. Salvati, general manager, Island Creek Coal Co., and national chairman, program committee.

C. B. Officer, vice-president, Sullivan Machinery Co., and chairman, Manufacturers' Section, Coal Division.

COAL-PRODUCTION METHODS—TODAY AND TOMORROW

Paul Weir, vice-president, Bell & Zoller Coal & Mining Co.

PROGRESS OF MECHANICAL LOADING AND CONVEYOR MINING

T. F. McCarthy, general superintendent, Clearfield Bituminous Coal Corporation.

John H. Richards, mining engineer, Hanna Coal Co. of Ohio.

Thomas Murphy, superintendent, Northwestern Improvement Co.

C. F. Hamilton, vice-president, Binkley Mining Co.

H. B. Husband, general manager, fuel mines, Chesapeake & Ohio Ry.

James White, superintendent, mine No. 48, Peabody Coal Co.

COAL-CLEANING PLANT, NORTHWESTERN IMPROVEMENT CO.

E. R. McMillan, mining engineer, Northwestern Improvement Co.

MONDAY, MAY 11, 2:30 P.M.

Chairman: J. D. Rogers, vice-president, Stonega Coke & Coal Co.

MODERN PRODUCTION METHODS AND THE FUTURE OF COAL

Eugene McAuliffe, president, Union Pacific Coal Co.

NEW THINGS IN MINE SAFETY

Locomotives Painted With Aluminum and Having Reflex Mirrors
—J. V. Berry, Industrial Collieries Corporation.

Broadcasting Safety Messages Underground
—John Lyons, safety engineer, Bell & Zoller Coal & Mining Co.

Safety With Mechanical Mining
—A. J. Ruffini, Wheeling Township Coal Mining Co.

Bonus Systems
—Eugene McAuliffe, president, Union Pacific Coal Co.
—Ernest Todd, chief clerk, Bell & Zoller Coal & Mining Co.

HITCH-DRILL PRACTICE

Frank Schull, general superintendent, Binkley Mining Co.

PORTABLE MINE-CAR COMPRESSOR

F. C. Carothers, general superintendent, Pond Creek Pocahontas Co.

EFFECT OF WIDE PLACES ON ROOF

O. B. Pryor, general superintendent, Elm Grove Mining Co.

A representative of the Pennsylvania Coal & Coke Co.

TUESDAY, MAY 12, 10 A.M.

Chairman: Harry M. Moses, general superintendent, United States Coal & Coke Co.

OUR MODERN COAL INDUSTRY

C. F. Hamilton, vice-president, Binkley Mining Co.

NEW THINGS IN COAL CLEANING

A. E. Roberts, chief engineer, Heisley Coal Co.

W. J. Skewes, mechanical engineer, Pocahontas Fuel Co.

R. H. Sherwood, president, Central Indiana Coal Co., Inc.

Joseph G. Saricks, president, Wolf Collieries Co.

E. J. Weimer, general manager, Snow Hill Coal Corporation.

J. B. Morrow, preparation manager, Pittsburgh Coal Co.

W. E. Wolfe, electrical and mechanical supervisor, Clinchfield Coal Corporation.

T. C. Mullins, president, Northern Illinois Coal Corporation.

TRIP DISPATCHING AND CAR-MOVEMENT RECORDS

R. G. Lazzell, Island Creek Coal Co.
Discussion: Wm. J. Wolf, division manager, Consolidation Coal Co.

POWER-PLANT OPERATION

R. H. Sherwood, president, Central Indiana Coal Co., Inc., and Antioch Power Co.

ROCK TUNNELING WITH SHAKING CONVEYORS

M. A. Sharp, foreman, Union Pacific Coal Co.

TREATMENT OF TUNNEL DRIVING, ANTHRACITE FIELD

B. L. Lubelsky, explosives engineer and tunnel superintendent, Philadelphia & Reading Coal & Iron Co.

TUESDAY, MAY 12, 2:30 P.M.

Chairman: H. C. Faust, general manager, United Pocahontas Coal Co.

CUTTING-BIT TREATMENT

N. A. Emslie, division superintendent, Industrial Collieries Corporation.

E. H. Jenks, chief mining engineer, Rochester & Pittsburgh Coal Co.

H. E. Schweinsberg, production engineer, Valley Camp Coal Co.

James Hyslop, chief engineer, Walter Bledsoe & Co.

D. D. Wilcox, general superintendent, Superior Coal Co.

POWER EFFICIENCIES

E. J. Christy, Wheeling Township Coal Mining Co.

Discussion: C. H. Matthews, electrical engineer, Susquehanna Collieries Co.

THE ECONOMICS OF A.C.-D.C. CONVERSION

W. A. Buchanan, district manager, Appalachian Electric Power Co.

COAL BUMPS UNDER HEAVY COVER

John F. Daniel, chief, Department of Mines and Minerals of Kentucky

AEROMECHANICS AS APPLIED TO MINE VENTILATION AND FANS

A. Lee Barrett, Pittsburgh Coal Co.

WEDNESDAY, MAY 13, 10 A.M.

Chairman: H. L. Griffin, division engineer, Koppers Coal & Transportation Co.

PROGRESS IN RELATED FIELDS OF INDUSTRY

L. E. Young, vice-president, Pittsburgh Coal Co.

ACCIDENT RECORDS: COMPARISON AND CAUSES OF ACCIDENTS OVER FIVE-YEAR PERIOD

W. W. Adams, supervising statistician, Employment Statistics Section, U. S. Bureau of Mines.

Discussion: N. P. Rhinehart, chief, Department of Mines of West Virginia.

James McSherry, director, Department of Mines and Minerals of Illinois.

M. J. Grogan, assistant manager, Lynch Coal Operators' Reciprocal Association.

Wm. Richards, safety engineer, Madeira, Hill & Co.

Thomas P. Kearns, superintendent, Division of Safety and Hygiene, Industrial Commission of Ohio.

J. F. Bryson, safety division, Harlan County Coal Operators Association.

ROCK-DUSTING

P. H. Burnell, superintendent, Owl Creek Coal Co.

INCREASING EFFICIENCY IN TRANSPORTATION

Joseph Anstead, electrical engineer, Templeton Coal Co.

Discussion: Lee Haskins, superintendent, Zeigler No. 1 mine, Bell & Zoller Coal & Mining Co.

EMPLOYEES' SAFETY MEETINGS—OPEN AND CLOSED

Charles W. Connor, superintendent of mines, Nellis Coal Corporation.

J. B. Benson, Koppers Coal & Transportation Co.

G. A. Roos, assistant general manager, Philadelphia & Reading Coal & Iron Co.

W. J. Stiteler, Jr., vice-president, Coal Operators' Casualty Co.

WEDNESDAY, MAY 13, 2:30 P.M.

Chairman: W. L. Affelder, vice-president, Hillman Coal & Coke Co.

METHODS OF CUTTING OUT SLATE BANDS

W. D. Northover, preparation engineer, Rochester & Pittsburgh Coal Co.

PROSPECTING FOR COAL WITH DIAMOND DRILLS

C. E. Swann, chief engineer, Union Pacific Coal Co.

COAL CLEANING AT THE PEABODY COAL CO.

Jack Verhoeff, Peabody Coal Co.

RELATION BETWEEN LIFE OF ENTRY AND TYPE OF TRACK EQUIPMENT

F. F. Jorgensen, manager of production, Consolidation Coal Co.

George F. Bayles, chief engineer, Ohio & Pennsylvania Coal Co.

Paul Halbersleben, general superintendent, Sahara Coal Co.

GENERAL USE OF POWER AND ENERGY AT THE MINE

C. C. Knipmeyer, consulting engineer and head, electrical engineering department, Rose Polytechnic Institute.

WELDING AS A MONEY SAVER

E. S. Wade, superintendent, Windsor Power House Coal Co.

THURSDAY, MAY 14, 10 A.M.

Chairman: Peter F. Loftus, consulting engineer.

MODERN MINING METHODS AND COAL'S FUTURE

P. C. Thomas, vice-president, Koppers Coal & Transportation Co.

HIGH PRODUCTION IN CUTTING-MACHINE EFFICIENCIES

David Ingle, Jr., superintendent, Buckskin Coal Corporation.

Thomas L. Garwood, Chicago, Wilmington & Franklin Coal Co.

National Exposition of Coal Mining Equipment May 11-15

AN EXHIBIT of the latest in cost-reducing machinery for safe and efficient operation (A complete list of exhibitors appears on page 211)

CONVEYOR MINING

H. E. Willson, Laurel Creek Coal Co.

Thomas F. Steele, general manager, Penn Anthracite Collieries Co.

E. A. Siemon, division general superintendent, Hillman Coal & Coke Co.

NEW DESIGNS IN CAR CONSTRUCTION

Development of Mine Cars Over Eight-Year Period at Koppers Coal & Transportation Co.

—F. S. Follansbee, chief engineer, Koppers Coal & Transportation Co.

Reducing Costs With Modern Pit Cars

—C. J. Sandoe, vice-president, Perry Coal Co.

—A. R. Long, superintendent, New River Co.

—R. E. Hobart, mechanical engineer, Lehigh Navigation Coal Co.

MODERN PRODUCTION METHODS AT BELL & ZOLLER COAL & MINING CO.

A talking motion picture.

THURSDAY, MAY 14, 2:30 P.M.

Chairman: K. A. Spencer, vice-president, Pittsburg & Midway Coal Mining Co.

IMPORTANCE OF EFFICIENT PRODUCTION METHODS

R. E. Taggart, president, Philadelphia & Reading Coal & Iron Co.

MECHANICAL LOADING SYSTEM

T. J. Thomas, president, Valier Coal Co.

AIR CONDITIONING

H. G. Conrad, general superintendent, Knox Consolidated Coal Corporation.

HAULAGE PRACTICE

H. W. Saunders, chief engineer, American Coal Co. of Allegany County

Walter Buss, mining engineer, Knox Consolidated Coal Corporation.

TRACKLESS MINING

O. S. Batten, mining engineer, Utilities Elkhorn Coal Co.

WELDED RAIL JOINTS FOR MINE TRACKS

G. S. Jenkins, general superintendent, Consolidated Coal Co. of St. Louis.

Discussion: Irvin C. Sproul, mine foreman, Hanna Coal Co. of Ohio.

In Lighter Vein

MONDAY
8 p.m. to 2 a.m.

OCTET . . . famous group from Old Heidelberg Restaurant . . . nationally known . . . an outstanding feature.

"ICE-BREAKER" McCONNELL . . . a grand funmaker . . . guaranteed to get crowd together.

KELLY-BAHLKE DANCERS . . . in ensemble and specialty numbers . . . lovely girls . . . lovely costumes . . . exciting numbers.

WORLD FAMOUS ORCHESTRA . . . for dancing from 10 to 2

TUESDAY
8 p.m. to 2 a.m.

MINERS' NATIONAL AMATEUR CONTEST . . . sponsored by leading coal companies . . . to determine the best talent among our 400,000 miners . . . winner to receive national air audition

KELLY-BAHLKE DANCERS

ORCHESTRA . . . dancing . . . PLENTY OF FUN

WEDNESDAY
8 p.m. to 2 a.m.

KENTUCKY DERBY JR. . . . The running of the A.M.C. Handicap . . . only race in history that can be guaranteed to be won by a filly . . . jockeys—18 beautiful girls sponsored by coal companies

RHYTHM CRUISE . . . an entrancing trip from New York to San Francisco, via the Rhythm Cruise . . . a charming and unusual feature

THURSDAY
6:30 p.m. to 2 a.m.

ANNUAL "SPEECHLESS" DINNER . . . lives up to its reputation . . . the most important entertainment event of the convention, featuring:

WARD WILSON, famous radio and stage comedian

THE "DREAM GIRL" WALTZ . . . a lovely interpretation of beautiful music by the ballet

MISS CORNELIA OTIS SKINNER . . . in a few of her extraordinary character sketches

SELECTIONS by the OCTET . . . who will play a "return engagement"

DANCING . . .

A wonderful evening, not to be missed under any circumstances

HOISTING SHAFT

+ At East Bear Ridge Colliery

Raised From Slope to Main Tunnel

By H. A. DIERKS
James H. Pierce & Co.
Scranton, Pa.

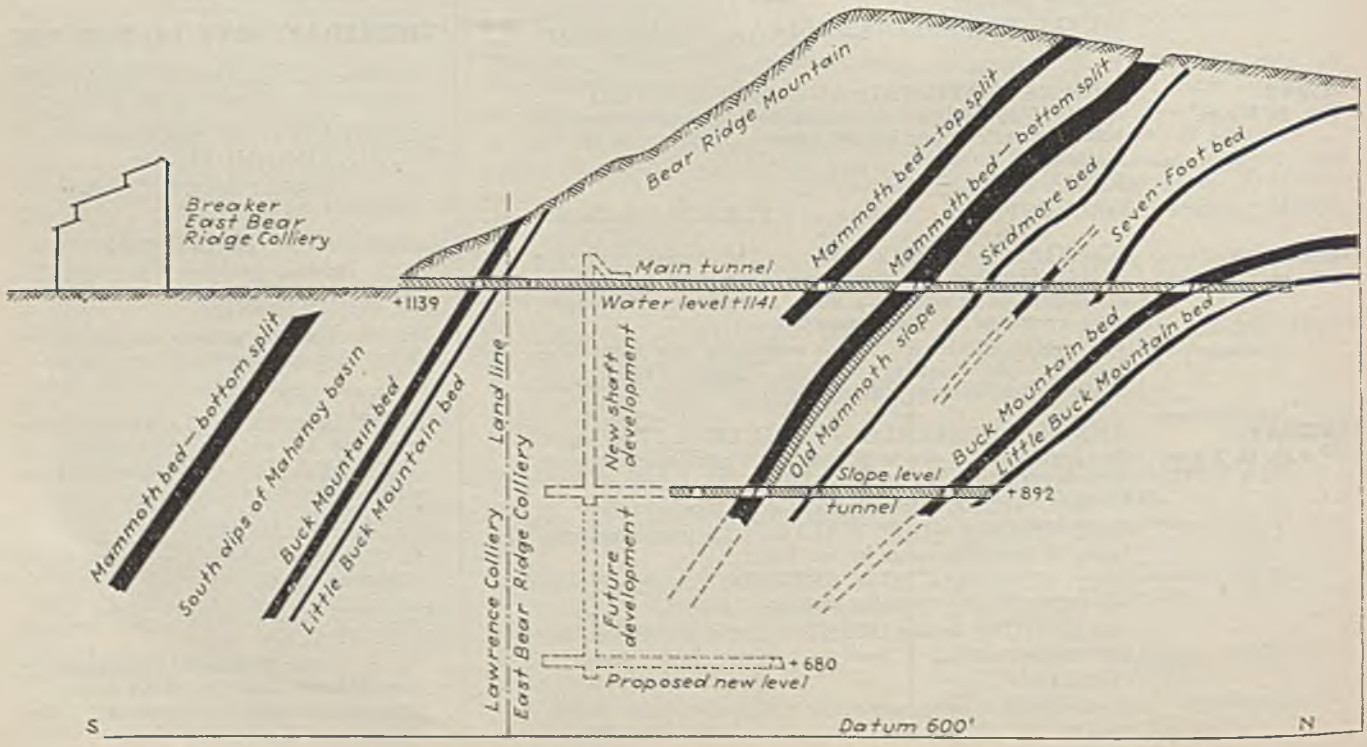
ONLY rarely in coal mines are shafts driven upward, though the practice is quite general in metal workings, and wherever an approach is available from below, a large saving can be effected by such procedure, and the work can be performed more rapidly than by sinking. No trouble is encountered from the presence of water, and, by drilling a hole and providing a fan, the shaft can be kept entirely free of fumes and deleterious gases. A shaft was upraised in this manner at the East Bear Ridge colliery, Mahanoy Plane, Pa., in 1934 and 1935.

East Bear Ridge colliery operates on the south dip of the East Bear Ridge anticline between the Mahanoy and Shenandoah basins of the Middle Western Anthracite Field. This particular association of coal beds is generally known as the Bear Ridge "overturn," which designation was given it in 1884 by the Second Geological Survey of Pennsylvania. It will be noted in the cross-section of the measures (Fig. 1) that the Mammoth and Buck Mountain beds appear twice in passing from left to right, yet both series of beds slope in much the same direction and appear in the same sequence, not in inverted sequence, as they would have done had an overturn occurred.

Knowledge gained from development, therefore, raises the question if this unusual geological phenomenon would not be termed more accurately a reverse thrust fault than an overturn, as the north dip of the supposed overturn basin seems definitely to be missing. On the other hand, no definite thrust plane has been found, but if there is one it would appear to be identified with a small mud seam lying between the conglomerate formation which constitutes the footwall of the Mahanoy basin and the sandstone which forms the hanging wall of the Bear Ridge formation.

The Water Level tunnel driven into Bear Ridge Mountain, known as the old "Girard tunnel," was driven about 1850, and serves now as the main haul-

Fig. 1—Cross-section through East Bear Ridge colliery



age road for East Bear Ridge colliery. Its portal is just north of the crop line of the Mammoth south dip of the Mahanoy basin, so that the tunnel penetrates only the underlying Buck Mountain and Little Buck Mountain beds in this formation. These beds, however, are not worked by East Bear Ridge colliery but by Madeira, Hill & Co.

About 400 ft. further the tunnel cuts first the Mammoth Top Split, then in turn the Mammoth Bottom Split, Skidmore, Seven-Foot, Buck Mountain and Little Buck Mountain beds, which dip south in the same sequence and nearly parallel with the same measures of the Mahanoy basin. These beds form the coal reserves for East Bear Ridge colliery from the anticlinal down to the undetermined depth of the formation.

Development Plan—All the mineral coal in these beds above the Water Level tunnel has been exhausted for some years. The reserves on the next lift, above what is known as the Slope Level tunnel, are also nearly exhausted, only small areas remaining at the extreme eastern and western limits of the property. To develop new coal areas it was necessary to provide a new level. Before this could be done, however, an analysis of the existing transportation and hoisting facilities had to be made, to determine whether 600 mine cars, the normal daily production, could be handled efficiently.

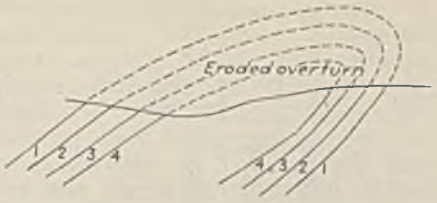


Fig. 2—Inverted sequence resulting from overthrow

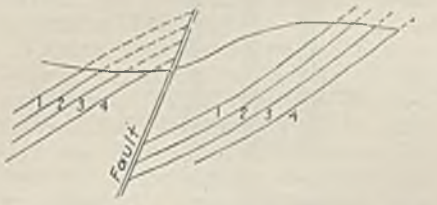
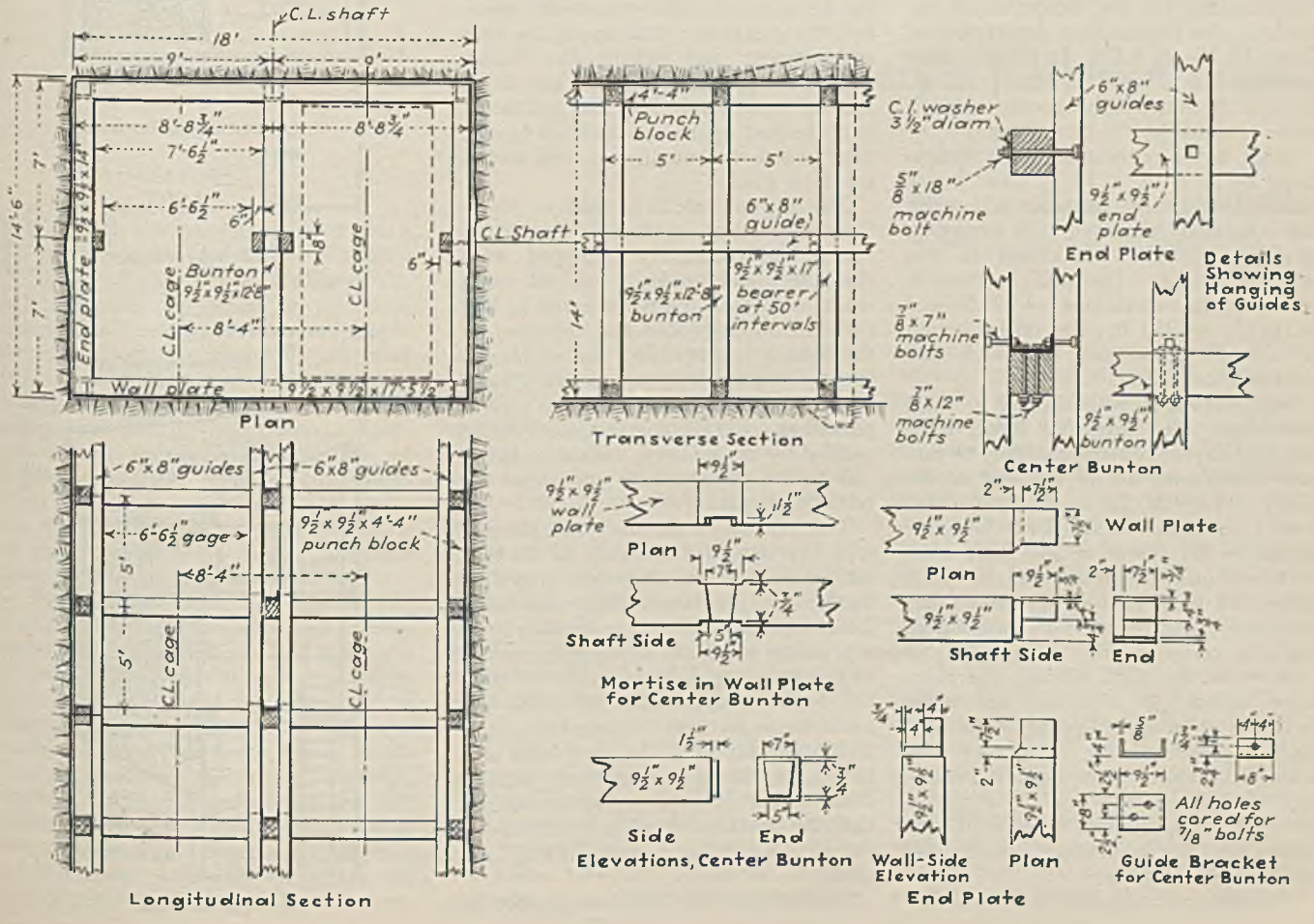


Fig. 3—True sequence resulting from faulting

The Main or Water Level tunnel has an elevation of +1139, the Slope Level tunnel an elevation of +900, and the proposed new level would have an elevation of +680 ft. above tide water. Approached by a car slope driven on the bottom rock of the Mammoth bed on an average dip of 60 deg., the Slope Level tunnel was serviced by a 250-hp. single-drum electric hoist with a maximum capacity of 170 mine cars per 8-hour shift. Any plan to open and develop a new level had to be based on the replacement of these inadequate hoisting facilities by methods more efficient and economical. After due consideration was given to all possible means of improving the existing facilities versus the substitution of new and better methods, a vertical shaft was finally chosen as the most favorable solution.

As the existing Mammoth slope provided means for reaching the Slope Level tunnel, the opportunity for raising instead of sinking the shaft quite naturally presented itself. For the same reason, the shaft needed only two compartments; no provision was necessary for cables and pipe lines, for they could enter the workings, as heretofore, down the old Mammoth Slope. Starting from the assumption that the cost of raising a shaft should be about 30 per cent less than that involved in its construction by sinking methods, satisfactory bids for its raising were finally obtained. Not much optimism as to the speed or safety of this procedure was displayed by the contractors in bidding on the proposed contract. This, of course, was due chiefly to the fact that local contractors lacked experience in this kind of work and to the scarcity in this part

Fig. 4—Details of shaft timbering



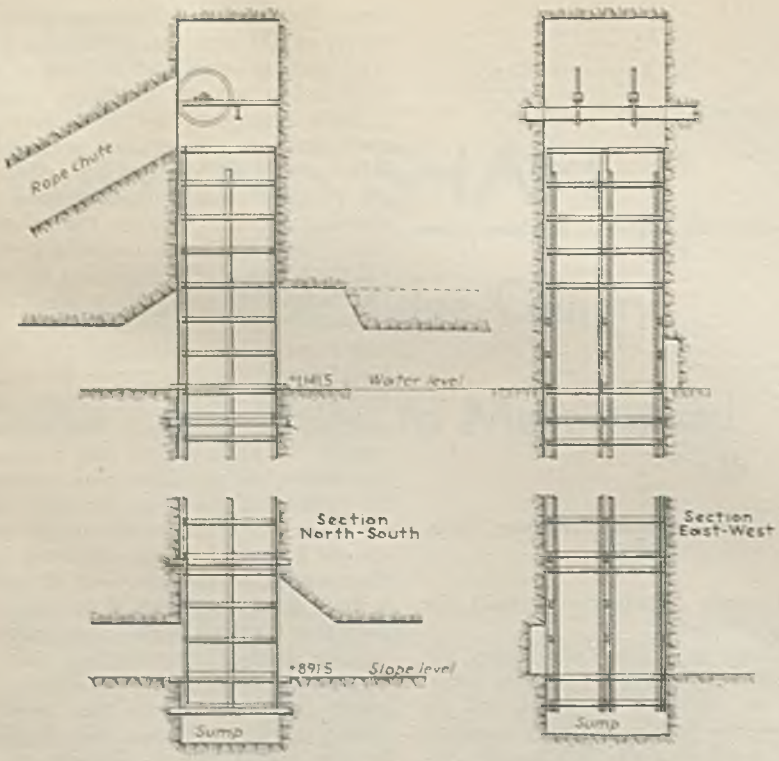


Fig. 5—Cross-section of completed shaft

of the country of rock men familiar with raising or stoping.

The contract finally was awarded to Hugh Dolan & Sons, of Pottsville, Pa., who were furnished detailed plans and specifications for the execution of the work by the engineering department of James H. Pierce & Co. In essence these specifications, of which details follow, covered the scope and sequence of work to be executed by the contractor.

Shaft to be rectangular with dimensions 14 ft. 6 in. x 18 ft. clear inside rock cut, and to be raised in full width and completely timbered with exception of guides. Shaft to be raised in two separate stages. The main portion is between the elevations +891.5 and +1141.5, or 250 ft.; the other section is between elevations +1141.5 and +1184.5, or 40 ft.

Shaft raising to be performed by shaft contractor, who furnishes labor, tools and explosives; colliery company to furnish compressed air to the foot of the shaft, to provide the necessary ventilation by means of an 8-in. borehole drilled in the center of one shaft compartment and to furnish at the shaft bottom all shaft timber, permanent and temporary, ready cut for installation. Colliery company also to remove all rock from the shaft-raising operation when loaded into mine cars and when delivered at an agreed point by the contractor. Shaft-raising contract to start when first bearer with the first permanent timber and the loading chute of the rock compartment have been installed by the contractor outside the terms of his contract.

The west compartment to be used for the storage and passage of rock and to be lined with 3-in. planks furnished by the colliery. The east compartment to be reserved for hoisting, ventilation and the passage of men. When the shaft has been raised within the limits specified, the contractor shall empty the rock compartment and remove the lining. Subsequently, all shaft sets are to be squared and plumbed by the contractor and checked by the colliery surveyors, after which the contractor will install the shaft guides.

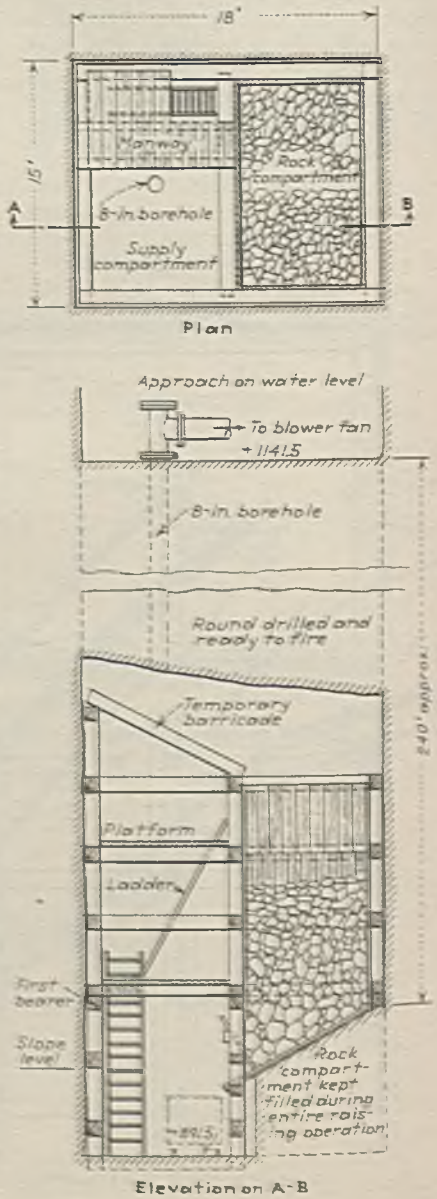
The contract rate to be paid per linear foot of vertical shaft height actually raised and completely equipped with shaft sets and guides. For all extra work performed and not covered by this contract, but requested and approved by the colliery management, the contractor to be reimbursed at cost or on a basis previously arranged. Workmen's compensation covering contract labor to be carried by the colliery. Blasting material to be furnished to contractor by colliery at cost.

The location of the shaft was planned with the object of utilizing to the fullest extent the existing transportation facilities in the Water Level and Slope Level tunnels. For this reason the shaft was placed about 300 ft. inside the portal of the tunnel and 50 ft. to the west of it. Separate approaches or drifts had to be made on both landings to obtain an efficient layout. The shaft hoist also had to be placed underground, because Bear Ridge Mountain rises so steeply that the installation of a hoist on the outside would have been difficult and costly.

Execution of the plan was started by driving approaches for the top and the bottom of the shaft simultaneously. When the location of the shaft in the Water Level drift had been reached, an 8-in. borehole was drilled vertically inside the planned shaft area. This hole had a twofold purpose: (1) to ascertain the exact rock formation through which the shaft was to be raised, so that the details of timbering in general and the placing of shaft bearers in particular could be planned in advance; (2) to provide efficient ventilation for shaft raising.

A small suction fan was connected to the borehole by a wooden duct. This fan cleared the shaft of powder smoke within a few minutes after blasting, maintaining ideal ventilating conditions at all times. Wood was chosen for shaft timbering, as no pressure was anticipated from the solid rock strata. Details concerning the framing of tim-

Fig. 6—General plan of shaft-raising procedure



ber sets and the method of installing shaft sets and guides are shown in Fig. 5. For all permanent shaft timber, including guides, the best grade of Gulf States long leaf yellow pine obtainable was specified.

Shaft bearers were installed at 50-ft. centers or at shorter intervals, as rock conditions dictated. They consisted of a regular shaft set with three extra wall plates of increased length placed directly under the two end plates and the center bunton. The length of the bearers was such that they had a minimum bearing surface inside the solid shaft wall of 18 in. After they had been carefully squared, plumbed and leveled, they were cemented into place for greater permanency.

Shaft Raising—The working method followed in shaft raising is shown in Fig. 6. The compartment used as a rock chute was lined with 3-in. hemlock planks. The other compartment was used as a manway and hoistway. It was equipped with ladders resting on platforms every 20 ft. The platforms covered only one half of the compartment; the other half was kept open for hoisting shaft timber and supplies. A small air hoist for handling shaft timber was placed at the bottom of the shaft where it could be operated by the bottom man. By a wedge bolt, the sheave, over which the ½-in. rope was carried, was fastened in the roof after the making of each cut.

Raising was started by building a loading battery at the bottom of the rock chute. This consisted of two chutes, 24x48 in., through which shaft rock was drawn into mine cars which were pushed through the shaft and then gravitated to a point where they were picked up by the general transportation system of the mine and hoisted to the surface for dumping. As the load of the loose material in the rock compartment would ultimately weigh over 1,000 tons, a rock ledge was left at the bottom of the compartment for support. The top of the ledge was given a pitch of 35 deg. and, being covered with mine rails, the rock slid readily down toward the chutes at the lower end.

When the shaft had been raised a sufficient distance the first bearer set was installed and carefully surveyed and leveled. It formed virtually the foundation stone for the shaft, all succeeding sets being plumbed to accord with this bearer. Throughout the raising, two plumb lines were carried constantly in opposite corners of the hoist compartment 2 in. from the two sides of the enclosing angle.

Shooting methods, costs, shaft equipment stations and hoist, and future shaft development will be discussed in the concluding article, to appear next month.

PORTABLE SUBSTATIONS

+ Assure Adequate Power Supply at Face

At Union Colliery's Kathleen Mine

By C. E. CAWVEY

Electrical Engineer, Union Colliery Co. Dowell, Ill.

POWER always has been a very important subject at the Kathleen mine of the Union Colliery Co. All power for operation of the mine always has been purchased and hence the monthly bill presented by the local public utility is a constant and very effective reminder that power costs always are present and power conservation and proper utilization are of prime importance. Also the mine operating officials have always been aware not only of the cost of power but also of the importance of having adequate power at the point of operations.

The Kathleen mine, at Dowell, Ill., was sunk in 1917, and, although a completely electrified mine at that time was a comparatively new thing, power-plant layout and equipment were designed to operate adequately and efficiently the mine from the beginning on a hand-loading basis and later on a mechanical-loading basis with only additions and minor changes. Although the power consumption now is much greater than in the early stages of operation, all the original equipment still is in use. Coal is mechanically prepared at the face, loaded, transported, hoisted and screened with electrically operated equipment. Empty and loaded railroad cars are handled by a 25-ton trolley locomotive on the surface and gob disposal is by an electrically operated aerial tramway.

Power is received and metered at the mine substation at 33,000 volts. Here it is stepped down by means of two banks of transformers, rated at 1,000 kva. each, to 2,300 volts, at which voltage power is distributed to the major operations. One 2,300-volt feeder goes to the main-shaft engine room, where it is subdivided and submetered on two circuits, one to the 2,300-volt motor-generator set for the coal hoist and the other to the tipple. The tipple circuit is stepped down to 220 volts. Another 2,300-volt feeder from the mine substation goes to the air-shaft engine room, where it is metered and then subdivided and metered to nine circuits. Power consumption and distribution to the different mine operations are checked daily, monthly and yearly; also a cumulative record has been kept since the first power consumption and billing. Accurate and detailed figures for the cost of power per kilowatt-hour and per ton of coal are available from the first ton mined up to and including the present time.

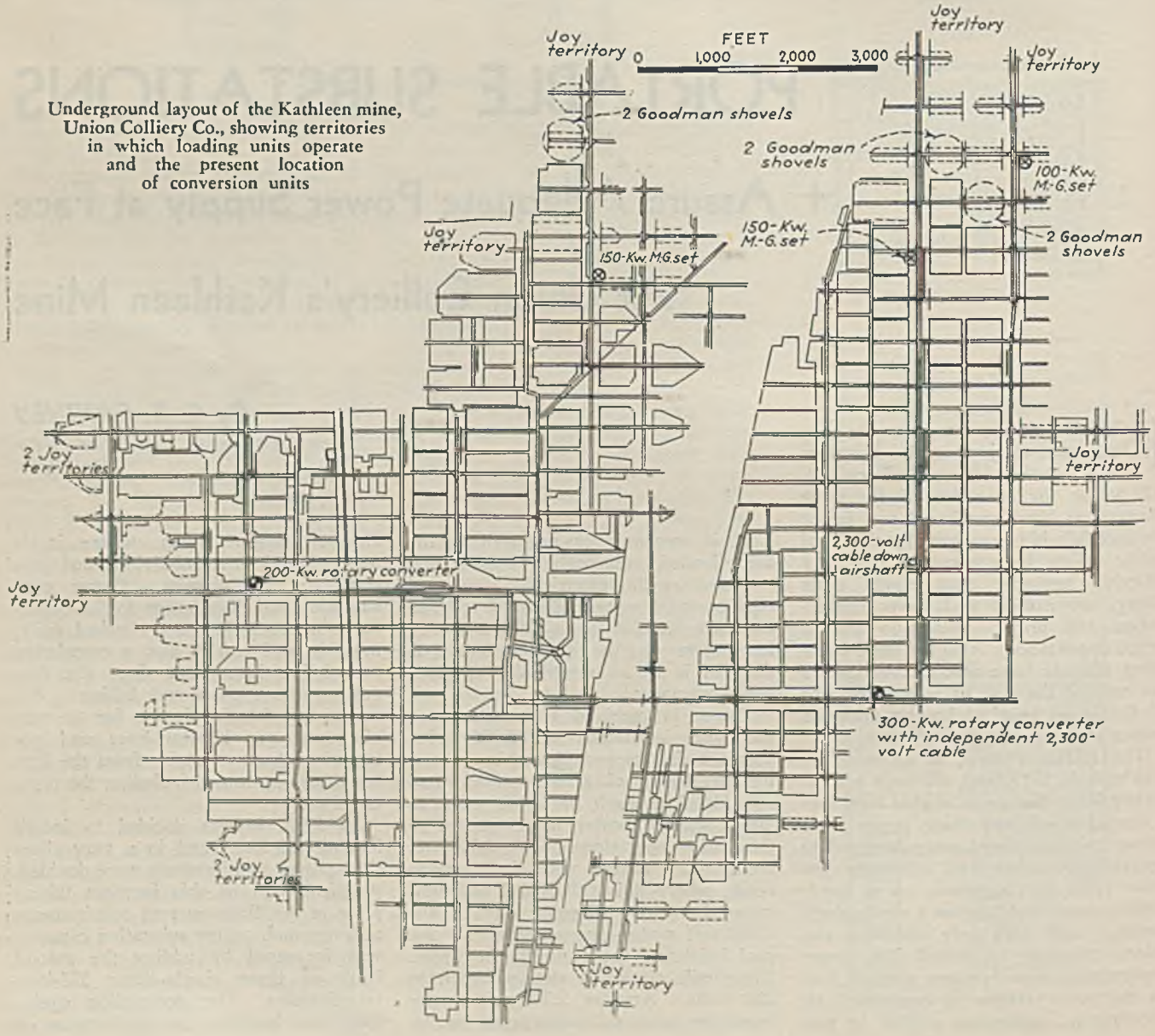
In 1925, it was decided to install loading machines and in a very short time power requirements were doubled, practically all of this increase taking place in the direct-current requirements underground. Mine substation capacity was increased by adding the second bank of three single-phase 333-kva. transformers. D.c. conversion equipment was increased by the addition of

900 kw. of capacity in two synchronous converters and three motor-generator sets. At an early stage it was apparent that, with the concentration of work due to the use of loading machines plus the increased demand for d.c. power and the need for the best of voltage regulation at the face, the old method of placing power-conversion sets in the engine room on top and adding positive and negative feeders was too inefficient and that, as the loading machines advanced and rapidly increased the distance from the central power plant, the transmission of d.c. would become increasingly difficult.

First addition to the conversion equipment was a 200-kw. rotary converter with semi-automatic switching equipment. The transformers and switching equipment were combined into a unit equipped with wheels to adapt it to operation on the mine track and make it ready for moving when it was necessary to change its location. The converter, with conventional cast bedplate, was equipped with removable wheels and axles to expedite its moving from one location to a new location nearer the working face. This was one of the first portable mine sets.

The next addition to the conversion equipment was a 300-kw. converter placed one mile inside the mine. This set was not made portable, it being the idea to make this set more permanent and depend on it to furnish d.c. for the main haulage locomotives and, as the working faces moved away from this set, to add smaller and more easily portable sets at the inside workings to furnish power for loading operations. This plan has been followed and in the section where this 300-kw. converter is located one 100-kw. and one 150-kw. automatic portable motor-generator sets are now installed at the inside points shown below. A third portable automatic motor-generator set is the latest addition to the underground d.c. distribution equipment and rounds out the program started in 1925 and 1926. No further additions are contemplated in the immediate future and the present sets will be moved as the working places advance.

These portable motor-generator sets can be disconnected, moved to a new location and reconnected in a very short time. If a.c. and d.c. connections are made available before shifting a set, it can be moved and reconnected for service in less than one shift. Compactness is a major feature of the sets, which consist of two trucks, one truck mounting a 275-volt d.c. generator driven by a 2,300-volt, 1,200-r.p.m., 80-per-cent power-factor, 3-phase, 60-cycle synchronous motor and the other truck all the switching equipment. This switching equipment protects the set against phase reversal, phase failure, a.c. low voltage, a.c. overload, field failure, overspeed, d.c. overload and short-circuit, reverse current, reverse polarity and bearing overheating. The switching equipment provides for automatic restarting after a.c. power failure



Underground layout of the Kathleen mine, Union Colliery Co., showing territories in which loading units operate and the present location of conversion units

and reclosing of the d.c. breaker after overload or short-circuit on the d.c. trolley and feeders, provided the cause of the trouble is removed. Other causes of trouble, such as overheated bearing, overspeed, overloads on a.c. incoming feeder, and incomplete start, require the visit of an attendant to reset the relays causing the outage. The trucks on which the equipment is mounted are of the mine-car type and are equipped with bumpers and couplings for moving on the mine track with a locomotive. All these sets have been moved underground and no trouble has been experienced in rounding curves or traveling on uneven track.

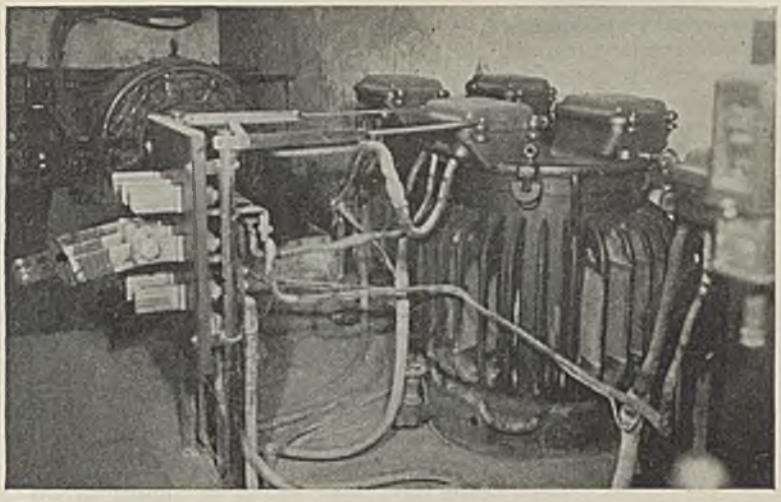
Incoming connections are made by plug-type receptacles which are easily and quickly connected and disconnected. Control cable connections between the switching equipment and the motor-generator set are made by a multiple-plug connection. Power connections are by disconnecting potheads with plug and receptacle.

Power for cutting machines is furnished by transformer banks located in crosscuts between the main haulage entries and the aircourses. To serve the cutting machines 2,300-volt three-phase cables are installed in every section of the mine, and, as these cables are large enough to carry both the cutting machine load and the smaller conversion sets, the motor-generator sets are furnished with 2,300-volt three-phase power by connecting into these cables at the locations chosen for d.c. distribution.

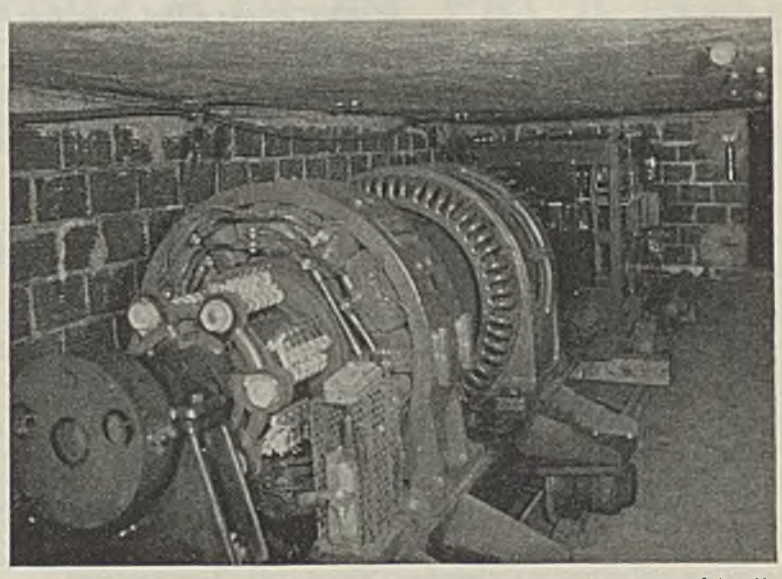
Cutting-machine motors are operated by 220-volt, squirrel-cage induction motors, which have a very poor power factor. By connecting the synchronous motor-generator sets on the cables supplying the cutting-machine power the lagging current is corrected at the source, thus making a considerable saving in cable losses as well as increasing the over-all power factor of the total mine load.

The motor-generator sets have a drooping-voltage characteristic to prevent them from picking up more load than they are able to carry. In other words, when a heavy load is thrown on the trolley or feeders served by a motor-generator set, the voltage drops as the load increases, causing the sets on top or the stationary converter a mile from the bottom to carry part of the load. When this load peak is passed the motor-generator voltage goes back to normal. During periods of light d.c. load, the voltage on the motor-generator is high, which results in a high excitation current on the synchronous motor and gives a larger power-factor correction in periods of lightest d.c. demand.

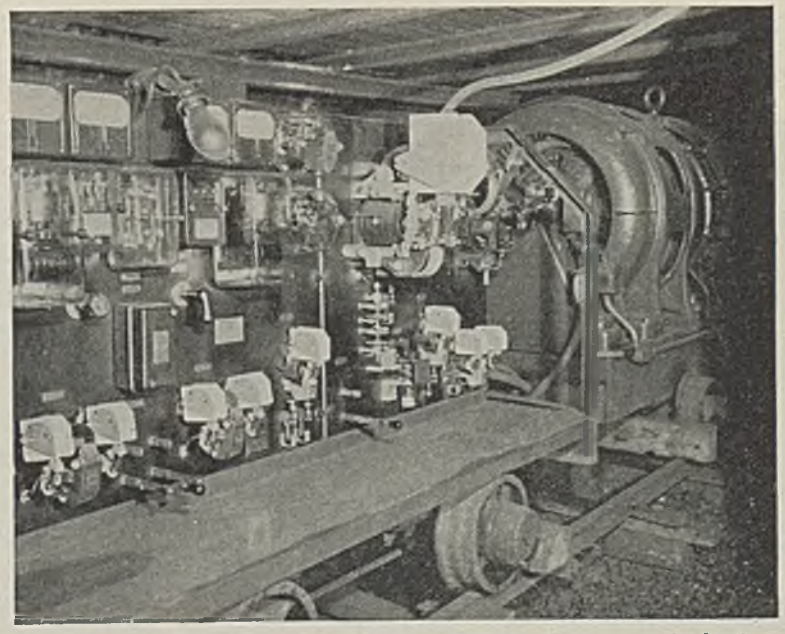
The power-factor billing for the mine is figured from a reactive kva. meter and a kilowatt-hour meter reading made on the first day of each month. A bonus is granted for a power factor of



This underground substation, containing a 300-kw. rotary converter, transformers and control equipment, supplies power primarily for main-haulage operations



Where conditions are suitable, portable conversion units are mounted in tile substations with sanded floors



Portable conversion unit stationed in a crosscut opening out on the haulage road. The switching truck is in the foreground, m.g. set in the rear

over 90 per cent and a penalty invoked for a power factor under 90 per cent. Since the installation of the synchronous motor-generator sets, and with other minor changes made, the power factor has been raised from an average of 85 per cent for a month to as high as 98 per cent without the purchase of any equipment purely for the purpose of power-factor correction.

The main purpose of the d.c. conversion sets is to furnish the proper voltage to machinery at the working faces. A minimum average of 220 volts is maintained for the Joy machines on development work and a 240 to 250 average is maintained on the Goodman machines which load out the panels developed by the Joys. When the voltage in any territory drops below these figures the condition immediately is corrected by moving a portable set or increasing feeder capacity.

One of the most important considerations in maintaining proper power to the loading machines is the division of load between the various conversion units. Due to the load centers shifting constantly, what is a perfect distribution at one time will be found faulty after a few machines have moved. It is then necessary to raise and lower voltages until a new balance is obtained. If this balance is not maintained and one station tries to carry more load than its rating, the circuit breaker will kick out, thus throwing an overload on other stations, which also are likely to kick out, and if the load happens to be heavy in two or more sections at the same time it is possible that all the stations will kick out before the overload is finally relieved. By taking into account the voltage characteristics of the various converters and generators, their location, the load nearest them, and regulating their voltage properly, the load each will carry can be regulated so that d.c. circuit-breaker operations will be cut to a minimum.

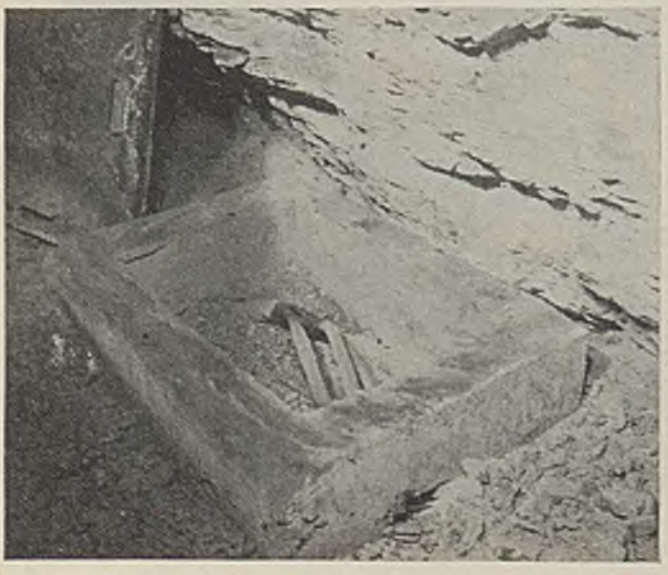
Operation of the load-redistribution system at Kathleen is reflected in the steps taken in a recent case where the motor-generator sets in the 7th North and 9th North Main East were kicking out when the main-line haulage locomotives in these sections were starting out with heavy trips. This condition grew out of the shifting of the partings from which the trips were moved to points farther inside. At the same time the loading machines and their accompanying equipment were moved forward. After checking the inside substation voltages and loads it was evident that some of this load should be shifted to the 300-kw. converter outside the 7th North, which investigation showed was carrying less load than usual. A.c. voltage on the converter was raised 5 per cent, which relieved the inside trouble, but at the same time put too much load on this substation. After increasing the a.c. voltage on the surface converters 2½ per cent, the load was again distributed properly and each substation was carrying its share of the total load without undue overload on any conversion unit.

The 2,300-volt distribution system underground supplies all the power for mining operations except for the 275-volt d.c. power which is furnished from the top by two converters and one motor-generator set which take care of main-line haulage to the bottom and overloads of short duration on the main-line haulage farther inside. Most of this 2,300-volt distribution cable is lead-covered, paper-insulated cable which is laid in 500-ft. lengths with open joints in concrete boxes with sheet-iron covers. These open joints are used in testing to locate shorts and grounds in the cable. It is standard practice to make joints by wiping on a lead sleeve when it is necessary to splice the cable between the ends of these 500-ft. lengths. This lead-covered cable is buried in the ground and the open joints have ground wires between the lead sheaths on the two sections of cable to maintain a circuit for ground currents. Wherever the lead cable comes near the bonded track a substantial ground wire is attached to the lead sheath and the nearest bond on the track.

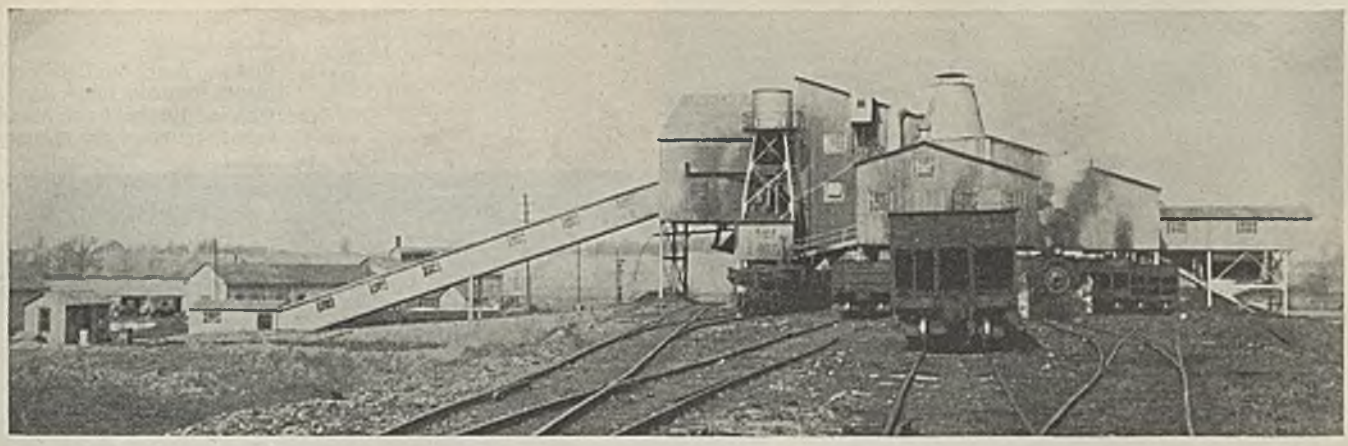
More recently, cable with a non-metallic sheath has been installed instead of the lead-covered cable. To date, this cable has proved very satisfactory. Most of the trouble with the lead-covered cable has been due to electrolysis and, since the non-metallic cable is not subject to this difficulty, it should be possible to eliminate practically all the cable faults by the use of non-metallic sheathed cables. To date there has not been a non-metallic sheath cable blow-up in over 10,000 ft. now installed; part of this cable has been in service over a period of more than three years.

Track bonding is maintained at all times, although all tracks are paralleled with negative feeders. Main-haulage tracks are paralleled with 1,000,000-circ.mil. stranded bare copper return feeders. All panel entry tracks are bonded on one rail and paralleled with a 4/0 copper wire which is connected to the main return feeder at the mouth of the panel. Cross bonds are placed every 200 ft. and at all switches on main-line tracks, and every cross bond is tied into the negative feeder. Loading machines, drills and d.c. shearing machines use the return feeders in panel entries for hooking on cable nips. Both positive and return feeders are run into every other room to the first crosscut to provide nip stations without running the cables across the panel entry track.

2,300-volt distribution cables are laid in 500-ft. lengths with open joints in concrete boxes with sheet-iron covers. The open joints are used in testing to locate shorts and grounds in the cable installations



Transformer sets serving a.c. cutting machines are mounted in crosscuts and walled off with tile. Doors are swung up by hemp ropes which burn through in case of fire and thus permit them to fall shut automatically



Sunlight preparation plant from the empty side

MODERNIZATION PROGRAM

+ Puts Sunlight Stripping Organization In Tune With Changing Market Demands

SUBSTANTIAL improvement in its position in the Indiana stripping industry has followed the recently completed modernization program of the Sunlight Coal Co. Although Sunlight had long been one of the outstanding operations, during the years immediately preceding this modernization program its relative importance in the State picture had been declining, largely because of decreasing production from the pits then being worked and increasing competition from plants with newer preparation facilities. When it decided to concentrate operations at the new No. 11 mine in the Parker Pelzer field north of Boonville, the company was faced with the problems of recovering a very rugged seam of coal, utilizing existing equipment as far as possible, and improving preparation. This necessitated modernizing and increasing the capacity of stripping equipment; redesigning haulage equipment to enable it to operate over the rough seam of coal; and the installation of an up-to-date preparation plant equipped to meet competition in the present-day market.

As the outcome of these considerations, the move from the old pits to the new was characterized by the installation of larger aluminum-alloy dippers on stripping shovels; adoption of truck haulage, using equipment with specially designed 15-ton bodies; and the installation of a combination wet-and-dry preparation plant with five loading tracks and a rated capacity of 500 tons per hour. Thus, with 23 years of stripping history behind it, the Sunlight organization embarks on a new cycle of operations with plant and equipment redesigned for the shipment of a quality product at the lowest possible cost. The measure of success attained is reflected in the fact that Sunlight has advanced from an intermediate position to the second largest strip producer in Indiana in the past several months.

Conditions in the Parker Pelzer field were directly reflected in the method of transportation now in use. The Indiana No. 5 seam being stripped varies from 3 to 7 ft. in thickness and averages 5 ft. 3 in. The general dip is approximately 1½ per cent to the north, but local grades, because of the unusually rolly character of the seam, vary up to 20 per cent. These local pitches follow no general rule as to direction, and inspection of a relief map of the coal bed lends color to the theory that the seam was laid down over ground in which streams had cut shallow valleys. The irregularity and sharpness of the pitches militated against either locomotive or trailer haulage, and consequently led to the adoption of the four-wheeled truck.

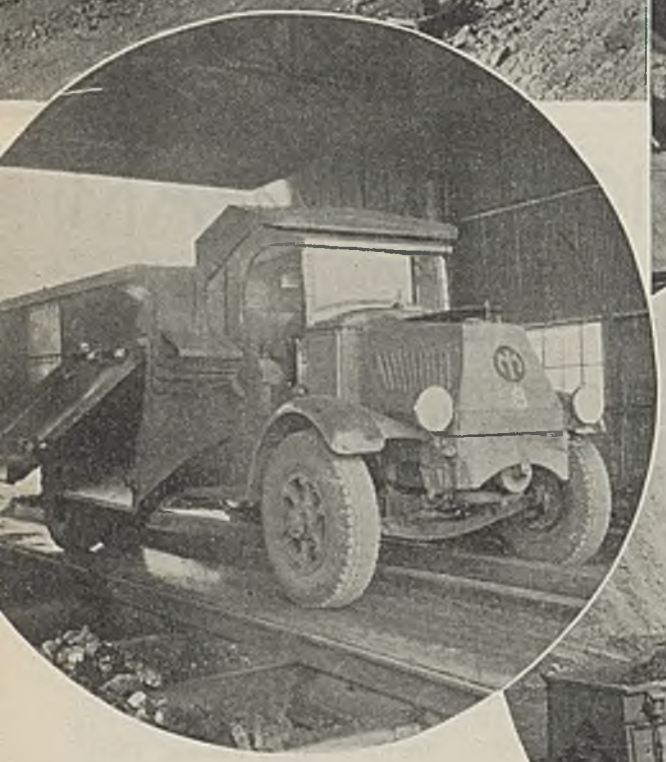
Cover over the field varies from 15 to 50 ft. in thickness and averages approximately 35 ft. In general, the overburden is made up of the following: earth and clay, 10 to 15 ft.; shale, 5 to 15 ft.; sandstone, 5 to 10 ft.; slate, 1 to 3 ft., directly overlying the coal. Thickness of the rock and the total thickness of the overburden decrease as the coal rises to hills or peaks.

Stripping is done by two separate units. Unit No. 1 at present is made up of the following equipment (pumps and other auxiliaries excluded): one Marion 350 track-mounted electric stripping shovel with 10.8-cu.yd. aluminum-alloy dipper; one Marion 480 loading shovel with 2-cu.yd. dipper; one Caterpillar tractor with bulldozer; one compressor with pneumatic jackhammer drill; and one skid-mounted transformer unit supplying 440-volt power to the loading shovel, compressor, pumps, etc. Unit No. 2 is identical with No. 1 except that a Marion 37 coal-loading shovel with 1¾-cu.yd. dipper is employed and the strip shovel is caterpillar-mounted. One Sullivan side-wall "Stripborer" drills the overburden for both stripping units.

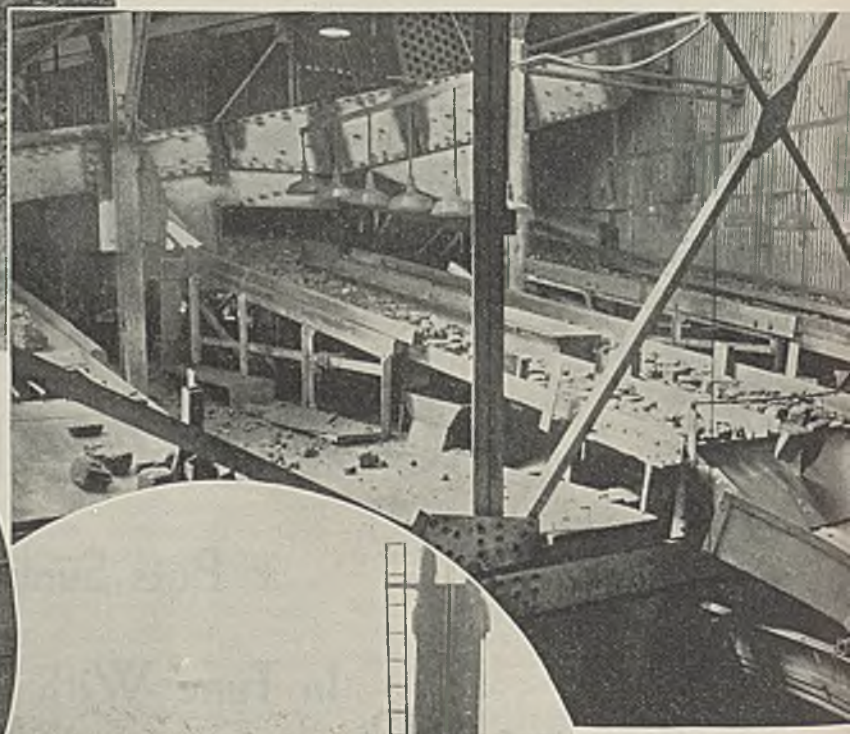
Stripping shovels are equipped with 90-ft. booms and 60-ft. dipper sticks, and have an effective dumping height of 67 ft. When first installed in the old workings, these shovels were equipped with 8-cu.yd. steel dippers. One of these dippers was replaced with the larger

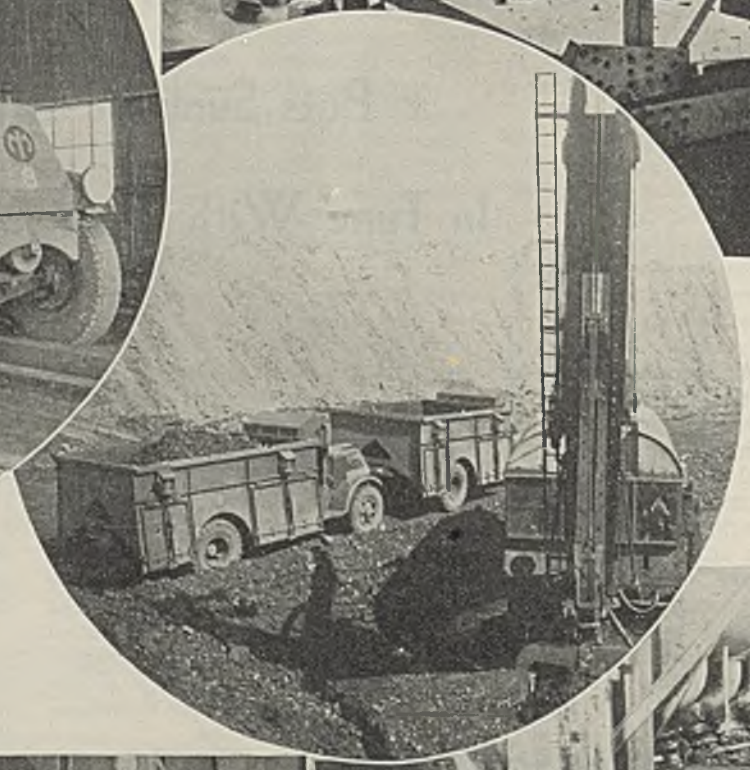
General view of No. 2 pit, showing stripping, loading and other activities

Picking floor, Sunlight preparation plant, showing lump, egg and nut tables. In the background is the lower section of the primary shaker



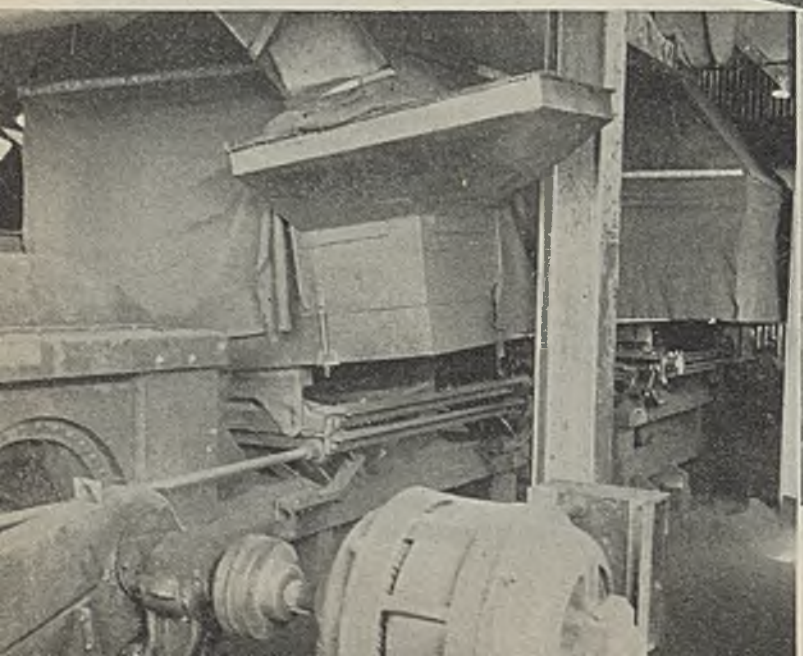
Latest-type truck over dump hopper at Sunlight preparation plant

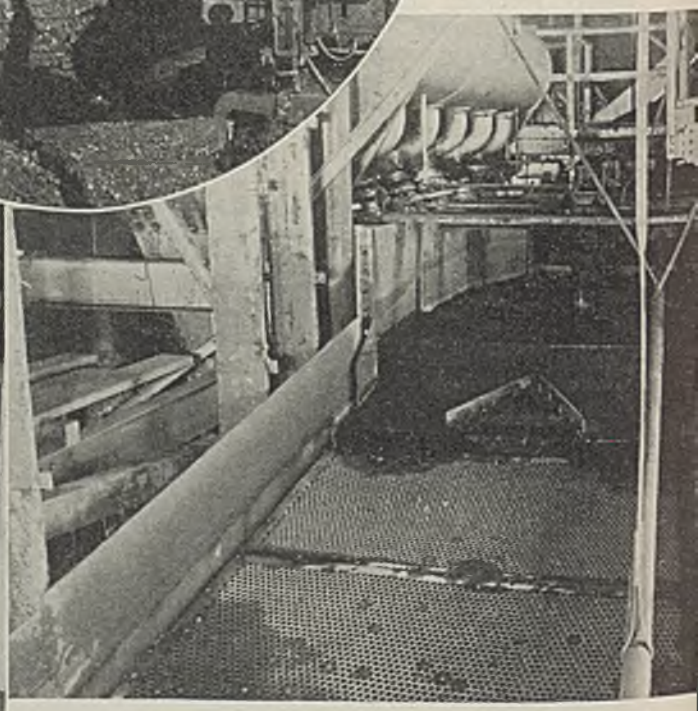




Two 15-ton trucks lined up beside the loading shovel in No. 1 pit

Four air tables clean the minus ¼-in. faction





2x¼-in. coal is washed in this 5-cell air-operated jig at Sunlight

aluminum dipper in 1935; the other dipper was replaced in 1936. A manganese lip was installed on the first dipper received, but failed to stand up under the prevailing digging conditions, due to improper design. It was replaced with a redesigned manganese lip which solved the problem. Teeth, made in accordance with designs developed by the Sunlight organization, are manufactured by Finkl of chrome-nickel-molybdenum alloy steel. Installation of the larger dippers, equipped with aluminum bails, hinges and doors, was largely responsible for an increase of 16 to 17 per cent in shovel yardage. The remainder resulted from a decrease in gear ratio in the swing which lessened the swing motor load and actually speeded up the swing due to more rapid acceleration, with consequent improvement in the smoothness of the digging and dumping cycle.

Operation of the stripping shovels on the steep grades encountered in the pits has presented no particular difficulty. Blocking is resorted to where the slant of the coal is so great that the deck cannot be kept level with the jack length available, although in some cases, where deviation from level has not been excessive, operations have been continued without appreciable effect on the units except for some increase in dolly wear. In moving up on grades too steep for the traction motors alone, the shovels are boosted along with the dipper sticks and crowd motors.

Pit width at Sunlight varies with the thickness of the overburden. In shallow overburden, a width of about 100 ft. is carried. As the depth of the overburden increases, pit width is narrowed to a minimum of approximately 75 ft. with 50 ft. of cover. As a 35-ft. berm is carried along the high wall, width of the coal cut ranges from 65 to 35 ft. The stripping units are followed up by the side-wall drill, which drills 6-in. holes, usually on 16-ft. centers, to the depth required for the width of the cut to be made. Overburden is blasted with L.O.X. prepared in the company's own plant. Normal loading is one cartridge, or bag, per 2½ ft. of rock. Actual explosive (oxygen) content of each bag is 14.3 lb.

Preparation of the coal seam for loading at Sunlight is based on the use of a bulldozer for removing the heavier material, followed by drilling and blasting. Hand shoveling and blowing with compressed air were rendered unnecessary by the installation of mechanical cleaning equipment in the tipple. Likewise, adoption of truck haulage eliminated trackwork in the pit, also handled by the cleaning crews, with the result that the total saving by the use of mechanical cleaning and trucks over manual coal cleaning and locomotive haulage was about four men per pit, or eight for the two stripping units in operation.

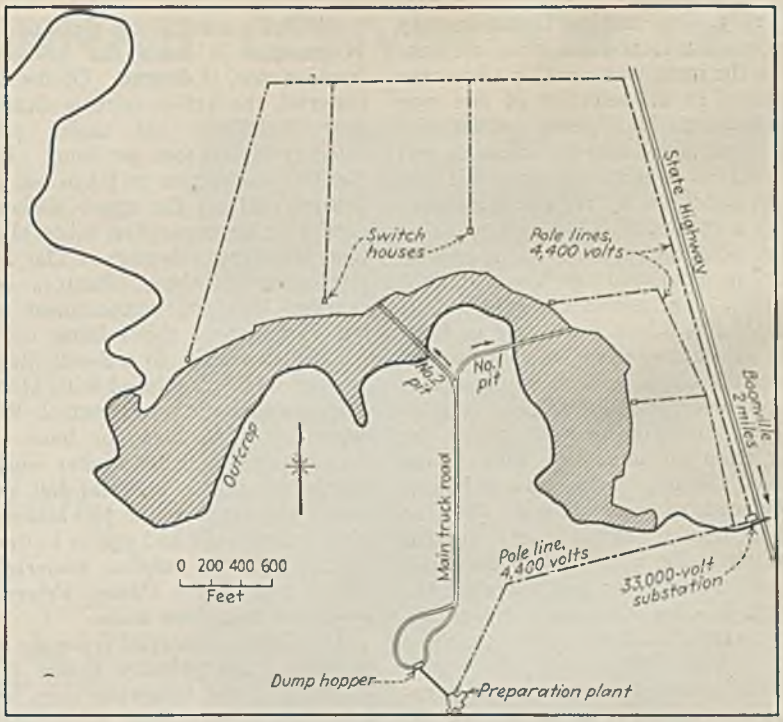


Fig. 1—Sunlight No. 11 strip pit, showing status of excavation as of March 14, 1936

Holes for shooting the coal are drilled on 6- to 12-ft. centers, depending on coal thickness, hardness, etc., and are shot with United States Powder Co. pellet powder. This powder is purchased in both 2x10- and 2x4-in. paraffin-dipped sticks to permit easy variation in size of charge. The 2x10-in. sticks are fitted with electric squibs by the manufacturer before dipping. In 3½-ft. coal, the charge usually is one 2x10-in. stick per hole; 4-ft. coal, one 2x10- and one 2x4-in. sticks per hole; 4½-ft. coal, one 2x10- and two 2x4-in. sticks per hole; proportionate charges are used for other coal thicknesses.

Eight Mack "AC" trucks are employed to haul the coal from the two loading shovels to the dumping station at the preparation plant. Each of the eight units consists of a 7½-ton truck with springs, rear axle and other parts strengthened as necessary to accommodate a body with a capacity of 15 tons. The unusual body design was developed by the Sunlight organization to concentrate 85 per cent of the load over the driving wheels.

To facilitate dumping, the body is divided into four compartments, or sections, by the use of an inverted V construction. One V running along the center line of the truck divides the body into two primary sections, each of which is further subdivided into two secondary sections by transverse V's approximately over the rear wheels. Four air-operated doors, each with independent control, allow the contents of the body to be discharged quickly to both sides of the units. Bodies for the first four units were of Heil manufacture and were equipped with doors with hook-type latches. Mack-built bodies were installed on the second four units purchased, and as a result of experience with the first four the design was changed to lower the center of gravity by reducing the slope of the primary V. Occasional trouble with the hook-type latch led to the substitution of the bar type on the new units, which also included revisions necessary to prevent the trip ropes on the loading shovels from catching on the air cylinders mounted above the doors. Bodies are constructed of Republic Grade 2 10-gage double-strength copper-molybdenum steel.

With eight trucks in service, equally divided between the two loading shovels, Sunlight shipped 78,698 tons of coal in 26 days in January, 1936. Round trips made by the trucks in traveling 7,791 miles totaled 5,557, or an average of 1.402 miles per trip. In 25 days in February, shipments totaled 74,023 tons; truck mileage was 7,236; number of round trips was 5,195; and mileage per round trip was 1.392. Gasoline consumption was close to 1 gal. per 1½ miles.

Extremely rapid dumping action makes it unnecessary to bring the trucks to a full stop over the dump hopper. Loading and dispatching in the pit are overseen by a checker with each loading unit, who keeps a record of truck movement and delays; oversees the handling and turning of the units to prevent interference with or damage to other pit operations or equipment; checks door position on incoming empty trucks to prevent spillage while loading, etc. Ability of the trucks to turn in front of the loading shovel quickly

and easily, thus making it unnecessary to maintain a clear road from one runway to the next, was a major advantage envisioned in the selection of this type of equipment. Main roads consist of 9 to 12 in. of mixed 2x3-in. limestone and chat laid on a prepared subgrade and kept in condition by regular trips over it with a grader.

The pole-line system of supplying power is employed at the Sunlight operation. The power company's voltage is 33,000, which is reduced to 4,400 at the substation, from which power to operate the tipple and pit equipment is sent out over pole lines. Laterals located at strategic intervals carry the power from the main pole lines to the edges of the pit. From switch houses at the end of each lateral, 750- or 1,000-ft. trailing cables carry current to the stripping units and to the skid-mounted transformer units serving the 440-volt loading shovels, compressors, pumps, etc. Trailing cables to these latter units are 500 ft. long. A secondary transformer station at the preparation plant reduces the main supply voltage of 4,400 to 440 for operating motors in the plant.

Capacity of the dump hopper at the preparation plant, also designed to receive coal in standard-gage cars, is 125 tons. From the hopper the raw coal is fed onto a 42-in.-wide belt conveyor 270 ft. long between pulley centers. Pitch of the conveyor is 18 deg. 24 min. It discharges onto the upper section of the primary shaker screen, which is fitted with bars and a side-discharge chute for taking off the plus 9-in. lump, which goes to a Bradford breaker for reduction to 2 in. and smaller. The breaker product is returned to the main belt by a Redler elevator, and the refuse, generally sulphur balls or lenses, is discharged from the breaker directly into the refuse bin.

The upper section of the primary screen also separates out the 2x0-in. fraction for mechanical cleaning. Provision also is made for loading this fraction raw, if desired. Of the 2x0-in. material, the ¼x0-in. size is cleaned on four American air tables with a capacity of 100 tons per hour. Part of the ¼x0-in. fraction is taken out of the 2x0-in. coal on the upper shaker section. Further separation takes place on two Morrison vibrators. The 2x½-in. size made on these vibrators is discharged into one compartment of the lower strand of the mixing conveyor for transportation to a 5-cell McNally-Norton washer equipped with McNally-Norton automatic reject control. Washer capacity is 250 tons per hour. Both the air tables and the washer work primarily on refuse material left on the top of the seam in the pit, and on sulphur lenses, balls and grains in the coal. Except for the sulphur material, the No. 5 coal on the Parker Pelzer tract is classed as a clean seam.

The 2x9-in. material from the upper section of the primary shaker is separated into the following sizes on the lower section: 6x9-in. lump, 6x3- or 6x4-in. egg, and 3x2- or 4x2-in. nut. Each of these sizes is picked on shaking picking tables with center reject troughs. Cleaned coal from the tables is discharged onto belt loading booms or, if desired, onto the upper strand of the mixing conveyor for mixing or for transportation to a Bradford breaker with 2-in. perforations which serves as a crusher. Reject and degradation from each table goes to a Bradford breaker for reduction in size and separation of impurities. This crushed coal is recirculated with the raw feed to the primary shaker.

Three screening decks on the secondary, or washed-coal, shakers permit separation of 2x½-in. washed material into 2x1½-, 1½x¾- and ¾x½-in. fractions, which may be loaded separately, as a group, or in various combinations, either with themselves, with the ¼x0-in. size from the dry-cleaning plant or with lump, egg and nut, each or separately, from the picking tables. Water through the bottom deck of the washed-coal shakers, carrying fines and degradation, runs to a sludge tank from which the fines are removed by a conveyor and discharged either to the clean-coal or refuse streams from the air tables.

The No. 11 preparation plant was designed by the Sunlight engineering staff and fabricated by the Marion Steam Shovel Co. Maximum output in any 7-hour shift to date was 3,778 tons. Due to the absence of banded impurities in the coal, reject loss is low, running 4 to 5 per cent of the plant input. Three Allis-Chalmers AR and 23 General Electric KG, MT, FK, KF, FT, K, KR and FTR motors totaling 614 hp., operate the plant. Starting and reversing switches and other controls were supplied by General Electric, and each motor is protected by a Trumbull Type A inclosed safety switch. Controls are arranged for sequence operation of the various plant units, and pushbutton stations at various strategic points, usually near the motors, are provided for emergency stops.

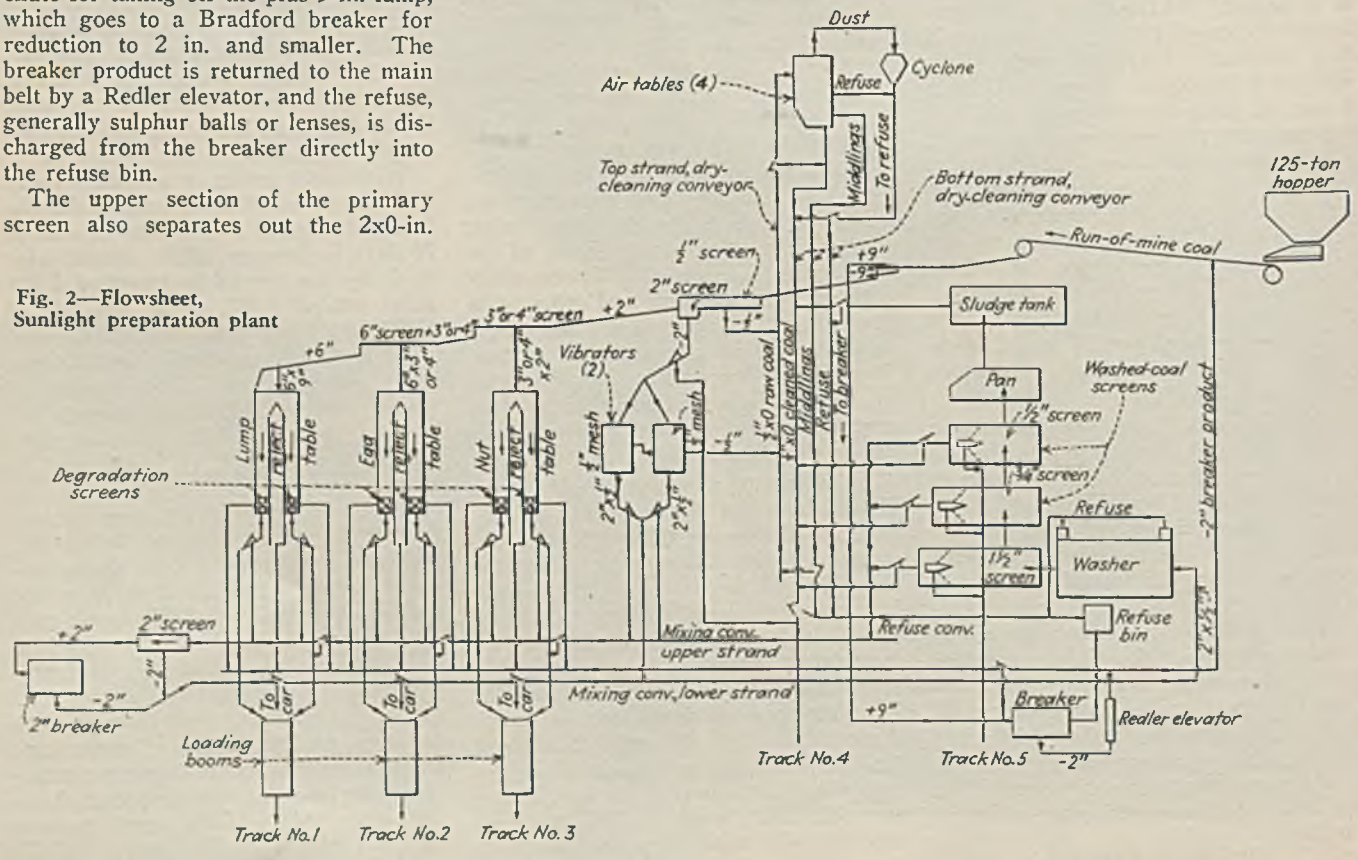


Fig. 2—Flowsheet, Sunlight preparation plant

WHAT THE CINCINNATI CONVENTION OFFERS

An Invitation From the National Chairman

TODAY, more than ever before, the industry must look forward to new things and, with this in mind, the program committee for the 1936 Cincinnati convention of the Coal Division of the American Mining Congress has worked out papers which will bring a well-rounded program before the operating men. I, personally, do not see how any up-to-date operating company can fail to send its best men to this convention for at least two days.

When this year's convention was first planned, officials of the American Mining Congress, with the help of operators throughout the industry, obtained the best State chairmen they possibly could to work up preliminary topics for discussion at the convention. These State chairmen, with the help of operating men within each State, met at the various localities and referred to the general committee a preliminary report as to topics which should be discussed, with recommendations as to the operating men who should present these discussions.

At a meeting in Pittsburgh the general committee took the recommendations of the various State committees and eliminated some topics and added others to a point where we felt it would be of interest to the industry today, and the program committee now feels, after doing this work, that we have prepared a program that is the best that has ever been presented at any of these conventions. We have brought this about by selecting the best topics, as well as the best operating men to present them.

We have arranged that the discussions will not be of long duration and not too many in any one session. The convention will run four days, having two sessions per day; beginning on Monday and closing Thursday afternoon. Details of the program are shown on pp. 180-181.

I have not said anything in regard to the exhibits; however, since all the available space had already been taken prior to Jan. 1, it was necessary for the management of the Mining Congress to open the third floor, and every indication at this time is that all space on the latter floor also will be taken. Never in the history of this convention has as much interest been shown or as much space taken. This in itself is an indication that this year's convention will be the most successful one ever held. There is no doubt that the manufacturers who are exhibiting their products are going to do so in a most able way, and there are many new things that will be shown.

The program committee is doing everything possible and feels at this writing that at least 5,000 operating men will attend this year's convention. Let me urge that all officials of the various companies see that some member or members of their force are sent to the convention, as it will mean dividends to each company represented.

P. E. Salvati

National Chairman, Program Committee
American Mining Congress

PAST CENTURY

+ Marked by Rapid Progress

In Development and Use of Explosives

By R. DAWSON HALL
Engineering Editor, Coal Age

ALTHOUGH powder manufacture probably is seven centuries old and the first documented record of its use in mining goes back to 1627, by far the greatest advances in the art of blasting in mineral recovery have taken place in the last hundred years. Development of high explosives, pellet powders, renewed interest in cushioned blasting, volley shooting and firing plugs are all part of the history of this latter period. With increased efficiency in use also has come greater safety. This year marks the centennial of American manufacture of the safety fuse. The turn of the present century witnessed the introduction of "permissible explosives," and these, too, have been used in increasing quantities, particularly in the bituminous-coal regions. Latest available data show that over 90 per cent of the total output of this type of explosives is used by the coal-mining industry. This industry also ranks first in the total consumption of explosives.

Substances which could be made to produce blasting pressures, like "Greek fire," apparently were known in ancient times, but these explosive mixtures does not appear to have been as favored nor was their composition the same as that of gunpowder. Friar Roger Bacon (1214-1294) is credited with having invented gunpowder, he [illegible] [illegible], however, [illegible] probably used the powder merely to create noise and brilliant flashes. The first use of powder for firearms appears to have been made by Berthold Schwarz in 1313. Martin Weigel (or Weigold) is said to have used powder for mining at Freiburg, Saxony, in 1613, but this statement has been questioned; the honor may belong to Kasper Weindl, who employed it at the Royal mines at Schemnitz, Hungary, in 1627.

High explosives, too, have an ancient lineage. A method of making fulminate of gold is given in a book ascribed to a Fifteenth Century Benedictine monk, Basil Valentine. Some students, however, believe this volume to be the work of Paracelsus, who lived in the Sixteenth Century. Whether Valentine or Paracelsus, the author, therefore, deserves to be titled the father of high explosives. In 1788—more than 150 years after the introduction of gunpowder into the mines—Hausmann treated indigo with nitric acid and so discovered picric acid. Seven years later, Welter made picric acid by subjecting silk to the action of nitric acid. Today this explosive is made by the nitration of phenol. In 1786, Berthollet substituted potassium chlorate for potassium nitrate as the oxygen source in combination with carbon and sulphur. This chlorate of potash was later to form the outstanding constituent in the Sprengel explosives, and today is generally used with fulminate of mercury in the making of electric and other blasting caps. In 1799, E. C. Howard discovered fulminate of mercury. Thus many of the cards in the explosives game had already been dealt before 1800, but no one knew how they were to be played.

The first record of blasting in American coal mines goes back to 1818, when John Flannigan, a rock quarryman, was sent from Milford, Conn., to Plymouth, Pa., to shoot down coal at the Smith Bros. mine. General use of explosives in the mines, however, probably came later. Both the cost of powder and the desire for large coal probably made the pick and wedge the only means employed at many mines until almost the close of the Nineteenth Century.

Cushioned shots and volley shooting—two features regarded as quite modern—date back to relatively early years. Schmidt advocated cushioned blasting in European metal mining in 1882 and also introduced what was known as the "Schmidt plug." In 1830, Moses Shaw patented simultaneous electric shooting, using silver fulminate and gunpowder; the next year, Robert Hare used the Leyden jar to ignite powder. But electric shooting at that time must be re-

garded as largely in the parlor-trick category.

When powder was first used for mining it usually was lighted by igniting one end of a trail, or "train," of similar powder, much like that laid by Guy Fawkes in 1605 when he hoped to blow up the British Houses of Parliament. In other cases, and later more frequently, it was ignited by squibs made of powder inserted in the hollowed centers of nested goose quills, straws or rushes, or in paper or wood tubes. In the modern type of squib, which is short and light, the near end is twisted by the manufacturer into a tight spiral, about 2½ in. long; this is coated with sulphur to form a sulphur "match" which burns without exploding, giving the man who ignites it about 30 seconds to escape to a place of safety. This squib acts like a rocket; the emission of gas drives the squib to the heel of the squib hole, through an opening in the tamping made by the withdrawal of the miner's needle. There the flame of the squib comes in contact with the powder charge. "Gas squibs" have a match coated with a composition that does not inflame but glows as it burns.

workings, learned about the new fuse, and undertook to sell it in the United States. Early in 1857, Joseph Bates and his wife, both expert in the manufacture of fuses, were sent with machinery for that purpose to Simsbury. Bacon, Bickford, Bates & Co. set up a factory in East Weatogue, near Simsbury. When fire destroyed that factory, Bacon left the company, which later was reorganized as the Ensign-Bickford Co., and another factory was built on Hop Brook by the company which is now celebrating the hundredth anniversary of the introduction of safety fuse in the United States. To what extent this fuse was used by coal mines in the early days of the company is not clear. Anthracite output at that time (1857) was only 1,071,151 tons and the total bituminous production was 182,500 tons.

Some time in the early 1830s Braconnot, professor of chemistry, Nancy, France, invented guncotton and nitrostarch, this enlarging the groundwork for nitro-explosives, which are the foundation of the modern high-explosives industry. In 1846, C. F. Schönbein, a German chemist, described the manufacture of guncotton by treating absorbent cotton, as it is done today, with a mixture of nitric acid and sulphuric acid, and Ascanio Sobrero, professor of industrial chemistry, University of Turin, Italy, while investigating the action of nitric acid on various organic substances, discovered nitroglycerin.

A turning point in the explosives industry occurred on May 19, 1857, when Lammot duPont was granted a patent for a gunpowder which he made from 72 parts of nitrate of soda, 12 parts of sulphur and 16 parts of charcoal, all powdered, mixed, granulated and glazed with black lead. Neither the glazing of the powder nor the use of nitrate of soda was new, but the combination of these two was patented and powder now could be made with the less expensive Chile saltpeter (nitrate of soda) instead of Indian saltpeter (nitrate of potassium). Thereafter, the coal-mining industry became an important consumer of black blasting powder.

Plants began to be constructed and taken over by E. I. duPont de Nemours & Co., a firm dating back to 1802; the first of these soda powder plants was built in 1858 on Big Wapwallopen Creek in Luzerne County, Pennsylvania. The product made is known as "E blasting powder." This was followed by a plant at Great Falls, a short distance up the Big Wapwallopen Creek. Five other potassium-nitrate powder mills were taken over in the Southern anthracite field. Others were built at Georgetown, two miles from Wilkes-Barre, Pa., by General Oliver; at Laurel Run, four miles from Wilkes-Barre, by the Luzerne Powder Co.; and at Nay Aug, near Scranton, Pa., by the Mutual Manufacturing Co., later torn down and reestablished at Stairs Junction.

All this points to the rapid growth of the demand for powder for the anthracite mines, which seem not to have been large purchasers before 1857. Many other plants have been constructed since in the anthracite and other regions as their output and need for explosives expanded.

Effective industrial use of high explosives was ushered in in 1859, when Alfred B. Nobel established a small nitroglycerin factory for treating glycerin with a mixture of nitric and sulphuric acids. Nobel from the first regarded the liquid not as medicine nor as an interesting chemical but as an explosive. This nitroglycerin was eight times as powerful as gunpowder, weight for weight, and thirteen times as powerful, volume for volume. In 1867 Nobel took out a patent for dynamite—nitroglycerin absorbed by a natural diatomaceous earth known as kieselguhr, which will retain three times its weight of that explosive—and for fulminate blasting caps. He also patented mixtures of nitrates, coal or other carbonaceous materials such as resin, sugar and starch, using comparatively small quantities of nitroglycerin with these active bases. Later he added paraffin, stearin and naphthaline with nitrates, which latter tended to absorb water and dissolve in it. He relied on the waxes mentioned to keep the nitrates from passing away in solution.

Sprengel explosives, which consist of an oxygenizing substance such as chlorate or perchlorate of potash, nitrates or nitric acid and a combustible substance such as nitronaphthalene, nitroaniline, picric acid, benzol, nitrobenzol, alcohol, ether or oils, were patented in 1871. These were made by mixing the oxidiz-

Sales of Explosives in the United States, 1925-1935[1]

Consumed by	1925 Pounds	1926 Pounds	1927 Pounds	1928 Pounds	1929 Pounds	1930 Pounds	1931 Pounds	1932 Pounds	1933 Pounds	1934 Pounds	1935 Pounds
Coal mining	211,616,811	236,484,618	207,684,766	188,241,485	194,855,999	166,211,592	128,343,769	104,017,805	107,917,468	121,398,036	132,408,129
Metal mining	109,602,301	113,439,237	104,469,220	95,413,474	111,588,377	92,732,820	58,586,248	29,895,558	33,372,374	46,316,847	53,032,152
Quarry and non-metallics	78,350,095	82,676,535	84,827,530	81,125,861	84,441,410	72,661,016	51,641,358	30,843,501	31,883,737	36,627,648	37,372,690
Railway and construction	49,737,899	52,748,215	54,690,196	58,852,124	57,488,805	83,795,827	82,970,910	50,438,981	25,941,830	100,931,796	82,805,575
Other purposes[2]	52,444,740	50,541,573	47,339,416	48,618,145	52,732,569	27,688,243	16,075,618	9,691,455	6,875,615	8,494,785	8,962,474
Grand total	501,751,846	535,890,178	499,011,128	473,251,142	505,708,360	443,090,498	337,564,903	233,887,300	255,987,391	314,767,922	304,581,020

[1]Total sales reported by manufacturers to U. S. Bureau of Mines. [2]Estimated by Institute of Makers of Explosives. [3]Used in agriculture, forestry, ice jams and for other miscellaneous purposes.

ing substance with the combustible immediately before use.

During these years safety fuse has received various coatings, including one of gutta-percha for submarine work. A lead or composition pipe filled with powder and rolled out was designed by a Cornish miner named Carbonis. In 1869, T. P. Shaffner patented a cap for safety fuse containing fulminate of mercury. With a clear sense of the dangers derived from igniting explosives with an open light, the Bickford safety lighter and nippers were devised and patented in 1887 and were designated in the "permitted" list by the British mining authorities in 1904. In 1888, battery blasting caps first came into use.

High explosives, however excellent they might be in hard rock, labored at first under a disadvantage in coal because a minimum of disintegration was desirable. For a while, accordingly, they were not used for the shooting of coal. They were appreciated only when it was realized that when they were exploded in restricted quantity they emitted a flame so short that it would not ignite a methane mixture.

Ammonium nitrate, the outstanding constituent of modern coal-mining explosives, as a powder ingredient dates back to May 31, 1867, when J. V. Ohlsonn and J. H. Norbin, of Sweden, applied for a patent on a powder consisting of 80 per cent ammonium nitrate and 20 per cent charcoal. But they found that, with the weak caps then available, it exploded with difficulty, so they cut the charcoal constituent to 6 per cent and added 14 per cent of nitroglycerin, making ammonium nitrate dynamite. However, a further difficulty was found in that the powder absorbed water, so they kept it in airtight boxes or in bags made air- and water-tight by a rubber varnish. Nobel later bought the Ohlsonn-Norbin patent, added paraffin, stearin and naphthalene, and in 1879 patented his "extra dynamites," which were gelatins containing this salt. Although the nitrate of ammonia dynamites were too prone to get wet and too difficult to explode, they were favored because of their safety, for they were extremely insensitive, yet excellent explosives when properly detonated.

Ammonium Dynamites Arrive

Ammonium dynamites were first manufactured in this country in 1882 by R. S. Penniman and J. C. Schneider at Kenvil, N. J., but were not used for general blasting purposes until ten years later. They had a somewhat favorable reception at that time, for operators were looking for a flameless explosive that would not ignite gas and some were asserting that it should not ignite coal dust, which already was being thought by some to be a hazard in coal mining. However, weak dynamites received even more favorable consideration because they also gave protection against gas-and-dust ignition, were more readily detonable and suffered less from the effects of moisture.

Liquid oxygen, first liquefied by Calletet in 1887, was not combined with carbon to make explosive cartridges until 1899. Although employed in the Simplon tunnel piercing the mountain ranges between Switzerland and Italy and by the Germans in Berlin subway construction, liquid oxygen was little used commercially before the World War. In 1915 the dire need for some explosive that required neither nitrates nor glycerin led the Germans to apply liquid oxygen to the shooting of coal in three coal mines, but today it is recognized that liquid oxygen is unsuited to such underground work. First demonstrated in the United States in 1923 at the Kelly Island Lime & Stone Co.'s quarry, Martinsburg, Va., liquid oxygen was already at that time blasting rock in the Real del Monte y Pachuca Co.'s mine, Pachuca, Mexico. Enos Coal Co. was the first to use liquid oxygen as an explosive in coal stripping near Oakland City, Ind., April 15, 1926, being followed the next year by the Norton Coal Mining Co., Nortonville, Ky., and the Black Servant Coal Co., Elkville, Ill.

Cordeau and Its Forbears

In an endeavor to suit safety fuse to the simultaneous explosion of several charges at a considerable distance, further improvements in such fuse had been attempted. In 1865, J. S. Bickford had patented guncotton fuse, and in 1876 William Leonard, of Boston, Mass., a ribbon of xylonite (celluloid) provided with a friction-match composition at one end. But eventually Louis L'Heure, Rouen, France, invented what he termed a "cordeau détonant," or detonating string, incorporating a lead tube filled with trinitrotoluene (TNT) and drawn out to great length. This was patented in the United States in 1907 and first used in this country at the Atlas Portland Cement Co.'s Northampton (Pa.) quarry in 1913. In the following year a factory for its manufacture was erected at Avon, near Simsbury; it is known in America as Cordeau Bickford.

Unlike safety fuse, the value of which is derived largely from the slow speed with which it acts, cordeau detonates at a speed of 17,000 ft. (over 3 miles) per second. Thus all the charges to which it is connected explode almost at the same instant. However, if there were two rows of holes, and the cordeau were run along and down holes in the front row and then along and down the second row, the charges in the front row would be exploded a few seconds before those in the back row, and the load on the back row would be partly relieved before the charges exploded. Thus the back row of holes would do as good work as the front row. The cordeau is shot into fragments and where it has been laid alongside the charge in a borehole it detonates that charge at all points at the same time, and not from certain foci, as with electric blasting.

Ever since the introduction of explosives, efforts have been made to find some way of reducing the degradation of the product. Early in the century —certainly before 1906—the hydraulic mining cartridge of James Tonge had been devised, with its pistons on one side of the main cylinder and its hand pump. Efforts were made by D. V. Sickman to develop a modification about 1920, and later by R. J. Mayer, about 1930. F. W. Whiteside, in the same year, or earlier, endeavored to bring down coal by a wedge or expanding bar actuated by machinery.

Meantime the manufacturers successfully developed explosives of a mild character using ammonium nitrate, which is slower in action than dynamite, and charcoals made of light material such as ground balsa wood, bagasse pith, ground cornstalks, ground oat hulls, dried beet pulp and ground popcorn. Compression and the corning or graining of gunpowder slow its action as an explosive, because the explosion depends on combustion, and compressed or coarse-grained bodies burn slowly. With explosives that detonate, on the other hand, density makes for speed, and, by decreasing the coarseness and compaction of the ammonium nitrate charge and the density of the charcoal, a mild explosive can be produced that pushes down the coal rather than blows it out. Smaller cartridges also were employed so as to cushion the blow of the explosion, but too small a cartridge may be insensitive, for speed of detonation depends in part on the compression of the charge.

Cushioned Shots Return

Cushioned blasting was revived and proved quite helpful in reducing the violence of shots. Revival of plugs, however, was delayed till 1935, one and a third centuries after their origination. Perhaps with black blasting powder more complete combustion is obtained as well as a milder action when plugs are used, for even with a balanced explosive, having enough oxygen to meet combustion needs, a little excess of oxygen outside the explosive may help to make combustion more complete. With a lowered temperature due to expansion within the hole, the fumes arising from the distillation of the coal around the hole will be reduced, and this condition has been noted with plugged shots, but whether it comes from better combustion of the powder or decreased distillation of coal or from both is not clear.

Black blasting powder put up in cartridges has for many years had a place in European blasting practice. The French type of pellets made by com-

pression alone without the use of paraffin, was introduced into America in 1926. Pellets have many advantages over the old loose blasting powder. The miner no longer has to make his own cartridges; he can now gage his powder with perfect assurance, for all the pellets are of the same weight. Moreover, pellet powder "pulls the end of the hole" better than loose powder. But the chief advantage is greater safety in handling, though such cartridges, of course, are not as safe as permissibles, for they will ignite gas and dust. Pellet powder is sometimes made in cartridges without division into pellets, but the cartridge is so grooved that it can be readily broken at 2-in. intervals by hand pressure.

In 1926 the first trials were made with liquid carbon dioxide in a steel shell containing a heater element—usually potassium chlorate—to create the warmth necessary to convert the dioxide suddenly to a gas. It was first used at a mine of the Harrisburg Coal & Mining Co. in Saline County, Illinois. Shooting by compressed air was first introduced in the latter part of 1931 at the Royalton mines, Royalton, Ill.

In recent years electric squibs have been devised for the shooting of black blasting powder, and, instead of burying the bridge wires in loose fulminate or other explosive, they may be dipped in a flammable composition, which on ignition will burst into flame and ignite the fulminate or fulminate mixture, thus forming what is known as a "matchhead." In general, fulminate is not used alone in blasting caps but mixed with 20 per cent of potassium chlorate, and a booster is provided that may be tetryl or trinitrotoluene.

For extremely wet work gelatin dynamites are used which contain a colloidal solution of nitrocotton in nitroglycerin; this is absorbed by sodium nitrate and wood meal. Being plastic, they can be extruded through a nipple into paraffin shells. No type of explosive gives so little deleterious gas. Blasting gelatin is nitroglycerin gelatinized by the addition of nitrocotton. A little chalk is added to keep the mixture free of acid.

To fire shots at intervals electrically many plans have been devised. One method used on the surface is to have two electric circuits both connected with one blasting machine which has three points of attachment. As the lever of the machine is pushed down, one of the circuits is energized, exploding the shot connected with that circuit. As it is pushed further forward, the other circuit becomes energized and the shots connected with the second circuit are fired. The difference in time is extremely short, but the load on the second shots has been lifted as desired before the second shots are fired. Another—and older—way is by inserting a substance in the cap which burns like a fuse and delays the explosion, the time being dependent on the length of this fuselike material. Some difficulty has arisen from the gas which the delay material emits when burning. This is corrected by arranging for the escape and cooling of the gases or by the choice of a substance that will burn without the formation of gas.

Delay shooting is not recommended for use in coal mines because the delayed shots might emit flame which would ignite the gas and dust liberated by the shots which exploded earlier. For safety all the shots should be fired singly after examination or be simultaneous, and the current should remain on the line as short a time as will permit the ignition and detonation of the charges.

Recent improvements have been to put the blasting cap and the leads to it in a paper cartridge with the leads so folded that they will not snarl on being drawn out. All the explosive manufacturers provide their blasting caps with a short-circuit, or shunt, and stray circuits will not fire them until the shunt has been removed. Pulling off the shunt scrapes the leg wires and leaves them straight and clean for connection to the main leads.

SAFETY MEASURES

+ Prove Worth at Wheeling Mines

Of the Valley Camp Coal Co.

PARALLELING and in fact antedating the modernization measures initiated two years ago at the Wheeling division mines of the Valley Camp Coal Co. (p. 171 of this issue) is a comprehensive program for the elimination of personal injuries. While the ultimate is yet to be reached, in the opinion of operating and compensation officials, results indicate substantial gains from both the humanitarian and dollars-and-cents standpoints. Fatalities and personal injuries have dropped sharply in number, while the money cost of accidents in 1934 in the case of Alexander mine (Table I) declined to only 12 per cent of the 1931 total. The Mobley record in 1934 was nearly equal to that of Alexander, and even in the case of Dartnell mine, where earlier improvements limited the possible magnitude of savings, money costs were cut to 42 per cent. In the announcement of the 1935 honors, the Dartnell mine was awarded a certificate of honor of the Joseph A. Holmes Safety Association, along with the Maiden mine of the company, in northern West Virginia, and the Ward mines, in the Kanawha field.

Reversal of the accident trend at Wheeling division mines took place in 1932. In the preceding year, a compensation department, functioning not only for the various Valley Camp mining companies in Pennsylvania and West Virginia but also for other interests of the company, was established at Wheeling, W. Va., and the full weight of the organization thrown behind a safety campaign. Since that time, the accident loss per $100 of payroll at West Virginia mines has been cut to approximately one-fifth the former figure and the premium rate on com-

Carrying out the safety theme, this indicator board at Dartnell gives a visual record of progress each month

Table I—Five-Year Safety Record at Wheeling Division Mines

	1931	1932	1933	1934	1935
Mobley					
Fatalities	2	1	0	0	0
*Non-fatal injuries	151	62	62	49	34
Production, tons	369,142	239,705	412,584	375,415	366,660
Man-hours of exposure	†	†	†	763,019	652,032
‡Relative cost of accidents	100	37	20	14	
Dartnell					
Fatalities	1	1	0	1	0
*Non-fatal injuries	39	39	34	48	18
Production, tons	120,423	172,790	308,073	373,189	311,395
Man-hours of exposure	†	†	†	655,019	530,065
‡Relative cost of accidents	100	69	23	42	
Alexander					
Fatalities	5	1	1	0	1
*Non-fatal injuries	119	71	75	46	63
Production, tons	380,020	325,855	470,253	423,482	435,855
Man-hours of exposure	†	†	†	653,029	740,650
‡Relative cost of accidents	100	40	41	12	

*Includes all non-fatal injuries for which a medical cost is incurred, whether or not resulting in lost time. †No canvass made. ‡On the basis of 1931 cost as 100.

Table II—Fatal and Non-fatal Injuries, Wheeling Division Mines, by Causes

	Mobley Mine					Dartnell Mine					Alexander Mine				
Fatalities	1931	1932	1933	1934	1935	1931	1932	1933	1934	1935	1931	1932	1933	1934	1935
Fall of roof or stone	..	..	..	..	..	..	1	..	1	..	2	..	1	..	1
Mine cars	1	1	..	..	..	..	..	..	..	..	3	..	..	..	..
Electricity	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fall in shaft	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..
Infection (blood poisoning)	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
Non-fatal injuries*															
Hand tools	6	4	..	..	3	3	..	3	4	2	7	3	8	9	3
Falls of stone, slate, coal	21	18	14	10	8	4	8	5	5	5	30	11	10	6	13
Track	10	..	1	..	2	4	..	..	..	..	10	..	2	..	2
Falling objects	..	2	3	4	3	..	..	..	..	..	..	..	1	..	..
Flying particles	..	2	..	..	..	..	9	4	9	..	..	4	8	2	4
Cable	..	2	..	..	..	..	..	1	1	..	..	1	1	..	..
Tripped, fell	..	4	..	..	..	..	3	2	2	..	..	4	4	4	..
Locomotives	11	2	7	2	1	3	3	..	2	..	5	2	1	2	5
Trolley pole	..	..	..	..	..	..	1	..	1	..	..	2	2	..	..
Mine cars	35	16	18	14	1	6	6	7	5	3	41	12	14	5	6
Animals	..	..	..	..	..	..	..	..	..	..	..	2	2	3	5
Electricity	10	2	2	1	..	2	..	..	..	..	4	..	..	..	..
Mining machines	7	4	4	2	5	3	4	2	2	2	2	2	2	1	2
Explosives	5	..	1	1	..	1	..	..	..	..	1	..	..	..	..
Handling stone, slate, coal, etc	33	4	5	13	6	7	3	7	10	6	17	19	15	9	11
Posts and supports	6	..	..	..	3	2	..	..	..	..	5	..	..	5	7
Shaft and slope	1	..	2	..	1	1	..	..	..	..	1	3	..	..	3
Tipple	1	..	1	..	1	1	..	1	..	..					
Railroad cars	..	..	..	2	..	..	..	..	6	..	..	..	..	..	1
Lamp fluid	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1
Other causes	5	2	4	..	..	2	2	2	1	..	1	6	4	..	..
Total non-fatals	151	62	62	49	34	39	39	34	48	18	124	71	75	46	63
Total fatalities	2	1	..	..	..	1	1	..	1	..	5	1	1	..	1
All injuries and fatalities	153	63	62	49	34	40	40	34	49	18	129	72	76	46	64

*Includes all non-fatal injuries for which a medical cost is incurred, whether or not resulting in lost time.

Table III—Fatal and Non-Fatal Injuries, Wheeling Division Mines, by Parts of the Body Affected

	Mobley Mine					Dartnell Mine					Alexander Mine				
Fatalities	1931	1932	1933	1934	1935*	1931	1932	1933	1934	1935*	1931	1932	1933	1934	1935*
Head	1	..	..	..	..	..	..	..	..	..	2	..	..	..	..
Internal injuries	..	1	..	..	..	1	..	..	1	..	..	..	..	..	1
Elbow	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
Pelvis	..	..	..	..	..	..	..	..	..	..	2	..	1	..	..
Chest and pelvis	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..
Thigh and leg	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
Electrocution	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Non-fatal injuries†															
Head	12	6	3	3	1	2	1	1	2	..	11	6	9	5	2
Eye	18	5	10	11	11	6	10	3	10	7	7	6	11	2	22
Shoulder	5	..	1	1	..	2	2	2	2	..	6	3	2	1	..
Arm	..	3	4	1	..	..	1	4	1	..	..	1	4	..	3
Wrist, hand, fingers	40	18	18	10	7	13	8	11	8	5	25	15	18	12	6
Spine, back	6	2	2	3	1	3	1	5	3	..	23	9	5	3	3
Ribs, chest	10	3	2	3	..	..	3	..	4	..					
Pelvis	5	2	1	3	..	2	1	1	2	1	5	1	2	1	..
Rupture	5	..	..	..	1	..	1	1	1	..	9	8	7	3	2
Hip and thigh	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..
Knee and leg	22	5	8	3	1	6	2	2	7	2	13	6	10	5	5
Ankle, foot, toes	28	18	13	11	3	5	9	4	8	1	25	15	7	13	4
Total non-fatal injuries	151	62	62	49	25*	39	39	34	48	16*	124	71	75	46	47*
Total fatalities	2	1	..	..	..	1	1	..	1	..	5	1	1	..	1
All injuries and fatalities	153	63	62	49	25*	40	40	34	49	16*	129	72	76	46	48*

*July to August inclusive. †Includes all non-fatal injuries for which a medical cost is incurred, whether or not resulting in lost time.

pensation has dropped from the maximum to the minimum.

Conduct of the safety program is primarily the responsibility of the operating department in the Wheeling division, which consists of the Dartnell and Mobley mines, Elm Grove Mining Co. of West Virginia, Elm Grove, W. Va., and the Alexander mine, Glendale Gas Coal Co., Moundsville, W. Va. The compensation department directs its efforts largely to care of the injured, to compensation matters and to origination of suggestions and recommendations for the attention of the operating department. This department also makes an independent check on safety progress through the medium of a safety inspector who regularly inspects mines and surface plants and checks compliance with working rules and regulations. Recommendations for improvements are a part of the report of the safety inspector, and in addition engineering crews are expected to file reports on unsafe conditions observed, together with recommendations for improvements. All this is, of course, in addition to the activities of the operating personnel, on which the primary responsibility for carrying on the safety work rests.

Care and Rehabilitation

While promotion of safe operation is one of the functions of the compensation department, its primary task is seeing that injured employees receive immediately the best of medical attention and that such attention is rendered as long as necessary, but no longer—an important point in keeping down cost of injuries. Scarcely less important is rehabilitation, which includes, as necessary or the case may be, temporary employment at light work as a means to full recovery, recommendations for a change in duties if warranted by disability or the past record of the injured employee, etc. A third task is conduct of compensation cases before boards and commissions to protect the company against unwarranted awards or penalties.

As a means of keeping all parties in touch with the results of safety work, monthly meetings of foremen and supervisors, operating officials, the safety inspector and the director of compensation or other representative of that department are held, at which accidents are analyzed and methods of preventing repetitions adopted. In addition to their individual efforts, employees function in a substantially similar manner through Joseph A. Holmes Safety Association chapters at each mine, which hold monthly meetings on injuries and their prevention.

Discipline for violations of safety regulations revolves around the use of a penalty book at each mine. Foremen are furnished with violation blanks, and

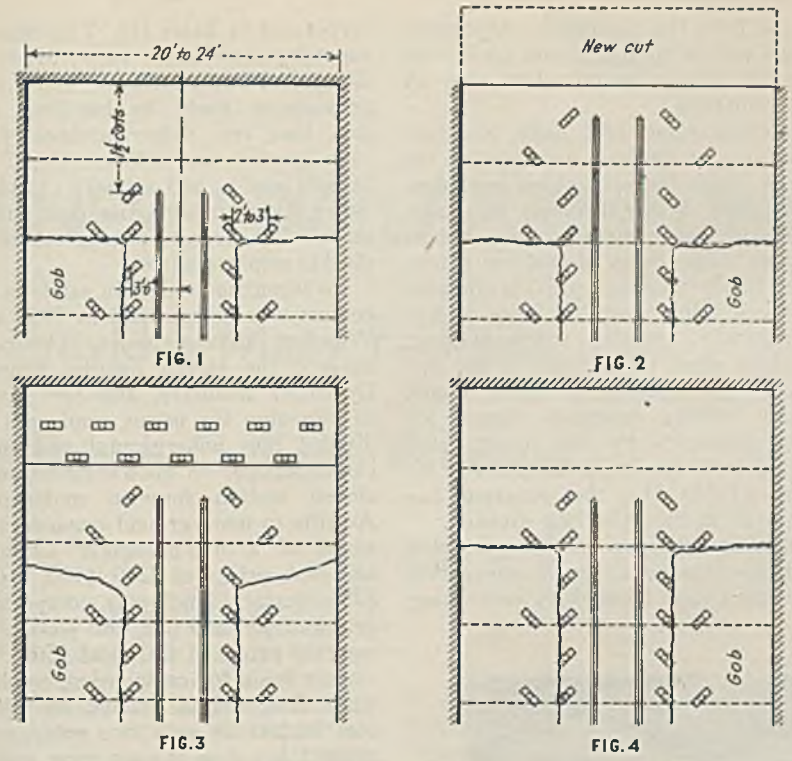


FIG. 1 FIG. 2

FIG. 3 FIG. 4

Systematic timbering is relied on to prevent injuries from falls of roof at Wheeling division mines

Fig. 1—Room cleaned up ready to cut. Roof has been made safe. Fig. 2—Room after cutting and before shooting. Four permanent posts are set as shown. Fig. 3—Method of posting stone when tight; if loose, it must be taken down. Two rows of posts 4 ft. apart (posts on not over 4-ft. centers) are set as shown until loading is completed, whereupon the stone is taken down. More posts are set, if required. Fig. 4—Room cleaned up and ready for cutting. Two additional road posts have been set. Road posts are 1½ cuts back from the face; gob and gob posts, two cuts. Cap pieces at least 3 ft. long, 3 in. thick and the width of the prop must be used with all posts. Wedges must be driven between post and cap piece, and all posts must be set tight. All overhanging slate in corners must be taken down and the rib squared up. Drilling holes into the top is forbidden.

when an employee is observed breaking the mine law or flouting company regulations, a record is made on a penalty blank and later recorded in the penalty book, which is open to all interested parties for inspection. Penalties are left to the discretion of the foremen, and may vary from one day to two weeks or dismissal, depending upon the seriousness of the offense. To insure complete understanding and observance of the special rules established by the company as a supplement to the mine law, and thus prevent controversy and working at cross purposes, these rules are compiled in the form of a manual ("Safety Rules and Practices") and distributed to every employee. As evidence that the rules will be studied and observed, the signature of each employee, with witness, is obtained on a receipt included in the pamphlet.

Befitting its importance, Rule 1 in the manual's general list is: "Report immediately to the foreman in charge all injuries regardless of how slight they may be." To make this rule really effective, every motorman, brakeman and foreman is required to have first-aid instruction, and each mine locomotive is equipped with an approved first-aid kit. This kit is checked in and out of the lamphouse each day, and the motorman is made responsible for its proper care.

Equipment and properties in good mechanical and physical condition—one of the foundations of any safety program—has been assured at Wheeling division mines by the modernization program inaugurated two years ago (p. 171). Guards are required on all stationary machinery and must be maintained in working condition. As a corollary to this rule, loose clothing which might be caught in moving machinery or parts is prohibited. All frogs and switches are blocked; insulated platforms are installed at all starters and trolley guards at all crossings; headlights and gongs in working condition are required on all locomotives; inclosed switches and starters are installed at all hazardous locations; and car stops, furnished by the company, are used by all loaders. Maintenance of haulageways, manways, working places and surface plants in the cleanest possible condition is constantly stressed, and the rules call for the storage of materials and supplies in an orderly fashion in places where they will not endanger men or equipment.

Closed lights (Edison, Model K) are used exclusively, and the mines are rock-dusted regularly with limestone dust. Dusting is carried into the room necks. When a room entry is driven up, a dusting machine is sent in and dusts not only the entry but also the room necks, which have been turned in anticipation of later operation. By the start of each new year the entire mine is freshly rock-dusted and all rock-dusting is inspected periodically and such work as may be necessary for a safely dusted mine is done.

Sand-filled dummies are standard for tamping shotholes, and all holes are fired electrically. Explosives and detonators are kept separate, regulations requiring that each be stored by itself in holes cut 10 ft. apart in the rib on the

Safety at the face is assured by care in timbering and blocking the coal and the use of car stops, safety headgear and shoes, and goggles

side farthest away from the track. In case of misfires, the foreman must be notified and is required to supervise personally the drilling and shooting of a new hole at least 2 ft. away from the unexploded hole.

With a very bad roof to contend with, Mobley, Dartnell and Alexander mines have been able to show a substantial decrease in injuries and fatalities from falls of roof material or coal (Table II). Credit for this advance goes to a systematic plan of timbering, coupled with unremitting pressure for care in dealing with the roof conditions encountered and the use of safety headgear. The timbering plan (Fig. 1) provides for the minimum of timbering consonant with safe operation. If, in the opinion of the foreman or the miner, conditions warrant additional posts, it is expected that they will be set without hesitation.

An even more striking improvement has been made in the injury record growing out of transportation and transportation equipment in general, and mine cars in particular, as a result of pressure on both miners and transportation and other day men. Care in blocking cars at the face and in boarding, riding or leaving man-trips is stressed continuously. Turning the pole while the locomotive is in motion; jumping on or off moving trips to throw switches; operating trips large enough or at such speed as to make loss of control or danger of injury a possibility; guiding sand onto the rail by hand while the trip is in motion and coupling or uncoupling cars from the inside of a curve or while standing on the bumper or inside the rail are forbidden. Brakemen are required to ride inside a car on empty trips and on the rear bumper on loaded trips. Gathering locomotives are not permitted to enter another section or go out on the main line without permission from the dispatcher. Absolutely no one except the locomotive crew—not even officials—is permitted to ride on the locomotives.

Handling stone, coal, slate, etc., furnishes one of the best measures of the way in which the safety idea has taken hold. Here it is difficult to lay down rules—although miners are required to examine large pieces of coal for cracks before lifting them—or provide effective guards or other means of more or less automatically insuring safety without conscious effort on the part of the employee. Consequently, progress almost directly reflects increased regard for safety principles by the miner, and, judging from results in this class of injuries (Table II), the program has gone over in the Wheeling division.

Protective clothing has been accepted as an essential factor in the prevention of injuries, and regulations concerning its use are included in the general rules, as follows:

"Rule 13—Goggles MUST be worn by ALL employees when spiking, cutting rails, picking, drilling, using lathe, emery wheel, cutting chisels or acetylene torch.

"Rule 14—All employees working in and around the mine shall be required to wear the approved safety hat. No visitor, inspector or any other person shall enter the mine without wearing the approved safety hat.

"Rule 15—All employees working in and around the mine shall wear approved safety shoes.

"Rule 16—All employees working in and around the mine shall wear approved safety goggles when using hand tools, except when in the act of shoveling coal or drilling holes." (This rule applies specifically to miners.)

Results of the protective-clothing program are reflected in the statistics incorporated in Table III. This table also supports, in different form, the conclusions cited in the reference above to improvements made in handling stone, coal, slate, etc. Safety headgear (MSA "Skullgards" and "Comfo-Caps," and "Cool-Caps") and shoes (Craddock-Terry) are sold at cost plus shipping charges. Screen-type goggles are supplied to employees free.

To stimulate interest in safety, a prize contest was inaugurated in 1935 at the Wheeling division mines. The contest covered the eleven months February-December inclusive, and for purposes of awarding the prizes employees were divided into underground and surface classifications. A third classification included section foremen underground. Awards to underground employees consisted of a five-passenger automobile and cash prizes of $200, $100, $50 and $25. Surface employees competed for prizes of $50 and $25, and section foremen for prizes of $100 and $50.

As a basis for competition, employees were divided into groups, as follows: coal loaders on each face entry, underground day men at each mine and outside employees at each mine. To take care of transfers, however, only employees working in a particular group on the last day of the contest period were permitted to compete for any prizes for which the group might be eligible. If a group in the underground classification had suffered no lost-time injuries, by which is meant injuries preventing a return to work on the next working day, each employee in that group who had not sustained a lost-time injury received a ticket enabling him to compete in the drawing for underground prizes. A separate drawing was held for surface employees who had not had a lost-time accident.

Only underground employees working the full eleven months with a group were eligible to draw for the automobile. Tickets held by other employees with a shorter record, if drawn first, were returned to the box, as these employees still were eligible for the cash prizes. Upon the award of the automobile, all other employees in that particular group were eliminated from competition for the four cash prizes, which otherwise were awarded as drawn, except that where an employee had worked less than eleven months with a particular group he received only the proportional amount of the prize in question, the remainder going to make up additional $25 prizes. Section foremen in charge of the groups winning the automobile and the $200 cash prize were awarded the two foremen's prizes, except that in case more than one foreman had been in charge of the section, the prize was divided among them in proportion to time served. The plan is being continued in substantially the same form this year, except that prizes are now awarded each month.

Safety in working places is assured by systematic timbering, car stops at the end of the room track and careful operation

MINERS' WELFARE FUND

+ Provides Many Facilities

For British Colliery Workers

Bathgate swimming pool in Lanarkshire

By R. DAWSON HALL
Engineering Editor, Coal Age

MANY COMFORTS and benefits have resulted from the operations of the Miners' Welfare Fund of Great Britain, which is financed by taxation on coal production and royalties. Of the $71,499,002 allocations approved up to Jan. 31, 1936, according to an interim report of the Mines Department, 35.05 per cent has been spent on recreation, 23.11 on health, 8.02 on education, 6.07 on research, 24.95 on mine welfare and 2.79 per cent on administrative expenses. Allocations for the bathhouse program outlined in the preceding issue (April, 1936, p. 145) are included in the allotment for mine welfare.

In planning recreation, consideration is given to three classes of persons: children under ten years, young people and adults. For the first groups playgrounds are provided. It was the opinion of the late Viscount Chelmsford, chairman of the fund for its first 10½ years, that for every 300 children an acre of ground should be provided, and that if the ground was not level, that fact was in its favor, as it could be made more attractive.

Moreover, the playground should contain a shelter to which the children could repair in case of sudden rain, with a lavatory, and a fountain, without, of course, the unsanitary cups and chains of earlier years. Sometimes these fountains are made of more than one height so as to accommodate children of different ages. A pond and a sand pit, he thought, are desirable if they can be provided with clumps of bushes to add beauty, to hide apparatus and create mystery. He also suggested a smuggler's cave. A somewhat plainer playground than that described could be provided for $5 per child.

Viscount Chelmsford declared that to spend $20,000 to $25,000 on a four-acre plot for 22 persons to play cricket or football, perhaps once a week, gave much less benefit for the money expended than a much smaller fund providing amusement for children. In fact, it was his feeling that altogether too much money was cheerfully devoted to "specialists," as he termed them, who made a contest out of what should be a sport. In the arrangement of these recreation grounds, the various pieces of equipment are not grouped but set apart, usually in grass plots.

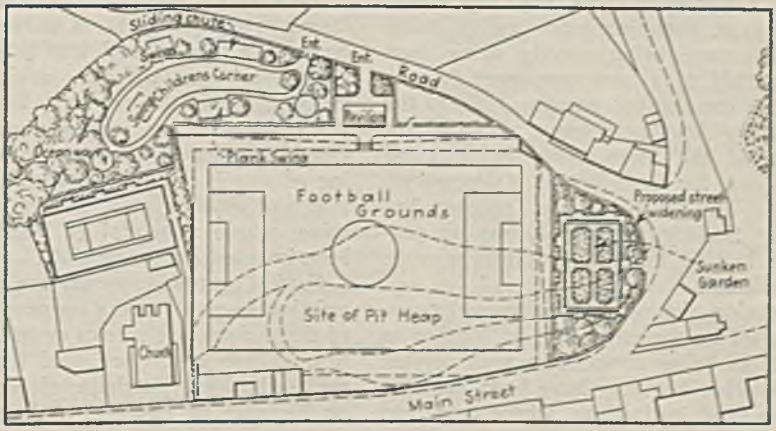
Shelters built by the British Fund usually have brick walls and tile roofs, much like the shelters in the parks of our larger cities, but usually without expensive trimmings. In some instances these are enlarged to serve as pavilions so as also to accommodate old folk. Some have a ladies' room with lavatories, a large central room for refreshments and a changing room with lavatories for men going and returning from tennis courts and the bowling green. As a rule they are protected by a "surround," a fence or wall to keep out older boys and girls. Many are under the care of an old-age pensioner, chosen for his patience and cheerfulness.

Recreation grounds for young people between 10 and 16 years of age give opportunity for football, hockey, cricket, basketball and a large number of games too numerous to mention. That such facilities are greatly appreciated is evidenced by the fact that at Lydbrook, in the Forest of Dean, a 100-year old dump containing 32,000 tons of refuse rock, covering 1¼ acres, was removed by voluntary labor of young and old in order to clear the way for a playground. To this area, two acres of unoccupied land has been added.

With such recreation grounds, the tendency has been to established a building that approaches an "institute," with reading room and library, a room for parlor games, rooms for committee meetings and evening classes, a swimming pool, floored over in winter to form a gymnasium, theater or hall; a room for billiards or bagatelle, and a buffet for light refreshments, even workshops and hobby rooms with carpentering, cobbling and basket making for boys and dressmaking, laundry work and cooking for girls. Dances, lectures, plays, exhibitions and sales of the product of the workshops and hobby rooms are opportunities such places offer.

Such provision has been made on the

Plan of Lydbrook Recreation Ground, Forest of Dean, England



Ocean Colliery Co.'s property at Treharris, Ton Pentre and Nantymoel, South Wales, the first two for boys only and the last for both sexes. That company also has a seaside camp at St. Athans that will accommodate 120 young people from the coal field at one time and can thus provide over 2,000 annually with a week's holiday at the seaside. This camp cost about $100,000 to erect and requires some $10,000 per annum for administration and maintenance. It is strongly supported by the district welfare committee. Such projects closely parallel, it would seem, the work of the Y.M.C.A.'s in this country.

Adult recreation is not overlooked. Places for games such as croquet, fiveten, teniquoit, lawn skittles, clock golf, etc.; grounds for hockey, lacrosse, football and cricket; stands for spectators, band stands, places for outside dancing, kitchen and flower gardens with seats take care of the active and those of declining years. Some of the recreation grounds have pavilions and clubhouses with lockers and are so broadly planned they tend also to combine their main functions with those of the "institute."

Ashington Mining School, Ashington, Northumberland, England

Several "institutes," halls and covered swimming pools have been erected of various sizes and designs. The Llay Institute of North Wales is one of the largest of these, costing $131,396, of which $77,864 was for construction and $8,273 for furnishing and equipment. However, such institutes are of many types, some being merely army huts converted to a new purpose. Among grants for unusual purposes, one to the Sirhowy Angling Society, about 90 per cent of the membership being mine workers, for a shelter at Ysbugorwyn, Wales, and another to the Tredegar Angling Society for a fish trap to prevent loss of fish during floods may be mentioned.

Motion-picture installations were condemned by the committee of inquiry in 1931 as being competitive with private enterprise, but they have been made in some fund institutions, where they help to pay for upkeep and increase interest. The liquor question arises as regards canteens, but the fund views it as a local issue and is disposed to leave it to the discretion of the local committees. In South Wales, shops, offices, banks, etc., have rented space, the rent paying some maintenance expense, but this also involves construction expenditures by the fund that the committee of inquiry believes are unwarranted.

Under health provisions are included ambulance services, nursing, hospitals and convalescent projects. The first usually provide a motor ambulance, often with a garage and accommodation for the driver. Allocations have been made also to provide motor tricycles for the transportation of invalids. Funds have been granted to provide first-aid equipment and ambulance classes and to purchase shields and challenge cups for first-aid competitions. The facilities are managed by a local welfare committee and serve the miners of one colliery or of a group of adjacent collieries, but sometimes the needs of a whole district are covered, as in South Derbyshire, by a single organization or, as in South Wales, where grants are made to the St. John Ambulance Association, which deals with the whole area. These grants are arranged, however, so as not to relieve the coal companies from their legal obligation under the Coal Mines Acts.

Nursing facilities provide accommodation or equipment for a nurse or the investment of a capital sum to provide income to maintain the service. In many instances, houses have been provided to serve as nurses' residences. One of the largest endowments for nursing service is one that serves the Rothwell and Stanley area, in West Yorkshire, where a capital of $82,732 has been invested for the purpose.

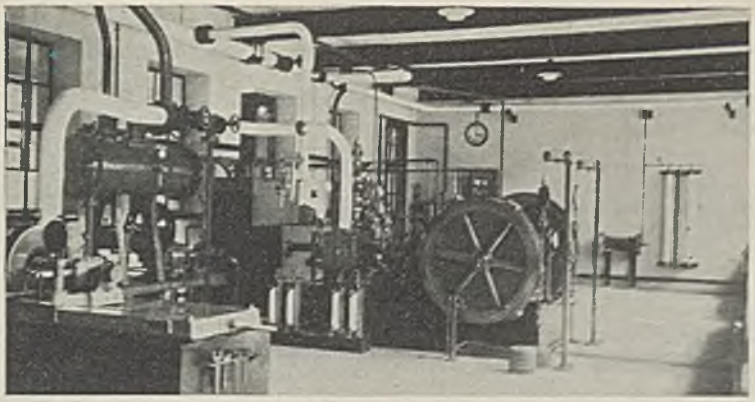
Capital grants frequently are made to existing hospitals where the greater part of the patients are miners or their families. These grants are used for structural additions, purchase of equipment or increase of endowment funds, particularly for endowing beds on which district or local committees will have some claim should cases requiring special attention come under their notice. But some cottage hospitals have been provided for the sole use of miners and their families, as at the Holmside and South Moor area, in Durham, where a building was erected at a cost of about $150,000 to accommodate 26 patients, and as at Treherbert, South Wales, where $34,067 was provided for a hospital to care for 12 patients. A grant has been made in the South Derbyshire district to supply spectacles for miners suffering from nystagmus or from the after-effects of accidents and for miners' children.

Higher Education Aided

No provision from the Miners' Welfare Fund has been made for elementary instruction, because this is regarded as an obligation of the local authorities, but much has been done to promote senior, advanced and university instruction for miners and their families. Grants have been made to schools of mines and colleges, notably the Treforest School of Mines in Glamorganshire, Durham, Birmingham, Sheffield, Leeds, Edinburgh and Glasgow universities and Nottingham University College. Large grants have been made to the Mining and Technical College at Wigan, Lancashire, England; toward providing and equipping the new Technical School at Coatbridge, Lanarkshire, Scotland; to the senior centers at Bishop Auckland, Blaydon and Houghton-le-Spring in Durham; and to similar schools at West Stanley, Horden and Durham, Durham, England.

Owners of mines have objected to money being expended for non-vocational education, holding that all the taxes collected from the mine output should be devoted to strictly mine uses. On the other hand, the majority report of the Departmental Committee of Inquiry declared that in the face of the fact that there were many idle miners who put a burden on the localities in which the mines were located, and as this burden fell largely on the industry, it would benefit much by anything that would induce some of the mining population to seek work in other forms of employment, and non-vocational training would promote such a shift to more active fields.

As here, so also in Great Britain, miners are asking more pay per stint or per day to compensate for irregular or shortened time, hence it would seem desirable to adopt measures that would cause at least the younger men to look elsewhere for work, though not enough to make the labor force inadequate. The committee of inquiry also urged that a broader view of life induced by non-vocational study would make better miners. Whether an overmanned industry like coal mining should bear all



Steam Engineering Laboratory, Lee College, Coatbridge, Lanarkshire, Scotland

the expense of training men for industries for which they leave or may leave the mine aroused question, and it seemed to the committee that if men were trained in agriculture, their training might at least in part be a charge on that industry.

In consequence of the belief that the purpose of the legislation was to assist the mine worker, whether in or out of the industry, a very limited number of grants have been made from the fund to give the children of miners, who show exceptional ability, the opportunity of cultivating that ability and making use of it in careers that would otherwise be unattainable. With this in mind, the Miners' Welfare Scholarship Scheme was established in 1926, with an endowment later increased to $847,049, to provide annually a number of scholarships for university-degree courses to miners or their children, which in practice have varied from eleven to nineteen.

The character of the appointees for honor degree university courses could be made plain only by recording their past records at tedious length, but the first appointee in the table, E. Jones, had attended evening classes in mining from 1926-1933 and had passed the London matriculation examination in 1933. Evening classes at St. Helens Municipal Technical School, 1923-1934, a first class manager's certificate in 1931, and matriculation at the Northern Universities examination in 1933 were qualifications of P. Pimblett, the second name on the list. It is well known that these examinations testify to a higher degree of scholarship than will serve to admit students to an American university or will permit a mining man to become foreman of a mine in this country. Income from the endowment fund in 1934 amounted to about $40,000 and approximately 97 per cent was disbursed in scholarships.

But other scholarships are provided, now also financed entirely from the General Fund, which is handled by the main committee as its own without reference to the district committees. This fund provided 24 grants in 1934 of an aggregate value of $4,842. For these additional grants the sum of $121,663 has been laid aside as an endowment providing an income of about $4,258. These scholarships are given to persons showing a lower degree of proficiency than have those who received the scholarships already described. Sometimes the grant enables the student to take a university-degree course, but often it is for much less advanced work and not infrequently it is training for a particular occupation, though seldom mining. In 1934, grants totaled $108,620 and the students 430, so the average amount of each grant was $252.60. Of these, students of mining numbered only 34 and received in all $10,010.

An endowment grant of $364,997 has been made for part-time education which probably will provide only one day's study a week. It is hoped from this endowment to provide 30 scholarships a year of an average value of $100, which should suffice to cover fees, books, instruments and traveling expenses and perhaps some compensation for loss of wages.

Non-vocational lectures were instituted by several of the districts out of the district funds of the Miners' Welfare Fund, but endowment for these now has been provided. Safety instruction has also been afforded out of the Welfare Fund, and this is supplemented by instruction given by the Safety in Mines Research Board, this expenditure being met by that board with funds which mainly are also derived from the Miners' Welfare Fund.

Grants have been made to this board for researches into matters affecting safety and health of mine workers and for the dissemination of facts linking research with mining practice. In 1934, $54,792 was granted for the study of roof falls, $16,546 to study of haulage accidents, $40,484 for research on explosions of coal dust and firedamp, $26,702 for explosives research, $13,388 for wire-rope research, $10,755 for health research, $10,414 for electrical research, $9,986 for spontaneous-combustion research and $15,354 for safety instruction.

Up to Dec. 31, 1934, $262,610 had been expended for the construction of homes for aged miners, some for endowment and some for the building of four cottages at Stanley, West Yorkshire, England. A grant of $1,338 was made to supply drinking water in a coal mine, Baggeridge colliery, South Staffordshire, England, through 11,808 ft. of 1-in. roadway piping, and 2,100 ft. of shaft piping. A 500-gal. tank with water continuously overflowing and thus kept fresh is connected to the shaft pipes with a reducing valve lowering the pressure from 750 to 60 lb. per square inch in a single stage at the foot of the shaft. To this grant the company added a contribution of $487. This same company also received a grant of $3,017 to construct a covered way from the bathhouse to the shaft, adding thereto $1,460 of its funds to complete the construction. The illumination in this covered way was so arranged as to enable the miners to adjust their vision to the full light of day, hoping that thereby the nystagmus which afflicted many of the men of that colliery would be ameliorated.

Candidates Awarded Scholarships in 1934*

Name	Age	Employment	Course to Be Taken	Educational Body
Workers In or About Mines				
E. Jones	22	Miner	Economics	Aberystwyth U.C.
P. Pimblett	27	Foreman	Mining	Sheffield U.
J. Rowbottom	28	Pipefitter	Economics	U. C. of South Wales and Monmouthshire
D. Russell	25	Repairer	Philosophy	U. C. London
F. Sargeant	24	Surface engine attendant	Electrical Engineering	City & Guilds C. (London)
W. Staton	23	Assistant surveyor	Mining	Durham U.
A. Thomas	25	Surface laborer	Arts	Cardiff U. C.
Children of Mine Workers				
M. Bailey	20	D. of surface worker	History	Kings Co. (London)
J. Bauld	20	S. of foreman	Chemistry	St. Andrews U.
H. Blissett	21	S. of surface worker	Geography	Sheffield U.
L. Bowen	19	S. of pump attendant	Geography	Manchester U.
R. Evans	23	S. of hoisting engineer	Medicine	London U.
J. Gronow	22	S. of underground haulageman	German and Philosophy	Aberystwyth U.C.
J. Mesham	22	S. of miner	History	U. C. London
I. Taviner	18	D. of surface worker	Mathematics	Royal Holloway C. London U.

U = University, C = College, D = daughter, S = son.
*These were chosen out of 692 candidates.

NOTES
From Across the Sea

GEOPHYSICAL exploration for mine water from points above ground have been made in South Wales by A. H. Cox, D. A. B. Davies and T. G. Williams, according to a report made by them to the (British) Department of Scientific and Industrial Research. In many parts of England and Wales trouble has arisen from incursions of water, and if such water could be located geophysically, greater safety would be assured, though usually the presence of water is known; all that is not known is where narrow workings or crevices are located that may be found to lead to the main pool.

This geophysical study was made in a field where something was known as to the presence of water. That part of the seam to the rise had been mined with rooms which were still standing and dry. Below these workings was a large coal pillar to prevent the water of the higher part of the mine from traveling down the pitch to the rooms below; below this were room workings full of water, and beyond these again were longwall operations from which water was more or less excluded by top caving and bottom heaving.

Tests were made by a.c. potential-ratio (ratiometer) and megger earth-resistivity methods. To a depth of 100 ft. the earth-resistivity methods gave fairly reliable indications, locating accurately the positions at which changes in the nature of the strata occurred, defining especially the junctions between drift and solid rock. But the correctness of the deductions drawn from such determinations necessarily depended somewhat on the relative uniformity of the superficial deposits and on the homogeneity of the outcropping strata. Steeply inclined measures and variable surface deposits introduced complications. Shale and sandstone outcrops could be ascertained with precision by electric traverse methods, but these differences interfered with determinations of the presence of water.

With the a.c. potential-ratio method the current penetration was great enough theoretically to reach down to the water-logged workings, but in nearly all the experiments the effects recorded by the ratiometer were indicated by the megger also, although its electrodes were so spaced that this current could not penetrate down to the water. The megger presumably was recording variations in the resistivity of the surface deposits and of strata down to a shallow depth. Consequently, it would appear that the ratiometer also, in the main, was recording resistivity variations in surface deposits and outcropping strata.

It would seem, therefore, that where there is a thin cover of drifted material or where the thickness of that cover is uniform, where conditions in general are regular and the measures nearly level, water or other seam changes might be detected satisfactorily. The authors lay stress on the importance of the absence of rails, steeply pitching measures and outcrops on drift. Thickening of sandstone also seems likely, to my mind, to create additional difficulties.

The authors, however, suggest that the attempt to ascertain how this method can be adapted to the finding of waterlogged workings should be renewed and urged that a method be devised of integrating the results given by a deep-current penetration method with those given by an instrument designed to give a shallow penetration only, so that a quantitative allowance could be made for effects which arise from shallow conditions only.

A MODIFICATION of Cardox and Airdox recently developed in Great Britain uses the shell designed for liquid carbon dioxide but replaces that liquefied gas with an explosive. In place of the heater also is used an igniter. The explosive powder is made by milling together, declared J. Hancock, addressing the Manchester Geological and Mining Society, of sodium nitrate and ammonium chloride, giving as end products roughly 47 per cent by weight of common salt, 30 per cent of water vapor and 23 per cent of nitrogen. If this is always so, the escaping products must be harmless. Of the products mentioned, two, salt and water vapor, suppress flame; all the products are non-toxic and none of them has an objectionable taste. The full pressure in the tube after the powder has exploded is 12 tons per square inch, though it is less on the walls of the borehole. According to Mr. Hancock, Hydrox is somewhat sharper in action than Cardox. It appears, he says, to do more work at the back of the hole and therefore it is not necessary to drill the hole as deep as with that blasting agent. The claim is made that at a Lancashire colliery the following results were obtained as compared with another explosive:

	Former Explosive Per Cent	Hydrox Per Cent	Difference Per Cent
+ 3-in. lump	41.27	46.40	+5.13
2x3-in. nut	9.67	8.30	—1.37
2x1¼-in. gas	6.65	5.30	—1.35
1¼x⅛-in. slack	29.20	26.75	—2.45
⅛x0-in. dust	9.84	9.20	—0.64
Pickings (inferior coal)	0.85	0.85	———
Pickings (slack out of nut washer)	0.85	0.60	—0.25
Dirt	1.65	2.75	.....

Incidentally it may be added that Hydrox steel-tube cartridges have been approved "for blasting in all mines to which the British Coal Mines Act, 1911, applies and in all circumstances in which permitted explosives are required to be used by the Explosives in Coal Mines Order, 1934." Under the rules established for their use, cartridges must be charged and primed in suitable building or buildings on the surface into which no matches, smoking materials or flammable material may be allowed to enter. They must not be carried into the mines in excess of daily needs, but an exception is made to the general requirement that cartridges unused at the end of a shift be brought out of the mine. They may be stored in a safe place accessible only to shotfirers or authorized persons. Stemming is required unless the cartridge protrudes from the shothole, and in every case a wood prop, sprag or other suitable obstruction must be used to prevent the ejection of the shell by the force of the explosion. Should the shot fail, no one may enter the face for at least 10 minutes thereafter.

BY SHEATHING or jacketing, said Mr. Hancock, the quantity of a "permitted" explosive can be tripled without igniting gas or coal dust. Sheathing has little effect on the power, sensitiveness, storageability or velocity of detonation of an explosive. Most of the permitted explosives are best clad in a coat of sodium carbonate, but, for some explosives, other sheathing materials such as borax would be better.

Sodium salts in the sheathing, said Mr. Hancock, so fill the return air from the shot that a lemon-yellow cap will form in place of, and of the same size as, the normal blue cap, but this is quite easily distinguished from the yellow flame obtained when the wick is turned up for purposes of illumination. In fact, the test can be made more readily because of the clearer definition of the lemon-yellow cap.

STINKS inserted into compressed-air lines have been used in metal mines in the United States to warn workers of a mine fire and to notify them to travel toward the shaft or to safety chambers. Coal mines in this country apparently have not so far adopted this method of warning miners, though metal mines have been active in this regard. At the Nundydroog mine, says the *Colliery Guardian*, an alarm of fire is conveyed to the workers underground by inserting eucalyptus oil in the compressed air mains. This oil not only travels in the pipes but on reaching the atmosphere of the mine is carried wherever the air current travels. Refuge chambers, with doors and compressed-air-pipe outlets, a central rescue station and gas masks also are provided.

WHETHER the use of explosives can be ruled out entirely by the introduction of compressed-air picks aroused a lively discussion at meetings of the Scottish Branch of the National Association of Colliery Managers. Stringent regulations in regard to shooting have lowered the number of shotholes that can be drilled, loaded and fired per shift. Exhaustive trials, asserted A. V. Reis, had been made by the Fife Coal Co. in the use of pneumatic picks, but the coal was so woody in texture that they were abandoned as impracticable. Character of cleat and other lines of fracture were important in determining where the pneumatic pick was a desirable tool for breaking down coal.

In hard seams, declared R. A. Westwater, use of pneumatic picks reduced the production per man and increased the percentage of small coal. Stating that in his Cardowan mine, Lanarkshire, Scotland, with about 100 pneumatic picks in service

—probably more than in any other Scottish operation—John Williamson observed that they could be economically used only under suitable circumstances. At Cardowan, with seam thicknesses varying from 20 to 33 in., a shot had to be fired every 4 or 5 ft. along the face line. Even then, he added, it became almost imperative to square down the top coal between the shotholes by hand picks. Pneumatic picks gave good results at Cardowan and explosives did not, but it must be remembered that his coal was hard and brittle and had a short cleat which made it break with a short cubical fracture.

Urging that pneumatic picks did not make excessive noise, William Duncan came to their defense. Cleat is not important, he said, if the coal be undercut. Where shots are fired on a longwall face while the loaders are working, the men continually have to move away from the area where the shots are being fired, which is certainly not a comfortable proceeding in a 30- or 36-in. seam, for the worker has to pass over the unloaded coal thrown into the traveling lane in front of the face by shots already fired. On the other hand, if the shooting is done off-shift, the place will be filled with fallen coal, and some roof may have to stand unpropped for three or four hours before the face is cleared. Moreover, some props may have been dislodged by shooting; as a result the roof is far from safe. Shotfirers might be required to place temporary supports, but how could they do that if the way were not cleared?

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Where no price is appended in the notice of a publication of the U. S. Bureau of Mines, application should be directed to that Bureau. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

Thirteenth Annual Report of the Safety in Mines Research Board, 1934. British Library of Information, New York, N. Y. 134 pp., 6x9⅝ in.; paper. Price, 62c.

Outstanding ascertainments of fact relating to mining recorded in this bulletin may be summarized as follows: (1) Coal dust can be wetted more effectively by a water solution of a suitable wetting agent than by pure water, and when so wetted the application of water will wet effectually any newly deposited dust so as to provide a dustless roadway with no pools of water. (2) From a deposit of weathered shale dust six times as much dust will be lifted by a blast of air as from a deposit of weathered gypsum dust, both when otherwise undisturbed. (3) Firedamp will travel up a slope of 1 in 10 against an air current. (4) Any obstructions near the roof, or objects traveling along the slope, will cause diffusion and retard or prevent methane from traveling up the inclination. (5) Methane released near the floor is less readily carried up the slope. (6) Inert dust can be made to extinguish a firedamp explosion. (7) A dust-projecting appliance, operated by Bourdon tubes which are flexed by the heat of combustion, can be devised. This device will extinguish a firedamp explosion. (8) Shock waves even without the heat of a blow-out shot or that of its incandescent particles will ignite mixtures of ethylene or methane with oxygen, but success has not yet been obtained in the ignition of firedamp by these means though pressures of 1,500 lb. per square inch have been applied.

(9) The faster a load is applied to coal-measure strata the greater appears to be the load needed to cause failure. (10) Where longwall faces in the Barnsley seam at a depth of 1,680 ft. below the surface were 99 ft. long, the sides, after an advance of 195 ft., approached each other 12½ in. at a point 300 ft. from the face. Where these longwall faces were 300 ft. long, the sides approached only 7 in., showing that the coal squeezed out more into the roadway when the longwall face was short than when it was long. A similar measurement at a depth of 2,475 ft. showed similar conditions. Thus a long face gave better working conditions than a short one, for the breaks in the sides and parallel to the roadways were less marked the longer the working face.

(11) When, in the North of England, a room is driven at an angle to the cleat, the roof develops fractures on the end of the working face which strikes the lines of cleat first—that is, in what is known as the "tight corner," though the authors do not thus describe it. Safety is increased by having the road on the opposite side of the room. If the center of the face strikes the cleat fractures first, the breaks occur at that point. If the order of cutting the cleat is reversed from one side of the face to the other, a diagonal break occurs from side to side and operation is endangered. Such conditions were obtained with rooms 6, 12, 18 and 24 ft. wide in several seams and collieries and at differing depths. (12) Rate of gas evolution is roughly proportional to rate of face advance. (13) In North Staffordshire it has been established that the loads imposed by the descending roof on face props are not determined by depth, and that where seams are highly inclined and floors are soft, the floor at faces advancing along the strike moves further downhill than the roof, hence underset props are displaced. (14) Even with flat stones, suitable for walling only 4.8 tons per square foot, equivalent to the weight of 67 ft. of strata was supported by a pack 5 ft. high with 10 per cent compression, from which it is evident that such a pack resistance would not prevent a stratum 67 ft. thick from separating from the strata above it. Control can be exercised, therefore, only on the underroof.

(15) Load oscillations increased considerably at a certain part of the road when trips were hauled up a slope by a two-cylinder steam hoist directly coupled to the haulage drum. These oscillations decreased as the length of free rope decreased. Evidence seemed to point to the fact that variations in torque synchronized with the time of vibration of a rope having a length equal to that between hoist and trip, suggesting either a resetting of the engine valves or, as may be added, the use of an electric hoist with an even torque. (16) With a hoist unwinding without use of its gears, the oscillations in load on a slope were greater than when running in gear, apparently because the gears retarded the movement of the trip more uniformly than the brakes alone. The stress with the engine running without gears was 124 per cent greater than the static load.

(17) When a rope wire is subjected simultaneously to corrosion and repeated stresses its deterioration is much more rapid for some reason than if corrosion and fatigue act separately, as shown by tests made under dry conditions and with a spray of tap water. The quantity of metal removed by corrosion may be very small, and the surface show no signs of rusting, but the effect of the spray is marked nevertheless.

Accident Experience and Direct Costs in Some Colorado Coal Mines, 1929-33, by E. H. Denny and F. R. Jennings. U. S. Bureau of Mines, I. C. 6860; 22 pp., 8x10½ in. Mimeograph.

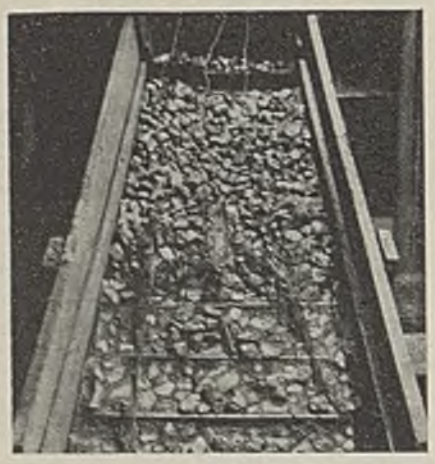
Many tabulations show respectively for 1929-33: (1) compensable accidents and medical cases, their number, days lost, medical and compensation costs; (2) similar data for non-compensable injuries and medical cases; (3) accident causes of compensable and non-compensable accidents, their number with days lost and compensation in totals and averages; (4) all accidents by parts of body injured; (5) fatal and permanent partial and total disabilities, their compensation cost in total and per case; (6) fatalities by cause; (7) compensable temporary disabilities, their number, days lost, compensation total and per day; and (8) the scale of time losses on which industrial accident disabilities are based by the Association of Industrial Accident Boards and Commissions. Proximate causes for accidents are not used for classification but are listed as "condition of surroundings or equipment, system of mining, illumination, pitch of seam, mine practices, discipline, supervision, state of mind of injured at time of accident, fatigue, ill health, lack of mental alertness, poor eyesight, carelessness, recklessness, loose clothing—any or several of these may be more important in causing accidents than the immediate cause ascribed." In this listing nothing is said as to lack of training or inexperience—two prolific causes of accident.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Use Herringbone Wire Catchers In Coaldale Breaker

To remove shooting wire from coal before shipment, herringbone catchers are suspended in chutes in Coaldale breaker of the Lehigh Navigation Coal Co. These consist essentially of strips of metal with

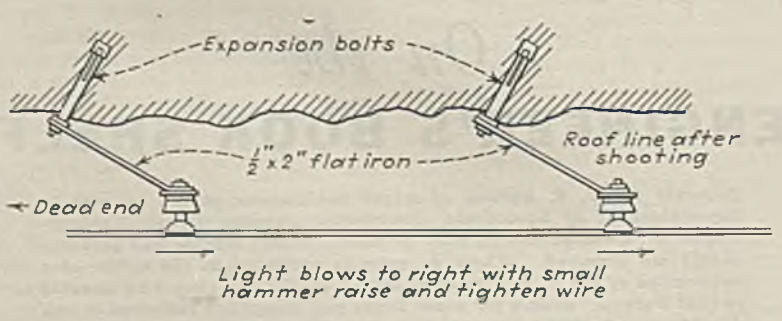


Three catchers and a load of wire

both edges divided into a number of segments by slanting cuts. Alternate segments are then bent in opposite directions, giving a herringbone effect. The catchers are installed so that the natural hook action of the segments will trap the wire.

Angle Straps Permit Raising Trolley Wire

Use of straps fastened at an angle to the roof allows trolley wire to be raised after installation, and at the same time tightened, reports Walter Iman, Kitzmiller, Md. Use of this type of suspension was the outgrowth of conditions encountered in the mine where it was originated. The roof was hard sand rock, and therefore could not be drilled with the usual roof auger. Consequently, it was necessary to employ a Fort Wayne drill, and as the height after shooting was limited, the holes for the expansion bolts had to be put in at an angle, as in the accompanying illustration. Straps were made of ½x2-in. flat iron, bent at one



Details of trolley installation with angle straps

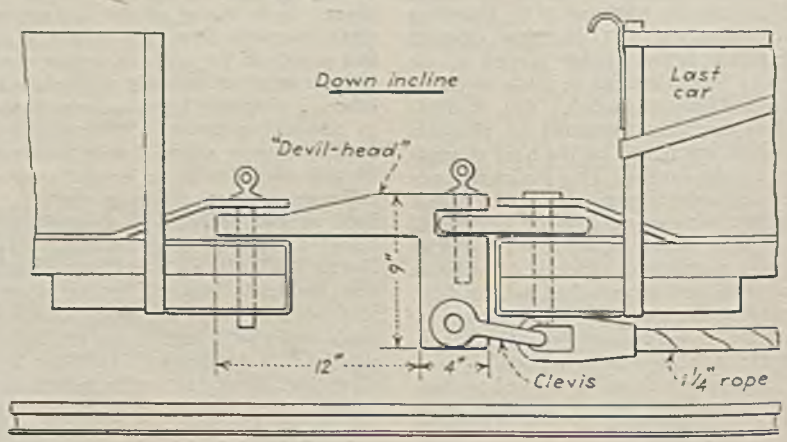
end to allow the hanger to be attached. With the trolley wire in place, tapping the hangers lightly sufficed to raise it nearer to the roof and also to tighten it. Tapping the hangers in the opposite direction, of course, lowers the wire. On curves, Mr. Iman points out, the holes must be drilled farther away from the track, the distance depending upon roof height and desired height of wire. Also, it may be necessary to increase strap thickness to ⅜ or ¾ in. on turns.

Rope Held on Incline Sheaves By "Devil-Head"

Successful operation of the incline at Soddy, Tenn., has been made possible by the use of the "devil-head" shown in the accompanying illustration, writes A. W. Evans, chief inspector of mines for Tennessee, Nashville. The incline in question was designed by Mr. Evans 35 years ago. Operated partly by power and partly by gravity, the incline is approximately two miles long and has a total curvature of 210 deg. to the right looking down from the top. Design was based on the use of a single track with central passing point, and the lower half is on practically a 4-per-cent grade.

Mine-car capacity is 1½ tons, and 50 loaded cars are lowered at a time. Much trouble was encountered in the early days of the operation of this incline, which led to the development of the devil-head to hold the rope down on the sheaves while the trip was taking the curves. Installation eliminated the rope trouble previously encountered. The devil-head, a gray-iron forging which can be made in any mine blacksmith shop, is inserted in the loaded

"Devil-head" in place ahead of the last loaded car



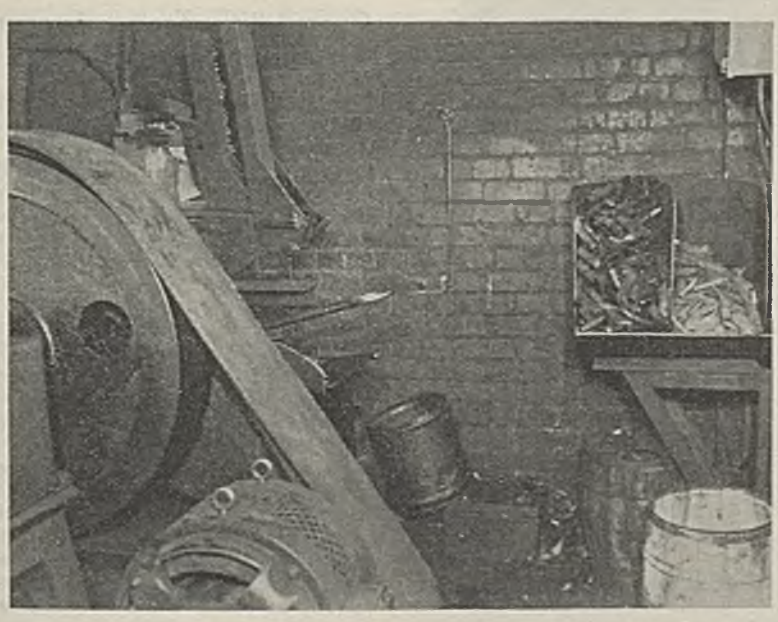
trip just ahead of the last car. It is not used in hoisting empty trips, but instead is thrown in the first car for the trip back to the top.

Swivel Bin Aids Bit Charging Incident to New Method

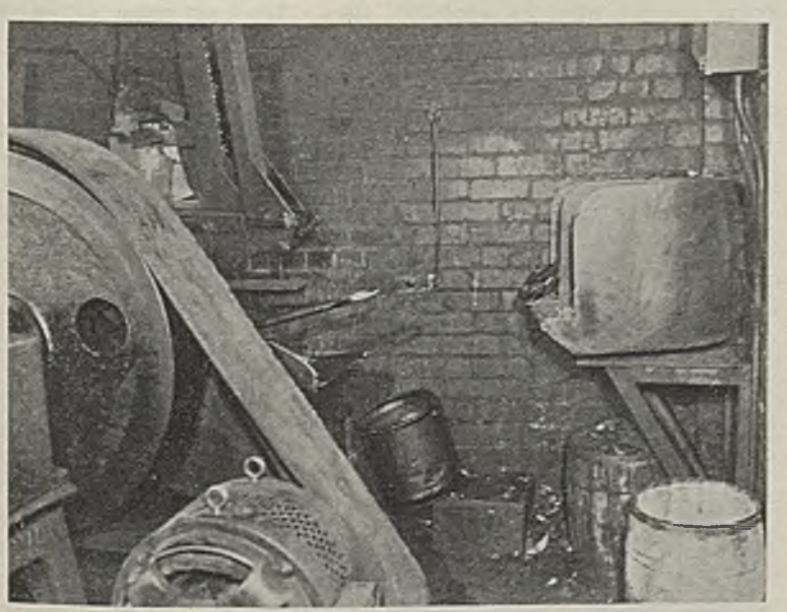
Reduced maintenance of setscrews, fewer lost bits, increased cutting speed, lower power cost and less wear on machine parts are the advantages obtained by a recent change in bit hardening at the Adena (Ohio) mine of the Wheeling Township Coal Mining Co. No change has been made in the quality of the steel (0.80 carbon) nor in the sharpening (Sullivan roller) that have been used for several years.

The bits, after being heated in a Diamond furnace fitted with foot-treadle feed magazine, and then rolled to shape, were dipped in water by hand. After a moment of point immersion the whole bit was immersed for about one second and then thrown onto an accumulating pile. Lack of uniformity was the principal difficulty. Even though the final temperature had been correct and the operator timed the immersions properly, variations were caused by some bits landing in the center of the pile, where accumulated heat from the other bits retarded cooling, and by others landing at the edge by themselves, where rapid cooling took place. Often the shanks were too hard for proper seating of the setscrews, the tips too soft, or the point necks too hard.

Air-cooling of the forged bit, reheating only the point, and then dropping the whole bit into Houghton No. 2 quenching oil is the new method. To perform this hardening without additional labor, an auxiliary reheating magazine was purchased and added to the furnace. An adjustable hearth facilitates localizing the heat to the point (back as far as the shank) and securing the proper temperature. Each time the operator presses the treadle to release a bit to the roller, the action automatically drops a reheated bit into the oil.



The bin is turned for filling with dull bits and with bits ready to harden



The bin is turned facing the heater magazines

The quenching tank holds 52 gal. and is water-cooled to maintain uniform temperature. For convenience in charging the bits into the magazines, a two-compartment ball-bearing swivel bin was built and mounted in the corner of the shop room adjacent to the furnace. After the dulled bits and the bits to be hardened are shoveled into the respective compartments, the bin is turned 90 deg. to face the magazines, thus making it most convenient for a man to reach them when engaged in doing the charging.

Tested with a file, the bits appear to be uniform in character. The shank is soft, but from there on the hardness increases to maximum at the tip. The bits are changed in the mining machines just as often as was the previous practice; but the dullness at the finish is considerably less marked than formerly. The mining machine's duty is undercutting in the Pittsburgh No. 8 seam. This improvement in bit practice is but one of the many refinements that have been inaugurated from time to time in connection with the proper tuning of all equipment to the 100-per-cent mechanization in the mine.

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Always Here

Each month and every month Coal Age's invitation to operating, electrical, mechanical and safety men to send in cost-cutting, time-saving or safety-promoting ideas appears in this department. We are always here to receive and pass along new ideas developed by men at the mines to meet the difficulties they constantly are called upon to face. Our aim is to collect and present tried and tested solutions to the problems encountered by others with the thought they also may be, at one time or another, your own problems. At the same time we stand ready to publish your own answer to a knotty question in the operating, maintenance or safety fields, so send it in, together with a sketch or photo if it will help to make it clearer. Acceptable ideas are paid for at the rate of $5 or more each.

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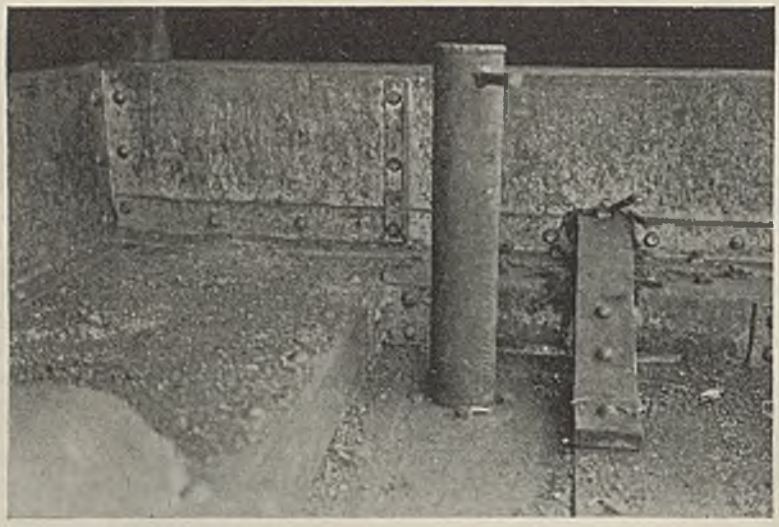


With the pipe screwed into the flange the car is ready to carry water instead of coal

Flanged Drain and Calking Make Dual-Purpose Car

By an inexpensive alteration a new mine car at the H. E. Harman Coal Corporation mine, Harman, Va., was changed to make it suitable for service either as a water car or coal car. The accompanying illustration shows the fitting which adapts the car for carrying water, which as yet is encountered in the new mine only in quantities that permit removal by bailing.

A hole was cut in the bottom of the car and a 4-in. pipe flange was bolted on with a suitable gasket. The plug fitted into the flange is a 4-in. pipe cut to a length slightly greater than the inside depth of the car and fitted with a welded cap and crossbar handle for screwing by hand. Calking with tarred oakum around the drawbar heads and at two or three other points was the only work necessary to render the car sufficiently watertight. Unscrewing and removing the pipe effects rapid emptying of the water from the car. However, experience indicates that a 6-in. drain would have been preferable.

When the car is to be used for coal the pipe is left out and at the start of loading a strong lump of coal is laid over the hole to prevent spillage of fines. The car (Enterprise) is of the four-axle type with a level-full capacity of 122 cu.ft., hence will hold 400 to 500 gal. of water with the level only about half way to the top.

Simple Device Put on Hoist Controls Visual Signals

Chance for question as to who erred in case of a premature start of the hoist upon apparent signal from a level has been eliminated at Alliance No. 2 shaft of the Lehigh Navigation Coal Co. by a signal lamp and home-made automatic control device installed in the hoist house. Now the lighting of a lamp confirms to the hoistman his hearing of a signal and the lamp stays lighted until the cage has traveled approximately 25 ft.

The halftone shows the mechanism, which is operated by adjustable pins mounted on a disk, which in turn is fastened to a pin attached to the end of the drum shaft. The function of the pieces of wood which ride on these pins is to open knife switches attached to cords inside of the box.

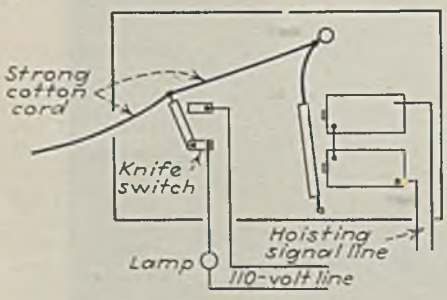


Fig. 1—Cords close and open the knife switch

Referring to Fig. 1, which for simplicity includes but one of the two duplicate equipments in the box, a bell with gong removed closes the knife switch and lights the lamp when a hoisting signal comes from a level in the mine. When the cage is standing at a level it is possible for the jerk of the bell tapper to close the knife switch because the outer cord is slack, due to a disk pin being adjusted so that with the cage standing at the level the piece of wood is held in a raised position.

A second disk pin with proper adjustment in the disk slot prevents the stick from dropping to a low position and thus pulling open the knife switch until the drum makes about three-quarters of a revolution. Two units are required at this shaft because the hoisting is from two levels. The depths of these levels are 960 ft. and 1,185 ft.

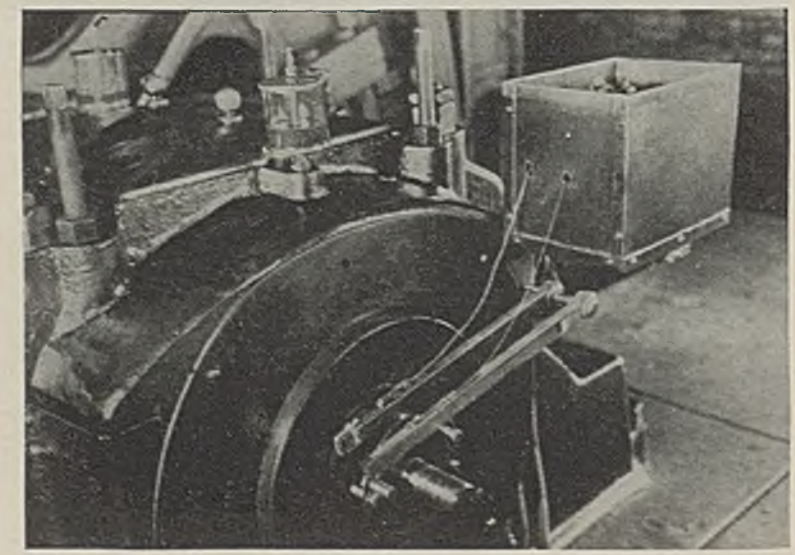
Curved-Pipe Trolley Supports Proved Efficient and Neat

Excellent appearance of the trolley wire on curves is an item that commands attention at the Mary Helen mine of the Mary Helen Coal Corporation, Coalgood, Harlan County, Kentucky. Because this trolley-wire construction has been in service nine years there is reason for taking a second look. The wire appears to have retained a uniformly smooth curve exactly paralleling the rail.

The illustration, made from a recent photograph, shows the curve at the portal of the main haulway. Pipe mounted parallel to the rail forms the support for the trolley-wire hangers, which are spaced 2 to 4 ft. apart, depending on the radius of the curve. This pipe in turn is supported by locust posts and braced arms made of pipe. Posts are spaced 6 to 12 ft. apart.

Although 1¼-in. pipe was used for the trolley-hanger support, officials at the mine point to certain places where it has bent slightly at points where it was weakened by the bolt holes. They say they would use 2-in. pipe if they were doing the job again. The construction method pursued

Rotation of the drum shaft clears the visual hoisting signal



In trolley construction neatness and utility usually go hand in hand

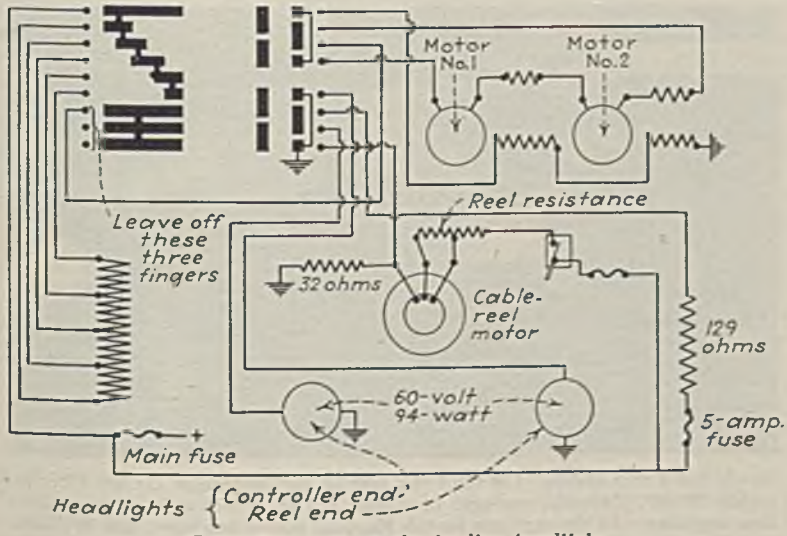
was to bend the pipe to proper curvature by repeatedly checking it by laying it on top of the rail.

Idle Reverse Parts Find Use As Headlight Control

Fingers and segments made idle by connecting motors permanently in series to reduce speed of a two-motor locomotive equipped with series-and-parallel controller can be utilized as headlight controls. Burning one headlight at a time is generally considered safer for the coupler and this is accomplished by the new connection.

In the accompanying wiring diagram showing the revised controller, the lower set of reverse drum fingers and segments are adapted to the headlight control. Moving the reverse handle to a given direction of locomotive travel automatically turns on the headlight facing that direction. Moving the reverse handle to the other position turns out the first headlight and lights the one at the other end.

This utilization of idle parts of the reverse drum was mentioned by B. F. Grimm, consulting electrical engineer, Koppers Coal & Transportation Co., in a paper. "Transportation in Coal Mines," read at a meeting of the Pocahontas Mechanical and Electrical Institute, Bluefield, W. Va. The practice is an outgrowth of the general move toward operating motors in series and adding a chain between axles to provide positive four-wheel drive.

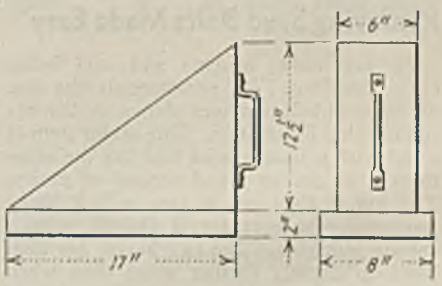


Controller turns on the leading headlight

Derail Block

Mines of the Reid Coal Co., Inc., Timblin, Pa., have standardized on the derail block shown in the accompanying illustrations, reports James Thompson, foreman, Distant, Pa. It has been found advantageous to drive producing, or room, entries to the rise as far as possible, and the miners generally push the loaded cars from the face of the room out on to the entry. As the grade on the entry ranges from 2 to 5 or 6 per cent in favor of the loads, runaway cars were frequent, and after trying out different derailing devices the block described herein was developed at the mine to stop cars before they could get out of the room entry.

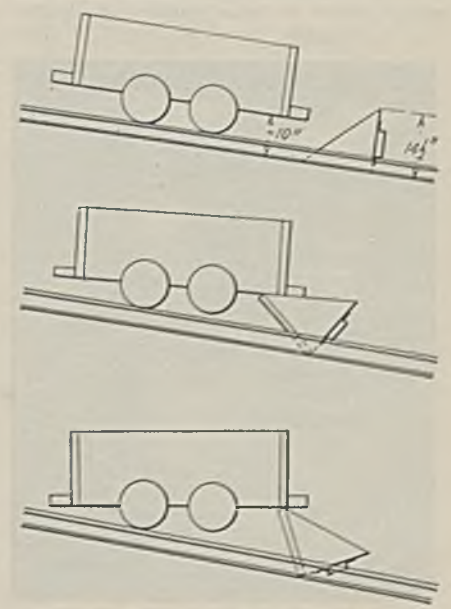
The block is made of scrap mine timber, such as 4x6's or 6x8's, sawed to the proper shape and assembled into an almost unbreakable block with 40D nails. The standard size of block is shown in an accompanying illustration. To the bottom of the block is nailed a piece of 2-in. plank 8 in. wide. The extra width on the bottom afforded by the plank makes the block less easy to upset, in addition to increasing the height 2 in. To facilitate moving and placing of the block by the triprider, a strap-iron handle is fastened on as indicated.



Details of derail block

The method of using the block is as follows: When the last empty in a trip is placed, the derail block is set between the rails immediately outbye the last empty placed, with the sloping side facing the cars. In case a car gets loose, the bumper strikes the sloping surface of the block and rolls it over. In rolling over, the block raises the front end of the car and lifts the front wheels off the rails, thus derailing it. To be successful, the height of the block must be somewhat greater than the bumper. At the Reid mines, the distance from the top of the ties to the bottom of the bumper is approximately 10 in., as compared with an over-all block height of 14½ in.

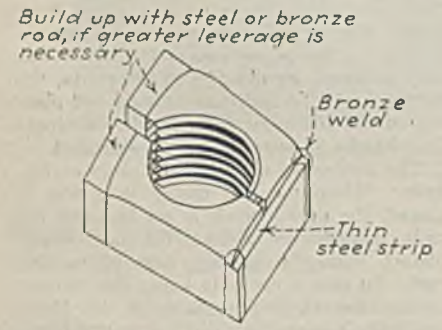
Successful use over a period of seven years has proved the positive action of the blocks, Mr. Thompson states. One man can make several in a day, and an outstanding advantage is the fact that as working places are abandoned in advancing up the entry the safety block can be moved up accordingly, thereby reducing the distance the car can run before striking the derail block.



Showing three steps in the derailment of a runaway car

Removing Stud Bolts Made Easy

To save time, tempers and stud bolts, *Oxy-Acetylene Tips* recommends the use of the stud-bolt remover shown in the accompanying illustration. The major item is a nut with a square head that has the same threads as the stud and screws on easily. The nut is then cut in two with a hacksaw or, if the operator is skillful, with a cutting blowpipe. The two halves are then lined up slightly farther apart than when a part of the original nut. Then a thin piece of sheet steel is bronze-welded across the cut on one end, leaving the opposite end open. This nut is then screwed on the

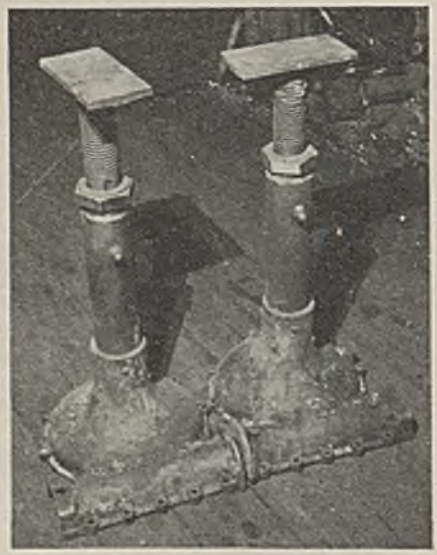


Details of stud-bolt remover

stud bolt. A crescent or pipe wrench is then placed across the open end so that the jaws grip only the front portion of the split nut. When pressure is applied, the wrench jaws tighten and force the two halves of the nut together on the screw threads. The stud can then be removed easily without damaging the threads.

Axle Housings Make Stands

Rear axle housing from old Ford trucks, Walter Baum, master mechanic, Perry Coal Co., O'Fallon, Ill., has found, can easily be converted into very handy adjustable stands. Screws in the two stands shown in the accompanying illustration were made from two pieces of shaft 15 in. long cut with No. 4½ USS threads. A keyway ½ in. wide and 12 in. long was cut in one end of each screw. These screws fit in bushings 6 in. long bored out to allow the screws to slip freely. Each bushing is made with a small shoulder on one end to hold it in the axle housing, to which it is brazed. Four inches down from the tops of the bushings, 13/32-in. holes were drilled in each axle housing and tapped with ½-in. No. 13 USS threads to accommodate setscrews with locknuts. These setscrews are run in just far enough to engage the keyways in the adjusting screws and thus keep them from turning while moving up or down, and then are locked in place with the locknuts. The 2¼-in. adjusting screws shown in the illustration were each fitted with T-irons 10 in. long and 4 in. across the face, which were welded in slots cut in the tops of the screws. Nuts used for adjusting the screws can be made by sawing one large nut in half. A number of different styles of tops can be fitted to adjusting screws so that when a change is necessary one set can be slipped out of the stands and the other inserted.



Completed stands, showing details of construction

All-Welded Inspection Car Is Pulled by Motor

Ample capacity for a large party coupled with ability to negotiate all types of mine tracks with a minimum of difficulty are features of the all-welded inspection car adopted for use at the Wheeling Division mines of the Valley Camp Coal Co. These are the Dartnell and Mobley mines of the Elm Grove Mining Co. of West Virginia and the Alexander mine of the Glendale Gas Coal Co. The car is designed to be pulled from place to place by a locomotive, and consists of an all-welded "bathtub" body suspended on two four-wheeled trucks. This suspension makes it possible for the car to negotiate the shortest of curves with relative ease.

The body of the car (Fig. 1) consists of a 7-in. channel to which are welded ⅜-in. side and bottom plates and suspension members. Angles welded across under the seats stiffen the bottom, and the wooden cross seats are bolted to short angles welded to the side plates. All wooden members are given a coat of creosote paint.

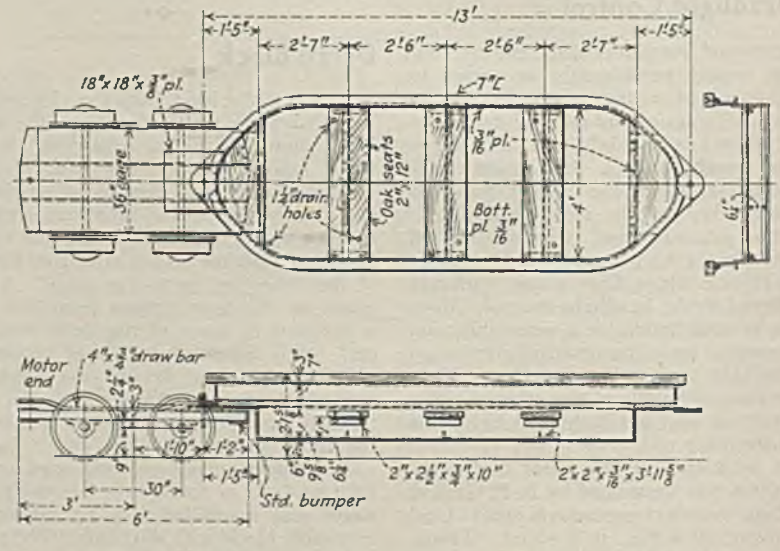


Fig. 1—Details of inspection car for 36-in. gage track

Ready for a trip inside. On the front seat of the inspection car are (left to right) W. W. Dartnell, manager of mines, and H. E. Schweinsberg, production engineer. In the rear are Joseph Kayuha, power engineer, and William Carroll, mine foreman J. F. McGlone, electrician, is on the motor.

WORD FROM THE FIELD

Coal to Get Broad Coverage At Power Conference

American industrialists listed to present papers at the World Power Conference, to be held in Washington, D. C., Sept. 7-12, indicate discussion of the economics of power, the theme of the meeting, will be authoritative and representative of all points of view on controversial topics. Formal acceptances of invitations to participate in the conference have already been received from 21 countries, and definite promise to take part has been made, though official action is yet to be taken, by 17 other nations.

Among papers already scheduled are the following: "Power Resources, Development and Utilization," Central Statistical Board; "Trends in the Utilization of Power Resources," Dr. Harlow S. Person, president, Taylor Society; "Internal Use of Statisties," Central Statistical Board; "Production and Distribution of Coal and Coal Products," Isador Lubin, Commissioner of Labor Statistics, in collaboration with the National Coal Association; "Planning for the Conservation of Natural Resources," Stuart Chase, economist, and W. S. Finlay, Jr., president, West Penn Electric Co.; "Conservation of Coal Resources," U. S. Bureau of Mines; "National Power and Resources Policies," George Soule, editor, *The New Republic,* and Floyd L. Carlisle, chairman, Niagara Hudson Power Corporation.

Other subjects to be covered include production and distribution of gas and petroleum and its products; organization and public regulation of private electric and gas utilities; organization of publicly owned utilities; conservation of petroleum and natural gas; planned utilization of water resources; utilization of small water powers; regional integration of electric and gas utility facilities; rationalization of distribution of electrical energy and gas; and rural electrification.

Particular interest in the series of "study tours" to be conducted both before and after the meetings has been evinced by European delegates, according to Dr. Harlow S. Person, managing director of the Taylor Society, who has just returned from a European trip in the interest of the power conference.

Bill Would Tax Fuel Oil

A tax of 1c. per gallon would be imposed on the sale of fuel oil for "the generation of heat or power" under the terms of a bill adding a new section to the Revenue Act of 1932, presented April 3 in the House of Representatives by Representative Patrick J. Boland, of Pennsylvania. As used in the new section, the term "fuel oil" includes crude petroleum and any derivative thereof suitable for use as a fuel

but does not include kerosene, gasoline, benzol, benzene, naphtha, or gas oil. The measure also provides for the imposition of a tax of 1½c. per gallon on imports of crude petroleum and fuel oil derived from petroleum, instead of the present impost of ½c. per gallon. The bill was referred to the House Committee on Ways and Means.

Mine Fatality Rate Wanes

Coal-mine accidents caused the deaths of 59 bituminous and 17 anthracite miners in March, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 30,692,000 tons, the bituminous death rate in March last was 1.92 per million tons, which is the lowest rate since April, 1933, when the figure was 1.86. The anthracite fatality rate in March last was 6.20, based on an output of 2,741,000 tons, as against 5.73 in the preceding month, when 6,461,000 tons was produced, and 6.49 in March, 1935, when production was 3,082,000 tons. For the two industries combined, the death rate in March last was 2.27, compared with 2.37 in the preceding month and 2.63 in March, 1935.

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STOKER SALES SHOW UPTREND

Sales of mechanical stokers in February last totaled 2,706, of which 2,342 were small residential-size units, according to statistics furnished the U. S. Bureau of the Census by 108 manufacturers. This compares with sales of 2,497 units in the preceding month and 1,373 in February, 1935. Figures for the first two months of this year show that 5,203 units of all types and sizes were sold, compared with 2,961 in the corresponding period of 1935. Sales by classes in the first two months of this year were as follows: residential (under 100 lb. of coal per hour), 4,407; apartment-house and small commercial heating jobs (100 to 200 lb. per hour), 354; general heating and small high-pressure steam plants (200 to 300 lb. per hour), 155; large commercial and high-pressure steam plants (over 300 lb. per hour), 287.

Equipment Display Tops Record For Cincinnati Show

A new record for interest and display of equipment is forecast for the exposition features of the 13th Annual Coal Convention and Exposition to be held under the auspices of the Coal Division of the American Mining Congress at Music Hall, Cincinnati, Ohio, May 11-15. Demands for space have been so great that it has been necessary to provide additional space for exhibits on another floor of the convention hall. The list of exhibitors as of April 18 included:

Ahlberg Bearing Co.
Allen-Sherman-Hoff Co.
Allis-Chalmers Manufacturing Co.
American Brattice Cloth Co.
American Cable Co.
American Car & Foundry Co.
American Cyanamid & Chemical Corporation—General Explosives Division
Anaconda Wire & Cable Co.
Atlas Powder Co.
Austin Western Road Machinery Co.
Automatic Reclosing Circuit Breaker Co.

Bethlehem Steel Co.
Broderick & Bascom Rope Co.
Brown-Fayro Co.
Bowdil Co.

Chicago Pneumatic Tool Co.
Cincinnati Mine Machinery Co.
Coal Mine Equpiment Sales Co.
Columbia Alkali Corporation

Deister Concentrator Co.
Dorr Co.
Duff-Norton Manufacturing Co.
Duncan Foundry & Machine Works
E. I. du Pont de Nemours & Co.

Thomas A. Edison, Inc.
Electric Railway Equipment Co.
Electric Railway Improvement Co.
Electric Storage Battery Co.
Enterprise Wheel & Car Co.

Fafnir Bearing Co.
Fairbanks, Morse & Co.
Flood City Brass & Electric Co.

General Electric Co.
Goodman Manufacturing Co.
Grasselli Chemical Co.
Gulf Refining Co.

Hendrick Manufacturing Co.
Hercules Powder Co.
Hockensmith Wheel & Mine Car Co.
Hulburt Oil & Grease Co.

Irwin Foundry & Mine Car Co.

Jeffrey Manufacturing Co.
Joyce Cridland Co.
Joy Manufacturing Co.

Kanawha Manufacturing Co.
Keystone Lubricating Co.
Koppel Industrial Car Co.
Koppers-Rheolaveur Co.

La Bour Co.
La-Del Conveyor & Manufacturing Co.

Lehigh Safety Shoe Co.
Leschen & Sons Rope Co.
Link-Belt Co.

Macwhyte Co.
Marion Steam Shovel Co.
Marlin Rockwell Corporation
McGraw-Hill Publishing Co.
McNally-Pittsburg Manufacturing Corporation
W. H. Miner, Inc.
Mine Safety Appliances Co.
Morris Machine Works
Morrow Manufacturing Co.
Mosebach Electric & Supply Co.
Myers-Whaley Co.

National Carbon Co.
National Electric Coil Co.
National Malleable & Steel Castings Co.
New Departure Manufacturing Co.
Norma-Hoffman Bearings Corporation
Nordberg Manufacturing Co.

Ohio Brass Co.

Penn Machine Co.
Pennsylvania Electrical Repair Co.
Phillips Mine & Mill Supply Co.
Portable Lamp & Equipment Co.
Post-Glover Electric Co.
Princeton Foundry & Supply Co.
Frank Prox Co.
Pure Carbon Co.
Pure Oil Co.

Roberts & Schaefer Co.
Robins Conveying Belt Co.
Robinson Ventilating Co.
John A. Roebling's Sons Co.
Republic Steel Corporation
Jos. T. Ryerson & Son, Inc.

Safety First Supply Co.
Safety Mining Co.
Sanford-Day Iron Works, Inc.
Simplex Wire & Cable Co.
SKF Industries, Inc.
Socony-Vacuum Oil Co.
Solvay Sales Corporation
Standard Oil Co.
Stephens-Adamson Manufacturing Co.
Sullivan Machinery Co.
Sun Oil Co.

Templeton, Kenly & Co.
Texas Co.
Tide Water Oil Co.
Timken Roller Bearing Co.
Tool Steel Gear & Pinion Co.
Bertrand P. Tracy Co.
W. S. Tyler Co.
Tyson Roller Bearing Co.

United States Steel Corporation and subsidiaries
Universal Lubricating Co.
Utility Mine Equipment Co.

Viking Manufacturing Co.

Watt Car & Wheel Co.
Weir Kilby Corporation
Westinghouse Electric & Manufacturing Co.
West Virginia Rail Co.
Williamsport Wire Rope Co.
Wood Preserving Corporation

The exposition is under the direction of the board of governors of the Manufacturers' Section, headed by C. B. Officer, vice-president, Sullivan Machinery Co., as chairman. L. W. Shugg, General Electric Co., will again act as honorary director of exhibits. Responsibility for the details in connection with the convention and exposition are in the hands of Mrs. Edith R. Coombes, assistant to the secretary, American Mining Congress.

Arrangements for the program for the eight technical sessions of the convention have been under the direction of R. A. Salvati, general manager, Island Creek Coal Co., and national chairman of the 1936 program committee. He has been assisted in this work by a committee of 77 coal men in different parts of the country. A special invitation from Mr. Salvati urging the industry to send a large delegation to Cincinnati next month appears on page 193 of this issue of *Coal Age;* the program for the technical sessions is published on pages 180-181.

RFC TO AID IN DEWATERING FLOODED COLLIERIES

Governor Earle of Pennsylvania received conditional approval on April 6 of his request for a loan of $600,000 from the RFC to help pump out the water from flooded anthracite mines in the Wyoming Valley. The floods in nine collieries in the Pittston-Duryea area, according to the Keystone executive, had thrown 6,000 men out of work, and unless the situation was remedied, he said, it would add $6,000.000 annually to the State's expenditures for relief.

Jesse Jones, chairman of RFC, acceded tentatively to Governor Earle's appeal after a similar request had been rejected by WPA on the ground that under the work-relief law funds could not be advanced for such a project.

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Advances in Research Stressed At Illinois Conference

Urbana, Ill., April 25.—Illinois research agencies and industry were each "put on the spot" at separate sessions of the coal division of the Fourth Annual Mineral Industries Conference, held here yesterday and today. Reporting to industry on the findings and progress of the research program started five years ago, representatives of the State Geological Survey indicated that telling strides have been made in the fields of coal classification, study of the constitution of coal in relation to its use, manufacture of briquets, carbonization and other scientific factors bearing on economic problems.

Representatives of the coal industry followed with a series of papers and discussions indicating which fields of research hold promise for bettering the economic position of Illinois coals. That concentration of vitrain, the 2-per-cent or less ash constituent of Illinois coals, which are of a distinctly banded nature, is responsible for the fine coals being of a smaller ash content than was otherwise explainable considering the normally dusty character of the high-ash fusain, was made evident from a paper by G. H. McCable, assistant geologist of the State survey. Results of quantitative determinations and coking-characteristic tests on the several banded constituents were outlined in his paper.

Investigations to determine the most effective sizes and combinations for domestic stokers with a view of standardization on a reasonable number of sizes was urged by the producing and sales interests. George W. Reed, vice-president, Peabody Coal Co., and chairman, Bituminous Coal Producers Board, District 10, outlined the strife and trouble of the last two decades in the coal industry as a proof of the necessity for some type of government regulation. T. J. Thomas, president, Valier Coal Co., was reelected chairman of the Illinois Mineral Industries Committee, and C. C. Whittier, president, Standard Chemical & Mineral Corporation, was again chosen secretary. A full report of the Urbana meeting will appear in the June issue of *Coal Age.*

Short-Course Program Ready

The third annual short course in coal utilization at the University of Illinois, Urbana, will be held on June 9-11. A. C. Callen, head of the department of mining and metallurgical engineering, and D. R. Mitchell, professor in the same department, will be in charge of the course.

In addition to featuring a question box, the program will include the following topics: "New Developments in Stokers," B. M. Guthrie, Fairbanks, Morse & Co.; "B.T.U. Determinations," Prof. Callen; "Preparation and Utilization of Coal: For Domestic Fuel," Prof. Mitchell; "For Small Steam Plants," L. A. Shipman, combustion engineer, Southern Coal & Coke Co.; "For Large Steam Plants," J. G. Worker, American Engineering Co.; "For Railroads," Prof. E. G. Young, department of railway engineering, University of Illinois; "Problems of Retail Fuel Marketing," Norvin H. Vaughan, assistant general sales agent, Consolidation Coal Co.; "Selling Heat vs. Selling Coal," Paul Hess, Heat Service, Inc.; "Sampling Coal Shipments," Prof. Mitchell; "Types of Solid Fuel," Prof. Callen; "What's What in Air-Conditioning," Prof. M. K. Fahnestock, department of mechanical engineering, University of Illinois; "A Year-Round Hot-Water Supply," R. E. Moore, vice-president, Bell & Gossett Co.; "Trouble-Shooting in Large Heating Plants," Osborne Monnett, Commercial Testing & Engineering Co.; "Changing Trends in Heating," W. B. Hughes, American Radiator Co.

New Preparation Facilities

Alabama By-Products Corporation, Praco, Ala.; contract closed with the Deister Concentrator Co. for Deister-Overstrom "Diagonal-Deck" coal-washing tables to handle a total feed of 28 tons of minus ⅜-in. material per hour.

Alston Coal Co., Minden (Mo.) mine: contract closed with McNally-Pittsburg Mfg. Corporation for McNally-Norton automatic washer to clean 3x0-in. coal and classify into 3x1¼-, 1¼x⅜- and ⅜x0-in.; capacity, 225 tons per hour; to be completed about Aug. 1.

Elkhorn Coal Co., Kona, Ky.: contract closed with the Morrow Mfg. Co. for rescreening equipment consisting of high-speed shaking screens, vibrator screens, loading boom and scraper conveyors; capacity, 125 tons per hour of 2-in. down.

High-Splint Coal Co., Hilo, Ky.; contract closed with the American Coal Cleaning Corporation for two American pneumatic separators, American air filters for

dust collection and other auxiliary equipment for cleaning 100 tons of minus 2-in. coal per hour; plant to be completed in May.

Landingville Coal Co., Landingville, Pa.: contract closed with the Deister Concentrator Co. for Deister-Overstrom "Diagonal-Deck" coal-washing tables with the following feed capacities: barley, 10 tons per hour; rice, 12 tons per hour.

Montevallo Coal Mining Co., Montevallo, Ala.: contract closed with the Jeffrey Mfg. Co. for combined washing plant and tipple with a mine-run capacity of 200 tons per hour. The washery, with a capacity of 90 tons per hour, will be equipped with surge bin, dewatering equipment, clarifying tank, storage bin for washed nut and slack, vibrating screens and refuse-handling facilities. Tipple equipment includes shaker screens, picking tables and loading booms for preparing and loading lump, egg, nut and slack.

Pittsburgh Coal Co., Pittsburgh, Pa.: contract closed with Roberts & Schaefer Co. for complete Hydro-Separator coal washery; capacity, 100 tons per hour, 4x1-in. coal; to be completed June 1.

Raven Red Ash Coal Co., Inc., Red Ash, Va.: installation of Stump Air-Flow cleaning machinery and accessories, completed by Roberts & Schaefer Co. Capacity is 50 tons per hour of 3x0-in. coal.

Will County Coal Co., Braidwood, Ill.: contract closed with the Robins Conveying Belt Co. for coal-handling and loading equipment with capacity of 150 tons per hour, including 30-in. mine-run belt conveyor, transfer chute with lip screen and a 30-in.x28-ft. belt-type loading boom with a 150-tons per hour capacity.

Hope to End Deadlock on Wages Before May 1 Deadline

Faced with an ultimatum from the miners that no further extension of the old wage agreement beyond April 30 would be granted, the anthracite wage conference several days ago put negotiations into the hands of a new joint subcommittee in an effort to beat the deadline. Members of the new subcommittee are: J. B. Warriner, president, Lehigh Navigation Coal Co.; A. B. Jessup, vice-president, Jeddo-Highland Coal Co.; Philip Murray, international vice-president, and Thomas Kennedy, international secretary-treasurer, United Mine Workers. While no details of the proposed agreement have been made public, hope was expressed in a statement April 23 that terms acceptable to both operators and miners could be worked out before May 1.

Prior to this optimistic announcement the only news which had leaked out from the conference was that the two parties were deadlocked on every major issue. Operators at the outset of the negotiations, which began in New York late in February, rejected the miners' demands for a 30-hour week, higher wages and equalization of running time. The union turned a deaf ear to the operators' counter-proposals for a reduction in basic rates. When the old agreement was extended to April 30 (*Coal Age*, April, 1936, p. 158), it was stated that a further extension would be made if the conference was unable to reach an agreement within the month. Later, however, the miners served notice such an extension would not be granted.

Department of Labor Launches Committees For Study of Silicosis Legislation

WASHINGTON, D. C., April 14—At a meeting of representatives of employers, employees, insurance companies, medical and safety men, held here today under the sponsorship of the U. S. Department of Labor, tacit recognition was given to the appointment, subject to revision and to the approval of Secretary Perkins, of four committees that are to lay down correct medical and engineering procedure for the prevention and control of silicosis and to outline the economic, legal, insurance, regulatory and administrative phases of the silicosis problem.

Fully a half million workers are engaged in industries which render them subject to silicosis, declared Secretary Perkins on opening the hearing, and, she added, 4,500,000 are subject to one or more occupational diseases. Damage suits have shown that these diseases may cause the employer much expense. The insurance companies in 1920 declared that the expectation of life of those confronted with occupational disease is five years shorter than that of those working where no such occupational disease exists.

Thirty-six industries have silicosis hazards, declared Dr. R. R. Sayers, Public Health Service, on being introduced by the chairman, V. A. Zimmer, director, Division of Labor Statistics, Department of Labor. Not one-half million but 1,200,000 persons are working in industries which expose them to silicosis. Lanza and Vane conservatively estimate over a half million persons as exposed to a harmful degree of silica dust. Formerly, it was believed that the injury arose from the cutting of the lung by silica dust and from irritation resulting thereform. Today it is believed that the action may be chemical. The hydrated non-crystalline forms seem more active than dehydrated crystalline forms in the irritation of the lungs.

Fine Dust More Harmful

The finer the dust the more detrimental it appears to be. The heavier dust falls to the ground largely outside the human body. Dust falls as follows: One-micron dust, 1 to 3 ft. per hour, depending on the specific gravity; 5-micron dust of a specific gravity of seven, 60 ft. per hour; 10-micron dust, with such speed that it would seldom enter the lungs. Working a while in dust, and working a while where there is none, the worker may be benefited by the time of his absence from the endangering dust, but he suffers the full effect of the summation of his exposures. So, intermittence in employment is not of any real value. High concentrations of dust are most effective in promoting silicosis.

Coal dust when mixed with silica dust, Dr. J. S. Haldane had declared, lessens the danger of silicosis, but this declaration cannot be regarded as proved. At Picher, Okla., Dr. Sayers and his associates had found that coal miners hired to work in the lead and zinc mines developed silicosis after an average of only 7½ years of labor, whereas other men averaged 13½ years in arriving at the same stage. This actually proved nothing, he declared, for in making their study all coal men were grouped in a single class. They might or might not have had exposure to silica dust while employed around the coal mines. Much statistical information is rendered useless in just that way. To get a basis for conclusions the past exposure must be known and, what is more, the past respiratory disease record of the worker. Judging from the literature of the disease, it is prevalent in some 26 countries. It seems that everyone is susceptible to its ravages. But some say the robust are the most likely to suffer—ves, and some the anemic. It is said that, even when removed to jobs without the silicosis hazard, 20 per cent of those who reach the first stage of silicosis and 40 per cent of those who reach the second stage will suffer from a progressive development of the disease. For practically all those who reach the third stage the disease is progressive.

Among the suggestions made by Alfred C. Hirth, Air Hygiene Foundation of America, was that by physical examination the employer should guard himself against employing men whom he may have to compensate for silicosis, though the disease has been created in some other man's employ. He sympathized, however, with the employees' objection to physical examination when such examination results in their being cast out of employment or placed at other work at a reduced income.

Juries Unable to Evaluate Evidence

Some legislation, declared Mr. Hirth, has been passed without due consideration. In some instances no medical boards have been created to determine the existence and extent of the alleged silicotic's disability. It is essential that jurors should not be required to sift such evidence, for they lack knowledge of the technique of silicosis and find the testimony unintelligible; in fact, even the court may not be able to understand and evaluate it, so far is it from its regular line of duties. Should a juror, on being questioned, show a competence to understand the testimony, that may be the very reason for which he is excused. On the other hand, commissions and medical boards have, or acquire, ability to understand and weigh the evidence as submitted.

Whether silicosis should be compensable or remain the subject of common-law actions in those States recognizing a common-law cause of action for occupational disease, asserted Mr. Hirth, is squarely before us. In Great Britain, and many of her dominions, silicosis and kindred diseases have been made compensable under Occupational Disease Acts, thus avoiding the filing of thousands of actions for damages by ambulance-chasing lawyers. Their fees are limited, fortunately, under many of the better-drawn compensation acts.

Medical experts should try to give the public some usable information as to the relationship between silicosis and disability. That may be asking the impossible, and expensive research may be necessary only in the end to prove unfortunately that it is impossible, but both time and money

would be well spent. If, said Mr. Hirth, we talked more of disability and less of silicosis, it would more exactly express our idea. One old darky, 84 years old, sued a company for whom he had not worked for 39 years, claiming his expectation of life had been shortened by silicosis. Mr. Hirth had seen few men of his age in such fine physical condition.

The employees' first contact with silicosis, declared Mr. Hirth, is not ordinarily occasioned by illness or disability, but by an interview with some "runner" drumming up business for his lawyer boss. Speaking generally, with a little persuading, able-bodied men with good jobs are convinced that they are afflicted with an insidious lurking disease and that their present employment means a premature death. So the employee signs a contract authorizing a so-called lawyer he has never seen to file a suit in his behalf, agreeing to pay him half of what he may recover and from the remaining share to pay all costs incident to the litigation. The employee signs the contract and has to quit the job. Many years are consumed in litigation during which he and his family are without support. In many cases he loses his job and receives no compensation. Silicotics are rare as compared with men driven from their jobs by shyster lawyers.

Is it just, asked John P. Frey, American Federation of Labor, to discharge a man or lower his wage for silicotic damage? Evidence of silicosis justifies not discharge or demotion but engineering measures to remove the offending cause. When typhoid attacks the citizens of a community, men are not removed from their homes; instead the water is purified.

Everyone wants to exterminate silicosis. Why, then, not do it? said Ellis Searles, editor, *United Mine Workers Journal*. No one wants to employ a man who will become a hazard. Medical examinations to exclude such a man are fair, but not examinations that discharge or demote a man wrecked in someone's employ. Then, also, too often are medical examinations used to get rid of men otherwise undesirable—too active perhaps in union matters or even men whose unionism has never been active.

Ignorance Delays Extermination

It is easy, said Dr. A. J. Lanza, assistant medical director, Metropolitan Life Insurance Co., to state that no one wants silicosis; therefore do away with it. But there is only too much ignorance as to the means of combating it, as to the causes of it and as to the medical conditions surrounding it. Standards for taking X-ray films are needed. The best diagnostic technique should be determined; how to get the most information with the least quantity of error.

Keep men from hazard and keep hazard from men are the two ways of avoiding accident, declared L. B. Kaycroft, Pennsylvania Self Insurers. Neither can be done entirely, but perhaps one can approach the desideratum 50-50.

Speaking for himself, not industry, O. E. Mount, American Steel Foundries, Chicago, stated that in his town a lawyer inserted a "Help Wanted" advertisement in the newspapers. When a man applied for the job thus offered he met this lawyer, who informed the applicant that he had an insidious disease that would destroy his usefulness and shorten his life. He was urged to sue the company which had given him his most recent employment. In Illinois, employees having lost their common-law defense, the employers framed laws making provision for compensation, hedging it around so as to prevent abuse by designing lawyers.

The following chairmen were appointed by the Division of Labor Statistics: Dr. Sayers, committee on prevention of silicosis through medical control; W. A. Cook, State Department of Health, Connecticut, committee on prevention of silicosis through engineering control; V. P. Ahearn, National Sand and Gravel Association, committee on economic, legal and insurance phases of the silicosis problem; L. M. Walling, Labor Commissioner, Rhode Island, committee on regulatory and administrative phases of the silicosis problem. Mining men have no part in any of the committees. The trend just now seems toward concentration on the abrasives and construction industries.

In a communication that arrived too late for presentation at the conference, E. F. Andrews, Industrial Commissioner, New York State, said that the depression had "thrown many older workers out of employment and prompted many of them to file either common-law suits or compensation claims. In New York State an epidemic of common-law suits starting about two years ago convinced employers that some solution of the long standing problem of silicosis was necessary . . . Abruptly, silicosis was made a compensable disease, at first under a bill providing limited compensation and then, when insurance rates were to be quadrupled and cash deposits of as much as $600 per employee required, under the all-inclusive occupational disease amendment enacted last year. It can be seen that our present problem was caused by the fact that employers ran for cover to the Workmen's Compensation Law when threatened with damage suits for millions of dollars.

"When employers in dust-hazard industries came under the present Workmen's Compensation Law, they found they were not much better off than before because of staggering insurance premiums. And the employees also were adversely affected," for employers threatened to shut down their plants rather than face these increased costs. Salesmen from other States, in selling their goods, emphasized the higher costs of operation in New York due to cost of occupational-disease compensation. Examination of employees was demanded by the insurance carriers, and many old and experienced workers were eliminated, not only because of silicosis but because of other physical defects. A bill drastically limiting compensation is now before the Legislature. Neither the Labor Department nor the workmen are proud of it, said Mr. Andrews, but the workers want their jobs back.

Coming Meetings

- American Mining Congress: annual convention and exposition, May 11-15, Cincinnati, Ohio.
- Big Sandy-Elkhorn Coal Operators' Association: annual meeting, June 2, Ashland, Ky.
- Illinois Mining Institute: 18th annual boat trip and summer meeting, June 5-7, on Str. "Golden Eagle," leaving St. Louis, Mo., at 11 p.m., June 5, and returning to St. Louis at 10 a.m., June 7.
- Mine Inspectors' Institute of America: 27th annual convention, June 29-30 and July 1, Shirley-Savoy Hotel, Denver, Colo.

Peterson Mine Fire Flooded

Practical extinguishment of the fire in the Peterson mine, Creighton, Pa., is reported by W. P. Morris, foreman in charge of fire-fighting operations under WPA project No. 5101. Originally operated by the West Tarentum Fuel Co., which ceased work in 1928, the mine was run as a truck operation in 1929. Adjoining the mine, in the Thick Freeport seam, are the Avenue No. 2 mine, Allegheny Coal & Coke Co.; Natrona No. 1 mine, Penn Salt Co.; Creighton Mine, Creighton Fuel Co.; McFetridge mine, McFetridge Bros.; Cornell No. 1 mine, Crucible Fuel Co.; and the Harwick mine, Harwick Coal & Coke Co.

The blaze in the Peterson mine started Jan. 1 in the timber framework and basket used in mushroom cultivation in the old workings. W. J. McGregor, inspector for the 14th Bituminous District, was placed in charge of extinguishment operations by Secretary of Mines M. J. Hartneady, and to secure the necessary funds a WPA grant was obtained through the influence of the Freeport operators. To bring the fire, covering a broken area of approximately 6 acres, under control, dams and flooding were resorted to, supplemented by air seals and a pipe line for extinguishing exterior blazes. About seven-eighths of the fire is believed to have been put out already and complete extinguishment is expected in the near future.

Personal Notes

WALTER L. BANTA, formerly New England representative of the Lehigh Navigation Coal Co., has been appointed assistant to G. W. Seiler, general sales manager, vice FRANK T. SWAIN, resigned.

R. B. BATTEY has been appointed assistant freight traffic manager of the Chicago, Burlington & Quincy R.R., with continued jurisdiction over the coal traffic department, effective April 1. The position of coal traffic manager has been abolished.

L. C. BRUCE, traffic manager, Stearns Coal & Lumber Co., Stearns, Ky., has been elected vice chairman of the coal and coke committee of the Southeast Shippers' Advisory Board, succeeding Lee Gunter, Knoxville, Tenn.

CHARLES F. DEBARDELEBEN has completed 25 years' service as president of the Alabama Fuel & Iron Co., and in commemoration of the anniversary the board of directors of the company presented a handsome engraved platinum watch to him.

S. H. EVANS was elected secretary-treasurer of the Southern Coal, Coke & Manufacturing Co., St. Louis, Mo., at the annual meeting of the board of directors. He succeeds H. H. Nieters, resigned. JAMES E. MAHEN, former sales manager, was elected vice-president.

PAUL R. EYRICK has been appointed chief

mining engineer by the National Coal & Coke Co. effective April 1, succeeding W. D. ARMSTRONG, who resigned to enter the service of the government. Mr. Eyrick formerly was general manager of the Southern Coal & Coke Co., Boothton, Ala.

M. HEARD has been appointed superintendent of the Gamma mine of the Alabama By-Products Corporation, succeeding C. J. Hager, deceased. Mr. Heard was general superintendent of mines for the Woodward Iron Co. for a number of years.

RUFUS J. IRELAND, JR., Amityville, N. Y., formerly assistant to the president, was elected president of the Owl Creek Coal Co., Gebo, Wyo., effective April 1, succeeding his father, the late Rufus J. Ireland, Sr. R. J. WARRINER, formerly sales manager, was elevated to the post of general manager, effective on the same date.

M. C. KIEFFER has been appointed vice-president in charge of operations for the Railway Fuel Co., vice W. E. Leake, deceased. Mr. Kieffer's old post as fuel agent for the Southern Ry. at Birmingham, Ala., has been filled by the appointment of W. E. SLOAN, formerly fuel agent at Knoxville, Tenn.

LEE LONG, vice-president, Clinchfield Coal Corporation, was elected president of the Virginia Coal Operators' Association at the annual meeting on April 18. Other officers chosen are: vice-president, J. L. OSLER, receiver, Blackwood Coal & Coke Co.; secretary-treasurer, GEORGE H. ESSER.

R. S. QUINN, formerly mine superintendent at Earling mine, West Virginia Coal & Coke Corporation, has accepted a similar position with the Chafin-Jones-Heatherman Coal Co. at Peach Creek, W. Va., where he succeeds KENNETH PICKING, who resigned to accept a position with the Appalachian Electric Power Co. in Logan, W. Va.

GEORGE ROBERTS, general inspector, Industrial Collieries Corporation, has been appointed division superintendent of the Johnstown division of the company, succeeding Frank Burton, deceased. EUGENE L. CROYLE, Johnstown division inspector, succeeds Mr. Roberts as general inspector; ROBERT H. ROSS, safety engineer, Johnstown division, succeeds Mr. Croyle, and GEORGE WETZEL, assistant mine foreman, takes Mr. Ross' old post.

PAUL SHIELDS has succeeded the late J. E. Lee as general manager of the Sheridan-Wyoming Coal Co. and also will fill the post of vice chairman of District 19 Bituminous Coal Producers' Board, formerly held by Mr. Lee.

D. N. SNETSINGER, sales manager for the last twenty years for the Pittsburgh & Ohio Mining Co., Cleveland, Ohio, has resigned that position to become vice-president of the Technical Sales Corporation, with headquarters in Cleveland.

W. H. [illegible] has been promoted from Eastern freight traffic manager to coal traffic manager of the Erie R.R., succeeding George H. [illegible], resigned. DAVID D. JAMIESON, coal clerk at New York, has been made assistant coal freight agent.

W. J. SUMMER, Grider Coal Sales Agency, Birmingham, Ala., has been reelected chairman of the coal and coke committee of the Southeast Shippers' Advisory Board.

C. N. SWEET, vice-president and general manager of the Standard Coal Co., Salt Lake City, Utah, was elected president of the company on April 8, succeeding his brother, the late Frederick A. Sweet, who died in March. The new president, who has been in the coal industry in Utah for many years, is succeeded as vice-president by FREDERICK A. SWEET, JR., head of the National Coal Co., also of Salt Lake City, and a son of the late Frederick A. Sweet.

C. M. WATT, general manager of the Loyal Hanna Coal & Coke Co., operating in central Pennsylvania, has been elevated to the presidency of the company. He will continue to hold the post of general manager and will make his headquarters in Philadelphia.

Bleek & Stoller

Charles E. Richardson

The 25th anniversary of Mr. Richardson's connection with the West Kentucky Coal Co., of which he is president, was observed on March 31 with a banquet at Sturgis, Ky. He came to the company from the Rock Island R.R., with which he had been assistant to the general superintendent of motive power.

L. P. Van Sant Killed

Leslie P. Van Sant, advertising representative of the McGraw-Hill mining publications in the St. Louis and Rocky Mountain territories, was killed in an automobile accident while returning to his home in St. Louis County, Missouri, April 27. Born in 1905 and graduated from Brown University in 1928, "Van," as he was affectionately known to his many associates, spent all his business life with the McGraw-Hill organization. He started as a correspondent in the departmental advertising division in January, 1929; in May of the same year he was transferred to the business department staff of *Coal Age* and *Engineering and Mining Journal* at New York headquarters and later was placed in charge of the business research division of the mining publications group. Early last year he was made advertising representative for the mining papers in the St. Louis-Rocky Mountain area. Mr. Van Sant is survived by a widow and two daughters.

Study Wide Range of Problems At Institute Sessions

Salt Lake City, Utah, April 25—A wide range of operating, safety and economic problems featured the technical sessions of the Rocky Mountain Coal Mining Institute which ended a three-day meeting here today. A theory of the origin of rock areas, or "wants," cutting out the coal in local sections in the Wasatch Plateau field of Utah was offered by H. B. Lindemann, engineer, United States Fuel Co. Planning of mines for safety and conservation of coal was the theme of a presentation by B. W. Dyer, district mining supervisor, U. S. Geological Survey.

Scraper mining at Elkol, Wyo., was described by Gomer Reese, general superintendent, Kemmerer Coal Co., who detailed the system used in working 27 ft. of coal in three 9-ft. benches in double-room units yielding 150 to 200 tons per round of all three benches in a place. A record of 807 tons in seven hours has been made at the Beulah (N. D.) mine of the Knife River Mining Co., with track-mounted loaders in a 22-ft. lignite seam, of which 14 ft. is marketable, declared A. C. Green, Goodman Manufacturing Co. A small loader driving entries in a thin seam has been able to show a cost of 54.6c. per ton of coal on the tarting, said Walter M. Dake, Joy Manufacturing Co., against a comparative hand-loading cost of 74.6c.; in another case, using a large machine, comparative costs were 41.5 and 71.5c. per ton. E. B. Gellatly, manager, underground conveyor division, Jeffrey Manufacturing Co., explained several different systems for the extraction of thin seams with conveyors.

Increase Car Turnover

Main-line haulage improvements and dispatching methods at the Independent Coal & Coke Co., which increased the number of cars to hand loaders per shift from 2½ to 4, were described by George J. Jackson, Kenilworth, Utah. Suitable permissible explosives, properly loaded, will give lump "equal in quality and quantity to that obtained from any other form of explosive or blasting device, and will produce it more economically," declared W. F. Kott, Hercules Powder Co., in an analysis of the factors governing proper explosive selection. Power was the subject of two addresses, one by J. A. Hale, Utah Power & Light Co., Salt Lake City, discussing the general aspects of central-station power and service, and the other by D. L. McKenzie and Arthur T. Hensell, Union Pacific Coal Co., detailing additions to that company's power plant to take care of increased load. A premium of 25c. per ton has been willingly paid by customers of the Utah Fuel Co. for dustless-treated coal, said Charles E. West, sales manager.

"There is hope for coal" was the [illegible] declaration of Bert E. Brewster, publisher, *Mining & Contracting Review*, and with the right kind of government regulation to prevent unfair practices, improved efficiency and a better product, proper education of the public and employees in the problems of the industry and [illegible] cooperation between employers and labor, that hope can be realized. If the Guffey act is upset, said Sydney A. Hale, editor of *Coal Age*, new legislation to meet the objections of the Supreme Court can be expected; if the act is upheld, modifica-

tions undoubtedly will be necessary, and the industry must be alert to see that such modifications result in no injury.

The rôle of the mine foreman in preventing accidents at the face was outlined by Frank J. Stortz, foreman, "C" mine, Union Pacific Coal Co., Superior, Wyo. Job analysis and the adoption of standard methods of performing various tasks will materially increase safety and efficiency, said William Moorhead, consulting engineer, Salt Lake City. Management must be convinced that it is more economical to prevent injuries than to pay for them, contended D. J. Parker, district engineer, U. S. Bureau of Mines, Salt Lake City. Number and cost of injuries in Utah and possible savings through increased safety were detailed by O. F. McShane, Utah Industrial Commission.

Glen A. Know, superintendent, Gunn-Quealy Coal Co., was elected president for 1936-37, succeeding Gilbert C. Davis, manager, Stag Canon Branch, Phelps Dodge Corporation. Revision of the safety code of the institute was delegated to a committee headed by Otto Herres, vice-president, United States Fuel Co., with D. J. Parker and E. H. Denny, district engineers, U. S. Bureau of Mines, and Mr. Reese as committee members.

A detailed report of the Salt Lake City meeting will be published in the June issue of *Coal Age*.

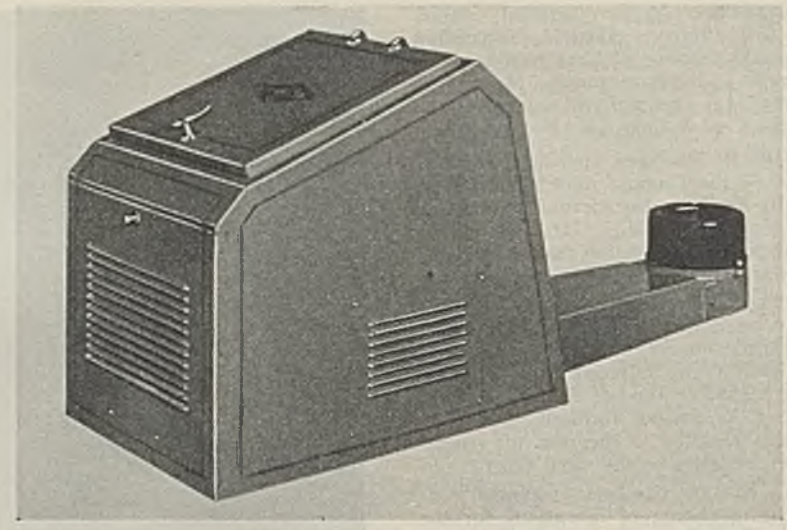
TVA Would Like $144,500,000 For Six More Dams

TVA recommended that six new dam projects costing $144,500,000 be undertaken in a report filed with Congress March 30. The report covers TVA progress and plans for integrated development of navigation, flood control, land conservation and power program. The dams proposed are the Gilbertsville, 23 miles from the mouth of the Tennessee River; Watts bar, Fontana and Coulter Shoals dams, the last named 604 miles above the mouth of the river. It also is proposed to raise the height of Wilson and Hales Bar dams.

Completion of TVA works already authorized by Congress will require $185,188,525, of which $111,000,000 has been appropriated.

Bearing Data Book

A new mine-car and locomotive section of the *Timken Engineering Journal* is now offered by the Timken Roller Bearing Co., Canton, Ohio. The new publication includes six sections covering the following: application of standard single-row bearings to through-axle designs, details of mine-car parts, and general recommendations for mine-car applications with hexagon nut and end cap as well as with combination nut-and-dust collar; application of standard single-row bearings to through-axle designs with demountable wheels; extended and stub-axle designs, using standard single-row bearings; double-cup bearings as applied to through, extended and stub axles; inside and outside journal-box designs for use with standard single-row bearings; and application of Timken bearings to mine-locomotive journal boxes and back axles.



Kelvinator's new automatic coal burner

New Coal Burner Appears

To meet the growing demand for automatic heating equipment using coal, Kelvinator Corporation has added five coal burners to its line of automatic heating equipment. Two small models are designed for small and medium-sized residences and three larger models for installation in larger residences, multiple dwellings, small apartments, stores, shops, etc. Each model may be used with warm-air, steam, hot-water or vapor-heating systems.

Through the scientific principle of underfeeding and controlled forced-draft these burners provide for complete combustion of all the fuel. With the underfeeding principle, coal is brought in under the fuel bed and preheated, thus liberating the volatile gases contained in the fuel, which are distilled off and, passing up through the fire bed, are completely ignited, eliminating smoke. Air is delivered to the fuel bed by means of a specially designed tuyere block which insures the distribution of air for proper combustion to all parts of the fuel bed. Transmission of the burner is of a special agitated type, equipped with five speeds and neutral, to permit feeding just the right quantity of fuel for the weather prevailing.

Safety features include a limiting device to prevent overheating of the furnace or boiler, a shear pin of soft steel to prevent harm to the mechanism in case metal or other foreign matter gets into the fuel-supply worm, and overload protection by means of an automatic resetting overload switch.

Coal-feed capacity of the five models ranges from 7 to 150 lb. per hour. The smallest size has a hopper capacity of 350 lb., while all the other models have hopper capacities of 500 lb. Hoppers are constructed of 14-gage welded seamless copper-bearing steel with cast-iron base.

The Motorstokor sales and manufacturing organizations have been consolidated in the Hershey Machine & Foundry Co. organization at Manheim, Pa., effective April 15.

A convenient new feature, the "Coal Flow," has been added to the Iron Fireman automatic coal burner. This device consists of a screw tube, or revolving worm, which conveys coal across the basement floor from the storage bin to the furnace. The tube may be installed below the floor level and the motor and transmission housing may be placed either behind or beside the furnace, leaving clear floor space between the furnace and bin.

Industrial Notes

ALFRED KAUFFMANN was elected president of Link-Belt Co. at the annual meeting of shareholders, succeeding George P. Torrence, resigned. Mr. Kauffmann, who was president of the company from 1924 to 1932 and has been first vice-president in charge of the company's Chicago plant operations for the last four years, also has been reelected a director. Other directors named are WELLINGTON WELLS, Boston, Mass.; J. REECE LEWIS, Philadelphia, Pa.; and B. A. GAYMAN, San Francisco, Calif.

LEE LLEWELLYN, formerly vice-president, Pittsburgh Coal Washer Co., has resigned his connection with that company to become associated with the KOPPERS-RHEOLAVEUR Co.

RELIANCE ELECTRIC & ENGINEERING Co., Cleveland, Ohio, has added to its sales force PHILIP A. SINGLETON, Philadelphia, Pa., and JACK K. WILLIAMS, Chicago.

BABCOCK & WILCOX TUBE Co. has appointed A. D. HEFFRON, JR., as district manager of Chicago territory with headquarters at 1502 Marquette Building.

NORTHERN EQUIPMENT Co., Erie, Pa., announces the appointment of C. H. TATE as Cleveland (Ohio) representative with offices at 1740 East Twelfth St.

J. O. DONOHUE and J. D. MCLIN have rejoined the sales staff of the NEW YORK BELTING & PACKING Co. With headquarters in Baltimore, Md., Mr. Donohue will cover Maryland, Delaware, Washington, D. C., eastern and northern Virginia, eastern North Carolina and West Virginia. Mr. McLin will make his headquarters in Dallas, Texas, from which point he will cover Nebraska, Kansas, western Missouri, Oklahoma, Texas, Arkansas and Louisiana.

GEORGE E. OLMSTEAD, of New Haven, who had been a manufacturer's agent in Connecticut, has joined the sales staff of

the Morse Chain Co.'s New York office as Connecticut representative. E. H. Jessop, formerly with the Morse Chain Co. at Ithaca, N. Y., is now in charge of Morse Chain sales for the Tranter Mfg. Co., 105 Water St., Pittsburgh, Pa.

Norris MVA Bill Attacked By Coal Producers

Senator Norris' Mississippi Valley Authority bill, which proposes to set up a super TVA in sixteen States between the Alleghanies and the Rockies, was vigorously attacked by spokesmen for the bituminous-coal industry at a hearing on April 1 before a subcommittee of the Senate Committee on Agriculture. John D. Battle, executive secretary, National Coal Association, conceded that no one could quarrel with the ostensible objectives of the bill to carry out flood control, aid navigation and promote irrigation, but added that "if MVA followed the same course as TVA has followed, then we are likely to find that hydro-electric power and its transmission and sale are dominant functions.

"Every new kilowatt of water power," he contended, "either displaces existing coal-generated power or preempts new power markets which otherwise might be supplied by new steam power plants with new outlets for coal." Coal-burning steam-generating electric plants in the Mississippi Valley area, he said, now represent an annual coal consumption of more than 17,000,000 tons, and to displace this tonnage would mean a permanent annual loss of $50,000,000, to say nothing of the fact that for every ton of coal displaced someone either directly or indirectly loses a day's work. "If this bill is in good faith a flood-control and navigation and soil-fertility proposition," Mr. Battle concluded, "and not a gigantic electric-power promotion clothed in the mantle of flood-control and soil-erosion prevention, then there ought not to be any sound objection to confining the major premises of the bill to flood control, irrigation and navigation."

West Virginia operators believe that flood control, navigation, irrigation and soil fertility are only incident to the grant of authority for the generation and distribution of electric power, said Carl Scholz, appearing as representative of the West Virginia Coal Association. "Investment of public funds in gigantic dams for the purpose of developing water power," he said, "the ultimate cost of which is projected in billions, means that we are on the threshold of hydro-electric development in this country that will further depress the coal industry of my State and the nation. Coal mines will lose their markets, they will suspend operations and thousands of miners will be automatically forced on the unemployment rolls.

"To relieve unemployment is the major problem of the nation," said Mr. Scholz, "and here we have the Congress proposing to expend millions to create unemployment. If the Federal Congress would expend the same billions on the expansion of markets for coal, and employ the same concern it has exhibited for agriculture, upon the coal operators and the coal miners, the coal industry would be the most prosperous of any industry in the nation."

George J. Leahy, vice-president, Republic Coal & Coke Co., with mines in Illinois and Indiana, who spoke for his company and the Indiana Coal Trade Association, said the coal industry does not fear fair and honest competition. "We believe that on a fair basis of comparison," he asserted, "electricity can be generated with coal more cheaply than by water power, and making the electricity with coal will continue great numbers of men in employment who will be permanently unemployed should the electricity be made with water power."

Secretary Dern, of the War Department, in a letter to the committee on April 6, said that the bill gave too much authority to a single independent agency over widely different activities and would result in waste and loss of efficiency. The Agriculture Department and Federal Power Commission asserted that the bill would duplicate and conflict with activities of their own.

Senator Norris characterized the operators' opinions as narrow minded. Reiterating that the bill was designed primarily to protect the soil, control floods and make rivers navigable, he said that water power is a byproduct, and that it would be an economic sin to throw it away.

Appearing in behalf of coal operators in Kansas, Missouri, Arkansas and Oklahoma, George F. Klein, assistant to the president, Mackie-Clemens Fuel Co., which markets coal in South Dakota, western Iowa, Nebraska, Kansas and Missouri, testified on April 11 that he subscribed to all that had been presented by other representatives of the coal industry in opposition to the MVA project. "There is no escape from the conclusion," he asserted, "that such a hydro power program means large-scale displacement of coal and immense damage to a great industry, with resulting permanent contraction of employment. The addition of immense hydro-electric power schemes to flood control and navigation, and letting the latter bear the lion's share of the total investment, may make for 'cheap' electricity, but only because hundreds of millions of dollars from the government treasury have been charged up to other purposes in the combination. That is why the coal industry regards government hydro-electric power as in reality subsidized out of the public treasury; why we regard it as unfair competition; why we object to it, as embodied in this bill, and in TVA, and in many of the projects launched or financed by PWA."

Chemists Consider Composition of Coal Relative to Age, Analysis and Uses

COAL RANK and constitution were the subjects of a number of papers at the 91st meeting of the American Chemical Society, held April 15 at Kansas City, Mo. To assist in the determination of coal rank, Prof. H. L. Olin, Iowa State University, recommended the Heathcoat method of measuring oxygen absorption, which, he stated, had been applied to a great number of coals. Potassium permanganate was used as oxidizing solution and a range of values in decreasing order was obtained for a number of coals from the lignites of North Dakota to the semi-smokeless coals of West Virginia. The values obtained with the various coals corresponded closely to the order of the rank of the coals as determined by other criteria. The method, it was asserted, employs chemical technique only and, therefore, should be more precise, in general, than methods depending upon the measurement of physical properties. It should prove useful, said Prof. Olin, in establishing an official coal classification.

As an alternative to determination of the oxygen content of organic substances by difference, W. R. Kirner, coal research laboratory, Carnegie Institute of Technology, proposed hydrogenation as a means of making direct microdeterminations. Two methods are available for direct oxygen analysis, said Mr. Kirner. The first involves burning the sample in an atmosphere of oxygen and then determining the oxygen content of the products, as well as the quantity of oxygen used in the combustion. With this method, carbon, hydrogen and oxygen are determined simultaneously. The second method involves burning the sample in hydrogen and determining the water formed by the union of the latter with oxygen. In both cases, microsamples of 3 to 10 milligrams were used in the investigations. The hydrogenation method is the more rapid of the two, a complete analysis requiring less than two hours. It ascertains only the oxygen content of the sample, and with it, it is not necessary to determine the nitrogen, sulphur or other elements, as is required where oxygen is found by difference.

Discussing the exhaustive chlorination of a bituminous coal, J. F. Weiler, Carnegie Institute of Technology, pointed out that in regulation of coal-distillation processes to obtain the greatest yield of the more valuable products and in determination of what other chemical processes might be employed to obtain desirable derivatives, it is necessary to know whether the carbon compounds in the coal are of the straight-chain or cyclic groups. Exhaustive chlorination of the coal at a high temperature offers a method of determining the relative proportions of the two groups, as the straight-chain compounds, being more volatile, are driven off, while the cyclic carbon compounds remain. A Pittsburgh coal chlorinated at 200 deg. C. for six days was thus found to have about 75 per cent of cyclic and 15 per cent of straight-chain skeletons. Much of the former being insoluble in various solvents, the coal must have contained many hexagonal structures —that is, phenolic bodies.

Treatment of Pittsburgh seam coal with the solvents aniline, tetralin and phenol at temperatures up to 400 deg. C. was detailed by Dr. Robert S. Asbury, Carnegie Institute of Technology. High-pressure stainless-steel apparatus was necessary, for the solvents boil, under normal conditions, at temperatures below those used in the experiments. With aniline at 225 deg. C., tetralin up to 400 deg. C. and phenol up to 300 deg. C., 47, 85 and 67 per cent of the coal, respectively, was made soluble. The products ranged from reddish sticky liquids to dark brown powders, all being extremely

complex organic chemicals. Though the ultra-microscope magnified the products 980 times, no particles could be seen. It is possible, Dr. Asbury stated, to concentrate most of the ash of the coal in the products not dissolved by solvents. This may be helpful in certain processes, such as the production of gasoline from coal. Some solvents dissolve more coal than others and, as in hydrogenation processes coal has to be dissolved before treatment, the values of the various solvents need investigation.

Results of a study of the properties of humic acid in Dakota lignite for the purpose of throwing some light on the behavior of the coal in briquetting, carbonization and storage were detailed by David M. Mason and Prof. Irvin Lavine, University of North Dakota. Samples of lignite were boiled under pressure with solutions of sodium hydroxide and sodium carbonate at varying temperatures, and the resulting solutions were treated with hydrochloric acid, which resulted in the formation of a flaky precipitate which, filtered and dried, left a fine brown humic-acid powder. The experiments showed definitely that higher yields of humic acid result when sodium hydroxide is used. Furthermore, dilute solutions of the alkalis specified give larger yields than more concentrated solutions, and for a maximum yield boiling must occur at temperatures above 130 deg. C. This information may be useful should later experiments show that humic acid must be added or removed prior to the briquetting of lignite. Slight variations in the character of the humic acid from the two processes were noted.

To Open New Lignite Mine

A new mine near Lafayette, Colo., in what is known as the "Lignite" field, is to be opened by the Boulder Valley Coal Co., with headquarters in Denver. The company plans to spend about $300,000 in development work.

Ben Franklin Property Sold

Sale of the Ben Franklin Coal Co. property at Moundsville, W. Va., to C. D. Terry, of Kewanee, Ill., for $13,100 has been confirmed by Judge W. E. Baker in U. S. District Court at Wheeling, W. Va. The sale was the result of federal receivership proceedings. The new owner is a son-in-law of M. J. McQuade, head of the Ben Franklin company. Reorganization of the company is contemplated.

Cost-Finding for Conveyor Belts

To assist users in keeping an accurate record of belt-conveyor costs, the B. F. Goodrich Co., Akron, Ohio, offers the "Cost-Finding Record Book for Conveyor Belts," consisting of a bound volume of record blanks covering all phases of conveyor operation and maintenance, including belt and conveyor description, tonnage handled, nature and cost of repairs, accidents, final condition of belt, and recommendations for future installations. Supplementing the record blanks are sections on conveyor-belt data and methods of prolonging belt life.

PERMISSIBLE PLATES ISSUED

Two additions were made to the list of permissible equipment by the U. S. Bureau of Mines in March, as follows:

Goodman Manufacturing Co.: Type 90 elevating conveyor; 1½-hp. motor, 440 volts, a.c.; Approval 298A; March 3.

Inertia Devices, Inc.: Megolite flashlight; Approval 604; March 13.

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To Boost Piney Fork Output; Add Shift at Lafferty

Production at Piney Fork mines of the Hanna Coal Co., in Jefferson County, Ohio, is to be increased soon to 5,000 tons per day instead of 4,000 as at present. Output will be boosted 500 tons per shift through the addition of mine cars and other equipment that may be necessary to achieve this objective.

A second shift has been established at Hanna's New Lafferty mine, which resulted in an output of 57,000 tons in March. The new force consists of 114 men transferred from Nos. 9 and 10 mines.

Exempt From Holding Act

The Westmoreland Coal Co., Pennsylvania Coal & Coke Corporation, Stearns Coal & Lumber Co., Berwind-White Coal Mining Co., and Clearfield Bituminous Coal Corporation have been granted exemption from the provisions of the Public Utility Holding Company Act of 1935 in orders issued by the Securities and Exchange Commission. In the case of the four first-named companies the Commission found that they are only incidentally holding companies, being primarily engaged in other business than that of a public utility, and do not derive a material part of their income from subsidiary utility companies. The last-named company, having leased its utility subsidiaries to the Pennsylvania Coal & Coke Corporation, was declared exempt from the provisions of the act provided that it refrained from exercise of voting rights, control of proxies with respect to subsidiaries' stock and from designating officers and directors of the companies.

Obituary Notes

HARRY H. WARFIELD, 65, treasurer of the Consolidation Coal Co. and a native of Maryland, died April 4 at his home in Plainfield, N. J.

FRANK HORTON, 68, superintendent of the Johnstown division of the Industrial Collieries Corporation, coal-mining subsidiary of the Bethlehem Steel Corporation, died April 4 from a heart attack at his home in Johnstown, Pa. His career in the coal industry began in the Broad Top field, but since 1901 he had been connected with mines in the Johnstown district. Joining the Bethlehem interests as a miner, he was promoted successively to fireboss, assistant mine foreman, mine foreman and superintendent, becoming division superintendent in 1923.

JOHN B. CORGAN, 69, State mine inspector in charge of the Tenth anthracite district of Pennsylvania, died April 9 at Mercy Hospital, Wilkes-Barre, after a complication of illnesses. For a quarter of a century he was associated with his father in the manufacture of a mine drill invented by the latter; he had been in the State inspection service more than twenty years.

R. H. JARRETT, 40, store manager for the Kingston Pocahontas Coal Co. at Hemphill, W. Va., died April 6 following a brief illness. He had been with the company more than fifteen years.

CHARLES J. HAGER, 67, superintendent of the Gamma mine of the Alabama By-Products Corporation, died April 12 at his home in Flat Creek, Ala., after an illness of several months. He had served in an executive capacity with the Pratt Consolidated Coal Co. for a number of years prior to its merger with the Alabama By-Products Corporation, after which he was for a time superintendent of the Flat Creek division.

WILLIAM E. MORROW, 69, formerly superintendent at operations of the Sloss-Sheffield Steel & Iron Co., Yolande Coal & Coke Co., Alabama Consolidated Coal & Coke Co. and the Central Iron & Coal Co., in the Alabama field, died late in March following a short illness.

Carbondale Property Sold

Physical properties of the Carbondale Coal Co. in Athens County, Ohio, were sold to the Sunday Creek Coal Co., according to an announcement on April 10 by E. W. Strong, of Cincinnati, representative of the William T. McClintock estate. Settlement of heirships necessitated the sale. The Carbondale company has been associated with the Sunday Creek company for some time.

Gas Lines Get Under Way

The Michigan Public Utilities Commission issued an order on April 14 authorizing the Grand Rapids Gas Light Co. to install a 60-mile pipe line to serve Grand Rapids with a 50-50 mixture of natural and artificial gas. Ground was broken the same day by the company to pipe gas from the Milbrook-Hinton-Belvidere Townships field in Mecosta and Montcalm counties within 60 days.

The Northern Natural Gas Co., Omaha, Neb., has let the installation contract for a new 20-in. welded-steel pipe line from the natural-gas fields at Hugoton, Kan., to a point near Mullinsville, Kan., about 100 miles, where connection will be made with the present main pipe line for natural-gas supply for municipalities in Nebraska and Minnesota.

Detroit's natural-gas line, scheduled for completion in July, reached an important stage in its development with the letting of a contract on March 17 for 44,000 tons of 22-in. seamless steel pipe for a 235-mile welded pipe line from Zionsville, Ind., to the city limits of Detroit.

WHAT'S NEW

In Coal-Mining Equipment

UTILITY JACK; PRESS

The "Acco" utility jack No. 35 is offered by the Welded Chain Division of the American Chain Co., Inc., Bridgeport, Conn., for applications involving stretching, pulling, binding or lifting. It is suitable, according to the company, for working loads up to 4,000 lb. The complete unit consists of the frame with operating parts, 10-ft. stretcher chain and 5-ft. anchor

chain. Weight is 34 lb. without chains.

Wright Mfg. Division of the company offers a new line of hydraulic and screw presses, including 25-, 40- and 60-ton hydraulic presses and 25- and 35-ton screw presses.

GRINDER SUPPORTS

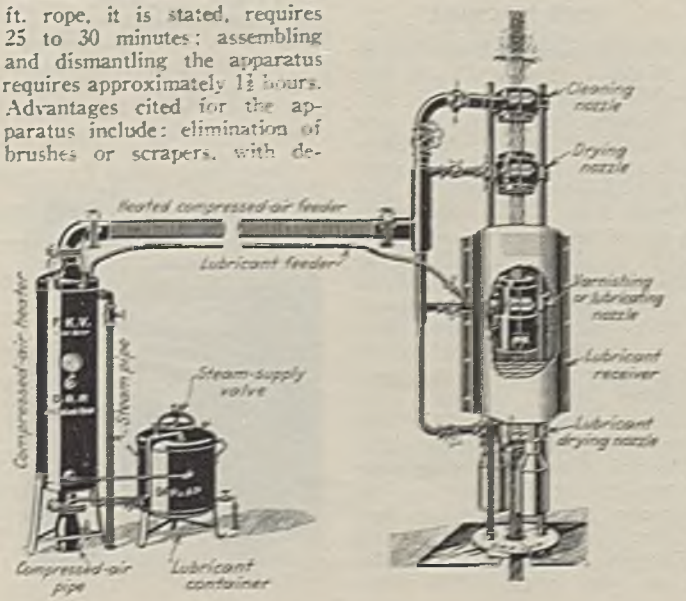
Ideal Commutator Dresser Co., 1013 Park Ave., Sycamore, Ill., offers a new line of supports to supplement the regular types furnished with Ideal "Precision" commutator and slip-ring grinders. The "O.E." support, according to the company, is attached to the motor so that the grinding tool with its resurfacing element is mounted on a rigid and inflexible base, is in the right position and is high enough for non-obstructed and easy operation with the work in the full view of the operator. With the "O.E." support the grinder may be mounted between the brush holders, permitting resurfacing without dismantling brushes or rigging and with the motor operating at normal speed in its own bearings, thus assuring a superior surface on a true-running commutator.

The "T.O." support is designed for attachment to the brush yoke and bearing pedestal; the "W" type for mounting Ideal grinders on larger exciters, motors and generators, using the main frame; the "Universal" type for attachment to the main housing and bearing support; and the "Plate" type for attachment to the end bell of the smaller classes of units.

ROPE OILER

John J. Colombel, 200 Broadway, New York City, as agent for Otto Adolphs, Dortmund, Germany, offers the "System Bocher" rope-cleaning and lubricating machine, stated to be used by 150 European mining operations. With this equipment, the hoisting rope to be treated first passes through a nozzle where it is cleaned by a jet of heated compressed air. Another compressed-air nozzle dries the rope, which then passes through a lubricating or varnishing nozzle, where the lubricant is evenly applied by compressed air, also heated. Finally, the rope passes through a drying nozzle to complete the treating operation.

To facilitate placing or removing the apparatus, provision is made for disassembling it into two parts by loosening a few setscrews. Treatment of a 2,500-ft. rope, it is stated, requires 25 to 30 minutes; assembling and dismantling the apparatus requires approximately 1½ hours. Advantages cited for the apparatus include: elimination of brushes or scrapers, with decreased rope wear; even distribution, thorough penetration and immediate drying of lacquer or lubricant, regardless of weather conditions; reduced cost; and greater safety.

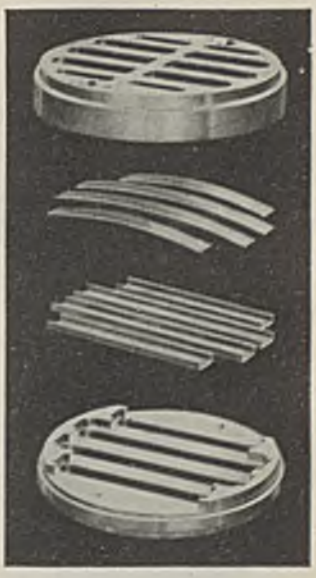


BUCKET CONVEYOR

The improved McCaslin pivoted bucket conveyor is now offered by the Mead-Morrison Division, Robins Conveying Belt Co., New York City, which stresses conformation to modern ideas of accessibility, demountability, adjustability and dependability. The improved conveyor is offered in three standard widths of buckets—18, 24 and 30 in.—with a chain pitch of 24 in. Speed varies from 40 to 48 f.p.m., handling 40 to 80 tons of coal per hour and requiring 7½- to 25-hp. motors.

CHANNEL VALVE

Ingersoll-Rand Co., Phillipsburg, N. J., announces the "Channel Valve" for compressors, which it states allows utilization of a greater-than-usual portion of the valve open-



ing, thus tending to reduce air-speed through the valve ports. The only moving parts of the new valve are a number of "valve channels" within each of which is a flat spring. When the valves lift, the springs straighten and a small quantity of air is trapped between springs and channels, forming cushions whose functions are to decelerate the valve channels after opening and bring them to a stop softly and quietly without impact. Advantages noted by the company include: practically silent operation; total elimination of impact; light weight of valve channels, which lift straight off the seat without flexing and return to the same position; increased efficiency; and longer life.

OIL-RESISTING HOSE

A new air hose designed especially to overcome the deteriorating effects of hot oil from compressors is announced by the Republic Rubber Co., Youngstown, Ohio. The tube, it is stated, is made from a compound similar to that used in oil-conducting hose and can be saturated with oil for long periods without affecting hose serviceability. Other features cited by the company include: high resistance to heat, high pressures, abrasion, cutting action and exposure to sun and weather; and great strength.

PYROMETER

Pyrometer Instrument Co., New York City, offers the "Pyro" optical pyrometer, which it describes as a totally self-contained direct-reading precision instrument which requires no correction charts or

curves, no accessories and no upkeep. Compactness and ease of manipulation, it is said, enable the operator, by means of a new concentrated test mark, to measure quickly (2 seconds) and accurately the temperatures of minute spots, fast-moving objects and the smallest streams. A master lamp, in addition to two service lamps, is furnished with each instrument for calibration. Various scale ranges are available to meet laboratory and plant requirements.

TRACTOR

Cleveland Tractor Co., Cleveland, Ohio, offers the new Model "30" Cletrac tractor, which develops 33 hp. at the drawbar and 38 hp. on a belt. The power unit is a 6-cylinder 3¾x4¼-in. engine with forced-feed lubrication to the crankshaft connecting rods and timing gears. Six-volt starting and ignition units are standard equipment. Three forward speeds are available: 1.75, 2.75 and 4.25 m.p.h. Steering is by the Cletrac controlled differential.

VARIABLE DRIVE

The new Reeves "Vari-Speed Motodrive" is offered by the Reeves Pulley Co., Columbus, Ind., to meet the need for a variable-speed drive which combines in a compact, self-contained inclosure any standard make of constant-speed motor, a variable-speed control mechanism and, where required, speed-reduction gears. Any make of foot-type constant-speed motor within standard NEMA dimensions may be used, it is said. Speed variation is secured by turning a handwheel and is infinite between predetermined limits, the company states.

The drive is available in horizontal and vertical designs, each built in four sizes to take motors from ¼- to 7½-hp. and providing speed ratios from 2:1 through to 6:1. Reduction units

of the helical-gear type in ratios up to and including 189:1 may be incorporated in the drive. In different combinations of sizes, ratios and reduction gears, output speeds ranging from 1.35 to 3,480 r.p.m. may be obtained. Units may, within certain limitations, be mounted on the wall, floor or ceiling, or on the driven machine.

PIPE MACHINE

As a companion unit to its Model-A "Standard" pipe machine, Beaver Pipe Tools, Inc., Warren, Ohio, offers the new Model-A "Special" unit, which it states will cut, thread, ream and chamfer all sizes of pipe from ⅛ to 2 in.; will operate geared tools to cut and thread 2½- to 12-in. pipe; will cut off solid round bars or stayrods from ¼ to 1 in.; and will thread bolts and stayrods from ¼ to 2 in. Features cited by the company include: wheel-and-roller cutoff; manual feed; fixed work head which does not tilt back; practical elimination of burr; swinging cone-type reamer which instantly removes all traces of any burr that may remain; standard wheels and rollers obtainable any place in the world; weeks

of service from a single cutting wheel with faster cutting—8 seconds for 2-in. pipe—practical elimination of upkeep cost; and adaptability to cutting steel, wrought-iron, brass, copper or cast-iron pipe.

PULLER

Chisholm-Moore Hoist Corporation, Tonawanda, N. Y., offers the "CM" puller, which it describes as a general-utility tool with capacities of ¾ and 1½ tons for pulling vertically, horizontally or at any desired angle. An efficient gear reduction in both sizes is said to reduce operating effort to a minimum—43 lb. for the ¾-ton unit, which weighs 17 lb. Minimum distance between hooks or. the ¾-ton size is 9 in. and the handle is collapsible to facilitate storage in tool boxes. Operation is controlled by two buttons, which permit quick chain adjustment. Mechanism and automatic friction brake are fully inclosed and are packed in grease to obviate future lubrication.

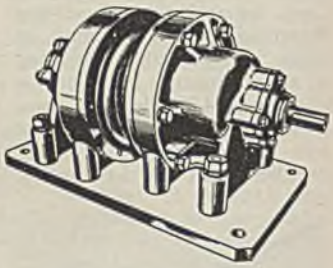
BLUEPRINTER

C. F. Pease Co., Chicago, announces the Pease "7" Model mercury-vapor-tube blueprinting machine for exposing blue, brown, and direct-process prints. Designed primarily for continuous printing of moderate volume, the machine offers —with good tracings and a fast blueprint or direct-process paper—a printing speed of 2 lin. ft. per minute with three tubes and 2½ ft. with four tubes. Speed range varies from 4 to

60 in. per minute. Current source is regularly 110 volts, although special machines can be provided for 220 volts. Overall height is 54 in.; width, 61 in.; floor space, 32x61 in.

VIBRATOR

Ajax Flexible Coupling Co., Westfield, N. Y., offers the new Ajax mechanical vibrator based on the principle of double rotating weights. Two weights instead of one, the company states, permit directional control of the impulses, or vibration, and the amplitude of vibration is controlled by the



amount of offset weight. Bearings, housing, size and speed characteristics are engineered to suit each application, and the units are designed for conveying, screening and separating, in addition to special applications.

DUST COLLECTOR

American Foundry Equipment Co., Mishawaka, Ind., offers the "American Dustube" dust collector, for which maximum simplicity and practicality of design are claimed. Collec-

tion, it is stated, takes place in easily removable woven-fabric tubes and the type of fabric can be varied to suit the specific application. Each tube works independently, and can be taken out of service when damaged without interfering with the operation of the remainder. New tubes, it is declared, can be inserted in 5 minutes. Application to many old or worn-out arresters is another feature stressed by the company.