COAL AGE

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

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The "Old Company"

HARD CONDITIONS breed strong men, lusty institutions and powerful traditions. No better illustration of this fact could be asked than the history of the Lehigh Navigation coal developments. Started more than a century ago by Josiah White and his associates after two earlier groups had abandoned the enterprise, desperate courage and bulldog persistence won success over difficulties which would have sapped the spirit of less sturdy souls.

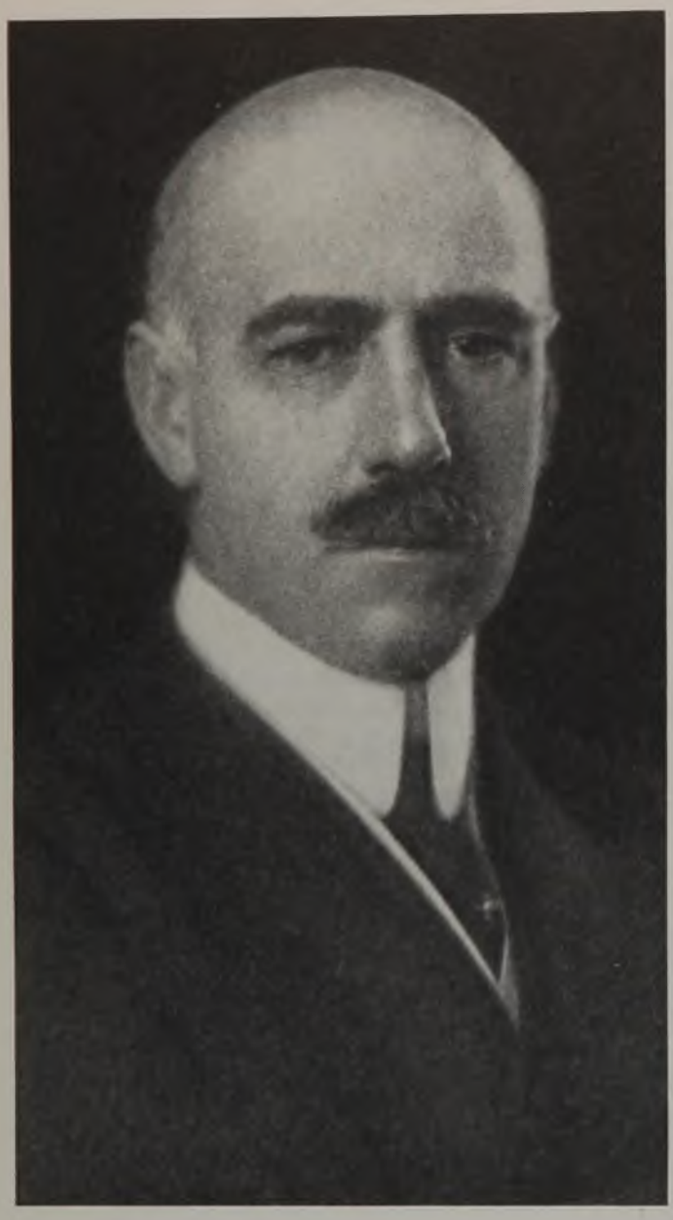
INSTITUTIONS, like men, however, either grow with the years or decay. To management at Lehigh Navigation, the heritage of Josiah White's pioneering spirit and resourcefulness has been received as something to emulate as well as to admire. Throughout its long career, Lehigh Navigation has shown a recuperative vitality that has kept it a leader in anthracite colliery practice and an eagerness to break new ground matching the zeal of its founders.

THE RECORD of pioneering developments in Josiah White's day set new landmarks; the records of his successors have been no less significant. As part of the development of a system for recovering coal from heavily pitching seams, for example, Lehigh Navigation drove the first mining tunnel in the United States. Some of the earliest wet-cleaning processes were the brain children of its men. Again, at Hauto, Lehigh Navigation pioneered in mine-mouth generation of electrical energy.

STRIP MINING at Lehigh Navigation properties is as old as the parent Lehigh company, for that method of recovery was employed at Summit Hill in 1820. Today, Lehigh Navigation stands as a leader in anthracite stripping practices. When big shovels were regarded as suitable only for bituminous open-pit work, the Navigation company demonstrated its faith in larger-capacity buckets at Cranberry.

WITH TIME there are some institutions which grow richer in years and poorer in achievements. But Lehigh Navigation management never has regarded great age as a passport to lasting fame or glorious tradition as a justification for present inaction. On the contrary, the company has taken such advantage of technical progress that today little remains but old rock dumps to attest its long years of existence. Buildings and plants suggest the most recent of developments—a product of the present decade rather than operations rooted in the early half of the Nineteenth Century.

THE "OLD COMPANY," in truth, is old only in name. While the record of its past achievements, so sketchily indicated in the preceding paragraphs, is impressive, the manner in which it is meeting present-day problems of production and merchandising is still more inspiring. These methods of the Lehigh Navigation Coal Co. are made the theme of this issue—*Coal Age's* Fifteenth Annual Model Mining Number.



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FLASHBACKS

+ In "Old Company" History

TEN YEARS after the last gun in the Revolutionary War had been silenced, a weary hunter moving through the deepening shadows of Panther Creek valley stumbled over a strange black substance. Could Philip Ginter revisit the scene of his 1791 discovery today he would find several thousand men busy mining that same black substance for shipment to markets which then were wildernesses. He might even see—to his eyes—fantastic machines taking great bites out of the very ground where once he stumbled. For the trifling mishap of this lonely Nimrod was to lead to the commercial development of the Lehigh anthracite field and the launching of a producing organization whose corporate history goes back to 1820.

While there is no record to indicate that Philip Ginter's vision could leap the years, he did have a hazy idea that the substance might be some of the new "stone coal" which had been used by a few blacksmiths and at the Carlisle arsenal during the late war. So he showed his find to his friend Col. Jacob Weiss, of Fort Allen, who was interested enough to take it to Philadelphia, where Ginter's guess was confirmed. The next year, the colonel and a group of associates which included Robert Morris, financial angel to the Revolution, banded together in the Lehigh Coal Mine Co. and purchased between eight and ten thousand acres of coal lands between Mauch Chunk and Tamaqua. River transportation costs ranging from $9 to $18 per ton for coal selling at the mines at $1 to $2, the hazards of that form of transportation and deep-rooted consumer preferences for wood, British and Virginia coals caused the temporary abandonment of the project a few months after the new company had built a road from the mines to the Lehigh River near Mauch Chunk.

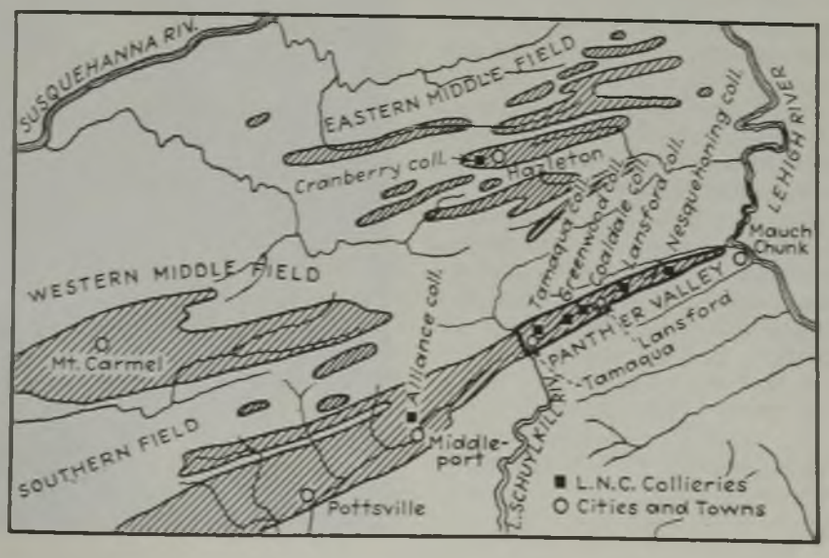
Although some improvements in navigation were made in 1798, the Lehigh Coal Mine Co. did not resume operations until 1803. Only two of the six arks floated toward Philadelphia that year, however, reached destination, and great difficulty was experienced in selling these cargoes. The new coal received its first real boost when Judge Fell in 1808 demonstrated that it could be burned in an open grate. Further impetus was given the infant industry during the War of 1812 when the Atlantic coast ports were closed to Virginia and foreign coals. Jacob Cist, Charles Miner and John Robinson were so impressed with the possibilities of expansion that they negotiated a lease with the discouraged owners for the development of the Lehigh properties. While the new lessees escaped neither the perils of navigation nor, at the outset, the indifference of consumers, rising prices for charcoal spurred manufacturers to make a real attempt to use anthracite, and prospects for the venture brightened. With the end of the war, however, the bottom dropped out of the coal market and the business again was abandoned.

In the meantime, fate was preparing the way for the entrance of a new group of pioneers who would pick up the broken threads and weave them into a more lasting pattern of success. Early in life, Josiah White, a sturdy Quaker lad from Mt. Holly, N. J., had resolved that, if he could accumulate $40,000 by the time he was 30, he would retire from active business, become a gentleman farmer and give full play to his suppressed inclinations for things mechanical. Apprenticed to the proprietor of a Philadelphia hardware shop at fifteen and the owner of a business in that line before he had attained his majority, Josiah reached his goal at the age of 28. He bought his farm, but almost immediately became intrigued with the future of water power and inland waterways.

The record of water development in Pennsylvania had been a sorry one. Two canal projects had been abandoned and "no public improvement by navigation had yet succeeded" in paying dividends in the State. Damming of large streams was looked upon with suspicion and distrust. "Here was a choice," he said in his yellowing diary, "between applying my means and my talents in a way or singular use to my fellow men and not impair my estate and not, as I thought, involve me in plague or trouble. Thus myself and others would be benefitted, especially as I believed I had discovered the true plan of making dams secure by the manner of laying the stone or material on it instead of against it."

So Josiah White made his great decision. His first venture in the new field was the purchase of the Falls of Schuylkill, for which he paid $14,000 in the spring of 1810, only to discover that he "had jumped out of the frying pan into the fire" and had jeopardized his fortune. Embarking into partnership with Erskine Hazard in a nail factory as one means of utilizing the falls, he wryly wrote that, when he needed low water, "I usually had high water." Always eager to experiment, he paid $21 for a ton of anthracite from the first arkload floated

Five of the seven active operations are concentrated in Panther valley



down the Lehigh River for use in the factory furnace. Following traditional methods with other fuels without success, a workman closed the furnace door in disgust and started for home; returning some time later for a coat he had forgotten, he found the hopeless fire red hot. And anthracite became irrevocably linked with navigation in Josiah White's dreams.

Unable to agree with the plans of those in control of the Schuylkill Navigation Co., Mr. White, then teetering on the edge of bankruptcy, turned his thoughts to the Lehigh district. Late in December, 1817, riding a borrowed horse and accompanied by George F. A. Hauto and William Briggs, "my stone mason, who also wanted to ride somewhere," he set out for his first inspection of Panther Valley and reached Bethlehem on Christmas Eve. As a result of that trip it was agreed that White, Hazard and Hauto would join in the development of navigation and secure control of the Lehigh mines. "We three at once set about to get a lease of twenty years on the Lehigh Coal Mine Co. coal lands of 10,000 acres for one ear of corn a year, if demanded, and from and after three years to send to Philadelphia at least 40,000 bu. of anthracite per year on our own account so as to be sure of introducing this coal into the market, by which means they would hope to make their mines valuable, for thus far they had proved valueless to the Lehigh Coal Mine Co."

The necessary authority to improve the navigation of the Lehigh River was granted White and his associates by the State Legislature on March 20, 1818. The next month White and Hazard were at work, sleeping in the woods for a week and using levels borrowed from Benjamin R. Morgan, "who had retained them as relics of the Union Canal Co. We knew of no other level in Philadelphia, and, if there had been, we would have been too poor to buy it." In June, plans were completed for organization of the Lehigh Navigation & Coal Co., with a capital stock of $50,000, to improve navigation and develop the mines. Rebuffed by many who probably lived to regret their skepticisms and finding still other men of means chary either of the navigation or the coal prospects, White and his partners agreed to two separate companies. As a result, the Lehigh Navigation Co., with a capital of $50,000, was formed Aug. 10, 1818, and the Lehigh Coal Co., with a capital of $55,000, on Oct 21, 1818. Less than two years later—on April 21, 1820—the two companies were merged as the Lehigh Navigation & Coal Co. The next year the name was changed to the Lehigh Coal & Navigation Co. and incorporated under that name by a special act of the State Legislature on Feb. 13, 1822. Over a century later (in 1930), the mining and sales branches were separated from the parent organization to form the Lehigh Navigation Coal Co.

Although there are records of scattered production and shipments of hard coal going back to 1807, the tonnage was small and the real history of the commercial shipments begins in 1820, when the Lehigh Navigation & Coal Co. sent 365 gross tons to the Philadelphia market. In 1821, shipments were 1,073 tons; "still," remarks Mr. White, "the consumption of families in Pennsylvania was insufficient to take this small quantity, but the balance was sold to factories." Shipments of 5,823 tons in 1823 resulted in a carryover of approximately 1,000 tons the following spring, and the Philadelphia managers begged their Mauch Chunk associates to limit the 1824 movement to 2,000 or 3,000 tons. Instead, the Mauch Chunk managers insisted on sending down 9,541 tons!

This bold disregard of the recommendations of the early sales agents had most fortunate repercussions for the company and for the industry. Seeing "so large a stock on hand" at a uniform price of $8.40 per gross ton, public interest and inquiry grew apace. "Stove makers and grate sellers now for the first time," wrote Mr. White in his diary, "began to boast of having preferable patterns of grates and stoves for burning anthracite. Some patriotic ladies also began their sample fires of anthracite: among them, the Widow Guest in Sansom Street stood the most conspicuous." And in 1825, the company shipped 28,393 tons to market.

Night on Summit Hill

Strip shovels now work where Ginter stumbled over "stone coal" in 1791

Steadily increasing demand, however, did not mean that all the troubles of this pioneering company were at an end. In 1842 a great flood wiped out practically all of the canal work which had been built some years earlier between White Haven and Mauch Chunk, and it cost yearly $1,000,000 to repair the damage. A second and still more deadly flood occurred in 1863, but, inasmuch as canal traffic had been declining since 1855, the managers of the company were ready to devote their major transportation building to railroads.

Their first excursion in that direction had been made in 1827, when a 9-mile gravity road had been constructed between the mines at Summit Hill and Mauch Chunk. Between 1837 and 1846, trackage had been laid between Wilkes-Barre and White Haven and joined up as the Lehigh & Susquehanna R.R. Several years later this line was extended to Mauch Chunk and Phillipsburg, and in 1871 it was leased to the Central Railroad of New Jersey. In 1904 the Lehigh Coal & Navigation Co. acquired a controlling interest in the Lehigh & New England R.R., extending from Slatington, Pa., to Campbell Hall, N. Y., and increased its stock ownership in the Lehigh & Hudson River R.R., extending from Phillipsburg, N. J., to Maybrook, N. Y.

Since Josiah White relinquished the presidency of the Lehigh Coal & Navigation Co. in 1841, nine successors, including the present incumbent, have occupied the presidential chair. Many of them, like the founder, have been leaders not only in their own company but in the industry as a whole; the long years of distinguished service of S. D. Warriner, for example, as official spokesman for the anthracite producers are still fresh in memory. Josiah White saw production grow from the modest initial shipments of 1820 to 454,258 net tons in 1850; last year, the commercial output of the Lehigh Navigation Coal Co. was 3,657,688 tons and the operations had a capacity in excess of 4,500,000 tons. To trace in detail the many changes in the structure and organization of the company which necessarily have accompanied this growth would exhaust a volume. Emphasis in this prelude has been deliberately placed on the earlier days because the pioneering spirit then so dauntlessly displayed has left a brand which still burns. How 1935 management is using the rich heritage of courage and resourcefulness bequeathed it by Josiah White and his associates in meeting present-day problems of production and sales is told in the pages which follow.

MANAGEMENT

+ At Lehigh Navigation Coal Co.

MANAGEMENT in its functional aspects is primarily cerebral: organization for action and managerial thinking, however, consciously or subconsciously, are influenced or determined largely by the material conditions surrounding the property to be managed. Management organization in the Lehigh Navigation Coal Co. mirrors the geographic compactness of its physical operations with five of its seven active collieries concentrated in the Panther Creek valley—a narrow basin between the Lehigh and Little Schuylkill rivers on the eastern edge of the Southern anthracite field—and the more distant of the other two properties, only fourteen miles from operating headquarters at Lansford. Such a set-up encourages simplification in organization structure, and this the Lehigh management has achieved.

The Lehigh operating organization is a combination of line and staff with functions clearly defined and authority definitely delegated. Executive, sales, general purchasing and accounting department headquarters are in Philadelphia; operating department headquarters, as stated in the preceding paragraph, are at Lansford. Supervision and control over all operating department activities are vested in the general superintendent, who reports directly to the president. Jurisdiction of this department embraces mining, preparation, company and contract stripping, operating plants and equipment, research, industrial relations and personnel work, safety, compensation and medical service, housing, warehouses, supply depots, and forestry.

Immediate supervision of various phases of the work of the operating department is allocated among a staff of fourteen officials (including six district superintendents), all reporting to the general superintendent. The specific functional assignments to each of these officials and the divisional breakdown of their subordinate staff organizations are shown in Fig. 1; the work of these different groups is discussed in detail in the articles which follow this over-all review. In addition to this general staff, the general superintendent also has an operating assistant who not only handles the many details commonly associated with the position of aide to a chief operating officer but also has direct charge of public relations in the mining area and, in cooperation with the district superintendents, participates in the handling of problems involving labor relations.

While each major staff official is coordinate in rank with every other major staff official and—subject, of course, to direction and veto by the general superintendent—is supreme in his own particular bailiwick, the key position is held by the district superintendents. All the planning and all the activities of the staff organization as a whole have a common objective: to produce a coal which will be acceptable to an exacting market as economically and as safely as possible. This may mean a change in mining methods, an improvement in preparation or sizing, design of new equipment, a revision in maintenance practices or the development of a new market outlet. Since direct responsibility for production, however, rests upon the district superintendent, the position he occupies in the management set-up is readily understandable. He must take the plans, the materials, the services and the equipment developed by the other divisions of the operating department and translate them into lower costs and a more marketable product—or know the reason why.

Generally speaking, the straight-line system of reporting from subordinate in a division to a staff division chief and from the staff division chief to the general superintendent, who is the chief coordinating officer, predominates in the Lehigh Navigation organization plan. But this does not mean that each division of the operating department works in a sealed compartment. Far from it! Moreover, the organization plan makes specific provision for certain official cross-reporting between the district superintendents and other divisions or division heads. District engineers, for example, are attached to the office of the mining engineer, but also report on operating problems to the superintendent of the district in which they are stationed. There is a close tie-in between district superintendents and the mechanical superintendent on questions relating to equipment and maintenance, and between district superintendents and the superintendent of preparation and stripping on coal preparation.

Official contact between the operating department and the departments located in Philadelphia usually is through the general superintendent, but there are some exceptions to this general rule. The general shipper, for example, acts as a liaison man between the sales department and the operating department in handling orders for coal shipment. Because inspection of coal loaded for shipment is under the jurisdiction of the operating department and not—as is the case with some companies—under the wing of the sales department, the superintendent of preparation and stripping reports on coal inspection directly to the president, to whom the sales department also reports.

The research division has two distinct functions: (1) to maintain standards of product and of materials used in production, and (2) to effect reductions in cost of materials and procedures and to develop new sources of revenue. The first function is performed in a well-equipped laboratory where coal inspection is controlled by means of sizing and ash tests and proximate analyses. In the testing of materials used in production, the laboratory works against definite standard specifications which are closely followed by the purchasing agent.

On the research side, emphasis at the present time is being placed on: (1) new methods of mining, (2) the handling of explosives in such a way as to reduce explosive costs and conserve prepared sizes, and (3) the adaptation of various types of timber to the special conditions met in the mines. The work on explosives is closely related to the supervision of explosive practices on the part of the miners. Each of these three projects is in charge of a separate engineer.

The company has given, and still is giving, extensive attention to the utilization of breaker waste, of which Lehigh Navigation has more than its share in the anthracite region, in the manufacture of ceramic building materials. A great deal of study also has been devoted to widening the market for very fine coal in pulverized form.

Attached to the division of preparation and strippings is a corps of service engineers who work in close conjunc-

tion with the sales department. These engineers handle consumer complaints in the field. This division also works with the sales department in service schools held at Lansford for retail distributors and their "trouble shooters."

Major forecasts for development at each colliery—covering production from each level, output from each vein, and the virgin or "remining" tonnage from each vein—are projected for ten-year periods subdivided into units of 100 working days. All coal recovered by stripping is classified as virgin. At the end of each 100-day unit, colliery development maps are posted to show actual output and the number of feet of gangway and tunnel driven as compared with the forecast for that particular period. Tonnage also is posted at the same time on the companion graphs to the development maps.

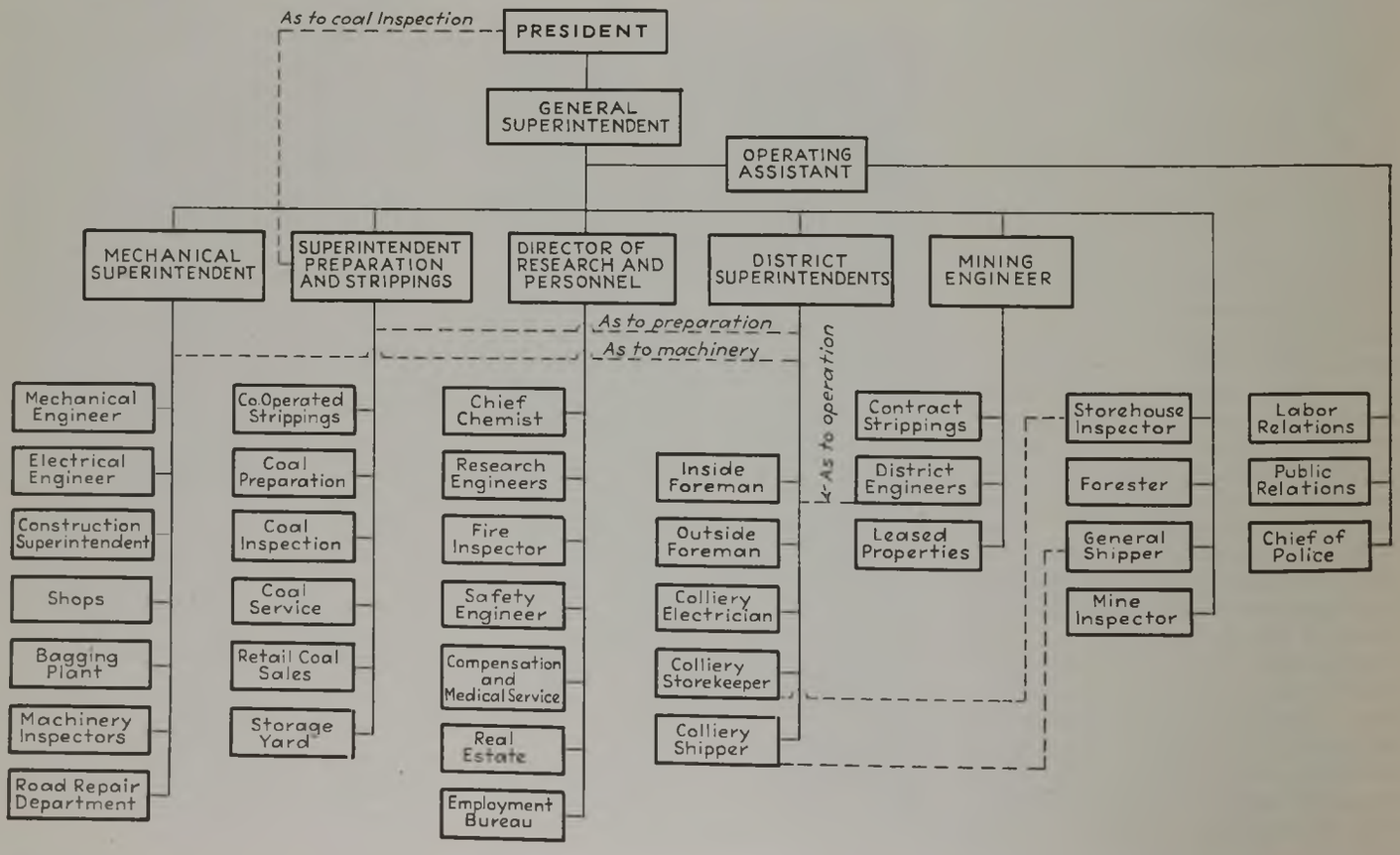
This system of forecasting affords both long- and short-range control of actual development work and the expenses incident thereto. Under the accounting methods of the company, the cost of shafts, main tunnels and main openings for ventilation purposes are capitalized; other development expenses are treated as part of the cost of production. All production-cost items are reduced to a per-ton basis; authorizations for capital improvements usually are coupled with a time element. Thus, while the money appropriation for development work may be authorized for a specific period, actual expenditure of that portion chargeable to operating costs is controlled by the production rate—i. e., the number of days actually worked. Under this system, the possibilities of inflated production costs in any period due to an attempt to catch up on delayed development work are definitely eliminated.

Top management at Lehigh Navigation believes that subordinate officials held directly responsible for the results achieved within the sphere of their activities should have more than a shadowy picture of what those results, measured in costs and efficiency, actually are. Every month each district superintendent is given the complete breakdown on costs in his district and for the operations as a whole. The inside cost sheet covers 52 individual allocations of expenses for: (1) Mining and loading, subdivided for (a) narrow work, (b) rock work, (c) chamber work, and (d) reopening workings and recovering pillars; (2) stripping; (3) inside transportation, subdivided for (a) haulage, (b) hoisting, (c) tracks, (d) wiring, (e) stable expenses, and (f) mine cars; (4) ventilation; (5) drainage; (6) general inside expenses, and (7) supplies sold and smithing. The outside cost sheet, with 56 individual allocations, covers expenses for: (1) Breakers, subdivided for (a) dumping, (b) preparation, (c) loading, and (d) refuse disposal; (2) transportation, subdivided for (a) haulage, (b) hoisting, (c) tracks, (d) wiring, and (e) stable expense; (3) general outside expense; (4) heat, light and power; (5) general colliery expense; (6) administrative expenses; and (7) reserves for local taxes, compensation insurance, mining hazards, depreciation, amortization of mine developments, depletion and amortization of leaseholds.

This breakdown is further subdivided to show: (1) Labor costs for (a) operation, (b) repairs and maintenance, and (c) total labor costs per ton; (2) material costs similarly subdivided; (3) combined labor and material costs, and (4) the increase or decrease per ton for each of the 108 individual allocations compared with the same period in the preceding year. Comparative data also are given on the number of mine cars loaded, average load, hours worked, commercial production and the percentage of each size loaded out.

Inside and outside section foremen also are furnished with sectional costs for each pay period at their particular colliery. The form containing these data gives the number of cars produced and total and per-car costs for mining, repairs above gangway, starters and loaders, timbering, narrow and rock work, total section cost, transportation, ventilation, drainage and miscellaneous costs, with comparative and cumulative total costs for each section of the mine. The foreman's breakdown on outside costs shows totals and per-car costs for transportation, breaker, maintenance and miscellaneous. In addition, he is given similar figures on heat, light and power costs, general colliery, and administrative expenses. In this way, each section foreman is as fully informed as to cost results in his particular field of operations as his superiors are for their larger domains, and is enabled to work out exact production costs for each working place in his section.

Fig. 1—The straight-line system predominates in the Lehigh Navigation Coal Co. operating department organization



MINING METHODS

+ At Lehigh Navigation Coal Co.

WITH steep pitches and substantial coal thicknesses as the general rule, the Lehigh Navigation Coal Co. employs a variety of mining systems at its seven active operations. Supplementing methods designed for application in steeply pitching measures is the use of mechanical mining aids where less than a sheet-iron pitch exists. With the exception of the Cranberry colliery, in the Eastern Middle anthracite field, Lehigh Navigation operations, however, are located in sections of the Southern field where folding was most severe; relatively flat areas, therefore, are the exception.

The seat of the company's mining operations is in the Panther Creek valley, and between the Little Schuylkill and Lehigh rivers. Active collieries in this valley are: Nesquehoning, Lansford, Coaldale, Greenwood and Tamaqua. Alliance colliery lies farther west in the Southern field near Middleport. Maximum width of the Panther valley basin, which spoons out and ends near Mauch Chunk, on the Lehigh River, is two miles.

Compared with Lehigh Navigation operations in the Southern field, pitches at Cranberry colliery, in the Hazelton basin of the Eastern Middle field, are relatively flat. Maximum pitch in local areas at Cranberry is 90 deg., varying from this magnitude to flat. In general, however, the pitch seldom exceeds 30 deg., and in the sections worked at present no pitch steeper than 35 deg. is encountered.

The Mammoth is the thickest bed worked at Cranberry, averaging 23 ft., against 2½ to 8 ft. for the other beds mined. Present operations in the Mammoth, which was first-mined years ago, are confined to robbing pillars. As a result of crushing and caving in the bed, the Mammoth pillars are attacked from the Four Foot split beneath. From gangways in the Four Foot, bed-height chutes 10 ft. wide are driven up the pitch on centers of 80 to 100 ft. Starting at the tops of these chutes, slants are turned to the right and left at intervals to meet similar slants from adjacent chutes. From these slants, rock holes are punched through the 4 ft. (average) interval to strike the various Mammoth pillars.

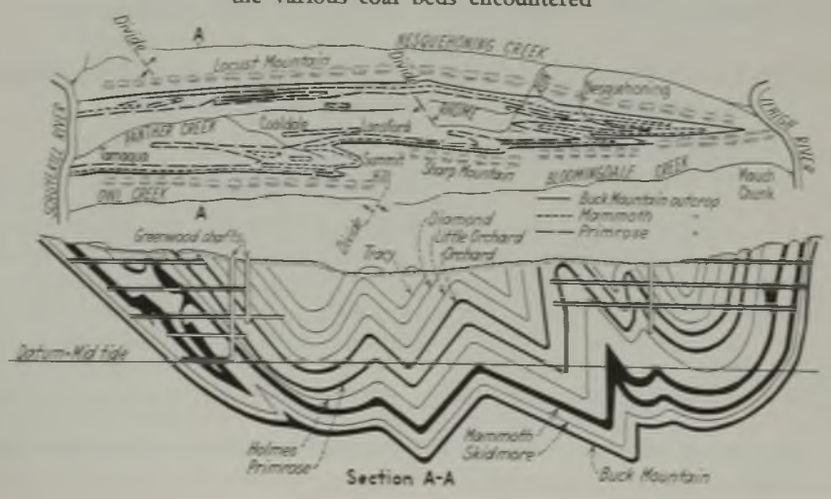
Other beds at Cranberry, from which most of the virgin-coal output comes, are mined by the breast-and-pillar system. From the gangways, chutes are driven up the pitch 15 ft. to start the breasts. Breast width is 24 ft. Centers as a rule are 50 ft., leaving a 26-ft. pillar. Pillars are robbed by cutting across the ends and then skipping them down to the gangway. If, as occasionally happens, wider pillars are left, they are split by pillar holes and worked down from the top in much the same fashion.

Sheet iron is used to transport the coal on pitches from 35 down to 12 deg. To facilitate running coal on inclinations near the minimum, galvanized sheets have been adopted. Experience has shown that galvanized sheets have double the life. They also retain a smooth surface during idle periods and, therefore, are in better condition for running coal upon resumption of operations. On pitches under approximately 12 deg., 35- to 36-cu.ft. buggies were employed in the past, but are rapidly being replaced by scraper loaders (p. 494).

With, at the present time, a maximum bed thickness of approximately 12 ft., Alliance colliery employs, in addition to conveyor and scraper units, the "full-breast" system of mining. Breasts are driven 24 ft. wide, including manways, on 50-ft. centers. No coal is drawn from the breasts as they advance, the excess resulting from mining flowing down the two manways (one on each side of the breast) to the loading chute. Upon completion of a breast, a 6x6-ft. pillar hole, or chute, is driven on the bottom rock up the center of the pillar. From this pillar chute, slant chutes are turned at intervals of approximately 30 ft., starting at the top, and the pillar is worked down from these slants. As a rule, only sufficient coal is drawn from the breast to keep it level with the downward course of pillar robbing.

Coal thicknesses are considerably less at Cranberry and Alliance than in the Panther Valley area and, with the exception of the Mammoth pillar work at Cranberry gangways, therefore, are driven in the bed at these collieries. In the valley, on the other hand, driving has been transferred, as a rule, to the rock or a thinner bed underlying the bed to be mined, as compared with the general practice in earlier days when mining was confined largely to the upper portions of the Mammoth and Primrose beds (Fig. 1), which usually were developed by slopes and gangways driven in the beds themselves. Under this system, breasts were driven as the

Fig. 1—Plan and section of the Panther Creek valley, showing relation of the various coal beds encountered



gangways advanced and robbing was deferred until the gangways had reached their limits. With the great coal thicknesses prevailing, output from a single breast was large and its advance correspondingly slow. As a result, gangway life was greatly lengthened, with corresponding liability to deterioration.

As mining was extended to lower levels, deterioriation of coal gangways started earlier and increased in magnitude, with consequent increases in maintenance cost. To reduce this cost, gangways were removed from the coal to the rock or the thin veins underlying the bed, particularly in the case of the Mammoth. From these main haulageways, panel tunnels were driven to the bed at intervals of 1,000 to 2,000 ft. From these tunnels, short gangways were driven in the bed, thus permitting mining and robbing in the panel sections before gangways required major repairs. Further improvement in drilling equipment and explosives has been reflected by a strengthening of the trend toward rock or thin veins for development work, with the result that now gangways and airways usually are placed below the bed, which is tapped by rock chutes.

Shafts are employed exclusively in the Panther Creek valley. Levels are established 200 to 225 ft. apart, measured vertically, and from each level crossmeasure tunnels are driven to intersect the various beds. Only occasionally, however, are gangways turned off these tunnels in the beds themselves. Usually, the connection is made to a haulage gangway in the Skidmore bed under the Mammoth. Where the Skidmore is too close to the Mammoth or is in bad condition, the Seven Foot bed is used if not too far away; otherwise, the gangway is driven in rock. Occasionally, a haulage gangway is driven in the leader above the Buck Mountain bed, but only where the Buck Mountain is vertical and gangways in the bed itself cannot be held open. As a rule, however, main haulage gangways on each level are driven under the Mammoth, and other beds, if mined, are developed from panel tunnels turned off the main gangways at 1,000- to 2,000-ft. intervals.

In driving rock tunnels, primary haulage gangways and subsidiary openings, post-mounted water leyner drills are employed—two in rock tunnels and one in Skidmore or other thin-vein gangways. Rock work, including mucking, generally is contracted. Drilling crews usually consist of a chargeman, driller and one or two helpers, who drill and shoot the face on one shift. On the next shift, a mucker boss and four men load out the broken rock and prepare the face for drilling.

With hand mucking, drilling depth is adjusted to give a daily advance of 1.8 lin.yd. in an 8x12-ft. place, yielding approximately 8 cars of muck at 115 cu.ft. per car, level full, which provides a full shift's work for a mucking crew. To reduce the cost of rock work, three Myers-Whaley track-mounted loading machines are employed at the Lansford, Coaldale and Greenwood collieries. With these machines, 12 to 16 cars can be mucked per shift, and their use allows mucking two 6x8-ft. rock chutes in addition to the face on a single shift. Actual shovel output is limited by conditions in the gangway, and to enable it to perform most efficiently, at least two faces must be mucked per shovel shift. Driving of rock chutes simultaneously with the tunnel or gangway face offers still another advantage in that the rock chute next to the face can be blasted first and the material thus yielded used as a barrier to confine fly dirt from the face rounds to a comparatively short area next to the face. Still higher mucking records are possible in driving double-track tunnels, which are made by driving a standard-sized tunnel and then slabbing one side to the required width. With one face and one slab, or skip, to load from, one loader at Lansford colliery averaged 23 cars per shift for a long period. Company mucking is the rule with the loading machines.

Table I—Results, in Part, of the 1925 Census of Inside Mine Timber, Panther Creek Valley

Length, tunnels and gangways, feet	522,986
Length, tunnels and gangways timbered, feet	224,880
Number of steel timber sets	2,403
Total, all timber sets, including steel	66,252
Wood timber sets lost by squeeze	13,417
Per cent of total	21.0
Wood timber sets lost by wet rot	3,821
Per cent of total	6.0
Wood timber sets lost by dry rot	46,611
Per cent of total	73.0
Average life, wood timber set, years	5.5

Shaker conveyor driving coal gangway at Alliance colliery

Timbering, where required in tunnels and gangways, also is done by the company. Three-piece sets (collar and two legs) usually are installed, although, depending upon conditions, one leg only may be employed with the opposite end of the collar hitched into the top or bottom rock, or legs may be replaced by hitches entirely. To reduce loss of timber by decay, the company started installation of treated tunnel and gangway timbers in 1925. Now approximately 10,000 sets are in service in nearly ten miles of openings in the Panther Valley. Preservatives include Wolman salts, Aczol, zinc chloride and zinc-meta-arsenite, with zinc chloride leading in number of pieces treated.

Standards in the valley call for treated sets in all openings where loss through mechanical damage or abandoment of openings before the expected life of the timber can be realized is not a limiting factor. Before adopting treated timber, every opening was surveyed to determine the number and type of sets and the causes of failure of untreated timbers then employed. This survey, summarized in Table I, showed that in a substantial number of cases the character and life of the openings would justify adoption of preservatives to increase timber life over the average of 5½ years revealed by the investigation.

Treatment is restricted to legs and collars, which are purchased already framed from wood-preserving companies. Short-leaf (Southern yellow) pine is used exclusively. In the case of zinc-chloride treatment, the specifications include the following:

Timber shall be of specie, quality, etc., as noted in L. N. C. Co. Specification G-2 with the following additions: timber must have at least 20 annular rings in the 4 in. from the first annular ring out, contain at least one-third summer wood, have not over 1½ in. of taper in 9 ft. and not over 2 in. of bow in 9 ft. of length. Peeling of timber shall be done immediately after cutting.

Table II—Loss of Tagged Pieces of Timber by Causes in Per Cent of Total Pieces Installed as Disclosed by Inspections in 1932 and 1934

	Tamaqua				Greenwood				Coaldale			
	Treated		Untreated		Treated		Untreated		Treated		Untreated	
	1932	1934	1932	1934	1932	1934	1932	1934	1932	1934	1932	1934
Total failed	14.9	33.7	51.7	71.5	14.6	34.5	45.3	64.0	28.3	49.1	47.7	82.8
Failed, dry rot	0.0	1.3	42.8	51.2	.....	0.2	22.1	46.1	1.1	2.7	12.0	33.9
Squeeze	9.4	11.2	6.5	10.9	3.8	7.4	14.0	17.9	19.5	26.2	21.2	26.9
Robbing	5.2	20.9	2.4	9.4	4.1	18.7	.....	.....	0.7	10.7	0.9	9.5
Sealed off	.....	.....	.....	.....	5.9	7.1	9.2	.....	.....	.....	.....	.....
Other causes	0.3	0.3	.....	.....	0.8	1.1	.....	.....	7.0	9.5	13.6	12.5
Average life of timber failed by dry rot, years, months	——*	5–2	.....*	4–3	.....*	6–11	.....*	4–11	.....*	6–11	.....*	5–1

Note: Approximately one-half the treated and untreated timber tagged is installed at the three collieries included in table.
*No compilation of average life made in this year.

Also, not less than 50 per cent of the inner bark must be removed. Timber must be carefully stacked and separated shortly after peeling to permit air circulation.

Seasoning shall not cover period of over two months, and if, at the end of that period, timber is not seasoned sufficiently to take absorption specified it must then be properly steam-seasoned to take amount of treatment specified. Mixed seasoned timber—that is, green and partially seasoned timber—must not be placed together in the tank for treatment, as it is impossible to secure uniform treatment with mixed seasoned timber. Treatment shall be full-cell with a 3-per-cent solution of zinc chloride, with minimum volumetric absorption of 40 per cent, or ¾ lb. of dry salt per cubic foot.

Species included in Specification G-2 are: short-leaf pine, loblolly pine, spruce pine or long-leaf pine. On quality and manufacture, the specifications provide the following:

Logs must be cut freshly from sound living timber and have good density, butt cuts; must be free from rot or any other defect that may impair their service; sawed off square at both ends; reasonably straight; free from crooks and knots; and closely trimmed. Heavily tapered timber is not acceptable.

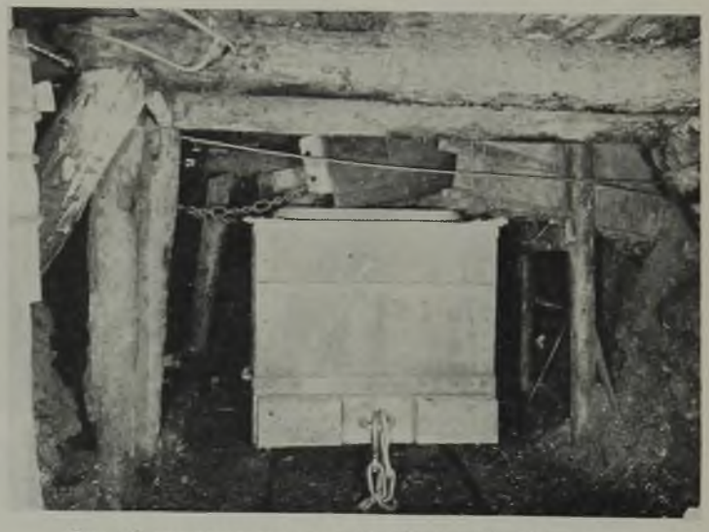
notably the "slant-chute" and "tap" systems, to meet certain special conditions. Breasts generally are driven 24 ft. wide on 60-ft. centers, although in some cases either the width or the centers, or both, may be reduced to 18 or 50 ft. respectively.

The breast-and-cutback system (Fig. 2) usually is employed in the thicker beds. Fig. 2 also shows the hip chute widely used at Panther valley collieries, which eliminates shoveling in running coal from the manway opposite the battery side of the breast where the hip chutes are driven in coal, as in Fig. 3. The pitch of the chute also facilitates running material from the face to the loading point in driving. Hip chutes are driven either along the bottom rock in the coal or in the rock immediately beneath, the latter method being employed where there is a possibility that

breast, also 15 ft. high, is started up the pitch on the bottom rock. When this second breast has been driven the proper distance, the first cutback is started and driven back to the top rock, the loose coal falling down into the space already excavated. The process of extending the breast and driving the cutbacks is then repeated until the old workings on the upper level are reached, whereupon the pillar is robbed down from the top.

Preliminary to robbing, a 6x6-ft. pillar chute is driven off the top of a rock chute connecting to the apex of the hip chute. Approximately 30 ft. below the top of the pillar, a pillar breast with straight battery is started off the pillar chute and cutbacks are made substantially as in the regular breast. The final operation is drilling the thin pillars on each side of the pillar breast

Chain-and-flight conveyors permit operation on adverse gradients at Alliance



One of seventeen scraper units discharging into car at Cranberry colliery

To obtain accurate data on life and causes of losses, installation of treated timber was accompanied by tagging of both treated and untreated types. This tagging extended to every individual piece in a set, and was supplemented by a record showing exact location of each piece both in the opening and in the set, type of treatment, date of installation, date of failure or loss and cause of failure or loss, as determined by regular inspection. Up to the end of 1934, 39 per cent of the treated timber had been lost from various causes; the loss of untreated timber was 73 per cent. Table II shows losses by causes at three collieries in 1932 and 1934 and indicates the extent to which dry rot has been checked.

With gangways and primary airways —in most cases—below the Mammoth or other bed, and therefore protected by substantial thicknesses of rock, complete extraction of the coal on the advance is now the rule at Panther valley collieries. Usually, the breast-and-pillar system or some modification is employed, supplemented by special systems, chutes or batteries will be difficult to maintain if placed in the bed itself. Driving hip chutes below the bed also makes possible entire elimination of the battery, as the short rock chute acts as a battery in controlling the flow of coal from the breast.

With the hip chutes below the bed, as in Fig. 2, the first step in breast-and-cutback mining is driving the main rock chute through which coal is withdrawn from the breast, as well as two smaller chutes connecting with manways in the breast under the first cutback. These manways are spaced to give a breast width of 18 or 24 ft. Then, starting at the top of the rock chute, the opening in the coal is gradually enlarged to both full breast width and height—15 ft. in the latter case. This breast is driven to the top rock. Sufficient coal is drawn off through the rock chute from time to time to maintain a level in the breast which will enable the miners to reach the face while standing on the loose material.

Upon completion of the first breast the coal is drawn off and a second (from either or both the pillar or regular-breast manways), as well as the stumps on each side of the battery, and blasting them down into the pillar chute. The miners then drop back another 25 or 30 ft. and start another pillar breast. Where the bed is vertical or nearly vertical, the pillar chute may be zigzagged from bottom to top rock along the center line of the pillar to keep the pitch in the various sections down to approximately 35 deg., which eases travel and at the same time permits flow of coal.

In case bed thickness does not exceed breast height, only the one breast along the bottom rock would be driven, although connections to the hip chute would be the same. If the coal is thick, however, the cutback system is employed, and if exceptionally thick or if the lift to the upper gangway is long, the breasts may be driven only half length. In "splitting the lift" in this manner a chute is driven up the Skidmore bed to a point half way between the upper and lower levels, where the usual connections to the bed are driven

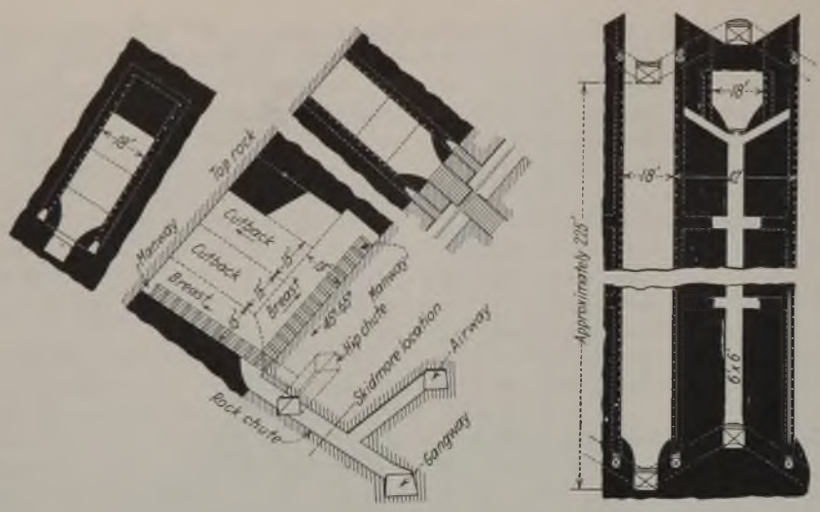


Fig. 2—Where coal thickness is great, the breast-and-cutback system of mining is employed. Sketch shows Greenwood colliery plan

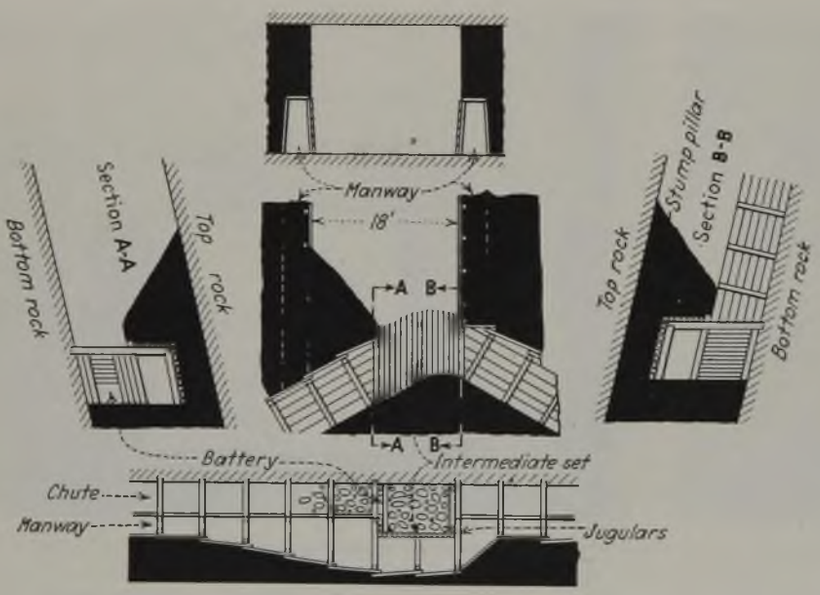


Fig. 3—Details of the jugular battery used in the Panther Creek valley

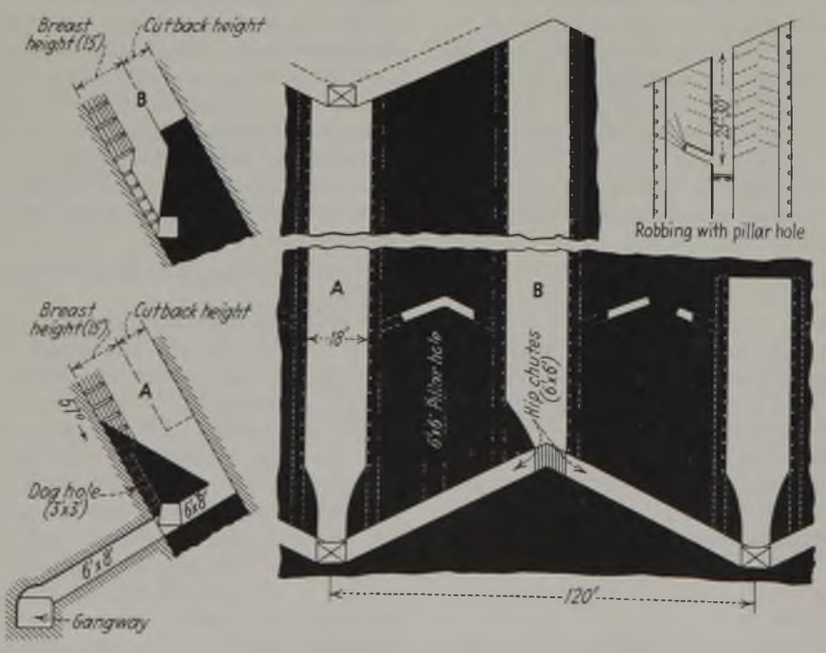


Fig. 4—Mining with hip chutes on 120-ft. centers, Tamaqua colliery

in the rock in preparation for mining in the same manner as from connections directly off the gangway. Upon completion of operations in the upper half the lower half of the lift is mined in the usual manner.

At Nesquehoning colliery, hip chutes usually are driven in the coal and are connected to gangways below the bed by rock chutes. Coal gangways are used in the thinner veins at this colliery, which, however, contribute only a relatively small tonnage. In contradistinction to the usual practice at other valley collieries, breasts are driven off the apex of the hip chutes. Pillar breasts are employed in robbing in the thinner beds. In the Mammoth and other thick beds, on the other hand, the pillar chute is employed. From this chute slant chutes are turned at 25- to 30-ft. intervals, starting at the top, and the pillar is worked down from these.

With the hip chutes in coal, batteries are necessitated at Nesquehoning. The type usually installed is known as the "jugular battery" (Fig. 3), which is widely used in steeply pitching beds to facilitate the running of coal from the breast and at the same time furnish an adequate bypass for air. In this system, the hip chute is widened about 4 ft., starting about 15 ft. from the point where the battery will be located. The maximum width is carried for approximately 15 ft., at which point the chute is narrowed to normal width in the space of about 5 ft.

One long timber set is placed on the stump side of the breast opening and another on the opposite side. Between these two sets a short intermediate set is placed, the three serving to support the stump pillar over the chute. Next a row of heavy props, or jugulars, is set with the props skin to skin in line with the bottom leg of the intermediate set and parallel with the bottom rock. The opening opposite the battery (Sec. B-B, Fig. 3) is then closed off with plank or poles, depending upon the weight of material to be supported.

The battery itself (Sec. A-A, Fig. 3) is formed by placing vertical props skin to skin to narrow the width of the opening between the jugulars and the bottom rock to approximately 2 ft., and likewise enough horizontal props, working from the top down, to reduce the height of the opening also to 2 ft.. Flow of coal through the battery is controlled by the loose coal in the loading chute, withdrawal from the chute being reflected in a corresponding flow from the battery.

Tamaqua is another colliery where hip chutes are driven in the coal, in this case from rock chutes 120 ft. apart. These hip chutes also act as the primary airway. Two breasts are driven off a hip chute, one (*A*, Fig. 4) from the top of the rock chute and the other (*B*) from the apex of the hip chute. The latter breast is equipped with a jugular

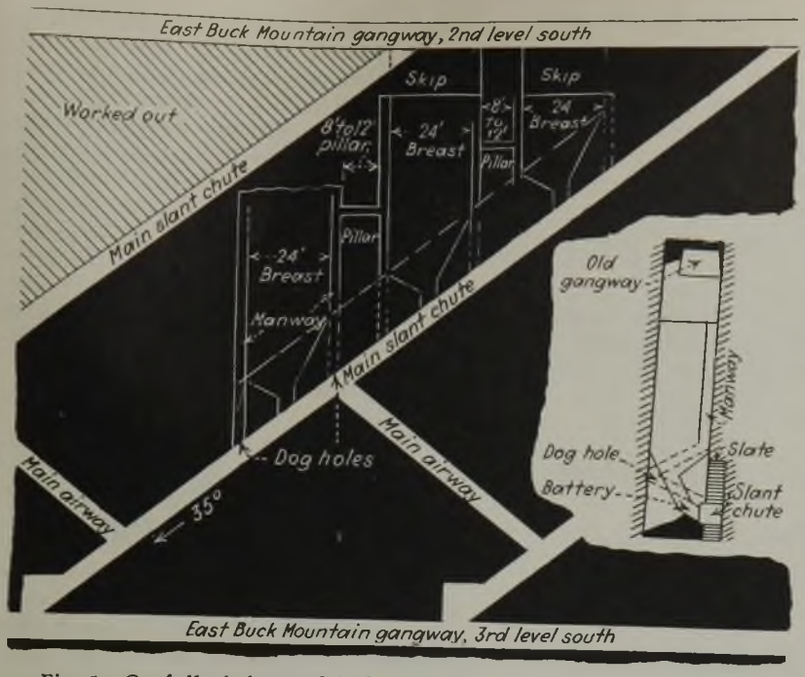


Fig. 5—On full pitches and in free coal, Tamaqua colliery uses the slant-chute system

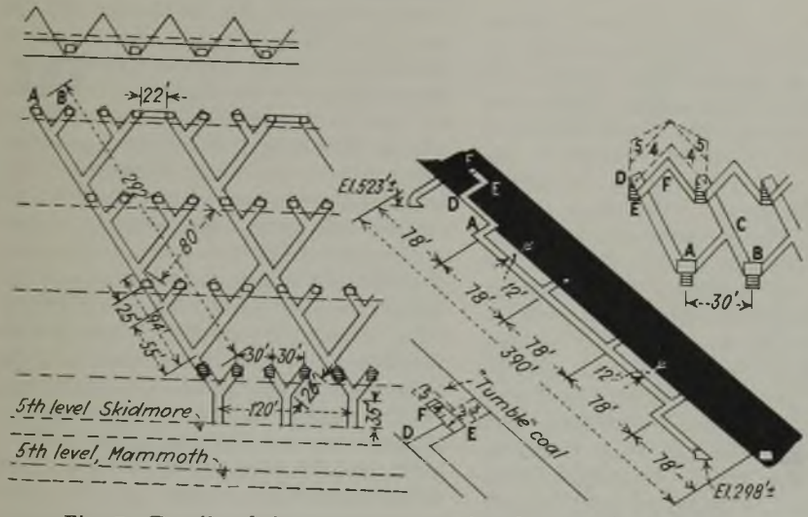


Fig. 7—Details of the tap system employed at Lansford colliery

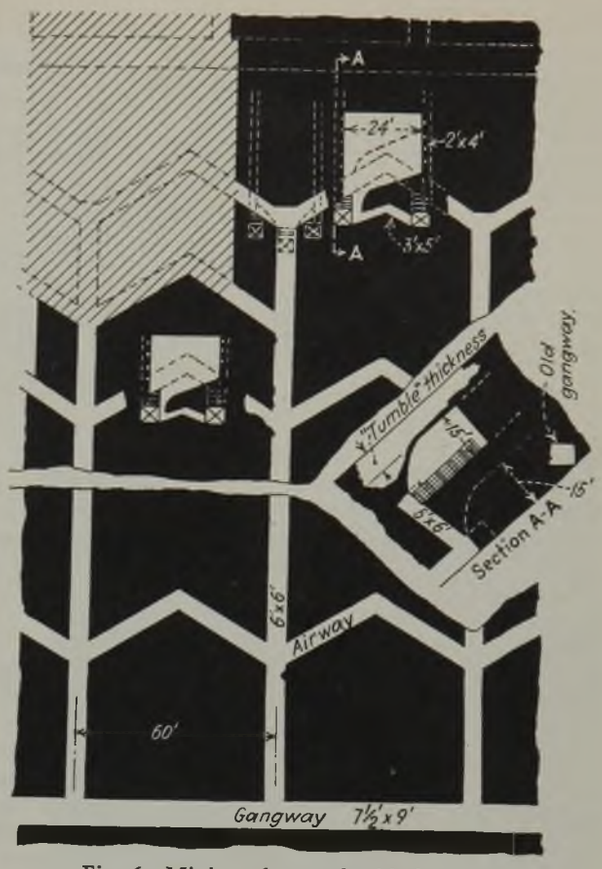


Fig. 6—Mining plan used with free coal at Lansford colliery

battery, from which the coal runs down one or the other slant to the rock chute. In starting breast *A* the rock chute is extended to the top rock, and excavation to breast width and height starts at this point, leaving a stump over the chute. In pillar robbing a pillar hole is driven up to the old workings, and the two halves are worked down in 25- to 30-ft. skips. If the manway in the adjacent breast is serviceable, the pillar on one side of the pillar hole is drilled from both sides and shot down; if this manway cannot be used, a short slant is driven from the pillar hole and the coal drilled from this slant, as well as from the pillar hole itself.

Tamaqua also employs the slant-chute method of mining (Fig. 5) in sections where the pitch approaches 90 deg., as well as sections where the pitch is less but where the coal is free. While requiring a substantial amount of narrow work and increased maintenance of main chutes while running coal, and also offering a more difficult ventilation problem, the system shortens the vertical length of the working places and offers a relatively light pitch along the slants for travel and running coal. Advance working is the rule. Main slant chutes are driven on a 35-deg. pitch, and are connected by a main airway above the gangway. In driving the slant in the Buck Mountain bed, the opening is made partly in the coal and partly in the thin bottom slate.

The first breast is started down from the top of the main slant chute, leaving a triangular pillar next to the old gangway. Breast width is 24 ft. inside the manways, and an 8- to 12-ft. pillar is left between adjacent breasts. Breasts are stopped short of the upper gangway, and the remaining coal is drilled and shot, or "tumbled." Pillars are extracted by drilling them from both sides and tumbling them also. Stump pillars are left in place until all the breasts are driven, and then are tumbled, starting with the triangular block of coal at the top of the slant. With this system, mining on one slant chute is deferred until robbing in the previous slant is completed. Gangway pillars are robbed on the retreat.

While splitting of beds is encountered at one or two other Valley collieries, this condition is most prevalent at Tamaqua, where the Mammoth splits into three beds on the north side. In this case the primary haulage gangway is driven in the rock below the top split, which is worked as a separate bed. Mining in the bottom and middle splits, however, is synchronized. As a preliminary, a gangway approximately 1,000 ft. long is driven in the bottom split. This gangway is connected at one end to the haulage gangway by a short rock tunnel. An airway is driven over the bottom split gangway, to which it is connected by stump chutes on 60-ft. centers.

Starting at the inbye end of the bottom split gangway, rockholes are driven off the tops of the stump chutes into the middle split. From these holes four or five breasts are driven, whereupon driving of breasts is started at the inbye end of the bottom split gangway. Operations are then carried on to the outbye end of the gangway, work in the middle split keeping four or five breasts ahead of work in the bottom split. This eliminates the possibility of loss of middle split coal by collapse of the divider and also insures that disturbance in the

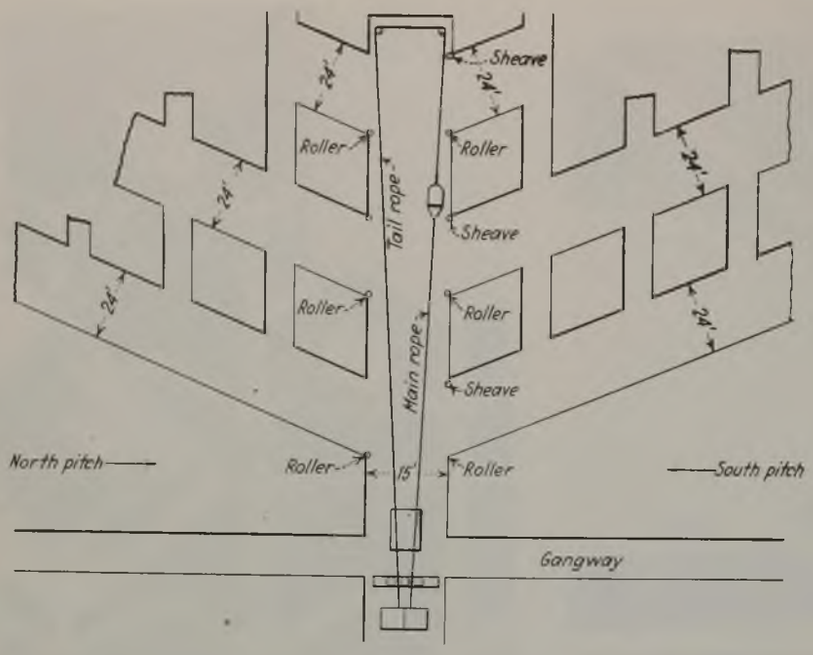


Fig. 8—Scrapers are used on relatively flat pitches at Cranberry colliery, as in this example in the spoon end of a basin

middle split will be reduced to a minimum when the bottom split work reaches that point.

At Lansford, mining generally is done with pillar chutes on 60-ft. centers (Fig. 6). This method was adopted for use in the "free" coal (coal which separates readily) encountered at this operation, which tends to run and therefore would be difficult to mine with the long breast normally used. Gangways and airways are driven in coal and the chutes are driven up the pitch from the tops of the stump chutes connecting the airway with the gangway. To start mining operations, slant chutes are turned from adjacent pillar chutes. These slant chutes meet at an apex and from this apex a back chute on a pitch of approximately 35 deg. is driven up half way in the bed. A breast 24 ft. wide and 15 ft. high is started off the top of this back chute. The coal between the top of the breast and the top rock is drilled and tumbled. The bottom half of the bed is then mined in a substantially similar manner, after which the miners drop back about 30 ft. and repeat the cycle. Pillars between breasts are mined by breasts driven from the main chute and worked in the same way as the others.

About two years ago the tap system was developed for mining the Mammoth between the sixth and fifth levels, where the lift is nearly 400 ft., or approximately double normal. To avoid the difficulties necessarily resulting from splitting the lift, the interval between the two levels was divided into number of sublevels by rock taps from slant chutes in the dividing rock between the Mammoth and Skidmore beds. The gangway serving the tap system is driven in the Skidmore, and from it short chutes are driven up the pitch. From the tops of these chutes, rock taps are driven to strike the bed. From every fourth tap a long slant chute is driven on a 32½-deg. pitch toward the upper level. These slant chutes, and subsidiary chutes from which additional rock taps are made, are driven in the rock half way between the Skidmore and the Mammoth. The tops of the main slant chutes are connected as in Fig. 7 to provide air circulation. An air return is provided by connecting every third slant to the upper level.

Mining starts from the row of rock taps just under the upper level, and the upper half of the bed is extracted first. This is accomplished by driving back chutes toward the top rock from the rock taps. The tops of these back chutes are connected by slants or hips. A cutback conforming in shape to the hip connection is then made, usually in three stages, to the top rock. The miners then make two or three cuts up the pitch approximately 8 ft. high and 7½ ft. deep, by which time the remaining coal tumbles. The cycle is then repeated in the bottom half of the bed.

Approximately two years' use of the tap system apparently shows a material increase in recovery, accompanied by a rise in percentage of domestic sizes. Driving under the Mammoth decreases the possibility of damage to, and maintenance of, chutes; the gas which would be encountered in the coal is avoided; better top is afforded; and the system also shortens the length of the rock taps. Slants are employed to cut down the amount of chute driving and the comparatively light pitch minimizes breakage of coal and also maintenance arising out of carrying away of timber by fast-moving lumps of material.

Cranberry colliery, with its relatively large proportion of nearly flat coal, offers the best mechanization possibilities of the several Lehigh Navigation operations. This condition has been reflected in the installation of seventeen scraper loaders (Evans, 1; Vulcan, 2; American Hoist & Derrick, 1; Sullivan, 9; Ingersoll-Rand, 4). On this total, two, with 35- and 32-hp. hoists, are installed in worked-out strip pits to work out pillars down the pitch. Eight 25- and seven 7½-hp. machines are in service underground on favorable, flat or adverse pitches, as the case may be. Crews for the 25-hp. units generally consist of five men; 7½-hp., three to four men. Each crew is provided with an electric drill and the coal is blasted off the solid in 10-ft. cuts.

Scraper jobs are laid out to furnish five working places as a rule, all operated from one hoist set-up. Fig. 8 is an example in the spoon end of a basin. Fifteen cars at 3⅓ tons per car is the normal output of a five-man crew in eight hours; three men generally average 9 to 10 cars. In 1934, with the machines then in use, the average output per man per shift was 8 tons.

At Alliance, conveyors and one scraper account for an output of 120 cars (115 cu.ft. per car, level full) out of the average of 560 cars hoisted per day. This includes 30 cars from clean-up work in the Orchard-Primrose basin, where elevating, mother and chamber conveyors were adopted to mine the relatively flat area of these beds. Excluding this basin, equipment in service at the time this article was prepared included one chain-and-flight and one scraper unit in a flat area in the middle split of the Mammoth; a chain-and-flight unit in the bottom split in the same section, consisting of a main, secondary and cross conveyors; and a shaker conveyor driving a gangway to split the lift in the Buck Mountain bed, third level, No. 2 shaft. In each case, a reduction in the expense which otherwise would be involved in installing the usual transportation facilities was the prime motive.

In the Orchard-Primrose basin, work has been completed in the Orchard bed, 2½ to 8 ft. in thickness and estimated to contain 18,000 cars of recoverable coal. Equipment consisted of a 24-in. chain-and-flight elevating conveyor installed in a 6x9-ft. rock chute driven on a 35-deg. pitch between the Old Orchard slope and the Orchard bed; two 24-in. 300-ft. belt conveyors installed in tandem from the foot of the slope conveyors; and three chain-and-flight chamber units discharging onto the belt conveyors. Chambers were driven 20 ft. wide on 60-ft. centers as the belt conveyorway advanced, and pillars were mined by skipping on the retreat. Coal was taken from the elevating conveyor to the surface in mine cars. Average cover over the Orchard was 80 ft.

To mine the Primrose, 100 ft. below the Orchard, a specially built chain-and-flight elevating conveyor was installed in a 6x10-ft. conveyorway driven on a

15-deg. pitch. Present mining operations are being carried on by three chamber units operating in tandem and discharging onto one of the 300-ft. belt units formerly used in the Orchard. Two to three feet of "falling stone" usually is held in place by single posts. Coal is taken from the elevating conveyor to the surface in mine cars.

A Joy 7-BU loader is installed in an experimental section in the Primrose bed at Coaldale where the maximum pitch is 12 to 14 deg. Coal thickness is 12 ft., and two places, either advancing or robbing, are worked at a time. Near the end of a robbing cycle, two new breasts are prepared for the loader. In starting the new places, a Jeffrey pit-car loader elevates the coal to car height. This pit-car loader also receives material from the Vulcan shaker conveyors which carry the coal away from the Joy loader until the places are in far enough to permit elevation of the conveyors to car height.

Breasts are driven up the pitch on 35-ft. centers and wide enough to accommodate an 11-ft. collar. The coal is undercut by a Jeffrey flameproof shortwall and is drilled with an electric drill. Conveyors are installed along the left rib in left-hand places and along the right rib in right-hand places to allow free movement of the loader through the crosscuts. Only half of the height of the bed is taken as the breasts advance. The remainder, together with the pillars, is shot down and removed in lifts on the retreat. The loading crew consists of seven men and the average daily output of the unit is 23 cars at 115 cu.ft. per car per shift of eight hours.

STRIPPING

+ At Lehigh Navigation Coal Co.

Fig. 1—Hell's Kitchen stripping, Nesquehoning colliery. Sixty feet of coal in the bottom is yet to be loaded

WITH a quarter of a century of experience as a background, Lehigh Navigation Coal Co. has adopted stripping as a definite part of its program to recover coal near the surface which otherwise would be lost and to provide a volume of low-cost tonnage to offset in part the higher cost of deep-mined material. Outcrop strippings, in several cases with local anticlines and synclines present, are the general rule, and at present stripping projects number sixteen, of which three are operated by the company.

Only three strippings are in virgin coal. At the others, up to 50 per cent of the coal has been removed by underground mining in the past. Ratio of overburden to coal ranges from 3½ to 5 to 1, depending upon whether the bed is virgin or partly mined, quality of coal, character of overburden (hard or loose) and adaptability to casting.

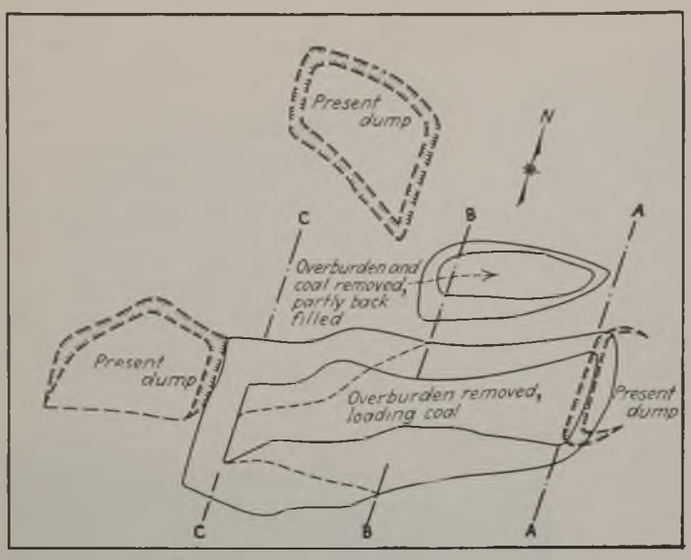
In many Lehigh Navigation strippings, depth and area have precluded casting. In these cases, however, the recoverable tonnage has warranted hauling overburden to dumping grounds away from the pit, either in trucks or dump cars. No. 1 Mammoth stripping, Cranberry colliery, falls in the first class. Overburden is loaded by a shovel and hauled out of the pit by Linn tractors, which also transport the coal to the breaker.

Cranberry also offers a basin stripping in which the overburden was hauled in cars. This stripping (Crystal Ridge) was started in 1925 and completed, except for a 70-ft. extension, in 1934. Area stripped was 2,700 ft. long and 500 ft. wide and contained 5,200,000 cu.yd. of overburden and 665,000 marketable tons of coal. Maximum depth was 165 ft. Overburden was removed by a Bucyrus-Erie 320B electric shovel with 7½-cu.yd. dipper, and was hauled in 30-cu.yd. standard-gage cars to a dump 5,900 ft. distant. Maximum grade to the dump was 3½ per cent. Coal was loaded by a 100B electric shovel with 3-cu.yd. dipper.

Stripping has been completed on the 70-ft. extension, and the coal is being loaded with a shovel into trucks for transportation to a loading ramp where it is dumped into standard-gage hoppers for transportation to the breaker. Stripping equipment was a Bucyrus-Erie 120B dragline with a 3½-cu.yd. clay

Fig. 2—Western end of the Summit Hill stripping, largest of the Lehigh Navigation projects

Fig. 3—Dragline making rock cut at Mammoth south dip stripping, Lansford colliery



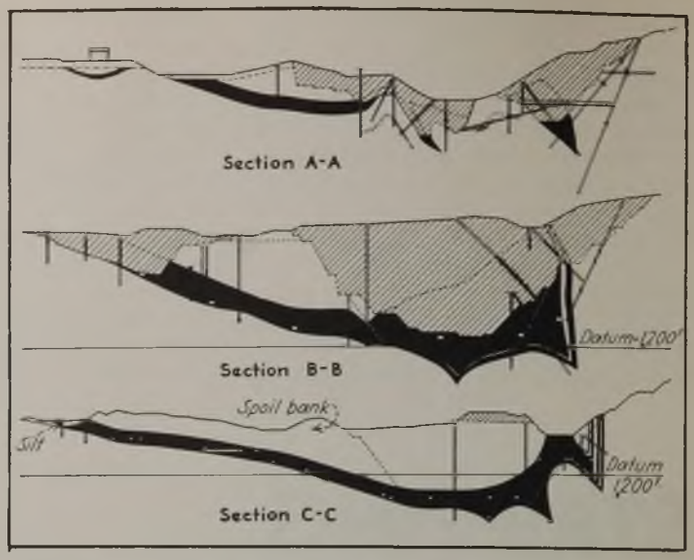


Fig. 4—Plan and sections of Summit Hill stripping, showing present dumps and progress of excavation

and a 4-cu.yd. rock bucket. The overburden was removed by casting and recasting to the west into the old Crystal Ridge pit. Coal uncovered totaled 46,200 cu.yd. Overburden yardage was as follows: clay, 27,300; rock, 73,500; breast material, 13,500. In addition to the 70-ft. primary strip obtained from the Lehigh Valley Coal Co., the stripping included a narrow strip along the eastern end of the old Crystal Ridge pit.

Another shovel and hauling job now in the final stages was the Hell's Kitchen stripping, Nesquehoning colliery, to recover a virgin outcrop of the Primrose bed 30 ft. thick on a 30-deg. pitch. It involved removal of 1,300,000 cu.yd. of overburden by two 70C Bucyrus steam shovels to uncover 514,000 net tons of marketable coal. Overburden was hauled out of the pit on an upgrade of 3 per cent in 4-cu.yd. side-dump cars pulled by 20-ton steam locomotives. A three-rail track was constructed to accommodate the 36-in. gage rock cars and the 42-in. gage mine cars used to

Fig. 6—Neyers north dip stripping, Nesquehoning, showing drilling for the final rock cut and also pillars of coal standing up against the bottom rock

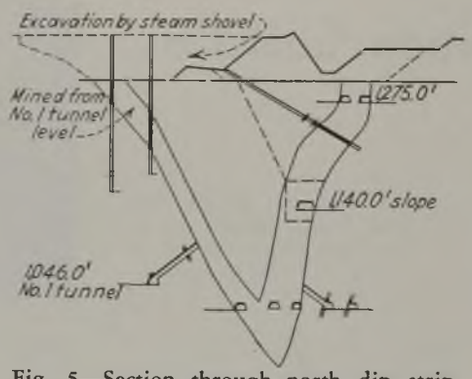


Fig. 5—Section through north dip stripping, Mammoth spoon basin, Nesquehoning colliery, where coal and rock will be removed in alternate shifts

haul the coal. Loading, originally done by one of the steam shovels, is now being completed by a 75A Lorain gas shovel with 1½-cu.yd. dipper.

The premier Lehigh Navigation stripping is Summit Hill, from which, to date, 7,300,000 cu.yd. of overburden and 3,000,000 cu.yd. of coal (2,200,000 tons) have been removed. When finally completed, it is estimated that overburden yardage will total 13,000,000; coal yardage, 5,000,000, yielding 4,600,000 net tons of marketable coal. Another section was added this summer where, by removing 240 ft. of cover, a virgin bed approximately 60 ft. thick can be loaded.

Equipment at Summit Hill is: one Bucyrus-Erie 320B electric shovel with 7½-cu.yd. dipper built up from 6 cu.yd.; two 120B electric shovels with 4-cu.yd. dippers; one Link-Belt K55 gas-electric dragline with 2-cu.yd. bucket; one Marion 37 electric shovel-dragline; one 50-, eight 55- and one 65-ton Heisler geared locomotives; two 55- and one 40-ton Vulcan rod locomotives; one 38-ton American rod locomotive; one 50-ton Baldwin rod locomotive; eleven electric and five gas Loomis Clipper drills; one Armstrong gas drill; one gas and one electric Sanderson Cyclone drills; two Ingersoll-Rand wagon drills; one Western spreader car; two Pennsylvania air compressors; one Ingersoll-Rand well-drill bit-dressing machine; one Model S Nordberg track shifter; one Model 60 Caterpillar tractor; and 35 30-cu.yd. standard-gage side-dump cars (Koppel, 1; Magor, 11; Differential, 3; Western, 13; and Clarke, 7).

Overburden is loaded into the 30-cu.yd. cars and hauled to one of the three dumps (Fig. 4). Coal is loaded into railroad cars for transportation to Lansford breaker for preparation. Tracks are laid with 80-lb. rail and maximum grade out of the pit is 3 per cent. Dumps have been established, where possible, over old crop falls. The Western spreader car is used to scatter the ridge on the edge of the fill resulting from dumping, and track shifting on the dump and in the pit is done by the Nordberg shifter.

Lehigh Navigation strippings also include a number of dragline projects. This type of equipment is used either for overburden removal alone or both overburden removal and coal loading. The clay is first stripped to the full width of the pit and piled on one or both sides, as conditions dictate—usu-

Fig. 7—Dragline loading coal to complete work in Lewis bed stripping, Alliance

Table I—Summary of Company and Contract Strippings

Stripping	Coal Bed	Condition of Bed	Contractor	Removal of Overburden
Cranberry				
Extension of earlier Crystal Ridge basin stripping	Mammoth, 50-60 ft.	Partly mined	J. Robert Baxley	Casting with dragline
No. 1 Mammoth, south dip outcrop	Mammoth, 30 ft.	Partly mined	Hill & Suender	Shovel loading, truck hauling
Nesquehoning				
No. 3 slope south dip outcrop, local syncline and anticline	Primrose, 20 ft.	Partly mined	Hill & Suender	Shovel loading, truck hauling
Wildip south dip outcrop	Primrose, 15 ft.	Partly mined	R. M. Griffiths	Primarily casting with dragline
Neyers north dip outcrop	Primrose, 15 ft.	Partly mined	R. M. Griffiths	Primarily casting with dragline
North dip outcrop, two splits, 3- to 4-ft. divider	Buck Mtn., 14 ft.	Partly mined	J. Robert Baxley	Casting with dragline
Hell's Kitchen outcrop	Primrose, 30 ft.	Virgin	Company	Shovel loading, hauling in cars
North dip, Mammoth spoon basin	Mammoth	Partly mined	Company	Casting with dragline
Lansford				
South dip outcrop, two splits	Mammoth, 20 ft.	Partly mined	A. E. Dick	Primarily casting with dragline
South dip outcrop	Mammoth, 40 ft.	Partly mined	Hill & Suender	Primarily shovel loading, truck hauling
Summit Hill basin	Mammoth	Partly mined	Company	Dragline and shovel loading, hauling in cars
Coaldale				
Fire Barrier anticline	Mammoth, 50 ft.	Partly mined	Hill & Suender	Shovel loading, truck hauling
*Rahn**				
North dip outcrop	Primrose, 15 ft.	Partly mined	W. F. Sheidy	Primarily shovel loading, truck hauling
Tamaqua				
Outcrop, local anticline and syncline, several splits	Mammoth	Partly mined	Hill & Suender	Primarily shovel loading, truck hauling
Alliance				
Outcrop	Lewis, 10 ft.	Virgin	R. M. Griffiths	Casting with dragline
Outcrop	Lewis, 10 ft.	Virgin	R. M. Griffiths	Casting with dragline

*Coal delivered to Greenwood breaker by truck.

ally the latter. The rock is then drilled and shot, whereupon the dragline makes a V-shaped cut down to the top of the bed. In case stripping depth is beyond the working limit of the dragline, the final rock cut usually is made with a shovel and the material hauled out of the pit in trucks, as at the Neyers north dip stripping, Nesquehoning (Fig. 6).

In a number of cases, the coal is loaded out by shovels in one or more lifts. Truck roads are carried on the coal behind the shovel. At the Alliance strippings, however, the dragline stands on top of the bed and drags the coal up from behind it as far down as the reach of the equipment will permit (Fig. 7).

At the north dip stripping in the Mammoth spoon basin, Nesquehoning, rock will be removed and coal loaded in alternate shifts by a 175B electric dragline with 3½-cu.yd. bucket. After clay and surface material is removed, the dragline will move along the pit from one end to the other on the top of the rock or coal, dragging up the rock and casting it to one side at night and dragging up the coal and discharging it into a specially built portable car-loading hopper on the day shift. The dragline employed, though designed for only 60 ft., has worked to a depth of 175 ft., the approximate maximum to which excavation in the coal will be carried.

Estimated yardages on this stripping are: overburden, 243,000; breast material, 67,000; coal, 67,000, yielding 73,000 tons of marketable coal.

On salvage strippings carried on by contractors, the coal is inspected at the dumping ramp for quality. On yardage projects, inspection covers not only quality but also losses in cleaning up.

MINE DRAINAGE

+ At Lehigh Navigation Coal Co.

ALTHOUGH its outcrops are ditched, flumes are installed to carry surface water over the crop falls and subsidence breaks, and one colliery—Nesquehoning—has been freed entirely of pumps by a four-mile drainage tunnel, pumping by the Lehigh Navigation Coal Co. averaged 9.1 tons of water per ton of coal shipped during the five-year period 1930-1934. At Cranberry, which is the wettest colliery, 21 tons of water per ton of coal was raised last year.

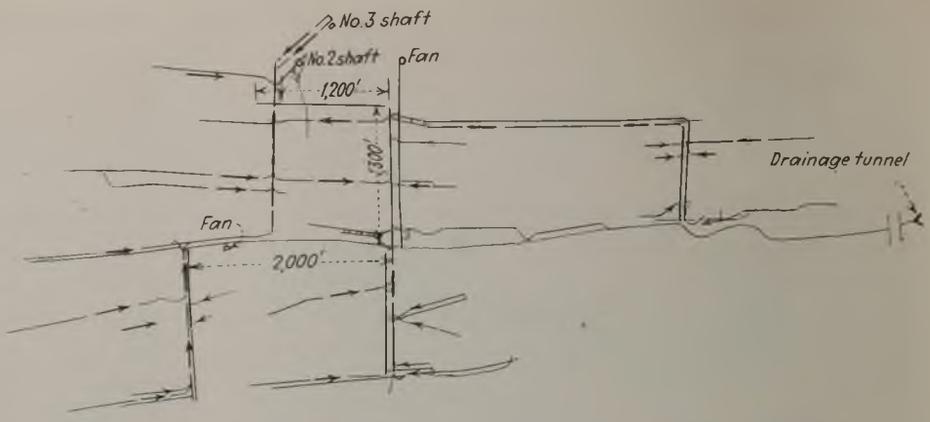
To decrease mine-drainage expense, with its heavy power costs, all thirteen of the main underground pumping stations are fitted with full-automatic controls, and thus are operated without regular attendants. Each of the two largest pumping stations (Greenwood and Cranberry) has motors totaling 1,950 rated horse-power; Greenwood has three 650-hp. motors, and Cranberry, four motors rated 300, 500, 550 and 600 hp. All the larger pumps are direct-connected motor-driven centrifugals.

Water is pumped from depths 150 ft. below sea level and is elevated as much as 1,200 ft. Main pumps discharging to the surface operate against heads up to 800 ft., and relay pumps handle water from lower levels to these main stations. To protect shaft and main pumping stations, the main-haulage tunnels of the various levels are equipped with emergency flood-control dams designed for pressures from 5 to 100 ft.

Generally speaking, portable or gath-

ering-type pumps are not used underground, because rock tunnels and gangways which serve as haulways are driven on an upward gradient of 0.58 per cent and drainage ditches 3 ft. wide and 2 ft. deep (measured from the top of the rail) are excavated along one rib. Exceptions are a few 50-g.p.m. d.c. motor-driven triplex pumps used in driving dip breasts and dip gangways. Cranberry is equipped with eight of these pumps—the largest number at any one of the seven collieries. A few compressed-air-operated pumps are used in dip places where open-type electric motors are prohibited because of gas.

The mine waters average about 300 parts per million of free sulphuric acid which rapidly corrodes ordinary metals. At times of low water in certain collieries and in other collieries when flood water enters through old workings, the acidities increase to high concentrations. That some water is low in acid, however, is indicated by a test at Alliance in May, 1931, which showed only 20 parts per million of free sulphuric acid.



Water from all workings and levels of Nesquehoning colliery flows to the drainage tunnel and thence to the Lehigh River

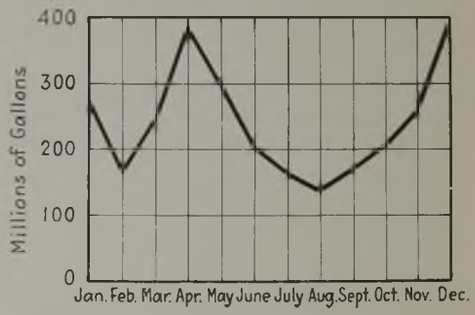
Parts of pumps in contact with water are built of acid-resisting bronze, and special linings are used in cast-iron, steel and wrought-iron discharge columns, which in most cases are installed in coal-, air- or water-hoisting shafts. Wood pipe is used only for emergency flood pumping; under these conditions it has successfully withstood pressures of 200 lb. per square inch.

Until a few years ago the standard discharge columns were of cast-iron "bolted" pipe with wood lining, and many of these columns in sizes up to 24 in. (outside diameter) are still in service. Three years ago a 12-in. o.d. steel pipe with bitumastic lining was installed in a borehole at Alliance and grouted in place. Its present service condition has not been determined, but some of the lining has loosened and has come out with the water.

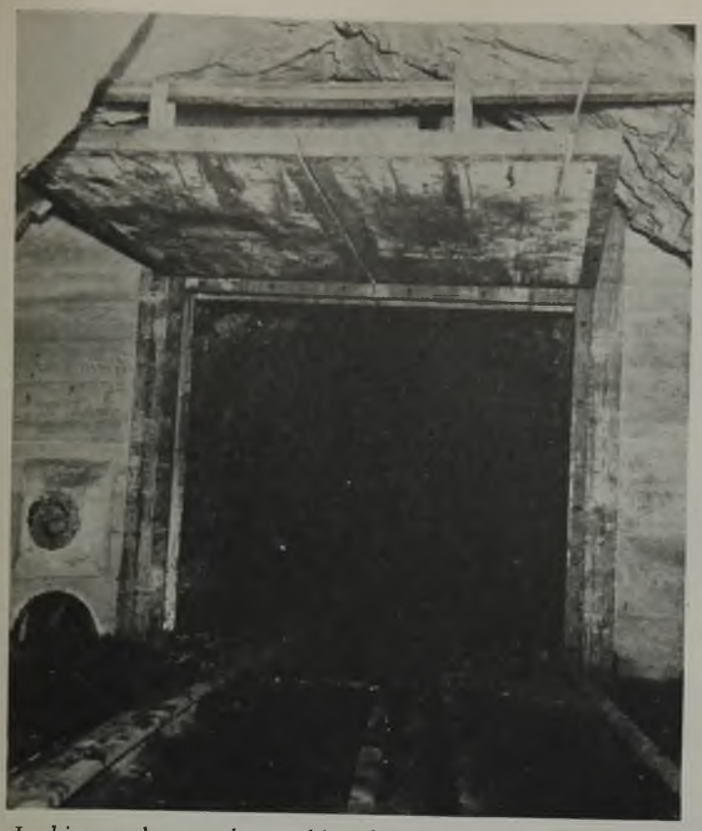
Two years ago, at Lansford No. 6 operation a lead-lined 16-in. o.d. discharge column with screw couplings was installed in a borehole, but the lead lining was made to project beyond the steel so that it made a tight joint when the pipe was screwed up. Aligning clamps assured that the neat cement grouting would be of uniform thickness around the pipe. This column is 560 ft. long and serves as the discharge for two 2,000-g.p.m. 8-stage pumps driven by 550-hp. motors and situated in the Primrose bed at the fourth level. Nine months later, an 18-in. wrought-iron pipe with wood lining was installed to a depth of 750 ft. in No. 12 shaft, Greenwood colliery, to replace a 20-in. wood-lined cast-iron pipe which had

Full-automatic pumping station in Tamaqua colliery containing three units, each consisting of a 500-hp. motor and a 2,000-g.p.m. 610-ft. head, six-stage all-bronze pump

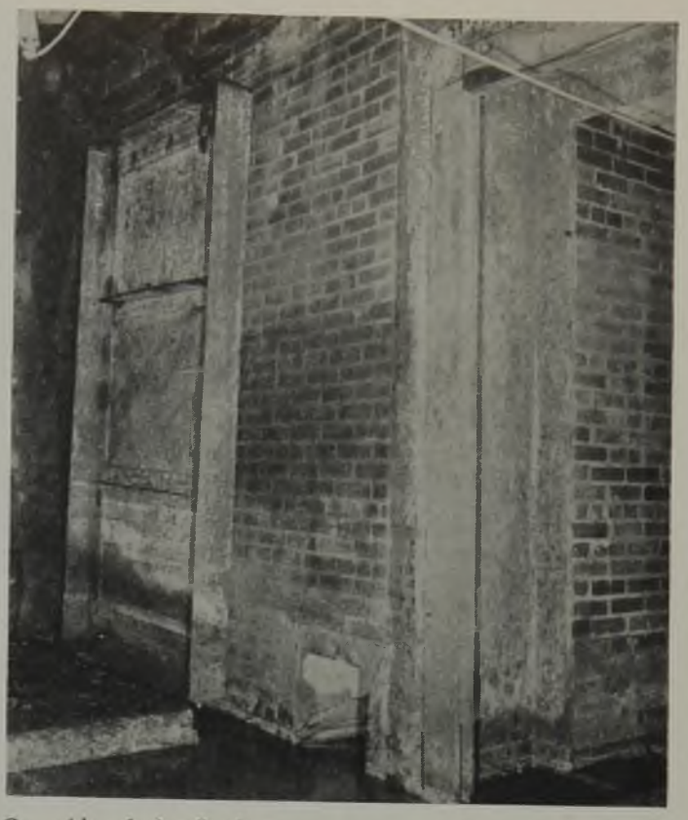
Half-round steel flumes such as these at Tamaqua conduct water over crop falls and surface cracks



Nearly three billion gallons of water was pumped out of Cranberry colliery during 1934



Looking outbye at the top-hinged steel-door emergency flood-control dam for 100-ft. head, east main tunnel, fourth level, Tamaqua



One side of the flood-control dam, No. 3 level, south side, Tamaqua. Each door half rolls on an overhead track into a recess in the rib

given satisfactory service for ten years but had been destroyed by a fire in the shaft timbering. Dresser couplings were used for connecting the 18- and 20-ft. lengths. For distances of 5 to 6 in. from the ends, inside surfaces of each length were sandblasted and sprayed with lead.

Main pumps are principally of 2,000- and 3,000-g.p.m. sizes and have four to ten stages. Barrett-Haentjens, Allis-Chalmers, Cameron and Goyne units are used, with General Electric, Westinghouse and Allis-Chalmers motors.

All pumping stations except one at Cranberry are above sump level, so are not subject to accidental flooding by leaky or broken suction lines. Pump-room excavations are protected by steel and concrete, and, in the larger stations, bridge cranes facilitate maintenance. In several instances, control and signal wires from the station are extended up the shaft to the main substation on the surface, where an operator always is on duty. By pushbuttons he can start and stop the pumps. Red and green signal lights mounted beside the buttons indicate whether the pumps are running or stopped and other signals indicate high sump-water level.

Water-hoisting tanks are kept at several of the coal shafts ready for emergency, and at Tamaqua, one shaft has been fitted permanently with a water hoist. Here two 4,500-gal. tanks are handled in balance by a Vulcan hoist driven by a 1,200-hp. General Electric 2,200-volt induction motor. From a

In this full view of the Tamaqua dam, the edge of one sliding door appears at the extreme left where it is beyond the water-flow conduit. A manhole is partly visible in the door at the right

Tons of Water Pumped Per Year From the Panther Creek Valley Collieries

	Lansford	Coaldale	Greenwood	Rahn	Tamaqua	Total for Year	Tons Water Per Ton of Coal
1930.....	3,414,733	2,106,862	1,705,425	1,459,631	3,603,825	12,290,516	3.45
1931.....	3,755,258	1,820,458	2,538,083	1,243,695	3,382,100	12,739,594	3.8
1932.....	4,933,933	2,334,319	2,371,405	1,624,984	4,416,533	15,681,174	5.5
1933.....	8,327,929	3,728,608	3,266,110	2,806,029	6,496,125	24,624,801	8.9
1934.....	6,120,267	2,978,233	2,604,186	2,034,403	5,127,483	18,864,572	5.7
Totals.....	26,552,160	12,968,480	12,485,209	9,168,742	23,026,066	84,200,657	5.2

Note: Nesquehoning is drained by a tunnel and contains no pumps. Rahn colliery is shut down and is without a breaker, but mine pumping is continued.

depth of 800 ft., 1,080 tanks of water can be hoisted in 24 hours—an average capacity of 3,300 g.p.m.

This water hoist is also emergency equipment and is used about once a year. In August, 1934, it operated for ten days and handled 17,892,000 gal. of water; in the same period the electric pumps of the colliery handled 122,670,000 gal. At the central shops at Lansford a pair of tanks are stored ready to be rushed by truck to any colliery where emergency might call for quick conversion of the coal hoist to a water hoist.

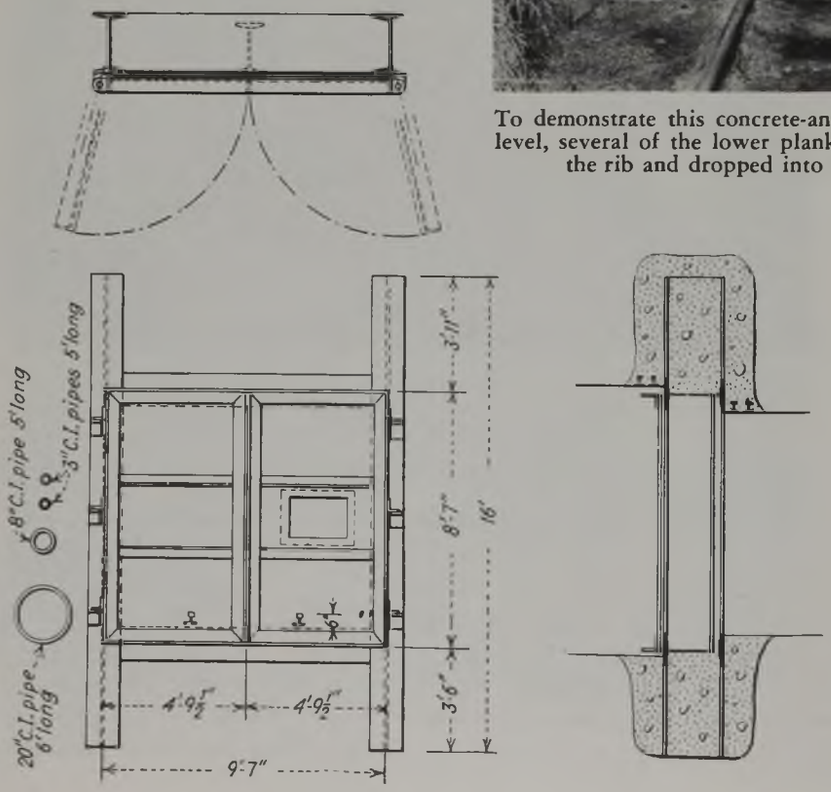
Nesquehoning colliery, with workings more shallow than the other Panther Valley collieries, which has no pumps, is drained by a rock tunnel to the Lehigh River. Section dimensions of this tunnel (which is 19,890 ft. long, is entirely through rock and was completed in 1912) are 7x11 ft. Elevation above sea level is 596.2 ft. at its intersection with No. 2 shaft and 547 ft. at the discharge portal; mean gradient is 0.246 per cent.

The portal, which is about one mile upstream from Mauch Chunk, was concreted in 1914. By 1920, however, corrosion compelled the replacement of the steel rails of the tunnel track; acid water also destroyed this second track, and it will not be renewed. Replacement timber is floated into the tunnel, only about one-half mile of which is timbered and that, fortunately, near the colliery end. During flood periods the tunnel discharges as much as 46,000 g.p.m. Natural ventilation, which reverses with the seasons, provides fresh air for men who wade in boots through the tunnel to make inspections.

Rubber gaskets are hanging loosely in place on this side-hinged steel-door flood-control dam in Lansford colliery, No. 6 shaft, fifth level

To demonstrate this concrete-and-plank dam in Lansford, No. 6 shaft, third level, several of the lower planks were taken from their storage place along the rib and dropped into the grooves in the concrete abutments

Side-hinged 100-ft.-head dam installed in Lansford colliery



In some areas, because of unfavorable surface contours, holes are cut to permit water to drain to tunnels; at Greenwood colliery, these holes also serve as air intakes.

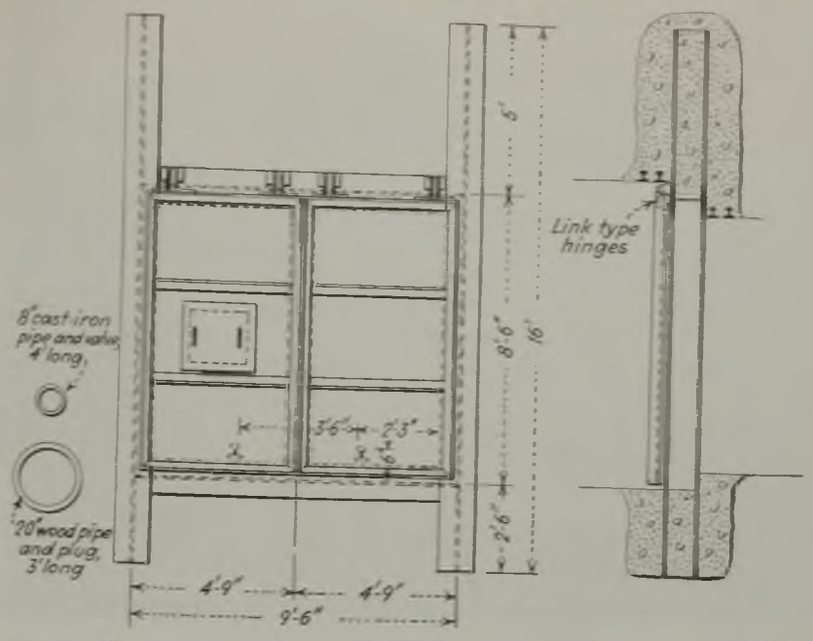
Because of the frequency with which wood flumes were destroyed by forest fires, by persons walking over them and cutting them for firewood, or by rotting, half-round steel flumes are now being installed extensively. Flumes 24 in. in diameter exceed others in total footage, although 3-, 4-, 4½ and 7-ft. diameters also are used. Unit lengths run from 12 to 30 ft. and plate thicknesses are $\frac{3}{16}$, $\frac{1}{4}$ or $\frac{5}{16}$ in. Sections are joined by rivets countersunk in the upper plate. Asphalt paint was adopted for the first installations, but experiments are now being made with aluminum paint.

Metal stakes driven into the ground

at each joint and fastened to the curved plates hold the smaller flumes in place. Flumes crossing ravines, supported on rail or structural steel bents spaced on 15 ft. centers or closer, have long bolts with distance pieces across the top.

As many as sixteen emergency flood-control dams are used in tunnels and gangways at most collieries. These vary in design from a simple concrete-and-plank dam 5 ft. high, and not sealable at the top to an elaborate steel-door dam capable of holding back 100 ft. of water. Wood dams consist essentially of two types: a dam in which 3-in. planks are dropped into vertically slotted concrete side abutments and another in which 8x8- or 5x13-in. cross timbers are piled one above the other against a concrete door frame and held in place and tightened by bolts through steel angles, which bolts also work against a wedge timber to close the joints between timbers. Alliance colliery contains a number of these heavy timber-type dams designed for heads up to 30 ft.

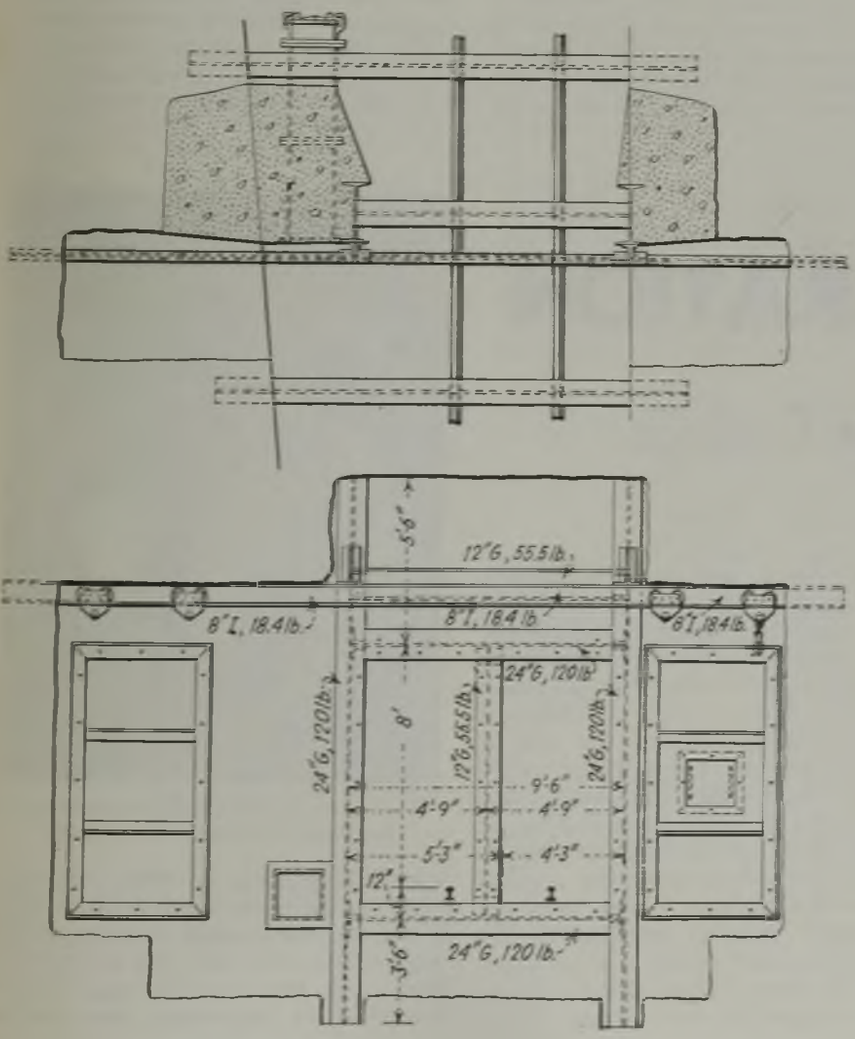
Steel-door dams consist essentially of three types with door frames in all rectangular openings built of reinforced concrete with a structural-steel frame. These dams are designed for heads of 35 to 100 ft. and the doors are in two sections. In one type the doors hang from tracks and slide into spaces provided in each rib. In another type the doors are hinged at the sides and in the third they are hinged at the top and swing against the top of the tunnel when open.



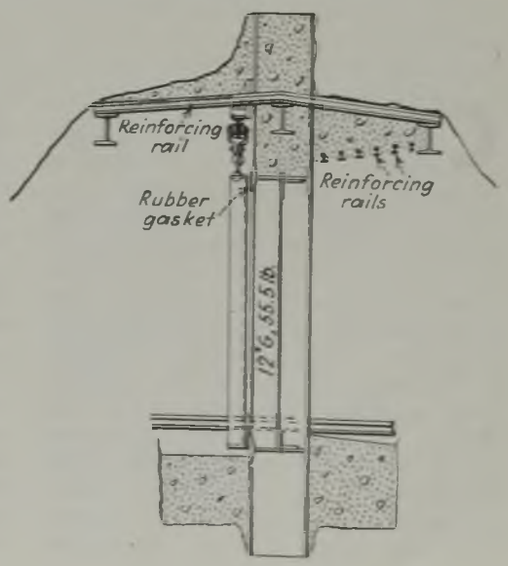
The top-hinged dam is the latest of the permanent types installed. Water-conduit and control pipes are cast into the concrete in a position as shown at the left

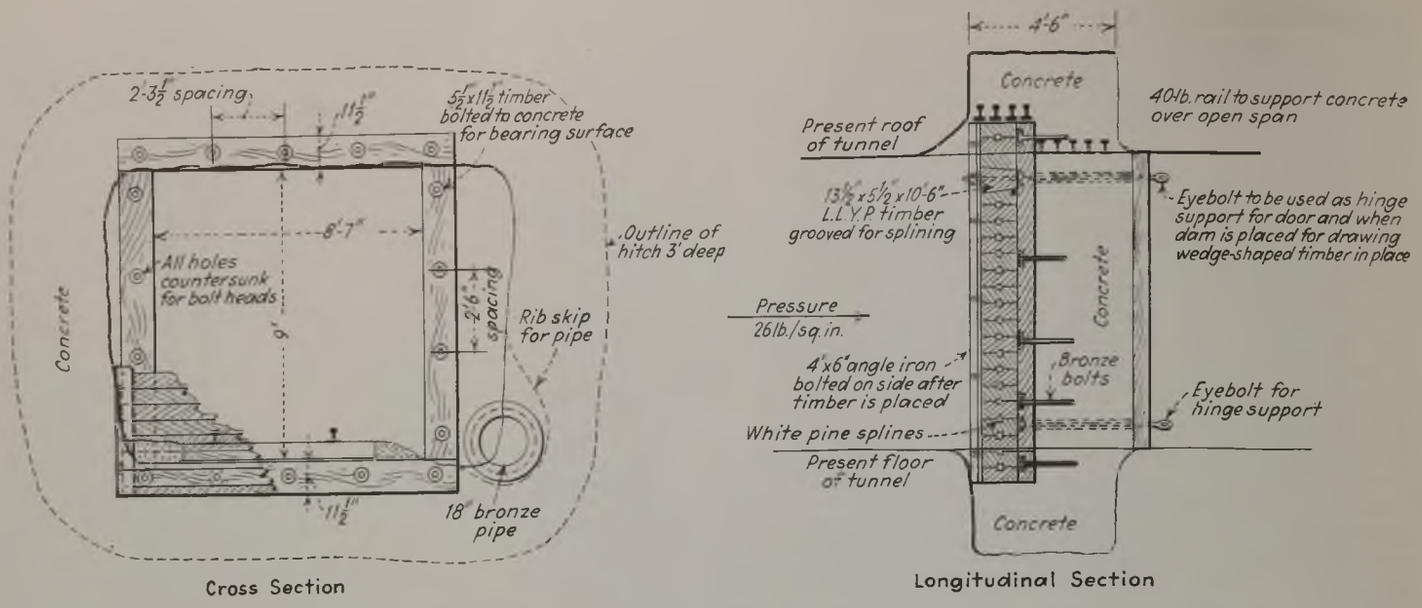
Link-type hinges provide such flexibility that the doors can be bolted against special one-piece rubber gaskets. Vertical beams, one in the center and in some cases another to strengthen each door, are stored near the dam ready to be bolted into the doorway when the doors are to be closed. These beams are of 8x12-in. 45-lb. H-sections or other sections of equal or greater strength. The doors are built of either 1-in. or ¾-in. plates.

Through one concrete side abutment of the doorway a bronze or cast-iron pipe 18 to 24 in. in diameter provides for normal drainage and also for control of water when the doors are closed. In some cases gate valves are kept in place on these openings, but in others the valves are applied to the pipes only when needed. A tapered wood plug is still another method used for closing the openings. Instead of pipes, however,



Sliding-door dam installed in No. 350 tunnel, Tamaqua





Several of these older type wedged-timber dams designed for 26-lb. pressure stand guard in the collieries

many of the low-head concrete-and-plank dams have rectangular side openings controlled by steel-plate gates.

One of the steel doors of each high-head dam is fitted with an 18x20- or 16x24-in. manhole. Flat steel plates cover these manholes and are bolted over rubber gaskets. Dams with doors hinged at the sides or at the top are the latest types to be installed. They cost less than the sliding type, but the one with hinges at the top must be equipped with a chain block for convenient and safe opening and closing. Lansford has three top-hinged, one side-hinged and five concrete-and-plank dams; Greenwood, one sliding door and fifteen concrete-and-plank; and Coaldale, four side-hinged and seven concrete-and-plank.

About half the electrical energy used annually at Cranberry is expended in pumping; during 1929, for example, the total power used per ton of coal shipped was 30.7 kw.-hr., and 15.3 kw.-hr. was energy used in handling water. Alliance, where 11 kw.-hr. per ton goes to operate mine pumps, stands second in size of dewatering load. Three to 10 kw.-hr. per ton of coal is used by pumping stations at the four Panther valley mines dewatered by mechanical means.

At Alliance and Cranberry, most pump-station maintenance is handled by local electricians and mechanics reporting to the colliery superintendent. Large construction jobs and heavy repairs are taken care of by men from the mechanical and electrical departments at Lansford. Five men reporting directly to the mechanical superintendent at Lansford inspect and maintain pumps at the Panther valley mines and one of these men makes regular inspection of pumping stations at the two other properties. Every possible precaution is taken to insure against pumping-equipment failures, which might result in flooding.

COAL PREPARATION

+ At Lehigh Navigation Coal Co.

COAL preparation at Lehigh Navigation Coal Co. is based on two general principles: selection of equipment to meet the particular conditions surrounding the cleaning and screening of the various sizes to present-day consumer standards, and inspection organized to detect any departure from these standards, either in impurity content, size or appearance. As a guide in its preparation work, the company uses the revised standards of the Anthracite Institute. These standards (Table I) establish the maximum limits for impurities and undersize or oversize for the eight standard sizes shipped from the seven Lehigh Navigation breakers now in operation. In addition, the company offers a number of special grades, including stoker buckwheat and stoker rice, which are closely sized—the most important consideration in stoker fuels—and low in ash; metallurgical rice and barley, below 10 per cent in ash and containing a minimum of undersize, and "Anthrafine" (No. 4 and No. 5 buckwheat), in which it specializes.

Conditions surrounding mining at Lehigh Navigation operations, particularly in the Panther Valley, bring up preparation problems encountered only to a lesser extent or not at all in other anthracite areas. Thick beds and heavy pitches necessitate chute mining. Consequently, gobbing of rock and other refuse in the mine is impossible, and the average refuse content of the raw coal varies from 34.3 per cent to 46.4 per cent. All this material must be removed in the preparation plant, and its

Three Lehigh Navigation breakers are equipped with cones for cleaning

character is reflected in the fact that all chutes and openings must be large enough to pass pieces 6 ft. in any direction.

As between large and small sizes, refuse content varies considerably, the percentage of impurities running substantially higher in the former. Consequently, pre-cleaners, or "headhouses," are installed at all breakers but Cranberry and Alliance, where steamboat and broken are jigged before crushing to eliminate much rock that otherwise would have to go through the rolls.

The flow of coal under this system is exemplified at Tamaqua breaker, which was reconstructed this summer to accommodate the sand-flotation method of cleaning. Raw mine-run from the dump is passed over bull shakers equipped with screen plates with 6-in. round perforations. Material over the shakers (lump) is discharged onto platform picking tables, where rock and other refuse are picked out. From the tables, the lump passes to the No. 1 rolls, where it is reduced to steamboat and smaller. The roll product is screened to remove the steamboat size, which goes to the No. 2 rolls for reduction to broken and smaller. In case broken is being shipped, the No. 2 roll product goes directly with the broken and smaller from the No. 1 rolls to the dirty-coal shakers ahead of the cleaning cones. Broken seldom is made, however, and this size usually is passed through the No. 3 rolls for reduction to egg and smaller.

Material smaller than 6 in. through the bull shakers falls onto steamboat shakers equipped with plates with 4½-in. round perforations, where this size is removed and chuted to two Wilmot Simplex jigs. The coal end from these jigs then goes to the No. 2, or broken, rolls. Material smaller than 4½ in. through the steamboat shakers is passed over broken shakers with 3¼-in. perforations, where this size is screened out and chuted to two Simplex broken jigs. In case broken is being shipped, the coal end from these jigs goes directly to the dirty-coal shakers; otherwise, it is run to the No. 3 rolls for reduction to egg and smaller.

Primary cleaning equipment at Tamaqua consists of one 18-ft. cone for broken or egg to pea, inclusive, and two square-topped cones for buckwheat No. 1, buckwheat No. 2 (rice) and buckwheat No. 3 (barley). Separation into these two size classes is made on the dirty-coal shakers receiving material from the rolls and jigs in the headhouse. Clean coal from the cones is sized on desanding and sizing shakers, from which the various sizes are chuted to their respective loading pockets. En route from the pockets to the railroad cars, the sizes from broken down to and including buckwheat No. 1 are passed over lip screens to remove degradation. Undersize from the lip screens is elevated to a bank of resizing shakers. These shakers also receive the oversize from the fines shakers, which in turn handle material through the pea deck of the prepared shakers. The resizing shakers also are used when egg must be broken down, as sometimes is the case. Egg is crushed in a set of stove rolls, which receive material from the egg deck of the prepared shakers.

Anthrafine (Nos. 4 and 5 buckwheat) will be handled in a special fine-coal plant now under construction. Specifications for this product are: No. 4, material through 3/32 and over 3/64 in., with not over 25 per cent of undersize; No. 5, material through 3/64 in., with not over 10 per cent of 3/64-in. size. The Tamaqua Anthrafine plant is the outgrowth of a demand for sizing of this product, originally met by the use of various types of screens which in addition to erratic performance were costly, bulky and expensive to maintain.

Deister - Overstrom Diagonal - Deck concentrating tables will be employed in cleaning Anthrafine at Tamaqua. Tables will be divided up into two banks to clean the two sizes, which will be made in two Hardinge counter-current classifiers operating in tandem. The first classifier will receive the water and fines from a settling tank. The product from this unit, No. 4 Anthrafine, will go direct to the No. 4 tables. The overflow, carrying principally No. 5 with some No. 4, will go to the second classifier. Overflow from the second classifier, carrying the No. 5, will go to the No. 5 tables, while the classifier product will be returned to the feed to the first unit. Adoption of this system was preceded by extensive experimentation showing the following results: greatly facilitated tabling; lower ash in coal; reduced loss of coal in the refuse. Installation of the same system at other breakers employing tables is contemplated.

While equipment differs, the Tamaqua preparation system applies in essentials at all other Lehigh Navigation breakers, with the exception of Cranberry and Alliance, where, as noted above, steamboat and broken jigs are omitted. Cranberry breaker is equipped with two Chance cones for broken to buckwheat No. 1 inclusive, and two Gyro-Separators for rice and barley. The slate end from the Gyro-Separators is treated on two Deister-Overstrom Diagonal-Deck concentrating tables to reduce loss of coal and permit shipment

Hauto storage yard provides reserves against sudden demands

Table II—Average Daily Output of Coal and Mine Rock, Lehigh Navigation Collieries

	Coal Shipped, Net Tons	Mine Rock Hoisted, Net Tons	Refuse Content, Raw Coal, Per Cent
Cranberry	2,000	50	34.9
Nesquehoning	3,500	600	34.3
Lansford	4,500	200	35.9
Coaldale	4,400	600	44.4
Greenwood	2,000	400	42.1
Tamaqua*	2,800	300	44.4
Alliance	1,400	100	46.4

*Two shifts.

Table I—Standard Anthracite Specifications, Round-Mesh Screen

	Screen Mesh Inches Diameter		Maximum Per Cent				
	Through	Over	Oversize	Undersize	Slate	Bone	Ash
Broken	4⅜	3¼	5	15	1½	2	..
Egg	3¼	2 7/16	5	15	1½	2	..
Stove	2 7/16	1⅝	5	15	2	3	..
Chestnut	1⅝	13/16	5	15	3	4	..
Pea	13/16	9/16	10	15	5	5	..
Buckwheat	9/16	5/16	10	15	...	..	15
Rice	5/16	9/32	10	15	...	..	15
Barley	9/32	7/32	10	20	...	..	15

Shutter-type flat picker on end of chestnut shaker, Greenwood breaker

of low-ash rice and barley. For maximum flexibility, the breaker is built in two identical halves, either or both of which can be operated at one time. Alliance breaker is equipped with one 15-ft. Chance cone, egg to buckwheat No. 1, inclusive, seven Deister-Overstrom Diagonal-Deck concentrating tables, rice and barley; and one Gyro-Separator, Anthrafine.

Cleaning equipment at the remaining Lehigh Navigation breakers consists of jigs, concentrating tables, Hydrotators and Gyro-Separators, as follows:

Nesquehoning—steamboat and broken, four Wilmot Simplex jigs; egg to pea, inclusive, 38 Simplex and Lehigh Valley jigs; flat chestnut, two Deister-Overstrom Diagonal-Deck concentrating tables; buckwheat Nos. 1 and 2, thirteen concentrating tables, same type; buckwheat No. 3, one Hydrotator; Anthrafine (Nos. 4 and 5), two Gyro-Separators.

Lansford—steamboat and broken, six Simplex jigs; egg to pea, inclusive, 8 Simplex and 25 Liberty (Lehigh Navigation design and manufacture) jigs; buckwheat Nos. 1, 2, 3, 4 and 5, 35 Deister-Overstrom Diagonal-Deck concentrating tables.

Coaldale—steamboat and broken, four Simplex jigs; egg to pea, inclusive, 34 Liberty jigs; flat stove, two Liberty jigs; flat chestnut, two Liberty jigs and two Deister-Overstrom Diagonal-Deck concentrating tables; flat pea, one table, same type; buckwheat No. 1, twelve Liberty jigs and two tables, same type; rice, five tables, same type; barley, two Liberty jigs, two tables, same type, and one Gyro-Separator; Anthrafine, two concentrating tables, same type, and one Gyro-Separator.

Greenwood—steamboat and broken, four Simplex jigs; egg to pea, inclusive, 27 Lehigh Valley jigs; buckwheat No. 1, four Liberty jigs and two Plat-O concentrating tables; buckwheat Nos. 2 and 3, two Hydrotators; Anthrafine, two Plat-O tables.

The Lansford and Coaldale breakers also are quipped with rake-type Dorr classifiers for dewatering the finer sizes. At Coaldale, five units are in operation, as follows: rice, 1; No. 4 buckwheat, 1; No. 5 buckwheat, 1; refuse, 2. Six classifiers are used to dewater No. 5 buckwheat at Lansford. Feed to the Anthrafine units at Lansford consists of the underflow from a 15-ft.-diameter settling tank which receives the breaker wash water. Overflow from this tank goes to a 100-ft. Dorr thickener. Operating as a clarifier, this thickener removes the fine material from the water, which is then recirculated to the breaker as wash water.

Flat pickers are employed at practically all Lehigh Navigation collieries, reflecting an increased sensitiveness among purchasers to the presence of this material in shipments, although its quality is equal to that of the other coal shipped. Nesquehoning colliery probably employs the most elaborate equipment for treatment of flats. Primary flat removal from egg, stove and chestnut at this breaker is accomplished by Frederick pickers. Secondary shutter-type pickers perform further removal of flats from chestnut just before it goes to the loading pockets.

The first operation on chestnut at Nesquehoning takes place before this size is jigged, and the flats resulting are treated on two concentrating tables. Clean coal from these tables goes to a set of rolls where it is crushed to pea and smaller and recirculated to the breaker feed. Clean coal from the chestnut jigs is passed over the shutter-type units, and the flats removed are crushed, screened and distributed to the various clean-coal pockets. On stove and egg, flats are removed after the coal is jigged. These flats are crushed to the next smaller size and recirculated.

Frederick flat picker operating on egg at Nesquehoning

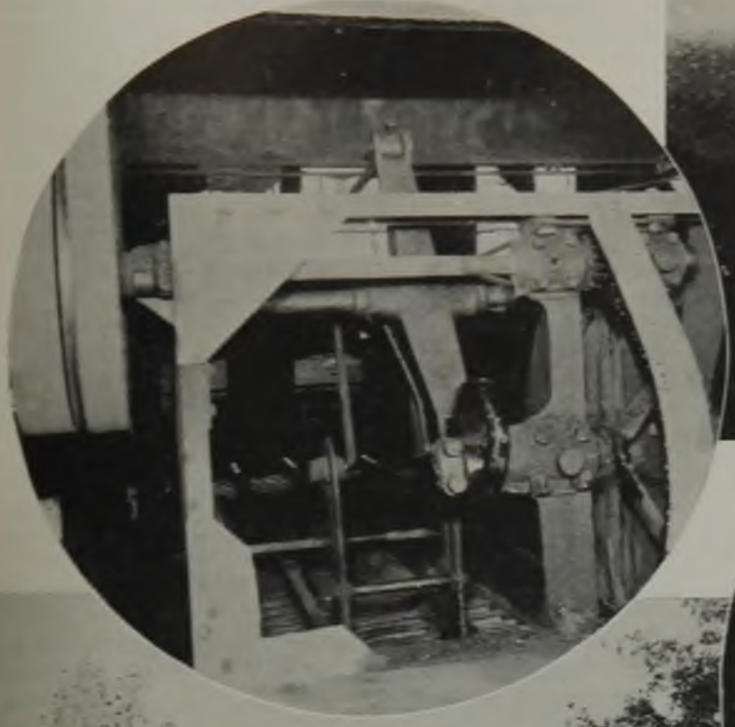
Shutter-type flat pickers usually are employed at other collieries where this material is present in troublesome quantities. Egg, stove and chestnut, all or in part, are the three sizes treated in this manner, particularly the latter. The pickers, varying somewhat in type to meet the requirements of the particular sizes on which they are employed but all operating on the same general principle of providing backward-slanting openings through which the flats escape, are installed either on the ends of the sizing screens or in the shaking carrying chutes used at some of the breakers. Usually, the crushed flats are recirculated to the cleaning units.

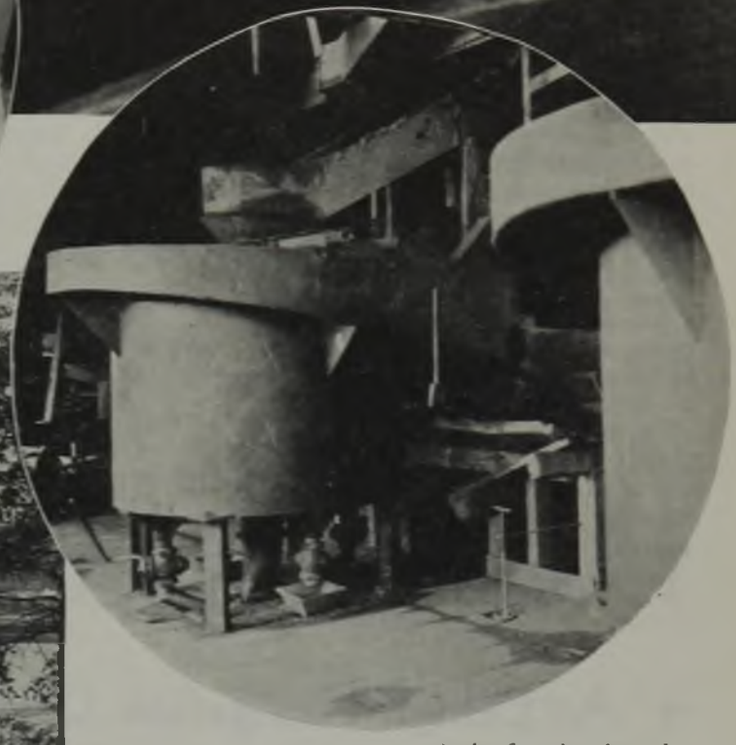
Pure mountain water is employed for coal washing at the Tamaqua, Greenwood, Coaldale, Lansford and Nesquehoning breakers. The latter breaker had used such water, impounded in dams in near-by streams for some years, and consequently was able to hold the record for low maintenance cost. Furthermore, shipments from Nesquehoning, as compared with those from the other breakers—at that time using mine water for washing—presented brighter and fresher surfaces, due to the fact that

Picking floor, Coaldale breaker. Bull shakers are equipped with cast manganese steel plates to resist wear

...ng steam sizes at
...gation collieries

Rake-type classifier employed for dewatering fine coal in Lansford breaker

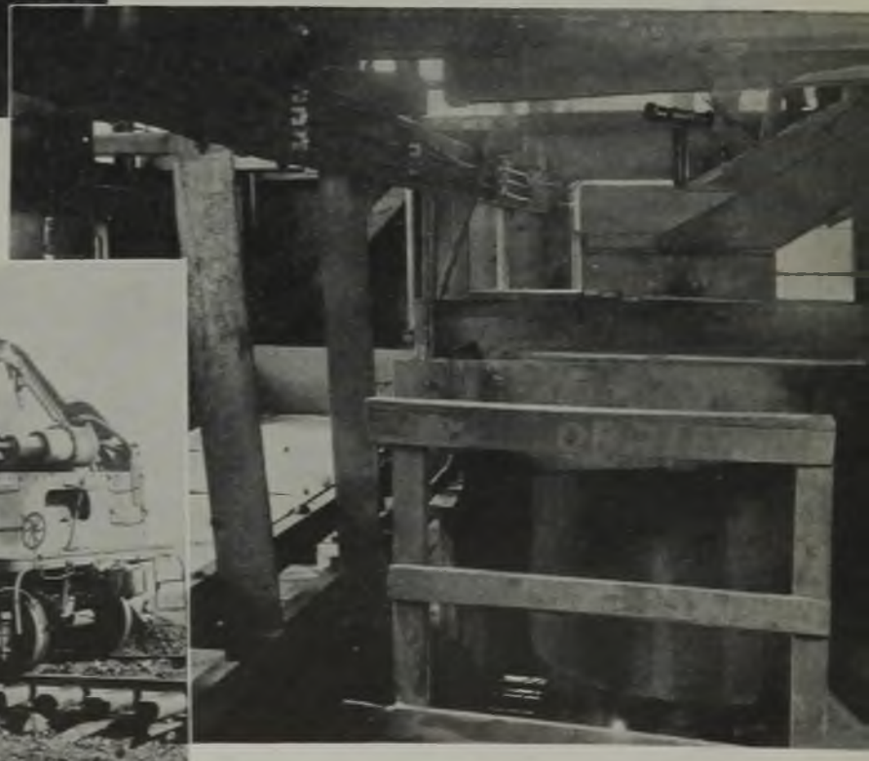




Anthrafine is cleaned in these fine-coal units at Nesquehoning

One of two fine-coal cleaners on Nos. 2 and 3 buckwheat, Greenwood breaker

Still Creek dam, the source of fresh water for washing at Tamaqua, Greenwood, Coaldale and Lansford breakers



Side-dump cars hauled by steam locomotives are used for refuse disposal at Lehigh Navigation collieries

the water used for washing and spraying was free from the "yellow boy" (an ocherous deposit) and clay normally present in mine water. To secure these same advantages at the other breakers the company (through the Panther Valley Water Co., a subsidiary) dammed Still Creek, a stream north of Panther and Nesquehoning creeks.

Storage capacity of the Still Creek dam is 2,500,000,000 gal., and the water flows by gravity to the Tamaqua, Greenwood, Coaldale and Lansford storage reservoirs through a 30-in. pipe 12 miles long.

Shaker plates and chutes, constituting as they do a major item of expense in breaker maintenance, have received special attention at Lehigh Navigation collieries. On bull shakers and steamboat and broken shakers, Taylor-Wharton cast manganese steel plates have been adopted because of their increased resistance to wear. At Alliance breaker, for example, a life of 260 to 288 days has been secured from cast plates, as against 44 to 48 days for rolled plates.

Chrome-steel (12 to 14 per cent Cr.) plates are widely used on steam sizes at Lehigh Navigation breakers to resist acid and wear, although with the use of fresh water at Panther Valley collieries acid-resisting material is not necessary. Generally, chrome-steel plates are applied to washed sizes, as a tendency to block appears when used to screen unwashed material. At Cranberry breaker, however, chrome steel is used on all sizes from barley to chestnut, inclusive, and on dirty-coal shakers a life of 1,440 shifts has been recorded, against 72 shifts with steel plate. At all breakers life of chrome steel—costing about five times as much—ranges from ten to twenty times that of ordinary steel.

Loading cars at a number of breakers is accomplished with special equipment designed to minimize drop and thereby breakage (p. 538 of this issue).

Inspection houses are established at all the collieries, and are manned and equipped to insure a complete check of the condition of every car before it leaves the colliery yard. An inspection crew consists of a head inspector and three assistants. One of the assistants has the duty of inspecting breaker refuse to prevent loss of coal.

Inspecting of coal starts as it is loaded into the car. The coal is constantly under observation as it flows out of the loading chute, and when substandard conditions are noted, the car is condemned and the coal is returned to the breaker for repreparation. If no unusual conditions are noted, the car is dropped into the loaded yard, where it is sampled at nine points on the top by two assistant inspectors. In taking these samples, the inspectors check the appearance of the coal. This check includes general appearance, dull coal, cinders, chips, discoloration, excessive segregation of fines and any other factor which in the judgment of the inspectors would affect marketability.

Samples obtained are screened to determine the percentage of undersize and oversize and also the gradation of the material within the upper and lower limits of the size. Hand-picking is employed to sort out the slate and bone in all sizes down to and including pea in determining impurity content. Results attained by hand picking are checked regularly by float-and-sink methods. Sizes smaller than pea are tested in specific-gravity bottles and float-and-sink machines, and results are used to determine ash from standard curves. As a check, actual ash samples are run at regular intervals.

TRANSPORTATION

+ At Lehigh Navigation Coal Co.

TRANSPORTATION at the collieries of the Lehigh Navigation Coal Co. involves the use of 130 electric and 56 steam locomotives underground and on the surface to handle an average of approximately 37,000 tons of mine rock, raw coal and breaker refuse per day. At the Summit Hill stripping, fourteen additional steam locomotives are employed in hauling coal (included in the above total) and overburden (excluded).

In the Panther valley, where five of seven operations of the company are located, development is by shafts from which cross-measure tunnels are driven to cut the various beds. All shaft hoists are equipped with platform cages. Shaft landings have been standardized, as in Fig. 1 to permit rapid and flexible handling of cars with a minimum of shock and spillage. Loaded cars are brought to the caging point by a "go-devil." Empty cars are bumped off the cages onto a transfer car, which is moved from cage to cage by a double-drum hoist and discharges the empties downgrade to another "go-devil" in the empty hole.

Standard landing capacity is 60 cars. If additional capacity is required, auxiliary turnouts are constructed a short distance from the main tunnels. Transfer cars also handle loaded cars at times, but under the system in Fig. 1 they are required to handle empties only, thus avoiding the shock and spillage incident to handling loads.

Double-drum hoists with straight cylindrical drums clutched for hoisting from various levels are standard at Lehigh Navigation collieries. Two Panther valley hoists are steam-operated. Nine others (Treadwell and Vulcan) are driven by electric motors, as follows: 900 hp., one; 950 hp., one; 1,000 hp., three; 1,200 hp., one; 1,250 hp., three.

Two shafts are in operation at Alliance, where hoisting equipment consists of one Vulcan double-drum unit with an 850- and one Allis-Chalmers unit with a 500-hp. motor. One major inside slope is equipped with a single-drum Finch hoist with a 150-hp. motor. Cranberry is operated entirely by inside and outside slopes, of which the largest is No. 1 at the breaker, equipped with a double-drum 675-hp. Vulcan hoist.

Once hoisted, it is necessary in practically all cases to haul the cars to the dumping point at the breaker. This task usually falls to a steam locomotive, although at Coaldale, where the shaft landings are established underground, the cars are brought out by electric locomotives. Hauling coal and rock from strip pits is another major item in surface transportation. The third is refuse disposal. Car capacities in stripping and refuse service range up to 30 cu.yd.; gradients up to 3½ per cent. Nordberg track shifters are widely used to facilitate moving tracks on refuse and spoil banks. A few steam locomotives also are employed in shifting railroad cars.

Steam locomotives in service include 42 mine-gage and 28 standard-gage

Table I—Type and Number of Electric Locomotives at Lehigh Navigation Collieries

Trolley	Cranberry	Nesquehoning	Lansford	Coaldale	Greenwood	Tamaqua	Alliance
General Electric, 20-ton	..	1	..	4	..	..	..
Goodman, 20-ton	..	1	..	1	..	..	..
Westinghouse, 20-ton	..	1	1	..	..	..	..
General Electric, 15-ton	..	3	4	1	2	2	..
Goodman, 15-ton	2	..	..	..	..	..	..
Westinghouse, 15-ton	..	4	..	1	1	..	..
General Electric, 8½-ton	2	8	13	18	6	8	2
Jeffrey, 8-ton	..	..	..	..	1	..	..
Westinghouse, 8-ton	..	..	..	1	..	1	6
Westinghouse, 6-ton	10	..	..	..	..	..	..
Cable-Reel							
Goodman, flameproof, 8-ton	..	2	..	..	..	..	..
*Storage-Battery**							
General Electric, 8-ton	..	1	..	..	..	..	..
Gen. Elec. permissible, 8-ton	..	..	1[1]	..	..	..	..
Mancha, 6-ton	..	..	2	3	..	..	..
Ironton, 5½-ton	..	..	..	..	3[3]	..	..
Mancha, 5½-ton	..	..	..	..	..	1	..
Ironton, 5-ton	8	..	..	..	..	..	..
Mancha, 5-ton	1	..	..	..	..	..	..
Vulcan, 5-ton	1[3]	..	..	..	..	..	..
Vulcan, 2-ton	..	..	..	..	..	1[4]	..
Combination†							
Westinghouse, 10-ton	..	1	..	3	..	2	..
Whitcomb, 8-ton	..	..	1	..	1	..	..
General Electric, 7-ton	..	..	2	..	..	..	..
Total	24	22	24	32	14	15	8

*All battery locomotives, except as specifically noted, equipped with 42-cell, 29-plate Exide-Ironclad batteries.

†All equipped with 88-cell 17-plate Exide-Ironclad batteries.

[1]Equipped with extra battery for double-shift duty. [2]Includes two units equipped with A-14 72-cell Edison nickel-alkali batteries. [3]Equipped with two 42-cell 29-plate batteries—Exide-Ironclad and Exide-Hycap. [4]Equipped with two 24-cell 13-plate Exide-Ironclad batteries for double-shift duty.

units. Narrow-gage units vary in weight from 18 to 25 tons, with the latter predominating. Standard-gage units range from 40 to 70 tons in weight and include ten Heisler geared locomotives at the Summit Hill stripping.

To increase efficiency and lower the cost of underground transportation the Lehigh Navigation Coal Co. has continuously revised equipment, operating methods and maintenance practices. As stated in a recent study of company transportation developments (*Coal Age*, Vol. 40, p. 403), electrification of underground haulage began with the installation of an 8-ton Westinghouse trolley locomotive in 1906. This unit—the first of a fleet of electric locomotives which now totals 139 of all types (Table I)—is still hauling coal. Present energy consumption for haulage (including certain small d.c. loads on the trolley wire) is 2.324 kw.-hr. per ton. Total consumption per ton for all purposes is 25 kw.-hr. per ton. Haulage demand is 3,800 kw. out of a total of 27,398 kw.

Trolley locomotives, including main-haulage units, total 105. Condition at Lehigh Navigation collieries favor the use of trolley units, as gathering consists of spotting cars under the loading chutes of the various breasts along a gangway and assembling the cars when loaded. This permits carrying trolley wire and bonds to the face of the gangway as a rule.

Straight storage-battery or combination locomotives number 32. Two flameproof cable-reel locomotives complete the roster of 139. Where gas may be a hazard or where it may be inexpedient or difficult to string trolley wire to the face, these 34 units fill a definite need. Battery units also prove advantageous in short-lived sections where installation of motor-generator sets, trolley wire and bonding would not be economical.

Usually, locomotives haul directly from the loading chutes to the shaft landing. As a rule, the hauls do not exceed 3,500 ft., although occasionally distances up to 10,000 ft. are encountered. Where the haul is more than 3,500 ft., however, cars usually are taken to an intermediate parting, made by widening the roadway to accommodate two tracks. From these points the cars are hauled by a main-line locomotive.

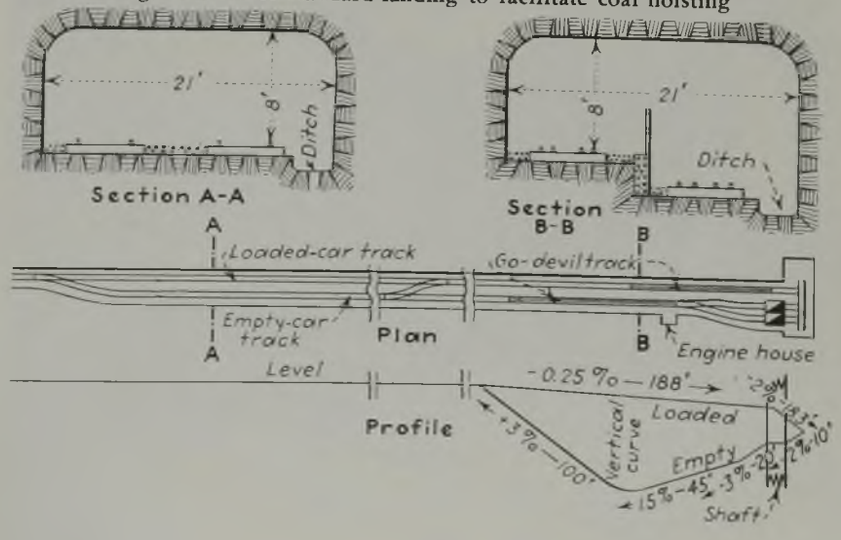
With the progress of the years, rail weight has been increased. Present standards call for 60-lb. rail on ties set at 20-in. centers on all haulways. Tracks are ballasted with mine rock or cinders. Curve radii run from 50 ft. to 100 ft. in the main, with certain exceptions to meet unusual conditions. Haulageways are driven on a minimum upward gradient of 0.35 per cent to facilitate drainage. Standard gradient is 0.58 per cent.

For the 32 battery and combination locomotives 35 batteries are provided, three of the units operating double shift and requiring two batteries apiece. Life of batteries on straight battery units is 54 months, and the average monthly cost is $31.41, based on an average battery cost of $1,696.20 (including freight charges, installation cost, special repairs, if any, and scrap value or allowance for equipment replaced). The cost for combination locomotives is $45.22, based on an average life of 46 months and an average cost of $2,080.05. With combination locomotives, however, battery life is affected by overloading, due to the ability of the locomotive to start heavy trips on the trolley, which the battery must handle beyond the wire. Battery life in the period 1920-24 was 24 to 30 months; present life mirrors research by the company to determine suitable types, improvements in the art of battery manufacture and advances in maintenance practice.

Transportation history at Lehigh Navigation offers an illuminating chapter of progressive development in mine-car design to insure longer life and lower maintenance costs. This evolution has been influenced largely by mining conditions. In loading from chutes—the general practice—all material from the breast must go into the car, including chunks at times weighing as much as a ton. All this material must drop at least 5 ft. to the bottom of the car, making shock an important factor. Acid mine water also takes its toll. The research department of the coal company has kept, and is keeping, careful records of the endurance of mine cars to ascertain just which type and construction of car suits its conditions best, and makes its specifications accordingly.

The first step in the evolution from the old wooden cars was the substitution of the composite, or semi-steel, type with wooden underframe and fabricated steel body. Increased rigidity and lower maintenance costs resulted, but adoption of locomotive haulage and an increase in the size of the material loaded called for still stronger construction. To meet

Fig. 1—Plan of standard landing to facilitate coal hoisting



this demand, fabricated structural-steel underframes were adopted. While an improvement, loosening or stretching of the rivets allowed acid mine water to seep in, rapidly enlarging the rivet holes and speeding the disintegration of the car. The average life of cars with fabricated underframes was between three and four years and one special study showed a maintenance cost of 7c. per ton of material carried.

In the search for a type of construction which would be free from these handicaps, the cast-steel underframe was introduced in 1919, and today all but 100 cars underground at four Panther valley collieries are equipped with cast frames. Welded underframes are installed on the remaining 100. Lansford has 450 cars; Coaldale, 1,200; Greenwood, 560; and Tamaqua, 560. As a result of this change and other improvements, maintenance has been cut in half. A special study showed that a modern car with cast frame and other improvements has a maintenance cost of only 2.1c. per ton.

Chute locations, gangway and tunnel widths have been standardized, and in keeping Panther valley mine-car height has been set at 5 ft. $\frac{3}{8}$ in. over the rail, wheel diameter at 20 in., length over bumpers at 9 ft. 4 in., body length at 7 ft. $7\frac{1}{2}$ in., width at 5 ft. $1\frac{1}{8}$ in., track gage at 42 in. and capacity at 114.87 cu.ft. Cranberry car capacity is 108; Alliance, 120 cu.ft. The latter cars consist essentially of a steel box mounted on a wood underframe. At Nesquehoning and Cranberry, side and end sheets are bolted to an outside wood frame supported on a wood underframe on which the bottom sheet rests.

In the first cast-steel underframe (Fig. 2) the structural-steel frame was reproduced essentially in cast steel with side sills, end sills and draft sills incorporated in the casting. To this frame the pedestals, bottom and end plates were riveted. Weight of frame was 1,300 lb. Loosening of the bottom plates and pedestals were the principal difficulties, later remedied in the case of pedestals by casting them integrally with the frame.

Improvements in the art of steel casting followed, and in 1930 cast-steel underframes with flat bottom and pedestals in one piece (Fig. 2) were introduced. These and other types of frames were manufactured for the company by the General Steel Castings Corporation, Taylor-Wharton, Reading Iron Co., Vulcan Iron Works and Buckeye Steel Castings Co. Weight of this underframe averages 2,250 lb. Shortly thereafter the General Steel Castings Corporation developed the "bathtube" type Commonwealth underframe shown in Fig. 2. These 2,000-lb. underframes were built to include draft and buffing gear (Miner Class "S") in a box-sectioned end sill to distribute longitudinal shocks over the entire frame of the car.

All-welded underframes with integral pedestals and floor plates were then given consideration. Four years has passed since these were first installed and now 100, made by the American Car & Foundry Co., are in service, some embodying improvements in design suggested by experience. They weigh about 2,190 lb. Results to date have shown that welding is an effective method of checking corrosion.

Because of the extremely adhesive nature of the fine coal, experience indicates that most of the advantage of the bathtub underframe is lost. The fines fill up the "tub," giving, in effect, a flat-bottom car of less capacity. This resulted in a return to the flat-bottomed Commonwealth frame (Fig. 2) modified in design to provide an upstanding flange which decreases the depth of the side and end plates.

Recognizing the strength of corrugated shapes, the cast-steel underframe with a corrugated bottom has been devised (Fig. 2). This frame, a Buckeye type, weighs about 1,820 lb. Of these, 150 have been purchased. With this frame the capacity of the car has been increased to about 120 cu.ft. Like the bathtub, flat-bottomed frame with upstanding flange and the all-welded underframe, the corrugated frame permits reduction of side- and end-plate depth, thus allowing old plates to be salvaged by cutting them off 6 in. above the bottom to eliminate the riveted section most subject to corrosion. These plates can then be riveted on again.

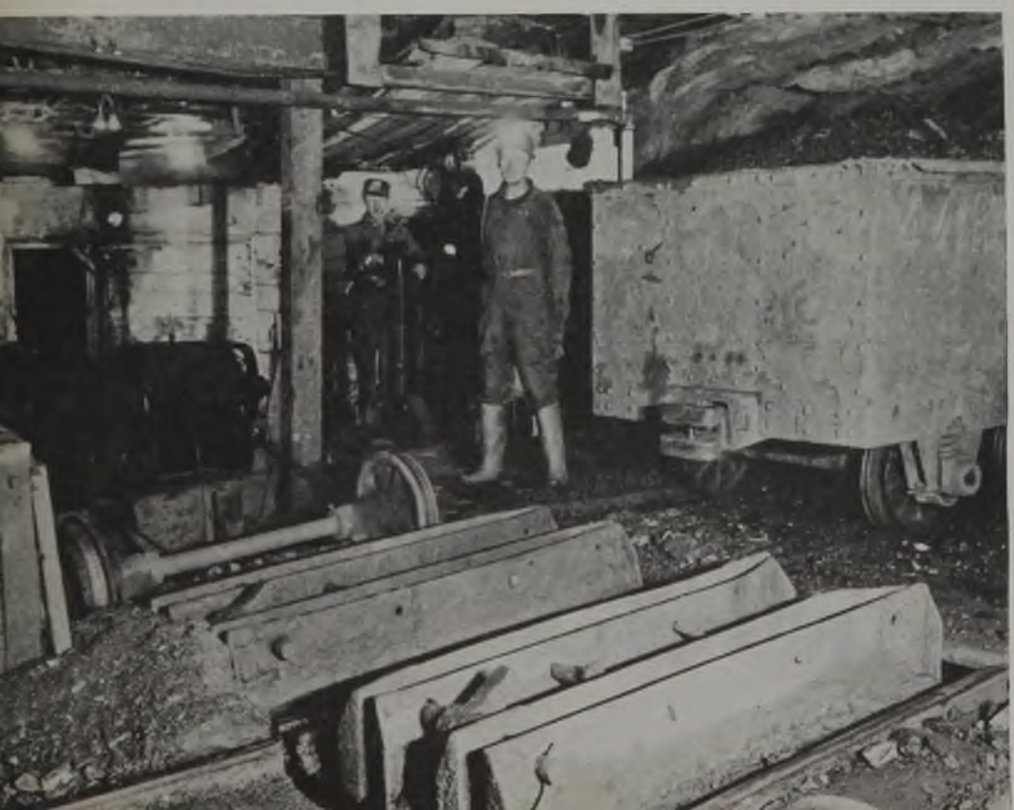
Cars for underground use at all the collieries except Nesquehoning are provided with roller bearings. With the exception of the Cranberry and Tamaqua cars, which are of the end-gate type, all cars are designed for rotary-dump discharge and are built with solid ends. Brakes with mechanical equalizers are provided on all cars at Cranberry, Lansford, Greenwood, Tamaqua and Alliance, and have eliminated many flat wheels which result where spragging is practiced. Inside wheels are standard at all Panther valley collieries. Hyatt bearings are used at Coaldale, Greenwood and Tamaqua, but the Lansford cars have Timken bearings. Alliance cars have Sanford-Day, and Cranberry cars Whitney Wonder roller-bearing wheels.

Another destructive influence is the starting and stopping of trips. At Lansford, Coaldale, Tamaqua and Greenwood the shocks thus generated have been reduced by a series of improvements in car design. Springs in the center drawheads were used in earlier car types to reduce starting shocks. Then the spring-type draft and buffing gear used with bathtub underframes was adopted to diminish starting and stopping shocks.

But a better method of curing this evil, if it could be adapted to mine cars, seemed available in the railroad-type friction draft and buffing gear. The Miner T-3 gear, designed with that end in view and provided with an alloy-steel coupler, has now been definitely adopted. With spring supports on axle mountings, shock to car wheels as well as to bearings and axles has been decreased. Track irregularities, against which it is difficult to provide where roadbeds are subject to mining stress, are compensated by these mountings, and the cars ride more easily by reason of the introduction of the springs.

Metals of great strength and long wear have been sought to prevent wrecks and afford long life to the car equipment in which they are used. At Lansford, Coaldale, Greenwood and Tamaqua, cast iron, manganese steel, cast steel and special alloy cast iron have all

Transfer car handling loaded cars, No. 9 shaft, Coaldale colliery



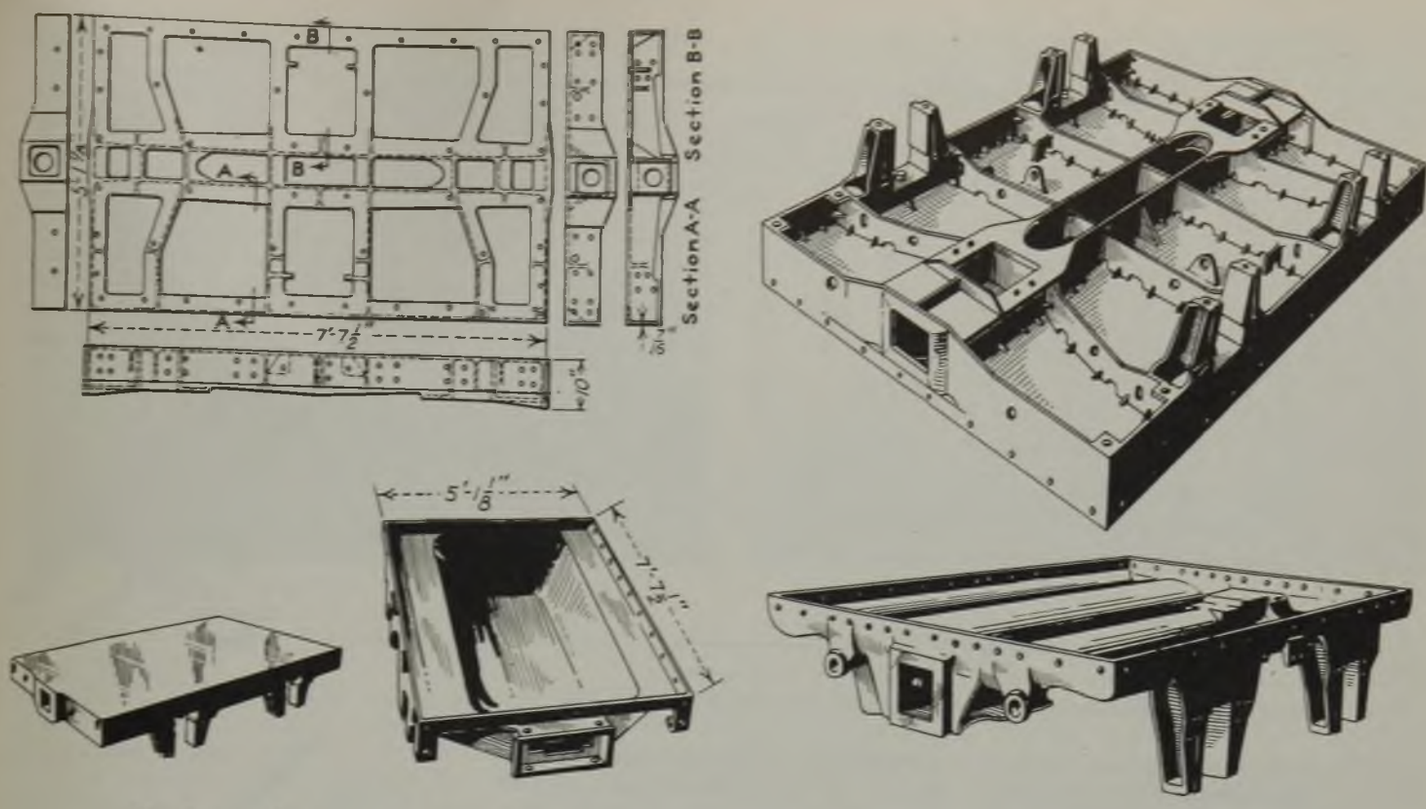


Fig. 2—Showing (top row, left) details of original cast-steel underframe without pedestals or bottom; (right) bottom view of late-type flat-bottomed frame with upstanding flange; (bottom row left) early frame with integral pedestals and flat bottom; (center) "bathtub" underframe; (right) "corrugated-bottom" underframe

been used for wheels, with the last in most general use. Bent axles used to be frequent, and to remedy this as well as to reduce wear a number of cars have been fitted with axles of heat-treated alloy steel (manufactured by the Bethlehem Steel Co.), which, though they cost two or three times as much as ordinary axles, seem likely to justify that expenditure.

No underframe failures, only one roller bearing and two wheels replaced and a minimum cost for other maintenance items is the striking record of the cars installed at Lansford in 1928. They are equipped with brakes, have flat-bottomed cast-steel underframes, special alloy cast-iron wheels and Timken roller bearings.

MINE VENTILATION

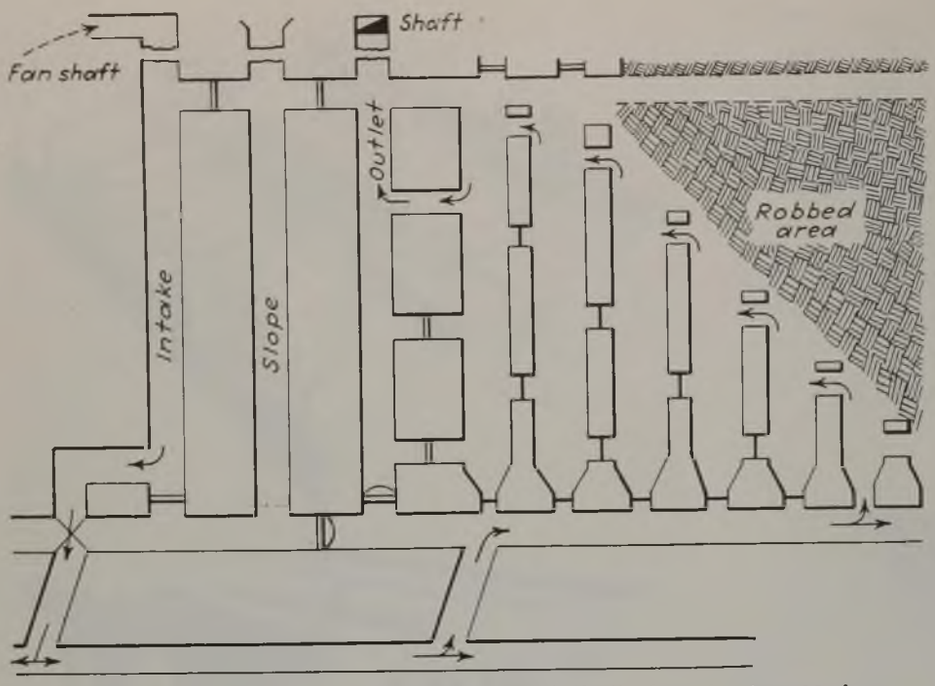
+ At Lehigh Navigation Coal Co.

SIX of the seven collieries of the Lehigh Navigation Coal Co. are classed as gaseous and are operated on a closed-light basis, but methane concentrations in the main returns seldom if ever reach 0.1 per cent. Because the beds pitch steeply from the outcrops and folding creviced coal and rock over large areas, most of the gas has already been drained to the surface. Local areas, however, may contain much gas, hence the ventilating problem is one of being prepared to reduce concentration in individual breasts, blind chutes and gangways, rather than moving large quantities of air at all times.

Eighteen main fans, all located on the surface, are in regular operation; the heaviest duty on any one—the Greenwood—is 260,000 cu.ft. per minute against a 4-in. water gage. Of the total fans, seventeen are driven by a.c. induction motors and one by a steam engine. Electric power requirements for main ventilation at the various operations range between 1½ and 5 kw.-hr. per ton of coal shipped.

Ventilation at Cranberry, where the beds lie on pitches between level and 35 deg., is handled much as in bituminous mines. This colliery operates on open lights. The breast-and-pillar system is used, with all air and haulage gangways in the coal beds, which run 3 to 8 ft. in thickness. Coal is brought out through shafts, slopes and drifts. No booster fans are used, but inside equipment includes seven motor-driven blowers with tubing to advance gangways beyond crosscuts. Tile stoppings are used on the main aircourses.

Ventilation methods at Alliance colliery are similar to those at the five Panther valley collieries, where haulage gangways and return airways usually are driven in the rock, especially in mining the Mammoth and Forty-Foot beds. In working the Primrose bed at Green-



Ventilation method at Cranberry, where the beds lie from level to 35 deg.

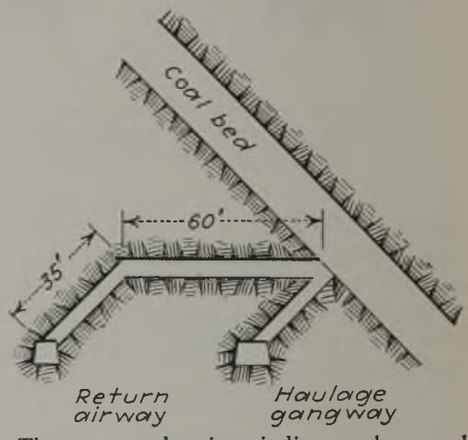
wood, however, gangways are driven in the coal. Rock-tunnel haulways usually are 8x12 ft. and the airways, which parallel them about 40 ft. above, are 6x8 ft. Rock crosscuts are driven from return airway to coal every fourth or fifth breast, and the air circulates up the rock chutes from the haulage gangway, or intake, through the breasts and back through the crosscuts. Seventeen to twenty men, as an average, are supplied by one split of air; however, the number may run as few as eight and as high as forty-five.

On the 7th and 8th levels at Coaldale, airways are placed on the same level as the haulageways, and overcasts or chutes are driven to the coal every fourth or fifth breast. Airways are 8x10 ft. and are laid with tracks. This system was adopted on these levels at Coaldale because of the broken condition of the rock through which the gangways are driven, and facilitates cleaning up falls in airways.

Underground booster fans are used only in the Alliance mine. Five are installed there at stoppings or at doors and no tubing is used in connection with them. The prevailing type is "No. 28 Volume" Buffalo blowers driven by 15-hp. d.c. motors.

Auxiliary blowers fitted with tubing are used in all of the steep-pitch mines except Greenwood. Nesquehoning has thirty 4-hp. motor-driven blowers and five Coppus air-turbine blowers; Tamaqua, eight Coppus blowers; Coaldale has some motor-driven and some air-driven (total eight); Lansford has five motor-driven units; and Alliance one air-driven unit. These blowers with tubing are used for driving blind chutes and gangways, for making connections, and in driving long tunnels. Air-turbine-driven blowers are preferred to motor-driven units where much gas is generated or may be expected. At Greenwood, blind chutes and connections are ventilated during driving by 6-in. sheet-metal tubing in which a compressed-air jet, installed at the heading end, pulls air into the tube by injector action.

At all collieries compresed air is used directly for ventilation only as a temporary means of combating emergencies such as falls of rock or runs of coal.



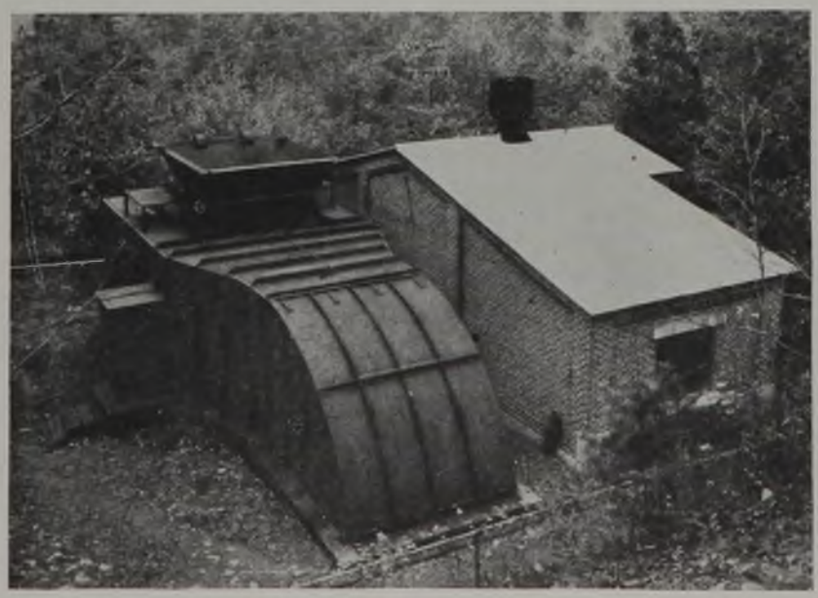
The upper drawing indicates the usual arrangement of airway above the gangway for pitching beds. The lower drawing shows the method in broken rock at Coaldale

Compressed air used in water-leyner drills employed in gangway rock work and the air used by jackhammers which some miners own and operate to drill shotholes in coal, of course, furnish a degree of ventilation. Continual vigilance on the part of the mine officials is necessary, however, to limit the compressed air to its economical uses.

Twelve of the main ventilating fans are exhausting and six are blowing units. Most main ventilation is the one-way type because several of the exhaust fans are located at a distance from the downcast hoisting shafts and in many places holes are cut from workings near the crop to the surface to serve as intakes or, in the case of blowing fans, as outlets. Some air also escapes through old workings and broken areas.

At Greenwood, holes cut from the surface of the mountain down to a water-level tunnel serve both as air intakes and as drains for surface water. A zig-zag muleway that connects with all levels serves also as an air intake. As electric

The motor room of this fan at No. 3 shaft, Nesquehoning, serves also as a d.c. substation. Both controls are full-automatic



Alliance colliery uses several ventilation boosters such as this blower which operates in No. 1 tunnel, Skidmore slope, No. 1 shaft

Control buttons, signal lamps and alarm bells for the three mine fans and for an outlying motor-generator are grouped in the main substation at Nesquehoning

locomotives have practically displaced stock for haulage, the muleway now finds more use as a manway.

When construction of the latest fan installation at No. 10 shaft, Greenwood, was under way, in 1928, special care was taken to reduce resistance in the shaft, which is 18 ft. 2 in. x 19 ft. and 600 ft. deep. It was necessary at that time to resurface the shaft, and coincident with that work it was lined with pine planks set flush with the faces of the timbers and fastened by Monel metal nails. Equipment at the top of the shaft consists of a 12x5-ft. Vulcan fan driven by a Westinghouse 325-hp. 2,200-volt 490-r.p.m. motor with full-automatic control. Pushbuttons for starting and stopping, operating signal lamps and an alarm are mounted on a panel in the main colliery substation several hundred feet distant, where an operator always is on duty.

Full-automatic and remote control is provided for all principal fan installations. Alarms function through failure of air pressure rather than through motor or power failure, hence a broken belt gives an alarm even though the motor still may be running. Practically all large fan motors are wound-rotor type and, in some cases, the control includes provision for operating the motor on rotor resistance to reduce fan speed during shutdowns or as a temporary means until pulley sizes can be changed.

Because of differences in elevations of the intakes and returns and due to the many openings at the crops, natural circulation has considerable effect on the ventilation. At some of the collieries—Alliance, for instance—fans are stopped whenever the colliery is to be shut down for as much as a week at a time. Natural ventilation then provides enough air for safe operation and inspection of automatic pumping stations, which in all cases are near the shaft.

For at least 25 years, stoppings of fireproof construction have been installed for permanent work in the Panther valley mines; wood is still used for temporary stoppings. Worked-out chutes are closed off with cement blocks.

Because of the low percentages of methane in main returns, few air samples have been taken and analyzed. Tests at Tamaqua in October, 1934, showed quantities between 0.065 and 0.08 per cent in the main return of the Arlington working, which has an exhaust fan. On a split ventilated by the Locust Mountain blow fan, a percentage of 0.02 was observed before firing and 0.07 after firing.

The State mining law specifies a minimum of 200 cu.ft. of air per minute per employee, but practices typical of all Lehigh Navigation collieries show the following: Alliance, 566 cu.ft.; Coaldale, 360 cu.ft.; Tamaqua, 455 cu.ft. These figures are calculated for the greatest number of men inside at one time.

Main Fans Operating at Collieries of Lehigh Navigation Coal Co.

Location	Make	Size, Ft. Dia. x Width	Delivering Cu.Ft.	Air Direction	Water Gage, In.	Air Shaft, Ft.	Motor Make	Motor Type	Motor Horsepower	Motor R.p.m.	Type of Drive
Nesquehoning:											
Wildip	Jeffrey	7x3	79,000	blow	1.8	8x10	G.E.	Ind.	75	480	long flat belt
No. 1 shaft	Jeffrey	10x4	230,000	blow	3.5	12 dia.	G.E.	Ind.	250	485	long flat belt
No. 3 shaft	Connel	11x5	160,000	exh.	2.6	10x10	W.	Ind.	250	485	long flat belt
Lansford:											
No. 4 air shaft	Jeffrey	12x4½	75,000	exh.	1.2	14x18	G.E.	Ind.	325	490	long flat belt
No. 5 West	Am.-Blow	10x3½	100,000	exh	2.7	4¾x12	G.E.	Ind.	100	485	long flat belt
No. 6 Mountain	Jeffrey	10x4	170,000	exh	2.25	12x12	W.	Ind.	250	485	long flat belt
Coaldale:											
No. 8 Mountain	Jeffrey	10x4	210,000	exh.	2.3	12x12	W.	Ind.	150	480	long flat belt
No. 9	Jeffrey	10x4	210,000	exh.	3.0	12x12	Al.-Ch.	Ind.	150	360	long flat belt
No. 8 Pr mrose	Sturtevant	12x6	30,000	blow	2.8	8x10	(steam driven)				direct
Springdale	Robin	5-ft. air-prop.	40,000	exh.	1.0	8x 8	W.	Ind.	15	715	direct
Greenwood:											
No. 10 shaft	Vulcan	12x5	260,000	exh.	4.0	18x19	W.	Ind.	325	490	long flat belt
Tamaqua:											
Locust Mountain	L.N.C. Co.	20x6¾	100,000	blow	2.0	9x16	W.	Ind.	150	485	silent chain
Arlington	Vulcan	12x5	104,800	exh.	3.0	12x15	W.	Ind.	150	485	long flat belt
Alliance:											
No. 1	Jeffrey	8x3½	150,000	exh.	2.7	10x10	G.E.	Ind.	125	575	long flat belt
No. 2	Sturtevant	10x5	116,000	exh.	2.5	12x12	Al.-Ch.	Ind.	150	575	long flat belt
Cranberry:											
No. 22 slope	Jeffrey	8x3½	105,600	blow	.9	8x8	G.E.	Ind.	25	575	silent chain
S. Wharton	Guibal	16 dia.	51,480	blow	.6	7x7	G.E.	Ind.	25	575	silent chain
N. Wharton	Guibal	16 dia.	53,120	exh.	.8	8x9	G.E.	Ind.	25	575	silent chain

Legend: G.E. — General Electric
Ind. — A.C. induction motor
W. — Westinghouse
Connel. — Connelsville
Am. Blow. — American Blower
Al.-Ch. — Allis-Chalmers
Stur'v't — Sturtevant
Robin. — Robinson
Air-prop. — Airplane propeller type
L.N.C. Co. — Lehigh Navigation Coal Co.

OPERATING PERSONNEL

R. E. HOBART
Mechanical Superintendent

JAMES S. MILLER
Superintendent, Alliance District

A. C. NEUMULLER
Forester

FRANCIS E. STERNER
Superintendent, Tamaqua District

CHARLES D. RUBERT
Superintendent, Coaldale District

H. S. GILBERTSON
Director of Research and Personnel

A. L. WALBRIDGE
Superintendent, Cranberry District

LEHIGH NAVIGATION COAL COMPANY

THOMAS D. LEWIS
General Superintendent

W. S. RAUSCH
Mining Engineer

FRED B. NOLD
Superintendent, Nesquehoning District

EVAN EVANS
Operating Assistant to General Superintendent

E. P. HUMPHREY
Superintendent of Preparation and Strippings

D. C. HELMS
Superintendent, Lansford District

F. R. EDWARDS
Storehouse Inspector

ELECTRIFICATION

+ At Lehigh Navigation Coal Co.

FROM its 1905 beginning, electrification at Lehigh Navigation Coal Co. collieries has taken over all steam loads except one shaft hoist and a number of locomotives on outside hauls. Electrical equipment and methods reflect consistent installation for reliability and economy and adoption of new equipment as soon as advantages are proved.

Combined electrical demand of the company's seven collieries in 1934 was 37,428 kw.; energy consumption was 82,257,863 kw.-hr. In 1913, when electric load became a major factor, demand was 2,200 kw.; consumption, 2,226,000 kw.-hr. Per-ton consumption was 0.6 kw.-hr. in 1913, or one thirty-seventh of the 1934 figure of 22.5 kw.-hr. per ton. Approximately 1,100 motors (excluding fractional-horsepower and mine-locomotive types) are now in use. In all but a few cases where no labor saving would result, mine pumps, fans and air compressors are equipped with full-automatic controls.

Electrically, the seven collieries are divided into three groups, each supplied exclusively with purchased power. One group consists of Nesquehoning, Lansford, Coaldale, Greenwood and Tamaqua collieries, all in a radius of 11 miles in the Panther Creek valley. This group is supplied with 25-cycle 11,000-volt energy through one metering station. Cranberry and Alliance each constitute a separate group served by 60-cycle 66,000-volt power. These two collieries, formerly operated by subsidiaries, came into the power picture in 1927, when they were merged with other company operations.

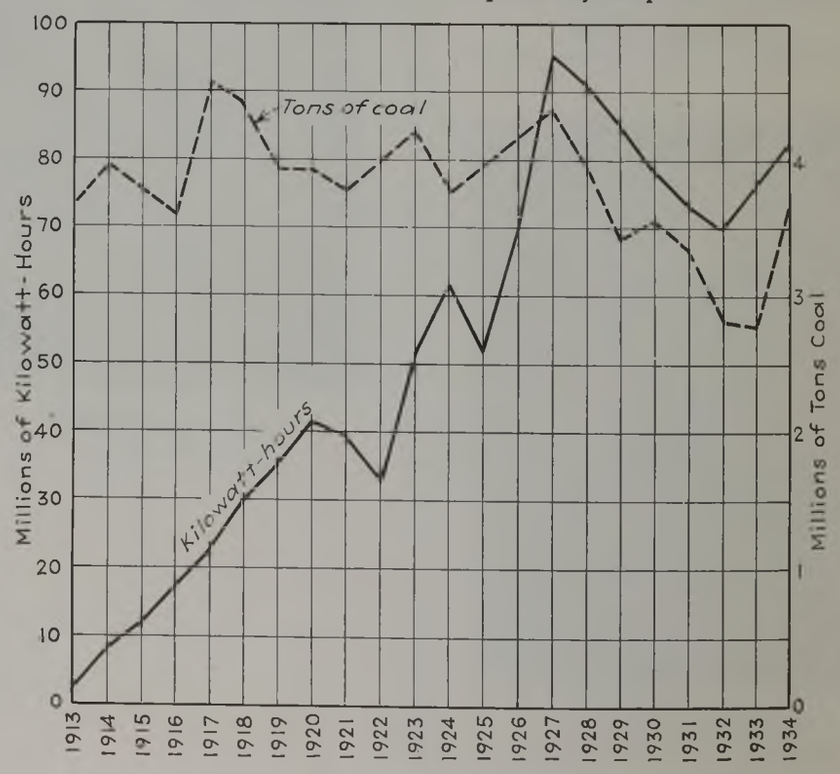
In 1905, the company built a power plant at Lansford with the following equipment: two d.c. generators, 400 and 225 kw., to supply a trolley system; two quarter-phase generators, 220 and 75 kw., lighting loads in surrounding towns; and two 25-cycle 2,300-volt 3-phase generators, 700 and 400 kva., colliery power. A 400-kva. unit was added to the 3-phase capacity in 1910, bringing the total to 1,500 kva.

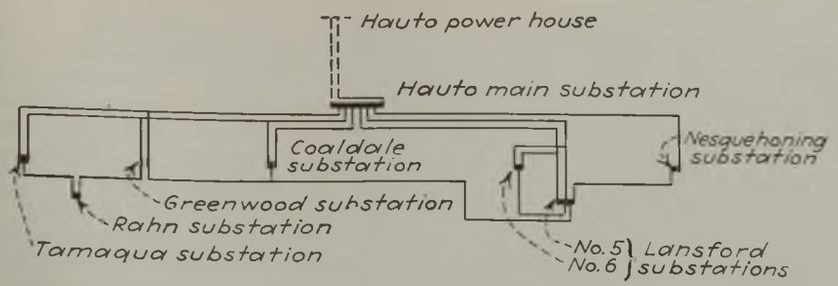
A new plant with three 12,500-kva. 11,000-volt 25-cycle turbo-generators was put in service in 1913 at Hauto—one mile across the mountain from Lansford—by the Lehigh Navigation Electric Co., a subsidiary. Pending completion of this plant the company installed a 400-kw. 440-volt 25-cycle power plant at its storage yard about one mile from Hauto. With the completion of the Hauto plant in 1913, electrification and the displacement of steam for hoisting, pumping and driving breakers got under way in earnest. In 1917 the Hauto plant was sold to the Electric Bond & Share Co., and the present owner is the Pennsylvania Power & Light Co. Sale of the plant was accompanied by negotiation of a long-term power-service contract based on a one-hour demand period. This contract called for the purchase of a specific quantity of fuel from the coal company and necessitated construction of a main substation and 11,000-volt transmission system by Lehigh Navigation.

This main substation, 1,000 ft. from the Hauto plant, is a brick and steel structure containing 11,000-volt truck-type panels and switches to handle two incoming circuits and six outgoing transmission lines. This equipment is always under the eye of an attendant. Lengths of transmission lines to colliery substations are: Nesquehoning, 24,000 ft.; Lansford No. 5 shaft, 14,000 ft.; Greenwood, 16,000 ft.; Tamaqua, 23,200 ft.; and Coaldale, 4,300 ft. To guard against pumping interruptions, the loop system was employed in building transmission lines.

Seventeen miles of two-circuit line and 23 miles of single-circuit line constitute the 25-cycle 11,000-volt system serving Panther valley mines. Earlier construction was based on A-frame-type steel towers, but experience indicated the superiority of wood poles with wood crossarms. Consequently, the latter construction was adopted for the lines last built. The 11,000-volt power is transformed to 2,300 volts and/or 440 volts at main substations at each colliery. In most cases, these substations also con-

By 1927, where the curves of totals for all mines begin to run approximately parallel, electrification had been practically completed





Unique for a coal company at the time of its installation was this loop system which transmits 11,000 volts to the "Valley" collieries

Connected Loads at Lehigh Navigation Coal Co. Operations

Districts	A. C. Motors (Except Synchronous) Outside No.	Outside Hp.	Underground No.	Underground Hp.	Synchronous Motors[1] (All outside) No.	Synchronous Motors[1] (All outside) Hp.	Rotary Converters (All outside) No.	Rotary Converters (All outside) Kw.
Nesquehoning	85	6,329.50	0	0	3	1,400	3	900
Hackle Bernie[2] (stripping)	6	456.50	0	0	0	0	0	0
Lansford	118	9,531.60	12	3,000.0	4	1,300	2	900
Coaldale	87	5,851.35	17	2,250.0	1	350	2	700
Summit Hill (stripping)	35	848.20	0	0	3	910	0	0
Greenwood	35	5,165	7	1,795.0	2	700	1	300
Rahn	9	1,484.50	10	1,662.5	0	0	1	500
Tamaqua	68	6,470.75	11	1,863.0	2	900	1	300
Alliance[2]	36	4,166.50	20	1,417.5	1	350	1	300
Cranberry[2]	112	7,521.00	23	3,894.5	2	495	1	300
Lansford shops	63	1,278.58	0	0	0	0	1	100
Hauto district (includes storage yard)	12	1,835.50	0	0	0	0	0	0
Totals	666	50,938.98	100	16,062.5	18	6,465	13	4,400

[1]Includes three synchronous motor-generator substation sets. [2]60-cycle equipment (all other districts are 25-cycle).

tain air compressors and d.c. conversion units, and in each instance the several equipments are supervised by one attendant.

The motor room of the mine fan adjoins the substation at Tamaqua, and at this and other collieries, outlying fans, d.c. substations and air compressors are equipped with full-automatic controls with operating buttons and signals in the main colliery substations and therefore under the supervision of the same attendants. In several cases control and signal lines for main underground pumping stations are extended to the surface and control buttons and signals installed in the main substations.

All d.c. conversion machines are located outside of the mines; rotary converters are the principal type. Total capacity of the thirteen converters in service, mostly 300 kw. but ranging from 100 to 500 kw., is 4,400 kw. The only 100-kw. machine supplies d.c. power requirements at the central repair shop at Lansford. One of the two 500-kw. units is stationed at Rahn colliery, which is shut down but kept dewatered. Synchronous motor-generator sets are now favored for substation units and include one 300-kw. unit at Nesquehoning, one 200-kw. unit at Tamaqua and one 200-kw. unit at Cranberry. All three are at outlying points where there are no attendants and, therefore, are equipped with full-automatic controls.

Other synchronous machines, principally driving stationary air compressors, total 5,490 connected horsepower. Compressor motors are direct-connected and sizes range from 250 to 650 hp. One 500-hp. synchronous motor drives the generator of a stripping shovel at Summit Hill. Lansford breaker has two 200-hp. synchronous motors, one idling to improve power factor and the other driving a wash-water pump. Magnetic clutches permit interchanging the units.

At the two 60-cycle collieries, capacitors provide additional power-factor correction. A 660-kva. capacitor installed at Alliance in August, 1932, paid for itself in 22 months and a 600-kva. unit installed at Cranberry in November, 1932, paid for itself in 14 months.

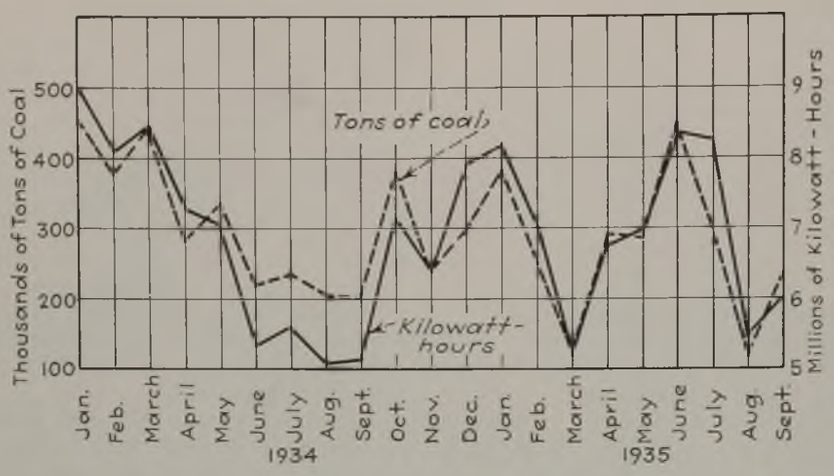
Locomotives (Table I, p. 507) operating from 250-volt trolleys constitute the principal underground d.c. load, the remainder consisting of a few booster fans, a number of blowers and, in some sections, conveyors, scrapers and loading machines. Direct-current feeder cables, insulated with rubber compound and protected by Ferrin circular loom, usually are taken into the mines through the shafts. Normally, one circuit is run to each level except where one cable is sufficient for the entire shaft load. In mines where branch feeders supply a level or a large section, automatic sectionalizing breakers are installed to minimize interruptions.

All trolley wire is No. 4/0, grooved section, and long-type track bonds with arc-weld steel terminals are employed. Crossbonds are installed every 300 ft. Length of d.c. circuits is limited to approximately two miles. Culminating an electrical safety program begun ten years ago, inclosed safety switches have displaced all open d.c. switches inside the mines and steel-inclosed starters have replaced open starters on stationary d.c. motors underground.

Motors in mine pumping stations and on slope hoists have either 440- or 2,300-volt windings. The lower voltage was generally used in early days, but the higher voltage features all installations in recent years. Practically all the 440-volt shaft and borehole cables are single conductors insulated with rubber and protected with circular loom. Many of the 2,300-volt cables are of the same type; 3-conductor armored cables without lead, however, are being considered as the new standard for this higher voltage.

A cable of this latter type—the largest installed in a coal mine—was put into service in No. 12 shaft, Greenwood colliery. Length is 880 ft. and the entire

From the substation (in the lower foreground), owned and operated by the coal company, 11,000-volt 25-cycle energy generated at the Hauto plant (background) of the Pennsylvania Power & Light Co. is transmitted to the Panther Creek valley collieries



Monthly variations of electrical energy used at all collieries closely parallel the total tons of coal produced

weight of 16,544 lb. is supported at the top of the shaft by the armor wires. Specifications are: three-conductor, 800,000-circ. mil, $\frac{11}{64}$-in. 30-per-cent Amerite rubber insulation, rubber-filled tape, conductors cabled together with jute fillers, one rubber-filled tape to form the jacket, jute and No. 4 B.w.g. galvanized wire armor heavily asphalted. The cable conducts 2,300-volt 25-cycle power to three 650-hp. motors in the fifth-level pumping station.

Most of the mine-pump motors are of squirrel-cage induction type and are started on reduced voltage. A few older pump motors are of the slip-ring type; in 1931, the automatic controls were improved by adding equipment to insert resistance in the rotor circuit to slow down the pumps before the motors are cut off the line, thus preventing shock from sudden water stoppage.

Slip-ring induction motors are used on all shaft hoists. Rating of the largest is 1,250 hp. Liquid rheostat controls are used on a few of the older installations, but the grid-resistance-type controls of the newer hoists have proved more satisfactory. The latest electric-hoist installation, made in 1930, is at No. 14 shaft, Tamaqua. Here a Westinghouse 1,200-hp. 2,300-volt 293-r.p.m. slip-ring motor drives a Vulcan hoist. Primary contactors of the controls are actuated by air cylinders with solenoid-controlled valves.

Breaker machinery is driven for the most part by 440-volt 300-hp. and 500-hp. slip-ring induction motors connected by long flat belts to the lineshafts of the transmission rope drives. Most of these installations have been in service about twenty years and their starting panels, of the manual type, are grouped in a separate control room in each breaker. Reversing switches to facilitate repair work are included in the controls. In the Tamaqua breaker, completely rebuilt this year, and in the new No. 5 buck plant, Nesquehoning breaker, individual motor drives are employed.

Double-deck squirrel-cage motors are not used. To enable the lower-cost plain squirrel-cage motors to start heavy loads, Madden slip-ring starters were installed on six 15- to 50-hp. motors in the rebuilt Tamaqua breaker. This starter, made under Bethlehem Steel-Nieman patents, consists of a centrifugal clutch hub on which is mounted the motor V-belt pulley or chain sprocket. The starter allows the motor to reach nearly full speed before it engages its load.

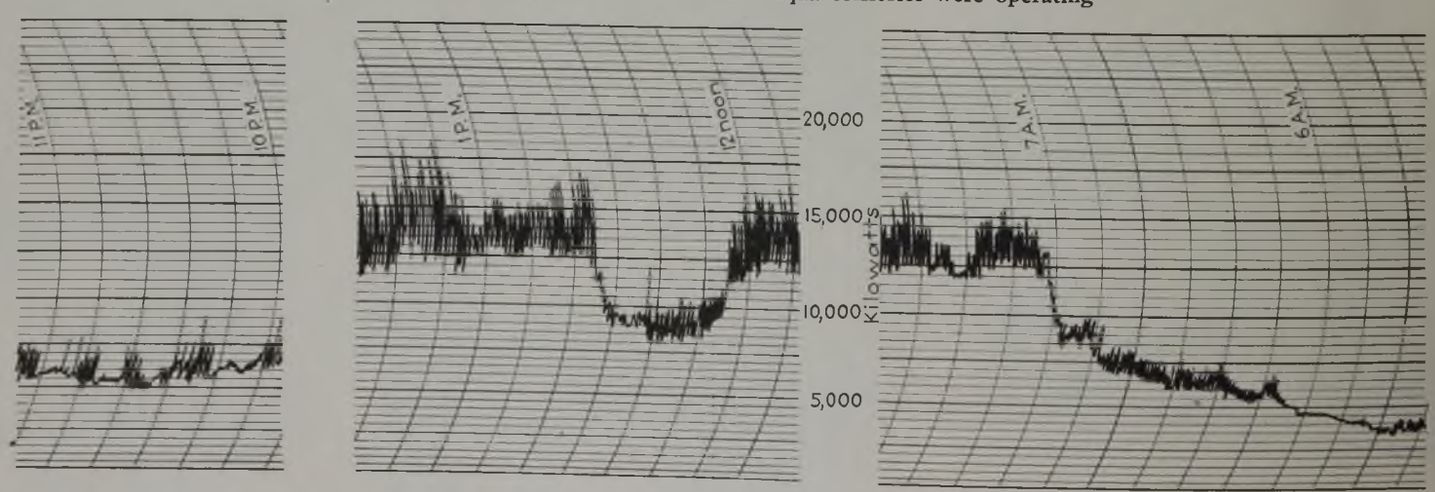
At Lansford colliery, Cutler-Hammer magnetic clutches are used on five motor drives. Besides the two 26-in. magnetic clutches on the 200-hp. synchronous motors already mentioned, two larger units are used on chain hauls handling mine cars to and from the dumps at the top of the breaker. Two more are incorporated in a compressor installation. A 300-hp. motor transmitting power through a flat belt and spur gearing drives the empty ramp chain haul without clutch connections; therefore, this haul is in operation whenever the motor is running. The loaded chain is driven from the same motor but is started and stopped by pushbutton operation of a 48-in. magnetic clutch. Another 48-in. clutch is used on a second pair of car hauls alongside the first.

In the main substation a 600-hp. Electric Machinery Co. synchronous motor is connected through magnetic clutches to two 1,800-c.f.m. Sullivan angle-compound compressors. Ordinarily but one compressor is in operation and the motor then furnishes considerable power-factor correction. The magnetic clutches permit shifting from one compressor to the other or operation of both.

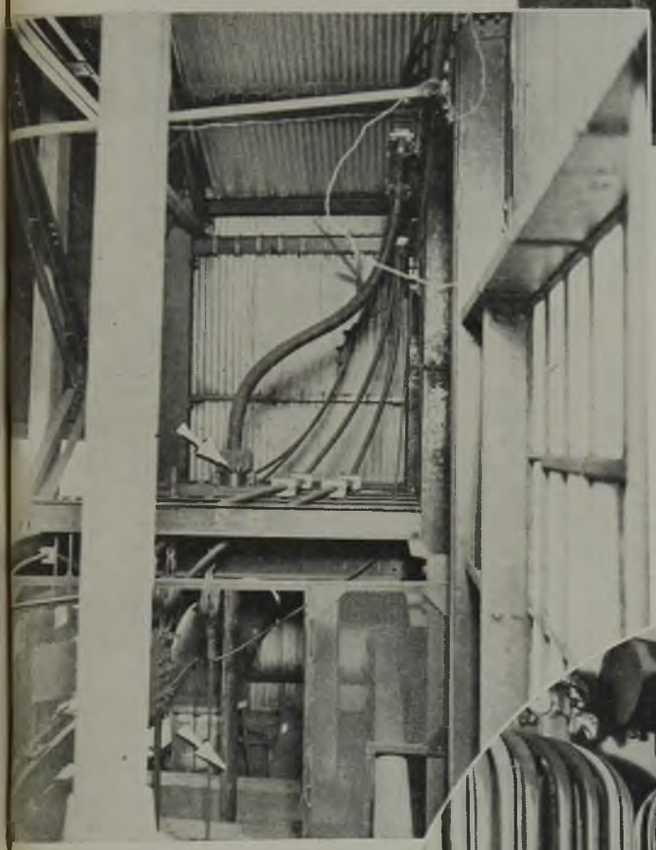
To facilitate economic control and maintenance of electrical transmission, distribution and power equipments, and to provide data for power-cost accounting, 258 watt-hour meters (excluding meters in company-owned houses) are installed and are read at the end of each month. Of these meters, 204 are at Panther Creek valley mines, 35 at Alliance and 19 at Cranberry. Power-charge classifications and the ordinary ranges of kilowatt-hours per ton are as follows: haulage, 1.2 to 4.2; hoisting, 0.9 to 3.9; ventilation, 1.5 to 5; drainage, 0 to 15.3; breaker machinery, 4.1 to 7.1; compressors, 1.2 to 7.5; lighting and charging stations, 0.2 to 0.6; and miscellaneous, 0.1 to 0.9.

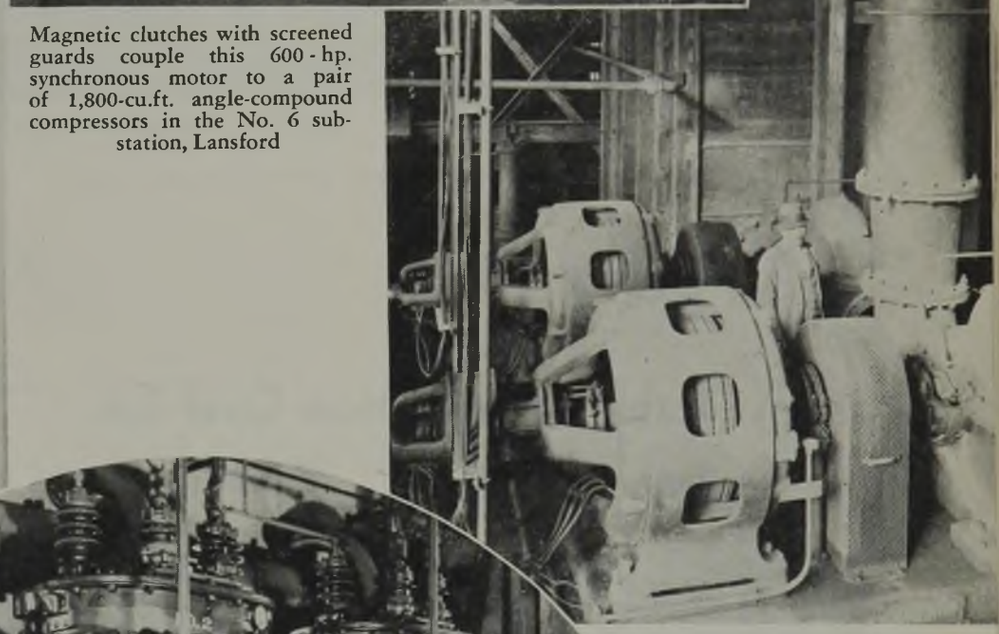
Electrical department employees number 69, 16 of whom are substation operators. Office help, inspectors, construction men, central winding-shop employees and metermen make up the remainder. Local electrical men at each colliery—termed district electricians—and their maintenance forces are not included in the electrical department roster, as they are on the payrolls of the colliery superintendents.

Typical sections from a 24-hour Hauto substation wattmeter chart for Oct. 17, 1935, when Lansford, Coaldale, Greenwood and Tamaqua collieries were operating



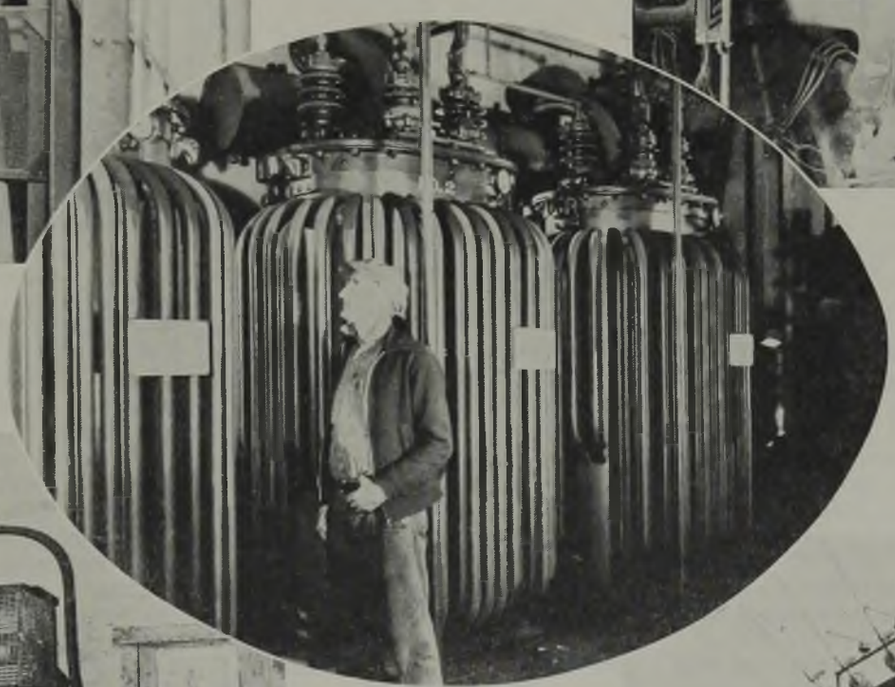
Arrows point to the new cable and its suspension at No. 12 shaft, Greenwood. This is the largest 2,300-volt three-conductor armored cable used by the coal industry in the United States





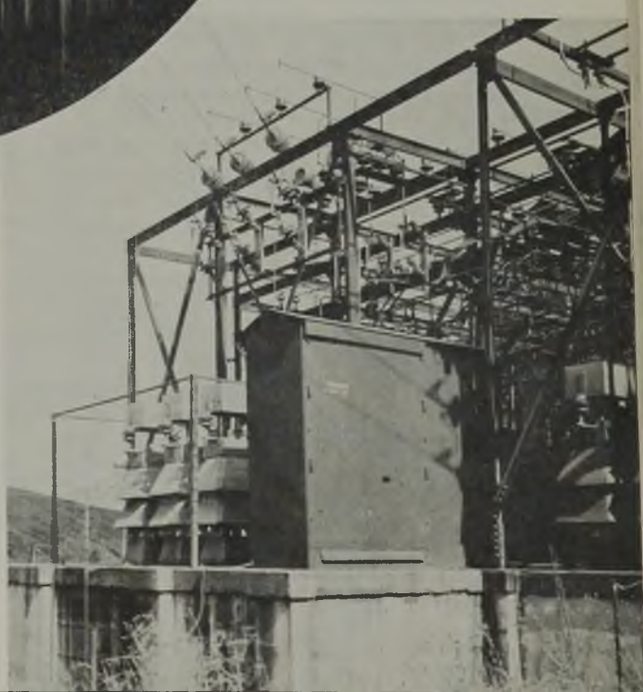
Magnetic clutches with screened guards couple this 600-hp. synchronous motor to a pair of 1,800-cu.ft. angle-compound compressors in the No. 6 substation, Lansford

In Lansford breaker, two 200-hp. synchronous motors circulate wash water and supply leading current for power-factor correction. The couplings, protected by screen, are of the magnetic-clutch type



Housed in the steel cabinet a the main substation, Cranberry is the 600-kva. 2,300-volt 60 cycle capacitor which paid fo itself in 14 months

Three 667-kva. single-phase transformers in a substation at Alliance breaker reduce voltage from 11,000 to 440 to supply the breaker motors



Where d.c. feeders branch to serve a separate level,

With heads protected and electric cap lamps, these miners await the cage at Alliance

SAFETY

+ At Lehigh Navigation Coal Co.

STRONG pressure on the major causes of injuries and fatalities is the keynote of the Lehigh Navigation Coal Co. safety program. Naturally, no possible cause of an injury is neglected, but logic dictates concentration on those classes of accidents taking the greatest toll as the best method of achieving maximum results. As both equipment and men are involved in injuries, prevention generally is approached from two angles: improvement of physical condition of mines and equipment, and development of a safety spirit among both supervisors and employees. Man-to-man discussion on the ground is favored, wherever possible, in putting over safety, supplemented by publicity and educational media of a general nature.

In addition to the usual perils of coal mining, Lehigh Navigation operations must cope with the additional hazards of working steeply pitching beds subject to rushes of coal and rock and sudden outbursts of gas following runs. While conditions therefore are somewhat more difficult than usual, definite progress has been made. In the period 1926-30, inclusive, for example, the fatality rate per million man-hours was 1.421; per million net tons produced, 5.125. On the basis of lost-time injuries, including fatalities, the rate per million man-hours was 93.65; per million tons, 337.85. In the period Jan. 1, 1931-Sept. 30, 1935, the fatality rate per million man-hours was 0.930; per million tons, 2.985. Considering lost-time injuries, the rate per million man-hours in this period was 80.05; per million tons, 256.89.

General supervision over surface safety is exercised by a safety director, who also acts as fire inspector. Underground safety is the responsibility of colliery officials, who, however, receive assistance in special problems from the main operating office. A regular check of ventilation, cleanliness and general mine condition is made by a mine inspector, who also investigates, in cooperation with colliery officials and, in many cases, the State mine inspector, all fatal and serious injuries, reporting directly to the general superintendent.

Since 1924, the Lehigh Navigation safety program has been based on ascertaining how injuries result as a means of prescribing proper remedies. In that year, a study of the causes of all serious injuries and fatalities was made and preventive measures were evolved. These measures supplement the mine law and were related directly to the findings in presenting them to employees by bulletins, posters and word of mouth. Furthermore, measures were segregated by occupations to make the appeal to each class of employee more definite, and listed not only dangerous conditions to watch for and report but also methods of accomplishing different tasks safely.

In improving physical conditions, attention is centered on maintenance of equipment in good condition—also an aid to operating efficiency; installation of guards around all moving machinery and along trolley lines at crossings and

Table I—Injury Record of the Lehigh Navigation Coal Co. by Years From 1926

	Man-Hours Worked	Output, Net Tons	Total Injuries and Fatalities*	Lost-time Injuries and Fatalities	Permanent Partial Disabilities	Fatalities
1926	12,206,508	4,152,481	3,203	1,323	10	22
1927	14,398,628	4,399,961	3,973	1,667	10	23
1928	15,421,545	3,968,632	2,954	1,064	6	14
1929	14,953,748	3,426,176	3,773	1,421	17	14
1930	13,405,846	3,564,248	3,655	1,117	13	27
1931	11,207,633	3,341,091	3,178	925	4	10
1932	9,154,709	2,860,553	2,555	774	7	4
1933	8,846,666	2,780,057	2,326	661	6	11
1934	11,206,904	3,657,668	2,975	916	16	16
1935†	7,965,856	2,437,084	2,234	597	10	4

*Includes all injuries reported, whether or not involving lost time. †January-September, inclusive.

points where coal is loaded into cars; good track carefully maintained; timber of the proper size placed in the proper manner; careful construction of manways, batteries, chutes, etc., and clean gangways, tunnels, manways and other openings.

Ventilation, in view of the irregular and unexpected occurrence of gas, has been the subject of special attention. Prevention of gas explosions also has been approached through electric cap lamps and safe blasting practices. In ventilation, the first rule is plenty of air without interruptions. Fans, therefore, are made of incombustible material as far as possible, and all electrically driven main fans are equipped with automatic starters, remote-control equipment, special recording gages, voltmeters and ammeters, thermostats and explosion doors.

Company standards call for large, clean airways and prohibit passage of air through gob areas to live sections. All return air is kept above the intake by constructing overcasts (p. 509) every four or five breasts to the primary airways. Friction is reduced by the frequent splitting; doors on gangways are eliminated; short-circuiting while loading from the chute is prevented; and, in case of a gas explosion, its effect is localized.

Introduction of overcasting has substantially reduced the number of auxiliary fans, although such fans still find a place in the operating set-up. Electric motor drives are forbidden, however, unless the air from the face can be shunted to the return ahead of the fan. Carrying precautions still further, a special report is required when underground electrical equipment is moved as evidence that the new location and the installation have been checked and approved as safe by the electrician, foreman and mine inspector.

Another factor in the reduction of injuries from gas explosions (Table IV) is the use of permissible electric cap lamps and flame safety lamps at all collieries but Cranberry. Installation of electric lamps was started at Lansford colliery in 1912, and at present 5,744 are in use. Ignition of gas by explosives was the third major line of attack, which, among other measures, involved substitution of electric firing units for fuse. The first of these units went into use in 1913. Now, 1,450 are in active service.

Explosives accidents as a class were made the subject of a special drive starting in 1930 after a thorough investigation

Table II—Injuries and Fatalities by Causes at Lehigh Navigation Collieries, 1931-35

	1931		1932		1933		1934		1935*	
	All Injuries†	Fatalities Only	All Injuries†	Fatalities Only	All Injuries†	Fatalities Only	All Injuries†	Fatalities Only	All Injuries†	Fatalities Only
Animals	11	..	6	..	3	..	8	..	8	..
Caught in machinery	12	1	10	..	11	1	10	1	16	..
Electricity	16	..	13	..	10	2	8	..	11	..
Escaping steam	9	..	5	..	9	..	14	..	9	..
Explosives	2	..	1	..	3	2	6	1	1	..
Explosion, gas	8	..	....	..	8	..	5	2	....	..
Falling material	104	..	97	..	76	..	96	..	73	..
Falls of coal, rock, etc	813	5	535	1	465	1	618	3	405	2
Falling persons	194	1	146	..	127	..	191	2	144	..
Flying material, coal or rock	375	..	242	..	205	..	259	..	202	..
Steel, etc	270	..	238	..	224	..	260	..	194	..
Gas asphyxiation	3	..	9	1	1	..	1	1	....	..
Handling material	390	..	402	..	396	1	505	..	397	..
Rush of material	14	2	10	1	16	1	13	1	12	..
Stepping on nails	53	..	36	..	27	..	37	..	37	..
Fixed objects	37	..	29	..	36	..	23	..	27	..
Striking obstructions	214	..	224	..	209	..	274	..	220	..
Transportation, coupling or spragging	67	1	55	1	51	3	57	4	54	2
Other transportation	122		117		101		124		75	
Tools, defective	3	..	2	..	1	..	3	..	1	..
Slipping	164	..	122	..	148	..	166	..	130	..
Handling	234	..	198	..	165	..	223	..	178	..
All others	62	..	58	..	34	..	74	1	40	..
Total	3,178	10	2,555	4	2,326	11	2,975	16	2,234	4

*January-September, inclusive. †Includes all injuries reported, whether or not involving lost time.

Table III—Injuries by Time Lost, Lehigh Navigation Collieries, 1931-35

	1931	1932	1933	1934	1935*
No lost time	2,253	1,781	1,665	2,059	1,637
1-7 days	460	392	298	377	226
8-10 days	94	68	66	70	46
11-14 days	104	73	79	111	51
Over 14 days	253	230	201	326	260
P. P. Disability	4	7	6	16	10
Fatal	10	4	11	16	4
Total	3,178	2,555	2,326	2,975	2,234

*January-September, inclusive.

Table IV—Fatal and Non-Fatal Injuries From Gas Explosions, by Five-Year Periods, 1913-35

	Fatal Injuries	Non-fatal Injuries	Tons per Fatality	Tons per Non-Fatal Injury
1913-1917	17	317	1,266,152	67,901
1918-1922	28	186	685,679	103,220
1923-1927	6	69	3,000,137	260,881
1928-1932	4	26	4,088,401	628,981
1933-1935*	2	11	4,437,205	806,800

*Two years, nine months.

Table V—Fatal and Non-Fatal Injuries Involving the Use of Explosives, Lehigh Navigation Collieries, 1923-34

	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935*	Total
Blown-out shots—fatal	1	..	..	..	..	..	1	..	..	..	..	..	..	2
Non-fatal	3	..	..	..	..	..	1	..	..	..	..	..	..	4
Dislodged shots—fatal	1	..	1	..	..	..	..	..	..	..	..	..	..	2
Non-fatal	..	4	..	..	3	..	..	..	..	..	..	..	..	7
Drilling into misfires—fatal	..	..	1	..	1	..	..	1	..	..	..	..	..	3
Non-fatal	1	..	..	1	1	1	1	..	..	1	..	..	1	7
Drilling into explosive—fatal	..	..	..	1	..	..	..	2	..	..	..	..	..	3
Non-fatal	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Excessive charge—fatal	1	..	4	..	3	2	..	..	..	..	..	1	..	11
Non-fatal	2	..	4	4	2	6	4	1	..	..	..	4	..	27
Firing from trolley wire—fatal	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Non-fatal	..	1	..	..	1	..	1	2	..	..	..	1	..	6
Firing from unsafe position—fatal	..	..	..	..	..	..	..	..	..	..	2	..	..	2
Non-fatal	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Flying material—fatal	..	..	..	..	..	1	..	..	..	..	..	..	..	1
Non-fatal	..	..	2	1	1	2	1	2	1	..	..	..	..	10
Fumes (returning too soon)—fatal	..	..	1	2	2	2	..	..	..	..	..	..	..	7
Non-fatal	..	..	..	..	1	..	..	..	..	..	..	..	..	6
Gas explosions (fuse)—fatal	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Non-fatal	6	12	2	1	..	..	..	..	..	..	..	..	..	21
Handling caps—fatal	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Non-fatal	..	1	..	..	..	2	..	..	..	..	..	..	..	3
Picking into powder—fatal	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Non-fatal	..	2	..	..	..	..	..	..	..	..	..	..	..	2
Premature (tamping)—fatal	..	..	4	..	2	2	..	..	..	..	..	..	..	8
Non-fatal	..	..	1	..	..	..	2	2	..	..	..	..	..	5
Short-fuse—fatal	2	..	..	..	..	..	..	..	..	..	..	..	..	2
Non-fatal	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shots fired by others—fatal	1	2	..	2	..	..	3	1	..	..	..	..	..	9
Non-fatal	3	..	1	1	..	2	..	..	..	..	1	..	..	8
Not classified—fatal	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Non-fatal	..	..	..	1	3	..	1	..	..	..	..	..	..	5
Total fatalities	6	3	10	3	8	5	4	4	0	0	2	1	0	46
Total non-fatalities	15	20	11	11	12	15	11	7	2	1	2	5	1	113

*January-September, inclusive.

Table VI—Injuries and Fatalities Involving Explosives in Terms of Man-Hours Worked and Tons Produced, Lehigh Navigation Collieries

	Per 1,000,000 Man-Hours		Per 1,000,000 Tons Produced	
	Fatal	Non-fatal	Fatal	Non-fatal
1923	0.368	0.921	1.392	3.480
1924	0.189	1.260	0.756	5.039
1925	1.030	1.133	3.600	3.959
1926	0.245	0.901	0.765	2.806
1927	0.555	0.833	1.874	2.811
1928	0.324	0.973	1.247	3.742
1929	0.267	0.736	1.026	2.823
1930	0.298	0.522	1.099	1.925
1931	0.000	0.178	0.000	0.597
1932	0.000	0.109	0.000	0.340
1933	0.226	0.226	0.725	0.725
1934	0.098	0.489	0.270	1.350
1935*	0.000	0.125	0.000	0.428
Average, 1923-30	0.383	0.908	1.396	3.312
Average, 1931-35	0.062	0.227	0.201	0.734

*January-September, inclusive.

of blasting injuries. Results (Tables V and VI) include a reduction in fatalities per million man-hours worked from 0.383 in the period 1923-30, inclusive, to 0.062 in the period of 1931-35; per million net tons produced, from 1.396 to 0.201. Non-fatal injuries from explosives were reduced from 0.908 per million man-hours to 0.227; per million net tons, from 3.312 to 0.734. Average yearly cost of fatal injuries was reduced from $21,048 (1923-30) to $3,769 (1931-34); non-fatal injuries, from $7,126 to $984. Total compensation and medical savings were approximately $95,000 to the end of 1934, in addition to an incalculable saving in suffering.

Preliminary investigation of blasting injuries covered a period of six months, after which the work and its importance were outlined to colliery officials. Then, with the assistant foreman in attendance, all miners, starters and rockmen were visited at their working places in order to inspect and discuss practices then in use, present the record of previous injuries and enlist cooperation. These visits, it was stressed, were to pass on helpful information on placement of holes, care of blasting machines, detonators and explosives; installation of firing lines; preparation of primers; charging of drillholes; misfires; and the cause and prevention of injuries.

Wide variations in conditions make establishment of a standard method of placing holes impracticable, but helpful assistance has been rendered in a number of instances. All blasting is electrical, with the exception of one colliery, and detonators include electric blasting caps, delay electric igniters with attached caps and some all-metal delay electric caps. Ten-hole electromagnet and five-hole permanent-magnet blasting machines are used unless more than ten holes are to be fired, in which case a 50-hole pushdown machine is employed. All blasting machines are returned at the end of the shift to a central station

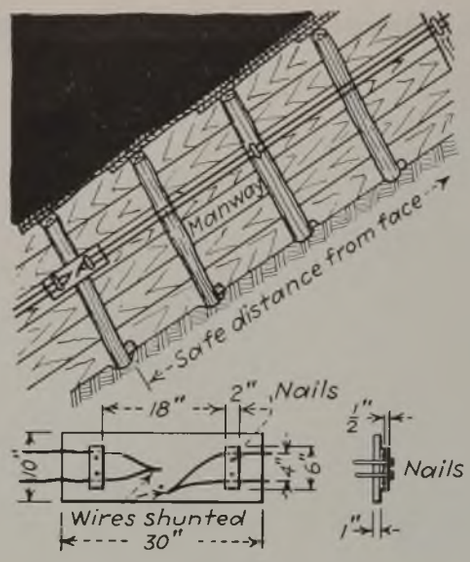


Fig. 1—Safety break in firing line protects man at face

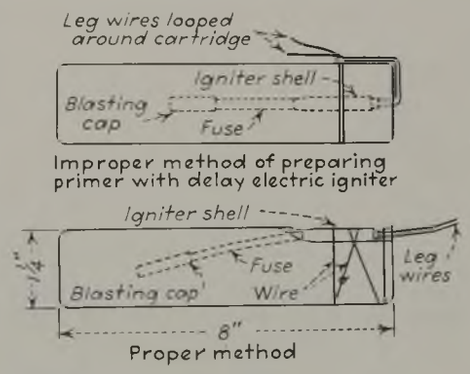


Fig. 2—Changing position of igniter checked explosive ignition

where they can be kept dry. Every six months they are inspected and repaired by the electrical department.

Detonators are taken into the mines in small quantities in a wooden box for protection and prevention of loss in the coal. The anthracite mine law limits powder quantities to 25 lb. or enough for one shift. Stress is laid on protecting explosives and keeping them in a safe place away from detonators and out of the line of shots. Special attention has been given installation of firing lines to eliminate confusing connections and thereby mistakes in firing. These lines are fastened in wooden cleats about 6 in. long securely nailed to timbers. Wires are kept apart and free from coal, rock, air lines, sheet iron and other metals. Safety breaks (Fig. 1) are installed a safe distance from the face and the wires are cut and the ends shunted. After connecting the lead wires, the miner joins the two circuits at the safety break on the way out. Connections are broken when returning after shooting, thus guarding the miner from the mistakes of others and, to some extent, from stray currents. Safety breaks have substantially reduced injuries and fatalities from shots fired by others.

Ignition of explosives, resulting in partial detonation, loose powder in the coal and dangerous gases, came into notice in 1931. Investigation disclosed that embedding the igniter in the cartridge was the cause, which was corrected by tying the igniter in place with the match-head outside the cartridge (Fig. 2). To reduce premature explosions from charging of holes, stress is laid on drills in good condition and large enough so that the charge will go in easily; preparation of primers to prevent loosening of the cap in charging; wooden tamping bars only; and avoidance of excessive force in tamping. Miners are expected to report misfires to the foreman, who sees that they are handled under competent supervision. Believing that prevention of injuries from misfires requires elimination of misfires themselves, the management, however, presses for proper preparation of explosives and charging of holes.

Safety headgear is worn by 90 per cent of the miners at six collieries. Introduction is under way at the seventh operation. In 1930, when the use of hats

Wheels, pulleys, belts and other moving parts are fitted with screens or railings to prevent injuries in surface plants

Use of trolley guards at loading chutes is one of the protective measures employed at Lehigh Navigation collieries

Hospitals or first-aid stations are maintained on each level. Above is the Dr. Young Memorial in the No. 9 shaft workings, Coaldale colliery

started, scalp injuries numbered 202, or 8.4 per cent of the 2,397 injuries incurred inside the mines. In the first nine months of 1935, scalp injuries numbered only 33, or 2.4 per cent of the 1,340 underground injuries.

When serious or fatal accidents do occur, the management believes in a thorough investigation, as outlined above, as the best basis for evolving preventive measures. In addition to submission to central office officials, copies of reports go to all colliery superintendents for discussion and appropriate action. In many cases, accident reports are made the subject of special meetings of operating officials, and regular—in many instances, daily—meetings on injuries is the rule among foremen at the various collieries. Employees are requested to report all injuries and appear at the first-aid station for treatment. Here, reports are made out for minor injuries; reports going to the colliery superintendent, thus insuring a check on injuries of this type.

First-aid stations or hospitals are installed on every level, usually near the shaft landing, and first-aid kits are placed in practically every fireboss' section. Placement of men also is adjusted so that each such section contains a complement thoroughly grounded in first-aid practice. With the cooperation of the U. S. Bureau of Mines, a training course for employees in the Panther Creek Valley was instituted in September, 1934, extending through to May, 1935. Approximately two-thirds of the men availed themselves of this training. First-aid and mine-rescue teams are maintained at each operation and receive instruction during regular training periods.

COMPRESSED AIR

+ At Lehigh Navigation Coal Co.

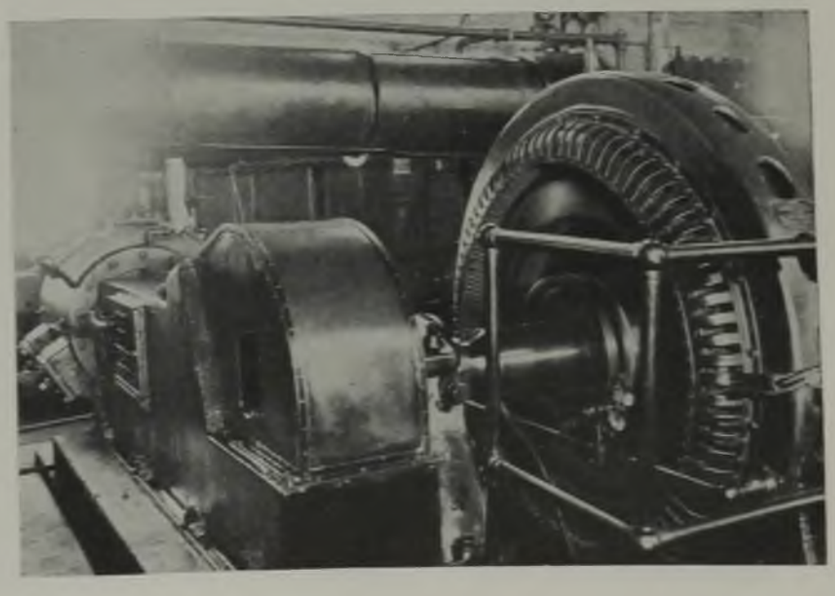
BECAUSE air drills continue to hold first place as tools for rock work, the compressing of air and its distribution to the mine workings accounts for as much as 7½ per cent of the electrical energy used at certain collieries of the Lehigh Navigation Coal Co. All but one of the large compressors are driven by synchronous motors and the total connected electrical load of all compressors is 5,745 hp. In addition to drilling, air also is put to at least a dozen other uses in and about the mines.

With the exception of a few portable machines, compressors are installed on the surface, usually in main power stations where an attendant is on duty. The few units otherwise situated are equipped with automatic starters having control wires extended to pushbutton and signal-light panels in the main substation. Protection for these few compressors without regular attendants includes thermostats on bearings and air cylinders.

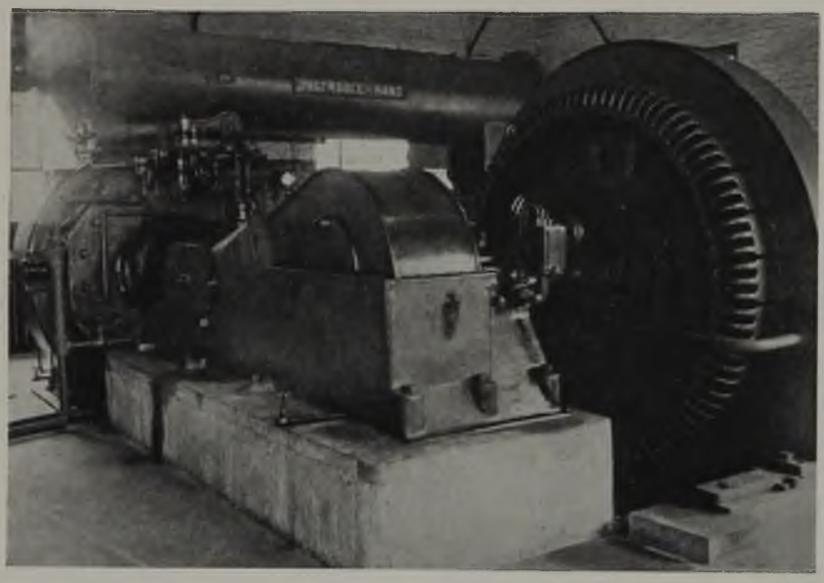
Twenty-two compressors ranging in capacity from 150 to 3,600 cu.ft. per minute and operating at a nominal pressure of 100 lb. per square inch constitute the stationary units at the collieries proper. Nine other compressors, in sizes from 150 to 842 cu.ft., are in coal strippings, central repair shops and as portables.

In every case of synchronous drive the motor is connected directly to the crankshaft. All excepting one unit, a Sullivan at Lansford, have rigid connections.

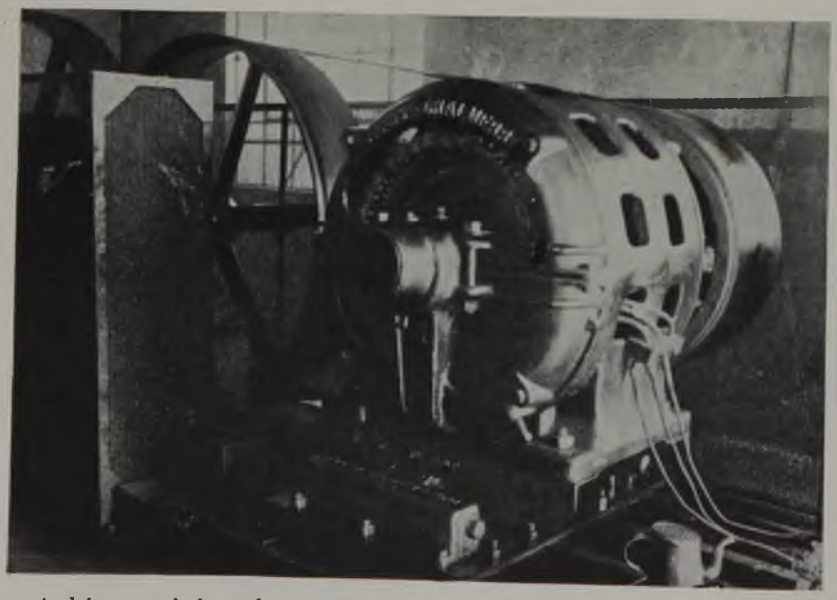
This 1,500-cu.ft. compressor and 350-hp. synchronous motor at Alliance colliery are typical of several of the main compressors



Contractor's men using water-leyner air drills in driving a tunnel on the fifth level, Lansford



Controls of this 650-hp. synchronous line-start motor and 3,000-cu.ft. compressor at Nesquehoning are full-automatic



A drive consisting of a gravity-tightening motor-mounting connects this 100-hp. motor to the 520-cu.ft. compressor in Tamaqua substation

This Lansford unit consists of two 1,800-cu.ft. angle-compound compressors installed one on each side of a 650-hp. 25-cycle 214-r.p.m. synchronous motor, and the shaft connections are made through magnetic clutches. When but one of the two compressors is in use, the extra capacity of the motor is utilized to improve power factor.

A 3,000-cu.ft. Ingersoll-Rand compressor at Nesquehoning is driven by a 650-hp. motor started on full line voltage (2,300). This unit is equipped with full-automatic control and operates without an attendant.

Each compressor has its own receiver outside the building and there are no valves between compressor discharge and receiver. In addition, as the receiver is fitted with a relief valve, the units are protected against overpressure.

Vapor explosions in receivers are guarded against by close supervision to reduce the quantity of air cylinder oil to a minimum safe for lubrication and by blowing out receivers daily. On a 1,500-cu.ft. compressor four drops per minute in the low-pressure cylinder and three drops in the high-pressure are the usual adjustments. Receiver blowout connections are at the lowest point except in a few cases where vertical dished-head receivers stand on solid concrete. In the latter a little water is put into the bottom so that the accumulating oil will be floated up to the blowoff level.

Nine thousand feet is approximately the maximum distance of air transmission and the usual steps of pipe sizes as loads diminish at points of branch connections are: 6-in., 4-in., 3-in., 2-in. and 1-in. An exception to the 6-in. maximum is a 10-in. cast-iron line in a shaft at Tamaqua. Most of the 6-in. lines in shafts are cast-iron, but in the last installation, No. 12 shaft, Greenwood, a 6-in. steel pipe with VanStone joints was installed. Underground receivers are used in some cases and these usually are within a few hundred feet of the shaft. Distribution piping in sizes of 4 in. and below is steel.

Uses of compressed air underground, arranged approximately in the order of their necessity, are as follows: contractor's rock drills, jackhammers used by a few miners to drill shotholes in coal, air-turbine-driven blowers and air jets for auxiliary ventilation with tubing, car transfers at shaft levels and landings, reciprocating pumps for gassy dip workings, priming a few pump stations by injectors, blowing dirt out of electric locomotives, blast for forges and transfer of batteries of a permissible locomotive. Those miners who drill coal by air furnish their own jackhammers, but they number only about 4 per cent of the total miners employed.

At all collieries the compressed air lines are arranged to constitute emergency water-line systems for fighting fires. The connections between high-pressure water pipes and the main air lines are in

place at all times and valves for proper control are included.

Above ground one of the important uses of compressed air is the operation of rock gates at breakers. In most cases this air is furnished by a compressor installed at the breaker and operated free of a regular connection with the main compressors supplying air to the mine workings. Other outside uses include end dumps for coal cars, machines used in sharpening contractor's drill steel, brakes and clutches of hoists, and all shop uses including chipping, riveting, and blowing dust out of machinery.

To assure proper lubrication, maintenance and safety at compressed-air stations the equipment is under the general supervision of an inspector who reports directly to the mechanical superintendent. As this same man is responsible for the inspection of mine fans and hoists, the cost of supervision over compressors is less than the salary of one man. In recent years, no developments of machinery or methods have appeared which would indicate that the status of compressed air at mines of the Lehigh Navigation Coal Co. will change materially in the near future.

Stationary Air Compressors in Use (Excepting Those at Shops and Strip Operations)

Make	Capacity Cu.Ft. Per Min.	R.p.m. Compressor	Motor — Make	Motor — Rated horsepower	Motor — Type	Location
Nesquehoning:						
Ing.-Rand	3,000	187½	G.E.	650	Synchronous	Substation
Bury	1,500	214	W.	375	Synchronous	Substation
Worth	500	203	Al.-Ch.	150	Induction	Headhouse at breaker
Lansford:						
Sullivan	3,600	214	E.M.	650	Synchronous	Substation
Ch.-Pneu.	1,500	214	W.	250	Synchronous	Substation
Pa.	525	250	G.E.	100	Induction	Breaker
Sullivan	150	...	W.	25	D.C.	Blacksmith shop
Coaldale:						
Ing.-Rand	1,600	...	.....	.....	Steam-driven	.....
Bury	1,500	214	Al.-Ch.	350	Synchronous	Substation
Worth	770	188	W.	150	Induction	Substation
Worth	830	202	Burke	150	Induction	Substation
Sullivan	500	...	W.	75	Induction	Substation
Greenwood:						
Bury	1,500	214	G.E.	350	Synchronous	Substation
Bury	1,500	214	G.E.	350	Synchronous	Substation
Tamaqua:						
Ing.-Rand	3,000	187½	G.E.	600	Synchronous	Substation
Pa.	520	240	Al.-Ch.	100	Induction	Substation
Bury	500	...	W.	100	Induction	Breaker
Alliance:						
Bury	1,500	225	Al.-Ch.	350	Synchronous	Substation
Ch.-Pneu.	400	...	G.E.	75	Induction	Breaker
Ing.-Rand	200	235	G.E.	40	D.C.	Breaker
Cranberry:						
Ludlow	1,600	...	W.	250	Synchronous	Substation
Ing.-Rand	....	...	W.	40	Induction	Substation

Note: Ing.-Rand. Ingersoll Rand; G.E. General Electric; W Westinghouse; Worth. Worthington; Al.-Ch. Allis-Chalmers; E.M. Electric Machinery; Ch.Pneu. Chicago Pneumatic; Pa. Pennsylvania

MAINTENANCE

+ At Lehigh Navigation Coal Co.

DESPITE steady and successful pressure to reduce expenditure on equipment maintenance in recent years, maintenance is still an important item in the cost per ton of coal shipped from collieries of the Lehigh Navigation Coal Co. The effect of machinery delays both on tonnage output and on fixed costs makes maintenance of mechanical and electrical equipment a major operating activity. Finding the most suitable lubricants, seeking better materials in general and designing improved layouts and parts are activities that naturally group under maintenance.

Although each colliery superintendent is directly responsible for the maintenance of his equipment and the local electricians and mechanics report to him, the whole activity is guided and supervised by the mechanical superintendent and his force of mechanical and electrical engineers, and machinery inspectors with headquarters at Lansford. Extensive repairs to equipment that it would be impractical to send to the Lansford central shop are handled or supervised by men sent from headquarters; this supervision is carried further at the five Panther valley collieries than at Alliance and Cranberry.

Reporting directly to the mechanical superintendent are the following men: an electrical engineer who has a force of 16 substation operators and 53 maintenance and construction men; a

Heavy repairing, electrical rewinding and foundry casting are done at the central shops at Lansford

About thirty Lehigh Navigation steam locomotives are overhauled each year

One hundred locomotive armatures were repaired in the electrical shop in 1934

mechanical engineer who has a force of draftsmen and designers; the shop superintendent, whose payroll includes 220 men occupied with mechanical repairs and construction; seven machinery and boiler inspectors and a foreman in charge of the coal-bagging plant. Central shop departments include a steam-locomotive repair shop, mine-car shop, and a foundry equipped for casting brass and iron. A research department with a laboratory in one of the shop buildings cooperates with the mechanical superintendent in selecting lubricants, determining the best grade and construction of wire rope and other materials for individual jobs and in the general testing of all materials received.

In 1934 the cost of all lubricants applied to machinery used in the mining, transportation and preparation of 3,657,668 tons of coal was $19,947, or approximately ½c. per ton. This figure, which is at least ¼c. per ton less than would have been considered a fair average a few years ago for a comparable group of anthracite mines, has been achieved by wider adoption of anti-friction and otherwise improved bearings, installation of centralized automatic lubrication on breaker machinery, and by finding improved lubricants for special jobs.

Roller bearings are now used exclusively on mine cars at four of the seven collieries: Lansford, Coaldale, Greenwood and Tamaqua. Timken bearings are used at Lansford, and Hyatt at the other three. Tests of lubricants for this duty are made by selecting cars with new bearings and with axles that measure up to standard, filling with the new lubricant and operating the cars in regular service, with inspections every four months, until failure of the lubricant—perhaps in 1½ years. As a result of tests on plain-bearing cars, a grease containing a small quantity of hair to give staying qualities was adopted for that service.

Centralized Ideal lubricators are used on shaker eccentrics and bearings in the Coaldale, Tamaqua and Cranberry breakers. Cranberry has nine units which lubricate 296 shaft bearings and 110 eccentrics. Breaker lubrication cost—material and labor—prior to the installation was 1.47c. per ton; now it averages 0.58c. per ton.

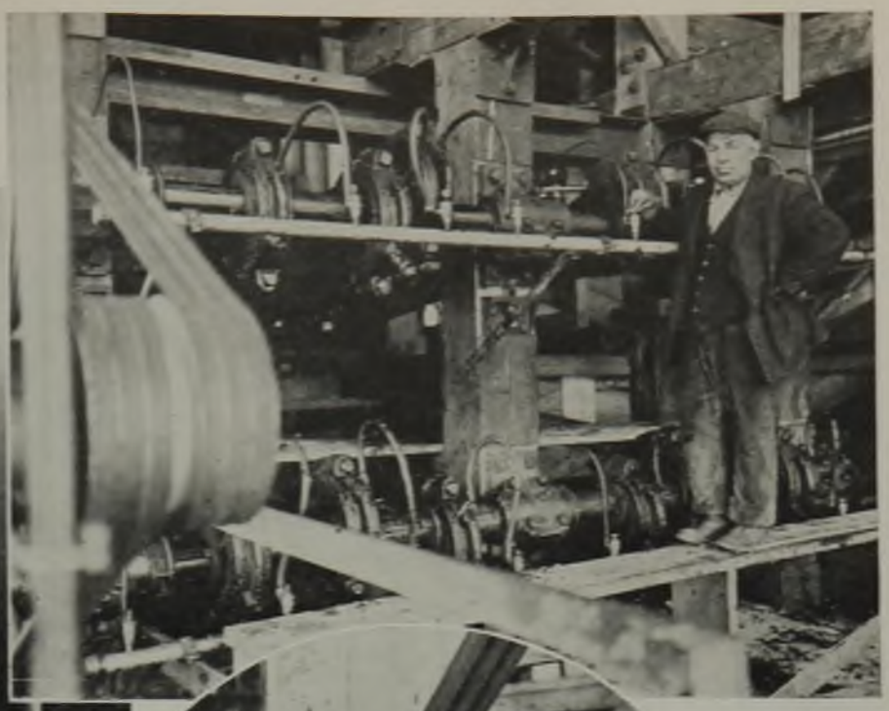
Heavy loads, fairly high speeds, continuous operation and exposure to a certain amount of splash of dirty water make the lubrication of eccentrics difficult. A proposed new grade of high-temperature grease is tested by applying it to one of a pair of adjacent eccentrics, making comparisons of operating temperatures and observing the staying qualities.

Eight types of oils and nineteen greases, not counting the summer and winter grades, are purchased by the company. The laboratory makes a complete analysis of each and tests its physical properties. The 27 grades mentioned include all special items of limited use—for instance, a cooling compound of hard-soap composition used temporarily to prevent metal contact in hot bearings until repairs can be made or until the proper standard lubricant can be found.

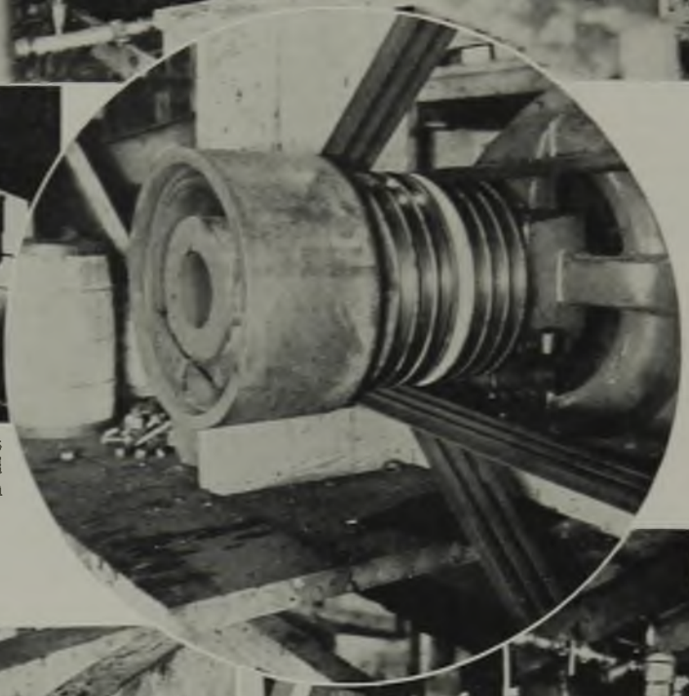
Determining the grade and construction of wire rope best suited to each job had been a fruitful activity of the research department, as testified by achievement of 50 per cent increase in life of 2-in. hoisting ropes on a gunboat hoist at Coaldale breaker and a 350 per

Looking from the headframe of Alliance No. 2 shaft we see in the distance the breaker with its gunboat hoist. Hoisting rope life is important from the standpoint of maintenance cost

Lubricators like these on Tamaqua resizing screens reduce lubrication and maintenance costs

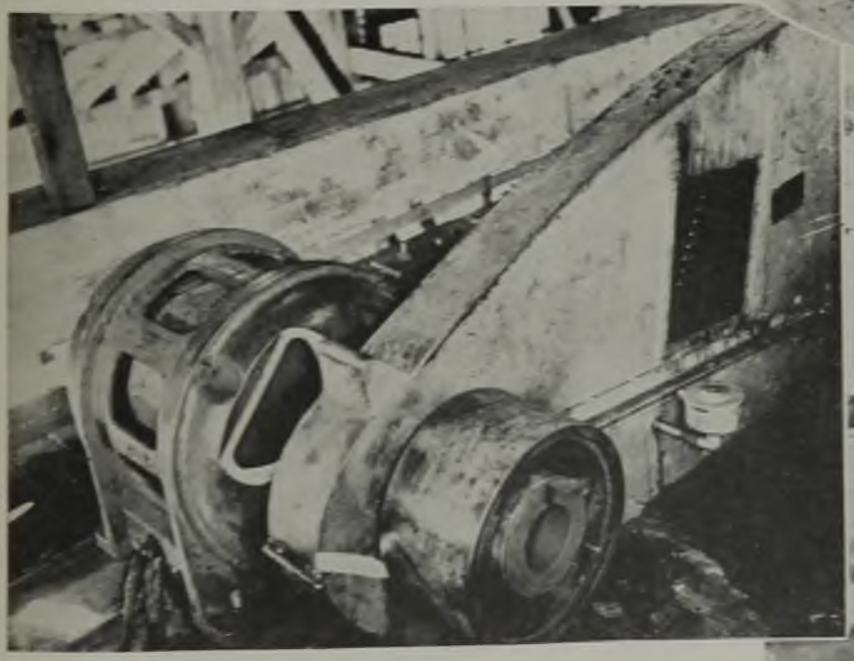


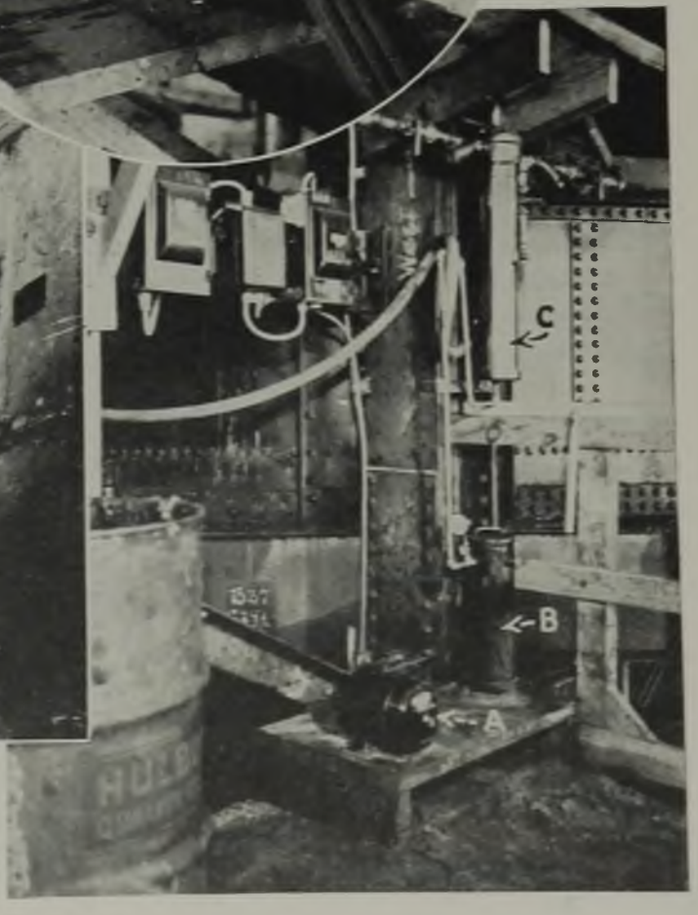
Centrifugal filter on a 11,000-volt transformer, main substation, Tamaqua. Filtering and testing of oil in transformers of this class is done once a year



Use of special clutch starters reduces maintenance as heavy loads can be started by motors and controls of simple design

Oil-tight cases for silent chains provide thorough lubrication and low maintenance cost. This drive, in Tamaqua breaker, consists of a squirrel-cage motor, clutch starter and silent chain





Lubrication of 104 bearings and eccentrics on the new equipment in Tamaqua breaker is handled automatically by this lubricator. *A* is the driving motor, *B* contains the pump and pressure regulating valve, *C* is the tank which holds 8 lb. of lubricant, sufficient for a full shift.

cent increase in life of one 1½-in. rope at Lansford No. 6 shaft. Change of construction from 6x19 to 6x25 was the principal factor in securing the improved service. Records of rope life have been kept for at least twenty years and the effects of lubrication, sheave diameter, fleet angle and other factors observed and corrections made where practicable. A rigid specification of all new ropes is that they be properly lubricated on the inside. An important duty in applying lubricant during operation is to seal the outside and prevent escape of the factory lubricant.

Practically all sheave wheels are 12 ft. in diameter and are interchangeable, so that a small stock of extras suffices for spares. When the rope groove of a sheave is below standard, the complete sheave is renewed. In all instances the wood-lagged drums formerly employed on main hoists have been replaced with grooved drums of cast steel. Ropes are inspected daily, lubricated and resocketed at fixed intervals, and renewed when inspections show a certain number of broken strands, reduced diameter or when a second stretch begins.

Three months is the typical interval between resocketing and three feet of rope usually is cut off. Resocketing is done to reduce concentration of wear on the section of rope which is in contact with the headsheave when the hoist is starting its load. Ropes of regular construction are used for all but a few special jobs—for instance, preformed ropes have been found superior for the Coaldale gunboat hoist and for a 6-yd. stripping shovel. With the exception of a few Lang-lay ropes on jobs where a greater wearing surface is needed, the regular lay construction is standard.

Service Record of Consecutive 2-In. Ropes Used on the Gunboat Hoist at Coaldale Breaker

Form	Type	Lay	Construction	Gunboats Hoisted
Plain	Cast steel	Regular	6x19	24,465
Plain	Cast steel	Regular	6x19	27,341
Plain	Cast steel	Regular	6x19	35,273
Plain	Cast steel	Regular	6x19	39,372
Plain	Cast steel	Regular	6x19	37,488
Preformed	Cast steel	Regular	6x19	61,284
Preformed	Cast steel	Regular	6x19	47,474
Preformed	Cast steel	Regular	6x19	54,981
Preformed	Plow steel	Regular	6x25	120,174

Performances of Consecutive 1½-In. Hoisting Ropes at Lansford No. 6 Shaft

Form	Type	Lay	Construction	Cars Hoisted
Preformed	Cast steel	Regular	6x19	53,062
Plain	Cast steel	Regular	6x19	56,828
Plain	Cast steel	Regular	6x19	76,642
Plain	Cast steel	Regular	6x25	79,725
Plain	Cast steel	Regular	6x25	185,034

Fig. 1—This report insures safety of underground electric installations

LEHIGH NAVIGATION COAL COMPANY

Approval To Install And Operate Electric Equipment in Mine

Number.....

Colliery.....Mine.....Date.....19.....

Change of location of.....

.....

from.....

.....

to.....

.....

Purpose.....

.....

We, the undersigned, hereby certify we have investigated the circumstances, approve the change, and declare the new location safe.

.....
Mine Foreman.

.....
Ventilation Inspector.

Equipment installed by.....
Colliery Electrician

This is to certify that I, a representative of the Electrical Department, have inspected the installation at the changed location, above described and approved by the Ventilation Inspector, equipment identified as

.....

.....

and find it in full accord with electrical rules and practices, inspection made.....

.....19.....

Remarks.....

.....
Electrical Dept. Inspector.

Note: Forward original to Min. Eng., retain copy at Colliery Office.

ORIGINAL

As stated in the article on transportation (p. 506), duty on mine cars is severe because most of the mining is in steeply pitching seams, hence the coal drops into the cars from overhead chutes and lumps weighing up to a ton may fall as much as 5 ft. Car maintenance is being cut from 7c. to 2.1c. per ton by adoption of cast-steel underframe cars in place of the structural-steel underframe car which some years ago superseded the original wood-frame car.

Maintenance of steam locomotives is a major item of mechanical repairs, although the use of fresh mountain water well suited to boiler feed has a markedly favorable effect on the life of boiler parts. Of the 70 steam locomotives of 18- to 70-ton size, 10 of the 28 which are standard gage are 60-ton geared type. Most of the 42 locomotives of narrow gage are 25-ton, but a few 18-ton units are in use.

At the collieries, only routine repairs are made on locomotives. Boiler repairing is done only by boilermakers sent out from the central shop. Each year approximately 30 locomotives are sent to the central shop for overhaul, 20 of them for light repairs and 10 for heavy repairs. Flue practice does not include reuse of worn flues by safe-ending, and flue ends are not welded into the sheet.

The foundry continues to be an important adjunct to the central shop, but as time goes on fewer and fewer cast-iron parts are made. At one time most of the cast-iron pipe, up to 20-in., was made locally. Now only special pieces and fittings are made, because factories are equipped to make a cheaper standard product. For certain pump-discharge columns recently installed, adoption of steel and wrought-iron pipes, lined with bitumen, lead or wood, has cut down the use of cast iron. The wider use of cast steel for repair and renewal parts in general also has cut the foundry output, as it is not equipped for

steel casting. One large job still handled by the shop foundry is the casting of 12-ft. headsheaves. The hub with steel spokes embedded is cast one day and the rim cast the following day after the former has cooled.

Maintenance of electric locomotives follows the same general plan of making only routine repairs at the colliery and doing the heavy repairing at the central shop. Emphasis is placed on inspection as a means of detecting what repairs are necessary to prevent lost time and to save greater expense at a later date. Motormen inspect their locomotives each day and the colliery electrician checks these inspections. About once every three months each locomotive receives a thorough going-over by a full-time locomotive inspector from the electrical department at Lansford. Copies of his report go to the colliery electrician, colliery superintendent, chief electrical engineer and mechanical superintendent. Inauguration of this inspection system resulted in reducing locomotive maintenance cost 50 per cent.

Improved batteries and more attention to charging and cleaning have raised battery life more than 50 per cent. Prior to 1924, batteries of combination locomotives lasted but 24 to 30 months, as compared to 46 months for batteries which have been replaced in the last few years. Battery lives of straight storage locomotives have been increased to 54 months. Present battery costs per month for the two types are: combination, $45.22; and straight storage, $31.41.

One hundred locomotive armatures were repaired at the central shop during 1934, and the total shop charge for these repairs was $4,480.70. Figured on a production basis, the company mined 36,576 tons of coal per locomotive armature failure and the locomotive armature repair cost was less than 0.1c. per ton. Other armature repairing handled by the central shop included 44 armatures from motors driving blowers used with tubing in mine ventilation and 49 armatures from motors of miscellaneous duties. Field coils repaired numbered 42 and the total cost of armature and field-coil repairs was $8,138.00, or approximately ¼c. per ton.

After a blasting battery has been in service six months it is sent to the Lansford shop for inspection regardless of its apparent good condition. This practice is an important factor in mine safety because it reduces the chance of misfires. Wound-field batteries, principally the Atlas Special No. 2 rated 25 volts, 1.5 amp. 25 ohms, have replaced all the permanent-magnet type formerly used. After a battery is inspected, cleaned and repaired, it is tested by firing a blasting cap which is connected in series with a resistance equivalent to nine other caps in series.

Thermometers, thermostats and indicating meters play a definite part in reducing electrical maintenance. All substation transformers with primaries connected to the 11,000-volt transmission are equipped with indicating thermometers and their maximum temperatures normally stay below 55 deg. C. If temperatures rise above 65 deg. C., an investigation is made. Cylinders of air compressors and their bearings, and also the bearings of fans, pumps, and of motors driving the equipment, are fitted with thermostats which act with the full-automatic controls to stop the motors if overheating occurs. Stationary a.c. motors, even in sizes as low as 10 hp., are equipped with ammeters to indicate unusual conditions or overloads which might ultimately damage the motors.

Safety is considered a primary factor in electrical maintenance of d.c. equipment used inside the mines. An electrical inspector from headquarters at Lansford inspects all feeders, trolley wire, bonding, electric heaters and d.c. motors (except locomotives). On a special form, with copy to the colliery superintendent, he reports all conditions affecting safety, efficiency and maintenance and makes recommendations for correction. When changes or repairs have been made, the colliery superintendent notes these on the form and forwards it to the office of the electrical engineer.

About ten years ago a start was made at replacing all open d.c. switches and starters with safety switches and inclosed starters; today, the 250-volt trolley wires (6½ ft. minimum height above the rail) are the only exposed d.c. conductors inside the mines. This inclosed equipment operates with far less maintenance than was required for the exposed and less safe equipment.

To guard against new installations being made in an unsafe manner or in unsafe locations in the mines a form report (Fig. 1) must be filed for each job. Signatures of the mine foreman, ventilation inspector, colliery electrician and electrical inspector from headquarters insure that the installation meets all requirements of standard practice and safety.

FORESTRY WORK

+ At Lehigh Navigation Coal Co.

TIMBER CONSERVATION has long been a precept with management of the Lehigh Navigation Coal Co. Practical experience and scientific study, however, have shown that Nature, left to her own devices, will do an excellent job of reforestation. Where man's assistance is most needed is in protecting Nature against human incompetence in cutting standing timber and against human carelessness in starting forest fires. Devotion of Lehigh management to the principles of forest conservation, therefore, finds its most concrete expression in an educational campaign to protect its timberland from conflagration and in the organization of a fire-fighting force to check the areal extent and damage done by fires once started.

Since the success of its educational efforts must depend upon public opinion and support, the company makes a direct appeal for public cooperation in and with its campaign and extends an invitation to the public and to its own employees to join in establishing the best and most efficient methods of combating the forest-fire evil. Why, it asks, spend money on reforestation or silvicultural operations so long as fires are permitted to destroy such investments? Both the public and the coal company itself must play a part in forest protection: the coal company must so operate its locomotives running in or near the woodlands that fires will not be started from engine sparks; the public using the woodlands for recreational purposes must recognize their obligation to prevent that use from being a menace.

As part of the educational campaign against forest fires, contests in forest-

Signs like this dot the countryside

protection essays and forest-fire-prevention slogans are conducted in the schools. Pupils are encouraged to establish small forest plantations under the direction of the coal company's forester. Forest-fire prevention slogans, posted at strategic points, catch the eye of the tourist and the transient and aid materially in keeping down the number of fires on company lands. These poster boards measure 8x11 ft., are placed at regular intervals and carry such pithy messages as:

"Better a dead match than a dead forest."

"No smoking will keep these forests green."

"The best cigarette in the woods is a dead one."

"Dead cigarettes mean live forests."

"Smokers, spare these trees!"

"A match has a head but no brains—forest ahead."

"You can't buy green trees at a fire sale."

"When your match goes out, be sure it can't come back."

That the campaign has been productive of results is shown in the following tabulation of the forest-fire record on company lands for selected years:

	1913	1916	1934
Number of fires ..	68	165	20
Number of acres burned	15,000	517	106
Cost of extinction	$1,912.70	$349.00	$75.00
Average number of acres per fire	222	3.1	5.3
Average cost per fire .....-	$28.13	$6.09	$3.78

In addition to regular fire-fighting equipment, the company has furnished its forestry crew with a four-cylinder portable Pacific Marine gasoline pump and 1,000 ft. of 1½-in. hose. Following fire trails and old log roads, the forestry crew has been able to use this outfit and pump water on approximately 50 per cent of the fires on company lands.

As a result of the campaign, forest fires no longer are looked upon as a necessary evil; young trees are now growing where they were not permitted to grow and the green hills are coming back. Natural reproduction, assisted by improvement cuttings and plantings, have materially augmented an auxiliary supply of small mine timbers. Although the local woodland holdings are not sufficient in size to produce an adequate supply for all the company's requirements, the growth now present is healthy and strong and, in an emergency, could be utilized to supplement the supply from outside sources.

Natural reproduction soon develops a healthy growth of trees like this

MINE SUPPLIES

+ At Lehigh Navigation Coal Co.

MINE-SUPPLY stocks of Lehigh Navigation Coal Co. averaged $446,733 in 1934, as compared to $954,476 in 1921, yet output for the two years was approximately the same—3,657,668 and 3,763,134 tons, respectively. Total yearly cost of handling materials was cut from $125,000 to $40,000. How was this done? The answer lies principally in the abandonment of the general storehouse system in 1922 in favor of a unit system which has been modified and perfected during its twelve years of operation.

The central warehouse at Lansford shops made daily deliveries to Nesquehoning, Lansford, Coaldale, Greenwood and Tamaqua collieries over distances of approximately 3½, ½, 1, 2 and 4 miles, respectively. With the unit storehouse system now in effect, each colliery maintains a necessary stock of materials, except that a few items, for special reasons, continue to be stocked at Lansford. Two more collieries, Alliance and Cranberry, which are 13 miles and 17 miles, respectively, from Lansford, previously operated by subsidiary companies, were acquired in 1926. The unit store set-up includes, in addition to the warehouses at each mine, a warehouse to serve strippings within a radius of six miles.

Trucks operated from the Lansford shops and under the supervision of the shop superintendent make daily deliveries of centralized materials to the five collieries within the four-mile radius. Each of the two outlying collieries dispatches its own trucks as often as necessary to handle equipment sent to the central shops for repairs and to bring back the items of centralized stock for daily needs. Mine-gage tracks link Nesquehoning, Lansford and Coaldale collieries with the Lansford shops and are used instead of motor trucks to transport certain heavy materials.

A storekeeper reporting to the colliery superintendent is in charge of the local unit store and also of the colliery accounting. Store personnel consists of a bookkeeper, ledger clerk, stenographer and warehouse man. Approximately half the time of the storekeeper and his assistants is properly chargeable to handling supplies.

General supervision of unit stores and the purchasing of native hardwood mine timber are handled by a storehouse inspector who reports directly to the general superintendent. This inspector has two assistants and an office in a building at the Lansford shops which houses the limited central warehouse for special items. All buying other than that of local mine timber is done by a purchasing agent in Philadelphia. The one exception is made because of the close contact necessary on the varying quality of timber, many points of delivery, and the large number of dealers.

Materials handled by the central warehouse at Lansford are as follows: pipe, headsheaves, mine-car material (iron and wood), flooring, materials for maintenance of buildings and for the 900 miners' houses owned by the company, parts for 94 trucks and automobiles, cement, concreting sand, brick, crushed stone for concrete, oxygen and acetylene, and telephone poles. In most cases these items are centralized because of carload freight advantages and consumption is less than would justify carload shipments to the collieries. An item such as headsheaves, which are 12 ft. in diameter and all of standard design, is centralized because renewals are few and quick deliveries are not required. Mine-car materials are stocked centrally because most of the repairing is done at the Lansford shop, where practically all iron and wooden cars have been manufactured.

For a time, lumber and timber were centralized items, but in general these were changed to unit-store items because their handling and hauling proved too expensive. For about eighteen months during code compliance, centralization, in order to secure better prices, was practiced with bar iron, cast-iron pipe and certain sizes of copper wire. The quantity-price angle of central stores versus unit stores is normally taken care of by the purchasing agent negotiating contracts for quantities of materials to be shipped over a certain period.

Items of mine timbering purchased by the Philadelphia office include yellow-pine gangway timber, yellow-pine chute timber and 1-in. mine boards in widths from 6 in. up, and in lengths of 6 and 10 ft. Purchased locally by the storehouse inspector are the following: oak gangway timber, oak chute timber, oak forepoling, 5-ft. hardwood lagging, 5½-, 6- and 7-ft. oak mine ties, 8½-ft. standard railroad ties and a limited quantity of yellow pine for gangways and chutes.

General wareroom in the unit store at Cranberry

All requisitions for materials pass through the storehouse inspector's office on their way to the purchasing agent; scrutiny of these requisitions for possible economies and transfers is an important duty of the storehouse inspector. His other duties include frequent and detailed examinations of stocks, supervision over colliery accounting and material distribution, transferring materials to the best advantage, supervision of scrap accumulations and shipments, adjusting claims with carriers and handling general correspondence relative to materials.

The storehouse inspector serves as the close tie necessary between purchasing and operating departments to serve the mines efficiently without waste. Reporting directly to the general superintendent and making frequent visits to the unit stores, he necessarily keeps in close touch with time, quality and quantity requirements for materials. Furthermore, he appreciates the problems of the general purchasing agent because he himself is a buyer of certain materials.

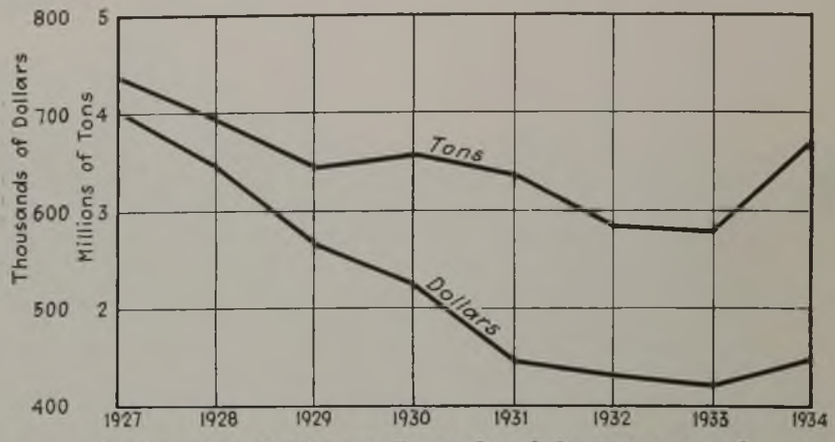
As a rule, the stock carried at an operation is approximately double the monthly average disbursement, and the stock turnover, including current monthly receipts, is around 40 per cent. For the company operations as a whole, percentages of main items to the total value of materials in stock are as follows: machinery and gearing, 26; electrical supplies, 12; car materials, 6; timber and lumber, 11; rail, sheet steel, etc., 5; pump parts, 4; bar iron and steel, 3; and pipe and fittings, 4.

One of the duties of the warehouse man at each colliery is to sell supplies to the miners each morning as they go to work. The following materials constitute the usual range of sales: paper for tamping, caps, fuse, igniters, dynamite, files, shovels, handles for hammers, axes and picks, carbide and carbide lamps (Cranberry only) and safety items such as gloves and protective caps.

Certain yards for mine timber include a power derrick, logroll, cutoff saw and electric transfer car, all arranged for short-route and minimum-cost handling and preparation of the heavy gangway timber, which is received in long lengths on railroad cars and is cut to proper lengths for mine use before being taken inside. The cutoff saw, which is the swing type and is equipped with air-operated dogs, is in a small building which also houses the derrick hoist and operating station for one-man control of both equipments. Operations that are supplied entirely with local timber have dispensed with this equipment.

In certain cases—Cranberry colliery, for instance—the derrick is used also for handling heavy machinery and materials such as large cast-iron pipe from railroad cars to yard storage space and/or to cars and narrow-gage trucks for transportation into the mine. The number of men in the timber-yard force is normally regulated so that by working only on days the colliery operates the timber requirements are met. An exception to the individual colliery timber yard is a larger yard near Lansford breaker which supplies Nesquehoning, Lansford and Coaldale collieries.

Timber and other classes of mine supplies are supervised carefully to hold stocks to a minimum consistent with safe and efficient operation of the collieries. Considering that most materials enter into maintenance and the total expenditure for maintenance, including mine timbering cost, was nearly $3,000,000 in 1934, it is evident that efficient handling of supplies deserves the close local supervision it receives.



Average value of mine supplies stock and the tonnage served

Transfer car, logroll, saw house and derrick included in facilities at the Cranberry timber yard

Each morning, the warehouseman is on hand to sell supplies to miners at Lehigh Navigation collieries

Space in the colliery timber yard for storing heavy equipment makes it possible to use the timber derrick for both jobs

INDUSTRIAL RELATIONS

+ At Lehigh Navigation Coal Co.

THE PERSONNEL PROGRAM of the Lehigh Navigation Coal Co. grew out of a study of a particular situation intimately associated with the local industrial background of the area in which the company operates. Five of the seven Lehigh Navigation collieries are directly contiguous—and contagious—to each other. While this makes very definitely for united action on the part of the mine-workers' union, it also facilitates closer administrative supervision on the part of the coal company.

Not only is the community one of the oldest in the anthracite region but during the 115 years of the company's history there has been comparatively little exodus or influx of mine labor to or from other mining districts. To the great majority, one of the most persuasive claims for consideration seems to be that "I was born in the Panther Creek valley and my father and grandfather worked for the company." There is an unmistakable sense of proprietorship in the right to work in the company's operations.

All these somewhat peculiar local conditions have an important effect upon the relations existing between management and men. The personnel policies developed to meet them are partly traditional and partly the fruits of conscious planning. In 1924, the office of director of personnel was created to coordinate the more specific personnel activities and to advise the operating department on questions of policy. Committed to the belief that the best results are achieved where every executive is in effect his own personnel officer, the director of personnel has preached this doctrine ever since the department was first established. A complete catalog of just what this means in daily operations would be difficult, since it includes almost countless issues involving employment, safety, discipline, adjustment of grievances and the dissemination of information concerning company problems.

Back in the War period and down to the 1925-26 strike, the employment problem was primarily one of finding men for jobs—not jobs for men. Labor shortage and general restlessness were common. Because of the compact character of its operations, in 1917 the company established a central employment office. This was placed in charge of an employment superintendent who had wide authority to hire on a requisition of the various operations and thus could relieve foremen of a more or less constant annoyance from the solicitation of applicants for a change in jobs. As time went on, however, the foremen became increasingly dissatisfied with this arrangement, feeling that they had lost some of the personal attachment which comes from selecting one's own men; the management, too, felt the need of giving greater scope to its more general interest in the employment situation.

Under a compromise plan put into effect about 1924, initiative in hiring was returned to the colliery officials. Actual engagement for the job now is made by the supervisor of employment, who may exercise a veto power over the foreman's recommendation if the situation seems to warrant such action. The wisdom of this revised policy has been confirmed in more recent years when unemployment has been acute. Without, it is believed, impairing the company's interests in securing suitable employees, it has often appeared desirable, if not imperative, to give consideration to relieving the financial distress of many families.

★ ★

Lehigh Navigation Coal Co. has never thought of a personnel program as a matter of doing a lot of nice things to make its workers happy and to gain their good will. Many of the activities which go by the name of personnel relations necessarily are "out" where an effective independent labor organization functions. The employees' interests have been exceedingly well taken care of in many respects by the United Mine Workers, who are more strongly organized in the Panther Creek valley than, perhaps, anywhere in the anthracite region. So the personnel job, as Lehigh Navigation sees it, is largely one of seeing that each new problem or situation is viewed not only from the standpoint of operating and financial results but from that of employee and community interests.

★

Market conditions during the greater part of the past decade have compelled producers to concentrate operations at their lower-cost properties. The Lehigh Navigation Coal Co. has not escaped this necessity. At the same time, however, it has made special efforts to promote the equalization of work—as distinguished from equalization of running time between high- and low-cost operations. An outstanding example of its endeavors in this field is furnished by the history of what was done to find other employment for the 800 men thrown out of work when the Rahn colliery was closed down permanently in 1931. As many as possible of these men were given jobs at other operations, but the immediate reemployment of any great percentage of the 800 was out of the question. In the course of time, however, management worked out a plan which practically abolished overtime at all Panther Valley outside operations. The man-hours thus saved made possible the establishment of a second maintenance shift in the various breakers and this second shift provided employment for approximately 200 of the men who had lost out when Rahn was abandoned. With few exceptions, the rest of the former Rahn employees have been absorbed at other operations of the company or given a small pension.

Although the Lehigh Navigation Coal Co. has no regular pension system in effect, it long has been the practice to grant small stipends to superannuated workers whose service has been continuous and satisfactory. At the present time there are 148 pensioners on the rolls and the annual disbursements for these pensions totals over $42,000. Some of the pensioners have worked for the company upward of sixty years.

Closely articulated with the employ-

ment administration are the compensation and medical services. The company is a self-insurer. While the workmen's compensation law regulates and limits the employer somewhat minutely, there is, nevertheless, considerable latitude left for company policy. The degree to which the company and the injured employees have been in agreement is indicated by the small number of petitions which have been filed with the referee and the compensation board during the past twenty years. There were 11,587 compensable cases in that period, but only 138 of them resulted in the filing of petitions against the company. These 138 cases involved claims aggregating $251,150.83; cases involving total awards of $96,804.42 were decided against the company. It is the policy of the company to make payments due on compensation awards as promptly as possible; in the more serious cases, checks are delivered to the homes or to the hospital.

The coal company has a medical staff consisting of a chief surgeon, six district surgeons and two nurses. There is a central dispensary in Lansford, but major surgical cases usually are taken care of at the Coaldale State Hospital. The chief surgeon's office is a point of very friendly contact with the employees and this contact is further strengthened by the personal visits of the chief surgeon to the homes of convalescent patients. Before a new man is hired by the company he is given a medical examination by the chief surgeon.

Housing activities of the Lehigh Navigation Coal Co. are a heritage from the days of labor shortages. Approximately 800 employees in the Panther Valley live in company houses. Monthly rentals (exclusive of rentals on executives' dwellings, which run higher) range from $6 to $25 per month. The only real "company town" is Kaska, near Pottsville, where Alliance colliery workers occupy 122 company houses.

In recent years, several outlying groups of houses which stood in the way of mining or other operations or which had become decrepit from long service have been abandoned and razed. A systematic program of repair and maintenance has been continued for the remaining houses and the standards for housing have been raised appreciably by the introduction of heating, lighting and sanitary facilities. As far as financial conditions have permitted, the houses have been kept in good repair by structural and external replacements and by painting. In many cases, aluminum paint has been used both as a priming and as a finishing coat with gratifying results.

From 1912 to 1931, the company conducted the Panther Valley Mining Institute, a night school operated in conjunction with one of the local school districts, in which instruction was given in mining methods and in mechanical and electrical engineering. Total attendance usually ran about 70. The incentive to attend these courses, however, was considerably diminished during the last years the institute was open because of decreasing opportunities for promotion. The institute probably will be reopened when employment conditions improve.

Revival of a foremen's training course, conducted for many years in conjunction with the institute, also is under consideration. In this course, the problems of the company were treated with great frankness and practical discussion was offered on such subjects as costs and realizations, safety and the handling of men. This work was temporarily discontinued in 1931 because the company felt that it was unwise to pursue the same courses year after year with the same men without allowing a rest interval during which the problems could be developed in a new light.

Until recently, hearing and adjustment of grievances arising under the agreement with the United Mine Workers consumed a large part of the time of the director of personnel, to whom appeals from decisions adverse to the complainants might be made prior to submission of the case to the Anthracite Board of Conciliation. This procedure has been modified with the idea of encouraging final settlements by the operating officials directly affected.

MERCHANDISING

+ "Old Company" Lehigh

MERCHANDISING in the early days of the anthracite industry was a real selling job. Wood—cheap and plentiful—was the mainstay of the domestic consumer; the few manufacturing plants then in existence along the Atlantic seaboard relied chiefly upon British or Virginia coals and on charcoal for their industrial needs. Nobody shattered the welkin clamoring for the new fuel from northeastern Pennsylvania. The hard-coal pioneers were compelled not only to develop economic and efficient means for transporting their product to the consumer but also to teach him how to use it and to encourage manufacturers in building special equipment in which it could be burned.

With consumer acceptance definitely won and increasing population affording a constantly expanding market, the industry then entered a period of years in which development at times was so rapid that it outstripped immediate demand. During that period, conditions were largely comparable with those which were to plague bituminous-coal producers in later years. Next came a prolonged period of experimentation in production and market control, and then the feverish war years when demand was so great that anthracite was not sold but rationed to frantic retailers and their customers.

Hailed by some as the beginning of a new era in distribution, the rationing, or quota, system actually marked the end of a century-old cycle. Although production levels from 1920 through 1927 gave no statistical indication of fluctuations which could not be dismissed as the result of mild winters or labor disturbances, profound changes seriously affecting the competitive position of anthracite were under way. Territorially the market was shrinking; worse still, other fuels were making farther and faster inroads among domestic consumers in the States which absorbed the bulk of the anthracite output.

Top management at Lehigh Navigation Coal Co. was among the first to sense these changes and to realize that strategy reminiscent of the resourcefulness of the pioneers would be necessary if the industry was to retain its existing markets and regain the competitive position it had enjoyed prior to the disastrous 1925-26 strike. Where the Navigation company in 1820 was faced with the problem of how most effectively to invade markets then held by rival fuels, present management was faced with the problem of how it could most effectively protect the markets it serves from the invasion of competitive fuels. Education, service and equipment were the weapons used to win the markets; education, service and equipment—built to meet present-day conditions—are the weapons now being employed to hold markets. And, where necessary, the sales department has been reorganized and expanded so that the greatest possible use can be made of these weapons.

Merchandising activities of the Lehigh Navigation Coal Co. are headed up by a general sales manager, who reports directly to the president of the company. Advertising, retail service, credits and industrial sales are under the immediate supervision of division managers on the staff of the general sales manager with headquarters at Philadelphia. The organization set-up also provides for a division manager in charge of bituminous sales and for a division manager in charge of outside purchases of anthracite for resale to customers who want to stock free-burning coal as well as the "Old Company" product. Responsibility for coordinating the work of these various divisions of the sales department devolves on the assistant general sales manager.

The greater part of the commercial production of the company is distributed through approximately 2,000 retail coal merchants scattered throughout the East, the Middle West and Canada. Distribution, however, is most highly concentrated in the Middle Atlantic and New England States, which absorb about 60 per cent of the output. To serve the territory in which "Old Company" coal moves, district sales offices are maintained at Philadelphia, New York, Boston, Springfield, Mass., and Buffalo. In addition, exclusive sales-agency arrangements for handling anthracite have been made with independent wholesalers in four other areas. The L. F. Owen Co. represents Lehigh Navigation interests in Chicago territory; J. B. Dykstra, Detroit, handles Michigan business; the George Hall Corporation, Ogdensburg, N. Y., looks after sales in northern New York State and in Ottawa, Ont., and its environs; the Empire Coal Co., Ltd., Toronto, covers other Ontario territory and the eastern provinces of the Dominion.

Lehigh Navigation Coal Co. fully recognizes that the first prerequisite to successful merchandising is a good product. Therefore, as described in the article on preparation practices (p. 502), the company maintains a rigid inspection system at the mines to make cer-

tain that each car of coal loaded for shipment conforms fully to standards of sizing, purity and appearance. This inspection service is under the jurisdiction of the operating department. Provision is made, however, for direct reporting on coal inspection to the president by the superintendent of preparation. As will be explained later, service men attached to the operating department also are available to handle dealer complaints.

Dealer service offered by the company to assist retailers handling "Old Company" coal in their merchandising problems falls into five broad classifications: (1) advertising, (2) yard service, (3) consumer service, (4) retail selling service, and (5) service schools. Advertising service is under the jurisdiction of the manager of the advertising division of the sales department; yard service is handled by the service division of the same department. Retail selling service is a joint activity of the advertising and service divisions; consumer service and the service schools are joint activities of the service division of the sales department and of the operating department.

The Lehigh Navigation company was among the pioneers in the anthracite industry in preparing annual advertising campaigns for the retail distributors. When this program was launched, in 1928, it also included direct newspaper advertising in the territory served by the company. That plan was abandoned several years ago in favor of advertising by and in the name of the individual retail merchant, with the Lehigh company participating in the cost. Direct advertising by the Lehigh Navigation Coal Co. is now confined to trade publications serving the distributing side of the coal industry.

Company financial participation in the advertising campaign of the individual retailer is based upon the annual tonnage handled by the dealer. Generally this participation is limited to a flat rate per ton and is subject to the further proviso that the company's contribution shall not exceed 50 per cent of the total cost of the campaign. In addition, the retail distributor's campaign must be approved by the advertising manager. The list of approved media covers weekly and daily newspapers, direct mail, outdoor signs and displays, radio and telephone directories. In no case will the company underwrite any of the cost of using theater, church or lodge programs, motion picture slides, school and college year books or other media in that category. If the retailer feels an irresistable urge to use such media, he is advised to charge off the cost to charitable donations. To qualify for company participation in the cost, the retailer's copy must either display the company trademark or mention "Old Company's Lehigh Anthracite" by name. Neither is it the company's policy to share in the cost

of advertising which mentions competitive fuels.

The company advertising portfolio includes a complete line of newspaper advertising copy for each season of the year, as well as direct mailing pieces. Advertising material supplied to the dealer consists of mats, electros, blotters, signs, window displays, direct-mail pieces, booklets, folders and envelope stuffers. Where, because of peculiar local conditions, special advertising copy may be required, the company advertising division prepares or cooperates in the preparation of such copy.

While, under certain conditions, the company will cooperate with dealers in radio advertising, that form of publicity is not widely recommended for the average retailer. This attitude is based in part, at least, on the company's own experience with broadcasting as a publicity medium. The Lehigh Navigation Coal Co. was among the first in the industry to use the radio. Its initial programs, employing the talents of a well-known concert singer, were criticized outside of New England as being "too highbrow," and a more popular type of program was substituted. Although the company felt that its broadcasting had a good effect upon the morale of its retail distributors, it was unable to trace any direct benefits to this form of advertising. Moreover, the growth of large network broadcasting which reached many points outside of its normal sales area and the difficulty at that time of buying split time were deterrents to continued use of the air. As a result, the broadcasting started in 1928 was discontinued after four years.

Yard service includes advice on the best methods of handling coal into and through the dealer's storage plant, quick loading and dispatching of trucks, improved chuting to dealers' bins and bagging of coal. This engineering service is based upon the experience gained in handling coal through the company's own breakers and the data collected from experiences of successful retail merchants and inspection of their yards and equipment over a number of years. Yard service and advice are furnished free to dealers who purchase more than 50 per cent of their tonnage from the Lehigh Navigation Coal Co. Prospective dealers and retailers who buy only an occasional car are given advice on yard problems, but no actual service work.

Retail consumer service covers general coal information; instructions on combustion; special advice relative to heating plants and proper radiation, how to reduce heating costs, advantages of coal over other fuels, vacuum-cleaning of heaters, heat regulators, blowers, automatic coal burners and the air-conditioning of homes. Much of the data upon which this service is based are derived from tests made in the company laboratories at Lansford. Trained service men are available to assist the retail coal merchant in his work with his customers.

George W. Seiler
General Sales Manager
Lehigh Navigation Coal Co.

In most cases, requests for the retail selling service originate with the company salesmen. The service may be given to an individual dealer or at a meeting of the entire dealer organization arranged in advance by the salesman. Among the topics which may be taken up at such meetings are employee selling, part-time telephone selling, how to sell the peddler trade, promotion of C.O.D. business, retail solicitation and how to combat cheap coal and other competitive fuels. Service department engineers also will train salesmen of the retail dealer in house-to-house solicitation methods

Much of the retail consumer and advisory selling work is presented through the medium of the service schools conducted at Lansford, where an intensive three-day course is given small groups of retail coal merchants. The first day the merchant students are taken to the mines and the breakers, visit the storage yard, see how coal is inspected and also visit the chemical laboratory of the company to watch the methods used in ash analyses and fusion tests. In the evening, the students spend two hours in studying the proper approach to prospective customers, how to handle consumer complaints, and the fundamentals of draft control.

On the second day, the students are taken to the physical laboratory, where they receive instructions in how stokers should be installed, the proper setting of coal and air adjustments, use of draft gages and determination of gas analyses. In addition, the students are told proper methods of fire control in hand-fired boilers and where to look for defects in equipment and installations. The evening session is devoted to discussion of clinker formation, various types of heating equipment and the defects most frequently encountered with each, and firing methods with blowers, stokers and magazine-feed heaters. On the last day, one of the stripping operations is visited; this is followed by a final round-up discussion on service problems in which the students are invited to take the lead, and talks on service and advertising. Because of the intensive nature of the course, the company endeavors to hold the registration for each class down to eight pupils. Since the courses were inaugurated in December, 1934, approximately 150 dealers have attended the schools.

Although the company has been testing heating devices in its Lansford laboratories for some time, except for a heat-control mechanism which was not actively pushed, the Lehigh Navigation Coal Co. did not begin to promote the sale of equipment through its retail distributors in a large way until this fall. Its first drive has been on service water-heating equipment The line now includes two models manufactured for the company by a well-known equipment manufacturer and its own patented hot-water regulator which can be applied to any type of tank water heater and which maintains a constant supply of hot water, guarantees no rust and saves about 35 per cent in coal consumption, and the Old Company furnace control, which is unique in design, guaranteeing uniform heat. Early returns from this campaign have been extremely encouraging, and the company plans to add other equipment to its line as arrangements can be made for handling suitable types. The equipment is sold to the dealer at cost.

One of the most interesting innovations in which Lehigh Navigation Coal Co. has pioneered is bagging coal at the mines. A bagging plant was put in operation at Lansford in the fall of 1931. The first month shipments totaled 328 tons and since that time over 100,000 tons of bagged coal has been sold. Coal is bagged in 18-, 25-, and 50-lb. quantities in heavy paper sacks. At present, bagged shipments are confined to the chestnut size, but study is being given to the market possibilities for other sizes. Breakage in transit is a relatively minor item; to cover this, each shipment, which is made in box cars, includes a few extra empty bags and ties. In a number of cases, retail distributors have resold bagged coal to independent and chain grocery stores, but the Lehigh Navigation company itself sells the bagged product only to recognized retail coal merchants.

As part of its general educational program, the company has established a "guest house" at its Coaldale breaker where visitors are provided with guides for inspection trip of the breaker and a typical underground section of the mine set apart for this inspection. Since the guest house was opened in 1931, approximately 75,000 visitors have accepted the company's invitation to visit the property and get a first-hand picture.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Machine Cleans Safety Lamps Thoroughly and Quickly

Cleaning of Wolf safety lamps is now a task less tedious than formerly, is done in a shorter time and with more likelihood of thoroughness by a special machine in use at Alliance colliery of the Lehigh Navigation Coal Co., Kaska, Pa. This machine is a compact assembly of brush, buffers, centrifugal cleaner and blowing cup, all operated by compressed air and fitted with inclosing cases and exhaust pipe to carry the dirt out of the room.

Fig. 1 is a view of the machine as mounted above a work bench and in handy position beside a Wolf naphtha filling tank of standard design. Progressive steps in the cleaning, after the lamp has been taken apart, are as follows:

(1) In a vertical position the lamp bottom is pushed through a slide where a long brush, *A*, with bristle pointing down, cleans the wick and adjacent metal parts.

(2) The lamp bottom is raised to a round hole of the same diameter in the bottom of a compartment, *B*, and a valve is opened to project an air blast against the wick and top surface.

(3) The hinged door, *C*, is opened and the double gauze air ring of the lamp is pushed into a spring holder mounted on a shaft inside of the round compartment. An air jet hitting the ring tangentially cleans it while turning it momentarily at high speed.

(4) The curved and hinged buffer plate, *E*, lined with sheep's wool, is raised from the buffer mandrel, *F* (also covered with sheep's wool), and coincident with the starting of an air turbine driving the mandrel the operator forces the glass chimney of the lamp over the mandrel buffer and holds it from turning for a moment to effect wiping of the inside.

(5) To clean the outside of the chimney the operator releases his grasp, allowing the chimney to rotate with the mandrel, and then pushes down on the outside buffer, *E*.

(6) The final step, but one which a deft operator usually has performed coincident with the former steps, is to put the two gauzes into cup *G* and swing this spring-hinged cup down and around to cover the hole in the bottom of compartment *B*. An air blast removes the dust and the air escapes back up through a vent along one side of the cup and into the exhaust pipe.

About 75 seconds is normal time required for unlocking the lamp, filling with naphtha, cleaning all of the parts in the machine and reassembling the lamp. When the cleaning is done by hand and includes brushing the double gauze air ring, the complete job on a lamp takes 95 seconds. When the work was done by hand the double gauze air rings were cleaned but twice a week,

Fig. 1—Mounted on a bench near the filler tank

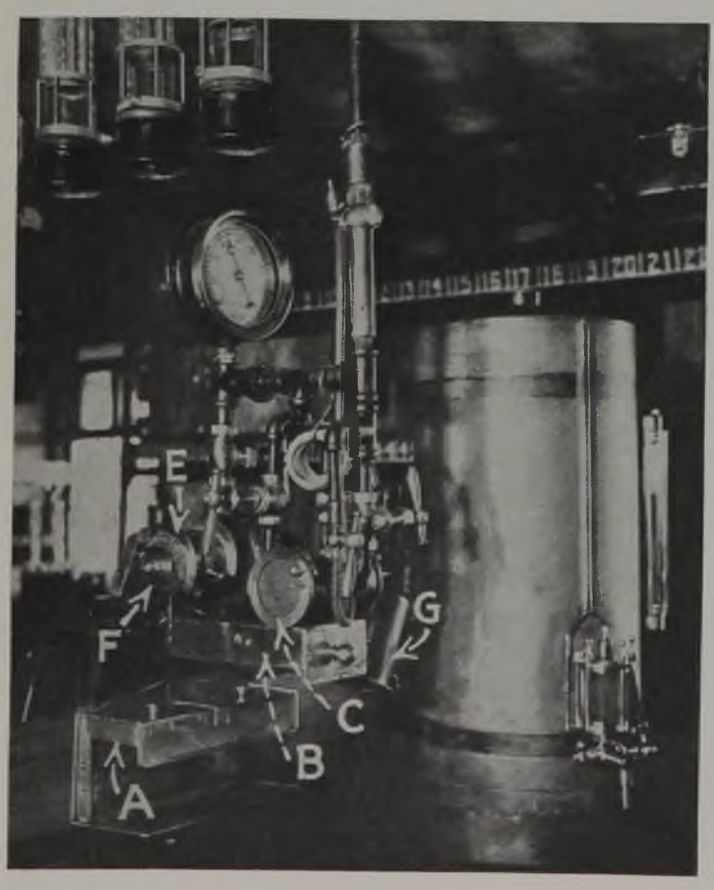


Fig. 2—A lamp is cleaned and filled in 75 seconds

Old Company's

OPERATING IDEAS in this month's section were originated by operating, electrical, mechanical and safety men at the collieries of the Lehigh Navigation Coal Co.—the "Old Company"—to which this issue, the Fifteenth Annual Model Mining Number of *Coal Age,* is devoted. In common with all forward-looking companies, Lehigh Navigation stresses the development of cost-cutting and efficiency-promoting ideas, which this department is organized to present this month and every month. In this objective men at the mines can assist by forwarding ideas developed at their operations. Sketches or photographs should accompany the ideas if they will help to make them clearer. Each acceptable idea will bring its sender $5 or more from *Coal Age.*

★ ★

whereas with the machine they are cleaned daily.

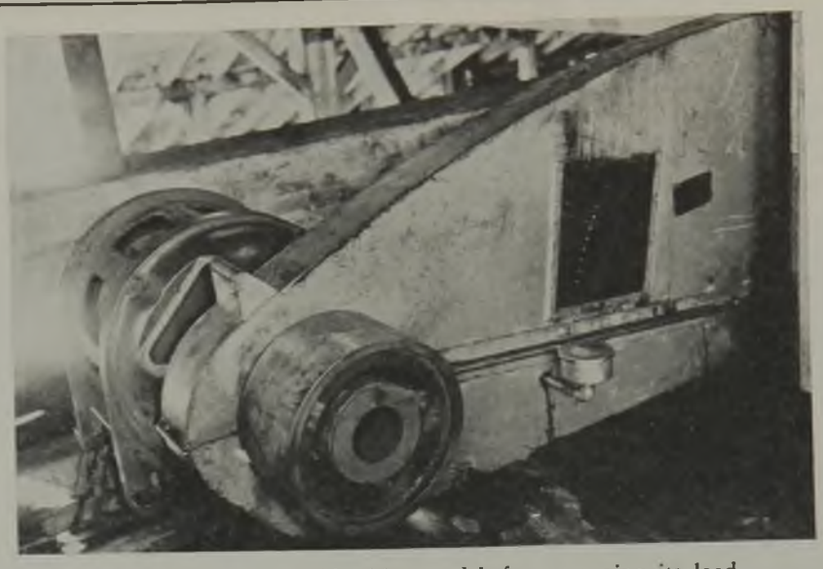
At Alliance 139 lamps are cleaned per day—96 for day miners, 18 for firebosses and 25 for men on night shift. Two lamps are provided for each man, so that one lamp is left in the lamp house for cleaning while the other is in use.

Air at 75 to 100 lb. pressure from the colliery compressed-air system is used to operate the machine. Three types of Wolf lamps, Nos. 100, 131 and 201, are accommodated by the equipment. William Jones, of Kaska, Pa., now in charge of the Alliance lamp house, devised and built the machine. His patent covering it was allowed Aug. 20, 1932.

Starter Broadens Use of Squirrel-Cage Motors

Conveyors and other machinery with heavy starting duties which normally call for slip-ring motors and secondary-resistance starters were equipped with plain squirrel-cage motors and starting switches in Tamaqua breaker of the Lehigh Navigation Coal Co. when that breaker was rebuilt this fall. A mechanical clutch mounted on the motor shaft and carrying the drive pulley or sprocket allows the motor to approach full speed before it engages the load.

The accompanying illustration shows one of these starters on a 25-hp. type CS motor which drives a buckwheat chain-flight conveyor. In this instance the drive connection is a silent chain. Mechanically the starter resembles an automobile brake; the friction band, however, is backed up by a number of spring-steel laminations the same width and shape as the lining and stacked to about 1 in. in thickness. The load is started without shock and the mechanism works equally well for either direction of rotation and acts as a load-limiting clutch.



The motor gains considerable speed before engaging its load

This type of starter is made under the Bethlehem-Nieman patents and is known as the "Madden Slip-Ring Starter." Those applied to motors of 15 to 50 hp. in the Tamaqua breaker were supplied by J. P. Madden, Bethlehem, Pa.

Use of Ammeters Is Extended To Smaller Motors

Installation of meters to check machine performance and to indicate abnormal conditions which might damage the electrical drive is now carried out on motors of relatively small ratings at collieries of the Lehigh Navigation Coal Co. Experience over many years with meters on the large stationary a.c. motors has demonstrated time and again the value of observing the meter indications.

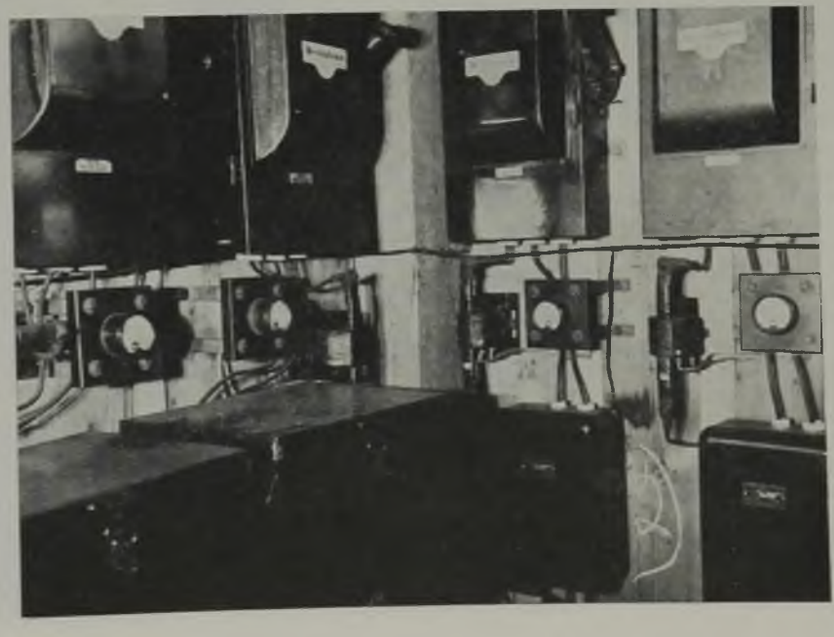
The accompanying illustration, showing a recent installation in the No. 5 buck addition to the Nesquehoning breaker, includes the controls of four 20-hp. 440-volt 25-cycle motors. A current transformer and an ammeter (40 amp. full scale), both of General Electric manufacture, are connected in one leg of each line between the safety switch and starter.

Metal Pipes With Air Jets Used for Ventilation

Instead of blowers driven by electric motors or by compressed-air turbines, Greenwood colliery of the Lehigh Navigation Coal Co. uses a limited quantity of steel tubing fitted with compressed-air nozzles to promote circulation by injector action. The accompanying drawing illustrates how 20-in. galvanized pipe, the largest size used in the mine, was employed to drive a blind tunnel extending 400 ft. from the main shaft, which conducts fresh air into the mine.

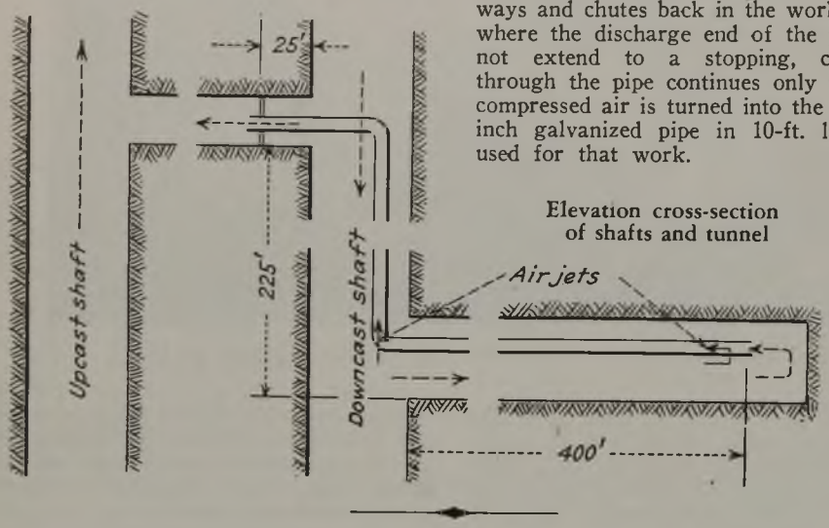
The pipe was installed from a stopping in a tunnel connecting the two shafts, thence 225 ft. down the intake shaft and

A glance at the meters tells if the loads are normal



to the face of the tunnel under construction. Two nozzles fitted into the 20-in. pipe and arranged to point toward the discharge end, situated at the stopping, were connected to the compressed-air supply lines through suitable control valves. After shooting, the compressed air was turned onto these nozzle connections to increase circulation above that normally resulting from main fan pressure. The 20-in. pipe is in 20-ft. lengths, some of which are spiral construction and some straight-seam construction.

In using pipe and air jets for the ordinary job of ventilating certain blind gangways and chutes back in the workings and where the discharge end of the pipe does not extend to a stopping, circulation through the pipe continues only while the compressed air is turned into the jet. Six-inch galvanized pipe in 10-ft. lengths is used for that work.



Elevation cross-section of shafts and tunnel

Column Flow Minimizes Coal Breakage In Loading Railroad Cars

TO REDUCE breakage in shipping prepared sizes, equipment for loading railroad cars at Lansford and Coaldale breakers of the Lehigh Navigation Coal Co. has been designed to facilitate the maintenance of a solid stream of material between loading pockets and cars. Lansford equipment includes the Adams lowering chute shown in Fig. 1. The vertical section of this chute is constructed with three sides only and is mounted so that the open fourth side faces a flat steel plate permanently attached to the breaker structure. This plate extends up to the bottom of the lip-screen chute built out from the pocket gate, and carries guides to permit upward and downward movement of the loading chute.

Raising and lowering of the chute are controlled by an electric boom hoist. When loading starts, the chute is dropped down to the bottom of the car. The bin gate is then opened, the coal passes over the lip screen through a heavy water spray and the chute is allowed to fill. The chute gate at the lower end is then opened and loading starts, the coal flowing in a solid column down the chute into the car. As the level of the coal rises in the car, the chute is raised by the hoist without stopping the flow of coal. This is made possible by omission of the fourth side of the vertical section and permanent attachment of its substitute to the breaker structure, so that the effective length of the vertical column can be increased or decreased by raising or lowering the loading chute.

The solid-column principle also has been applied to the design of a box-car loader for prepared sizes at Lansford. This loader consists of the three-sided vertical section mounted as detailed above, to which a spout entering the box car is hinged (Fig. 2). Two hoists are required for operation of the loader. From the position shown in Fig. 2 the loader is brought into position by raising the vertical section with one hoist and at the same time lowering the spout with the other so that it will enter the car door. With the spout in position, as in Fig. 3, telegraph chutes are fastened to the side openings and are run back into the ends of the car, where they are supported on horizontal pipes fastened into the sides of the car by screw jacks. The level of the spout opening in the car can be controlled by operating the primary hoist to raise or lower the entire loader.

Coaldale breaker employs the solid-column principle of loading prepared sizes with a hinged chute (Figs. 4 and 5). The discharge end of this chute, which is equipped with two bottom-opening gates, is raised and lowered by a hoist to suit the height of the coal.

For loading steam sizes in box cars, both Lansford and Coaldale employ the box-car loader shown in Figs. 6 and 7. This loader consists essentially of two main chutes hinged at the upper end to permit raising and lowering, two extensible spouts mounted so that they can be run into the box car and then opened out to discharge coal to both ends, a hoist, and the necessary telegraph chutes and supporting pipes.

When not in use, the carriage on which the spouts are mounted is drawn back under the main chutes (Fig. 6). To bring the extensible spouts into position for loading, the carriage is run forward, the wheel *A* (Fig. 6) running up on the inclined member *B*, thus bringing the spouts up under the permanent chutes. The carriage is then locked in position and the spouts are swung out into position. In extended position, the spouts are carried by retaining members *C* (Figs. 6 and 7), which in turn rest on the frame of the carriage. Telegraph chutes are used to conduct the coal to the ends of the cars. The hoist is used only for changing the elevation of the chutes, which otherwise rest in the appropriate notches in a permanent stand built on the loading platform.

Fig. 1—Adams lowering chutes in low and high positions, Lansford breaker

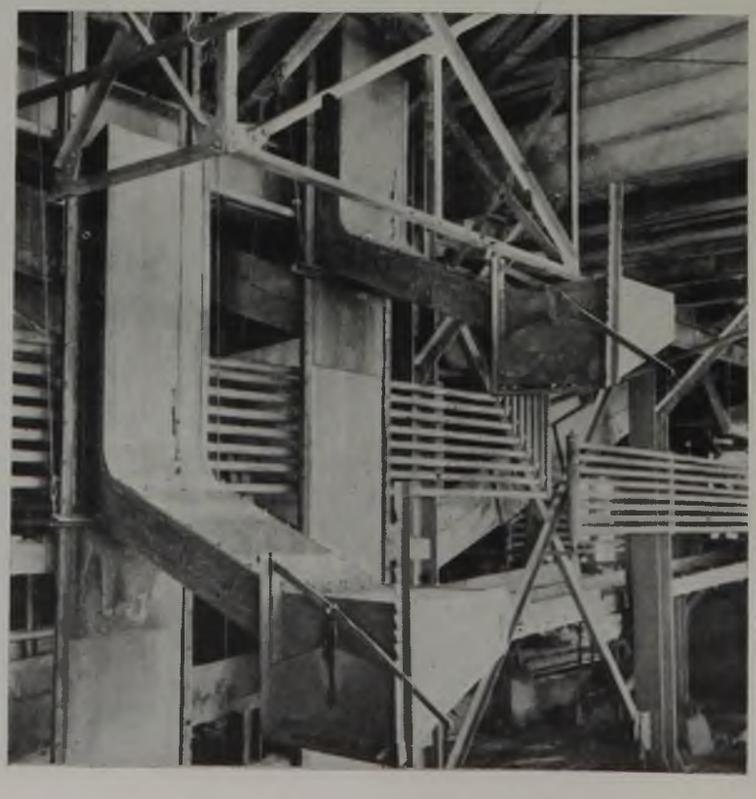
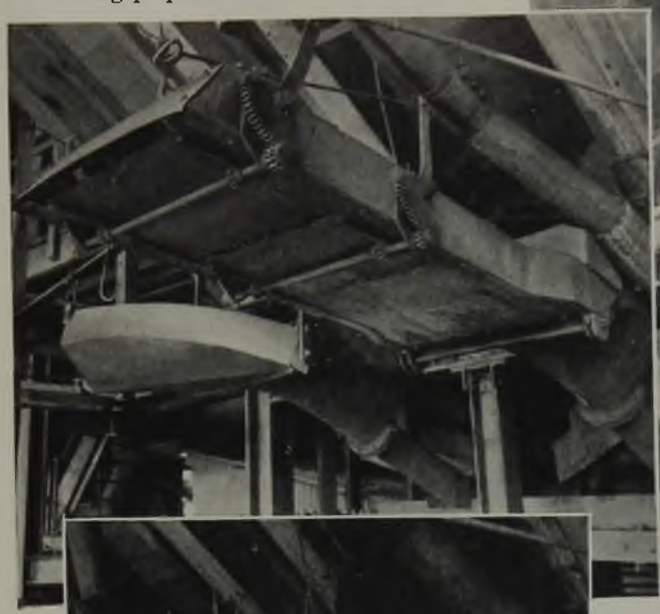


Fig. 2—Box-car loader for prepared sizes in inactive position, Lansford breaker

Fig. 3—Loader raised to working position with spout extended

Fig. 4 — Bottom view of Coaldale chute for loading prepared sizes, showing gates



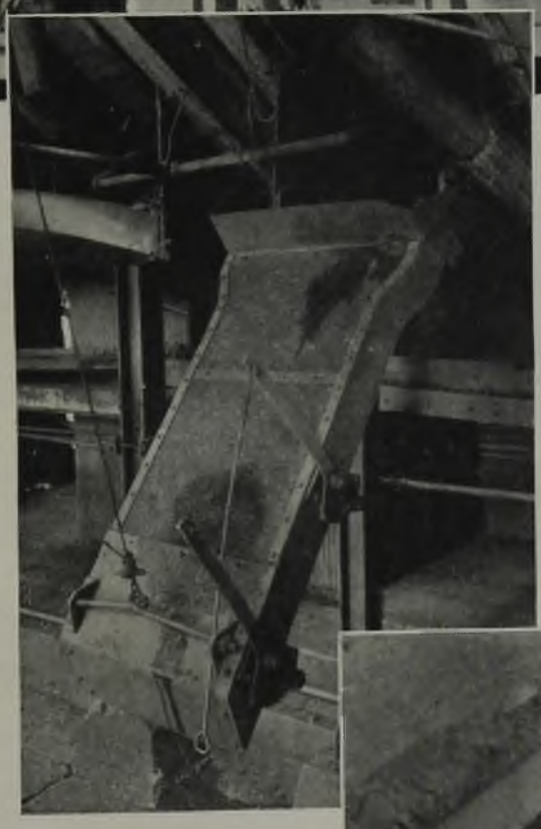


Fig. 5 — Coaldale loading chute lowered to working position

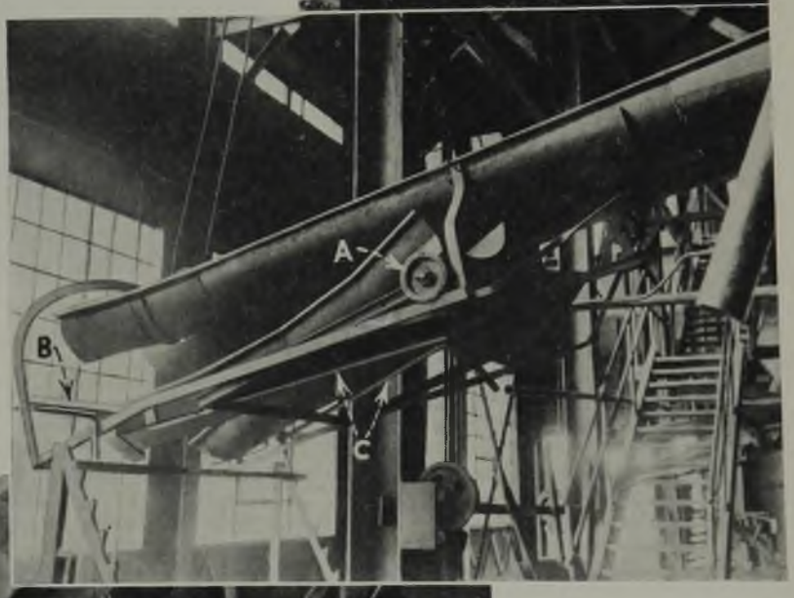


Fig. 6—Box-car loader for steam sizes, showing position of extensible spouts when loader is not in use

Fig. 7 — Carriage run out and extensible spouts in position for loading

WORD FROM THE FIELD

Stoker Makers to Cooperate With Coal Industry

Close contact with the bituminous coal industry, with exchange of opinions and data, is to be an important feature of the program outlined at the 18th annual meeting of the Stoker Manufacturers' Association, held in Chicago Nov. 15 and 16. The engineering committee of the association, headed by T. A. Marsh, Iron Fireman Mfg. Co., recommended keeping in close touch with the work of Bituminous Coal Research, Inc., the "proving ground" for the improvement of soft coal for stoker application.

Other projects include revision of heights standards for steel boilers, setting heights for cast-iron boilers, promotion of standardization of stoker sizes, obtaining improved reports on stoker production and sales, and increase of educational activities.

Supreme Court Test of TVA Set for Dec. 19

Test of the constitutionality of the TVA act will be taken up in the U. S. Supreme Court on Dec. 19, when argument will be begun. The court assigned this date on Nov. 18 in response to a motion by government attorneys requesting prompt action. Plaintiffs' briefs were ordered filed not later than Dec. 2, and government briefs not later than Dec. 16.

James M. Beck, former U. S. Solicitor General, and Forney Johnston, attorney for the Alabama Power Co., presented the plaintiffs' brief, in which the TVA act was assailed not only as unconstitutional but "revolutionary in its importance" because the government essayed, "through a board of three men subjected to none of the traditional checks, standards or restraints, to establish the government permanently in absolute control of the power of a vast region."

The TVA program, the brief stated, "involves the assumption by the government of a business which is intrinsically local in character, the regulation of which has been a matter of local jurisdiction from the beginning of the industry, the transfer of which to the government shatters the theory of the Tenth Amendment. . . .

"The proposal necessarily and directly involves a monopoly in fact through competitive exhaustion of the existing utilities and their inability to compete with a government free of taxation, free from adverse consequences or operating deficits and with unlimited funds to carry out its program and liquidate its mistakes."

The late Judge W. I. Grubb, in federal District Court at Birmingham, Ala., held on Feb. 22 last that sale of electric energy by TVA in competition with private utilities was illegal, though he declined to pass upon the constitutionality of the TVA act (*Coal Age,* April, p. 172). This decision was overruled on July 17 by Fifth Circuit Court of Appeals at New Orleans, La., which ruled that the act creating TVA was valid and that Congress had a right to adopt "any reasonable means" of disposing of surplus power (*Coal Age,* August, p. 348). Thereupon the plaintiffs took an appeal to the Supreme Court.

The city of Memphis, Tenn., signed a 20-year contract with TVA on Nov. 23, and as soon as the city works out the means of buying or building a distributing system, TVA will provide transmission lines into the city. A $9,000,000 bond issue for the system has been authorized by referendum vote.

David E. Lilienthal, TVA director, announced on Nov. 26 at Louisville, Ky., that TVA expects to enter the Kentucky field with low-rate power. He said that Norris dam is within transmission distance, and that power will be made available for those who want it. He also disclosed that TVA has been exploring foundations for a large dam on the lower Tennessee River in Kentucky.

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URGE INCREASE IN TARIFF ON RUSSIAN ANTHRACITE

A DELEGATION from the anthracite field of Pennsylvania, including representatives of the operators, miners and Congressmen, called on President Roosevelt on Nov. 18 to urge that the duty on Russian anthracite be increased from $2 to $5 per ton. The party included Louis C. Madeira, 3d, executive director of the Anthracite Institute; Thomas F. Kennedy, Lieutenant Governor of Pennsylvania and secretary-treasurer, United Mine Workers; Michael Kozik, president, District 1, U.M.W.; Representative P. J. Boland, Scranton, Pa.; and Representative F. E. Walter, Easton, Pa. Mr. Madeira told the President that imports of Russian anthracite had risen from 126,000 tons in 1929 to 375,000 tons during the year ended Sept. 30, 1935, an increase of 196 per cent. Approximately 90 per cent of the imported coal, it was pointed out, is of domestic size, which, translated into American labor, means 238,000 man-days of work, not including railroad labor.

Coal Investigations Planned By Testing Society

A number of coal investigations are under way or planned by the Committee on Coal and Coke, American Society for Testing Materials, Philadelphia. Among these projected studies during 1935-36 will be a continuation of experiments by Subcommittee I on Methods and Testing with a view of finding a satisfactory inert material for mixing with coal in the agglutinating value test as published in last year's report of the committee. The Ottawa sand now used as the inert material varies in regard to surface characteristics of the individual sand grains to such an extent that different shipments of this sand give different values when used on the same coal. Therefore sands from other sources will be investigated and tests will be made using manufactured materials such as fused bauxite and fused alumina, as they may prove more uniform than silica sand. The test is so sensitive to surface characteristics of the grains of inert material that, to be suitable, a substance must be very uniform in this respect.

Arrangements are being made by Subcommittee V on Tolerances to assemble data and make recommendations as to allowable differences between two laboratories analyzing portions of coal crushed to pass a No. 60 sieve, and tolerances as to allowable differences between two laboratories analyzing different portions of coal crushed to pass a No. 4 sieve (the 60-mesh coal refers to the laboratory sample, whereas the No. 4-mesh coal refers to the coal as submitted by the sampler to the laboratory). The subcommittee also will make recommendations as to tolerances for the volatile-matter determination in case of solid fuels other than bituminous coals, lignites, and cokes for which tolerances are now given in the Standard Methods of Laboratory Sampling and Analysis of Coal and Coke (D 271-33).

Subcommittee VII on Pulverizing Characteristics of Coal intends to continue investigation of the ball-mill method and the Hardgrove-machine method for determination of grindability of coal. Experiments will be conducted with a view of shortening the time required for the grindability determination by the ball-mill method. A factor that apparently needs investigation is how differences in specific gravity of the coal and of impurities such as slate and pyrite affect the determination. Some preliminary tests on coal and slate, using the ball-mill method, indicate that results obtained may be erroneous if the charge used is based on weight alone, and that the volume of the sample may be important. Another point that needs further study is how best to report grindability results and the practicability of converting results of one method to make them

comparable to those obtained by the other method.

Progress in the development of methods for the determination of coal friability—that is, the resistance to breakage or degradation in size on handling—has been made by Subcommittee XI on Coal Friability. More work must be done, however, before methods for this test can be presented to the society. Two methods of test are under consideration: a small-jar tumbler method using a sample of 1,000 grams of coal, the other being based on the Standard Method of Shatter Test for Coke, using a 50-lb. sample of coal. The small-scale tumbler test is considered applicable for testing the relative friability of coal, whereas the shatter test represents more closely the breakage taking place in the commercial handling of coal.

Subcommittee XII on Sampling Coal at Coal-Cleaning Plants has been collecting data to determine the variables that affect accuracy of coal sampling. The subcommittee probably will soon be able to formulate methods for coal sampling at coal-cleaning plants for determination of extraneous impurities by float-and-sink tests. Another project pertains to methods of sampling for determination of ash content.

Work leading to the standardization of methods of collecting gross samples by mechanical means and mechanical reduction of gross samples will be continued by Subcommittee XIII on Mechanical Sampling and Reduction of Samples. The latter probably will be standardized first, and then the subcommittee will study methods of collecting gross samples with a view to standardizing the principles underlying such methods. Mechanical methods of reducing gross samples to a convenient quantity for transmittal to the laboratory are now quite generally used by coal operators and large consumers of coal, as the hand method of reduction of samples, given in the Standard Method of Sampling Coal (D 21-16), is laborious and time-consuming.

A new subcommittee will be organized charged with investigating methods for determination of dustiness of coal with a view to recommending a standard method of test. In recent years a great deal of coal has been treated with oil compounds or chemicals such as calcium chloride to prevent the coal from being dusty when handled, and a standard method will be sought to test the efficiency of such treatment.

Decries Illinois Gas Project

PWA loans and grants which have been approved to finance the construction of natural-gas pipe lines to Pittsfield, Roodhouse, White Hall and Carrollton, Ill., will result in an economic loss of $1,024,317 to Illinois coal-mine and railroad labor, railroads and federal taxpayers, the Southern Illinois Reciprocal Trade Association declared Oct. 25 in a petition to Public Works Administrator Harold L. Ickes. Through its executive vice-president, James W. Bristow, the association asked Mr. Ickes to rescind the allotments, asserting that the projects are financially and economically unsound and would result in serious loss of employment to miners and railroad workers if carried out as planned.

Operating and Economic Phases of Mining Hold Attention at Illinois Meeting

MEMBERS and guests of the Illinois Mining Institute tackled both the operating and economic phases of coal mining at the organization's 43d annual meeting, held in Springfield, Ill., Nov. 8, together with an equipment show in which 49 exhibitors were represented. Safety, d.c. conversion equipment for mine use and the preparation and utilization of coal were the themes of the technical sessions, at which D. D. Wilcox, general superintendent, Superior Coal Co., and H. H. Taylor, Jr., vice-president, Franklin County Coal Co., Inc., presided.

An optimistic note was sounded by J. D. A. Morrow, president, Pittsburgh Coal Co., at the annual dinner, with George B. Harrington, president, Chicago, Wilmington & Franklin Coal Co., as toastmaster. Another

T. J. Thomas
President-elect, Illinois Mining Institute

upward spiral in the bituminous industry can confidently be expected, Mr. Morrow declared, in view of the trend in cost of production, delivered cost, industry's opportunity to produce, the public's capacity to consume and the possibility of new uses which will relegate power and heat to a subordinate position as outlets for coal.

The next upward spiral will have a much sounder foundation, and for that reason, said Mr. Morrow, he was opposed to the apparent desire of many operators to turn control of the industry over to the government. Nothing indicates that the industry will go so fast or so far or succeed so well with complete centralization of power. Rather, coal men should be granted the right of voluntary association for concerted action, subject only to a limited veto by the government in cases where such joint action falls outside well-defined limits of fair practice.

To keep the safety idea in the minds of its employees, the Sahara Coal Co., Saline County, Illinois, said Paul Halbersleben, general superintendent, follows the plan of changing the appeal from time to time, much as automobile manufacturers change car models, and for substantially the same reasons. One of the earliest plans for promoting safety adopted by the company was the construction of safety stations at the mines with men in charge of rescue and first-aid apparatus and materials. Installation of the stations was supplemented by the employment of underground safety inspectors.

The need for mine stations vanished with the setting up of a State rescue station in the county. Thereafter, greater stress was laid on inspection and mine and equipment condition, without, however, any marked improvement in the injury record. Working on the theory that attack from another angle was necessary, a program of 100-percent first-aid training was inaugurated. Resultant interest in safety was reflected in operation for a considerable time, including one calendar year, without a fatality. Later attempts to revive the same degree of interest through first-aid work were unsuccessful, leading to the conclusion that new appeals must be sought.

Bonus payments to foremen and two safety men in each section in charge of safety material were then adopted. The bonus was 1c. per man-shift worked without injury, with a penalty of $1 for every man-shift lost. The system was drawn up in this way to give both large and small sections in the hand-loading mines an equal opportunity. Safety men were changed each month to allow as many miners as possible to participate. If a section failed to earn a bonus, the safety men were paid a minimum of $5 to compensate them for any loss of time incurred. The miners, however, were not reached often enough and, furthermore, were not particularly interested in participating just to see a foreman get a bonus.

In view of the experience under this plan, it was concluded that every miner as an individual must be interested in the progress of a group of which he formed a part. The summer of 1934 was not good from the standpoint of injuries and August in particular was a high-cost month. Starting with the first pay period in September, therefore, the company went to every miner with prizes, consisting of a 12-lb. sack of flour to every man in every section finishing the pay period without a lost-time injury. The same plan was followed in the second pay period, with the further provision that men in sections finishing two periods without injuries received a 24-lb. gift of flour, instead of 12 lb. The flour was put up in cloth bags imprinted with the slogan, "Safety pays in many ways."

The result was a substantial reduction in the cost of injuries in September, and the plan therefore was continued through the next three pay periods with 4- and 8-lb. pails of lard as the prizes. The plan was successful in implanting the idea of group responsibility in the minds of the men, and the cost of injuries for the five periods, plus the cost of the prizes, was slightly less than the bogey set up by the company. The principal objection was that a serious injury in only one section might cost the company heavily while it was laying out money for prizes in the other sections.

A lottery plan was next adopted to run

to April 1, 1935. Under this system, men in sections working a full pay period without injuries each received a ticket allowing them to participate in a drawing for dinner buckets (bearing the Sahara shield and safety slogan) and safety shoes, as well as in the grand drawing on April 1 for prizes headed by an automobile. For two consecutive periods, two tickets were awarded for the second period, etc., thus giving the men in these sections a better chance in the grand drawing, although not in the regular drawing.

Results of the lottery plan were not so striking as those attained in the flour-and-lard period, although it is believed they would have been better had the lottery plan been adopted first. In this and the other appeals tried, the major problem was one of getting the men to talk and think safety. Best results, Mr. Halbersleben declared, were obtained in the first-aid-training and flour-and-lard periods, "because every man was reached by the company and it was to his benefit to see that his fellow workman was a safe workman."

Development of portable d.c. conversion units for underground service, perfection of a flameproof cooling and insulating liquid for transformers with the desirable characteristics of mineral oil, and the introduction of the mercury-arc rectifier for converting alternating to direct current are the major advances in electrification in recent years, said B. R. Connell, industrial engineer, General Electric Co. In the case of the mercury-arc rectifier, factors which are advantageous under all or certain conditions are: no moving parts; noiseless operation; ability to withstand overloads; elimination of commutators and brushes and external arcing or sparking; light weight; long life; and adaptability to several types of control equipment.

Comparison of the rectifier with other types of conversion equipment show: floor space—least, m.-g. set; greatest, rectifier; weight—approximately the same; maintenance—approximately the same as m.-g. set or slightly less than converter; efficiency—rectifier good at light loads and exceeded only by converter at full and overloads; rectifier efficiency higher at higher voltages; power-factor-corrective capacity—rectifier offers little without special equipment.

Fundamental factors in coal cleaning were discussed by Henry F. Hebley, research engineer, Allen & Garcia Co., who divided impurities into three classes in accordance with their origins: natural ash in the vegetation from which the coal is derived; layers of clay and sand deposited at the time the coal was laid down; minerals (limestone, gypsum, pyrites, etc.) deposited from water flowing through the coal; and dirt from roof, floor and cuttings.

Principles available in the cleaning of coal include: density separation, involving liquids heavy enough to float the coal while the heavier refuse sinks, generally too expensive except for testing; addition of sand, finely ground spar or clay to water to secure the same effect as density separation; use of an upward current of water, as in the jig; use of launders to separate coal, which tends to form cubes, and refuse, which is more or less flat, through the stratifying action of a flowing stream of water; use of the same difference in shape, together with the difference in friction, in the dry cleaning of coal on such equipment as spiral separators, mechanical picking tables and some air tables; use of rotary breakers employing the difference in the ease with which coal and refuse break up; and use of the difference in the "springiness" of coal and refuse. In the case of very fine particles, the "river-flow" principle is employed to a certain extent with wet, or concentrating, tables, and the difference in "wettability" between coal and refuse in froth-flotation processes.

Use of water for coal cleaning brings up the drainage problem for sizes under ½ in. Over this limit, gravity drainage generally is sufficient to avert trouble. The drainage difficulty increases with the fineness of the coal, as the surface to be wetted is greatly increased and the tendency to pack together is enhanced. Provided no pieces less than 1/100 in. are present, fines may be placed in perforated baskets, which are spun at high speed to remove the moisture. Such machines can reduce moisture from 20 to 7 per cent.

When other means of removing moisture must be resorted to, heat comes into the picture. Heat, however, is not enough, declared Mr. Hebley, as the moisture must be carried away as fast as the coal gives it up. Therefore, hot furnace gases, tempered with air, are passed through the coal mass to provide the heat necessary to change the moisture to vapor and then absorb the vapor and carry it out of the dryer. The higher the temperature, within practicable limits, the more moisture the air will carry. Care must be taken, however, that the water taken up by the gases is not precipitated before removal by a drop in the temperature. Also, the gases must have sufficient velocity to cut away the layer of vapor surrounding each coal particle so that the water underneath can be taken up.

Illinois Leaders

T. J. THOMAS, president, Valier Coal Co., Chicago, was elected president of the Illinois Mining Institute at its 43d annual meeting, held at Springfield, Ill., last month. Mr. Thomas succeeds C. J. Sandoe, vice-president, Perry Coal Co., St. Louis, Mo.

W. J. Jenkins, president, Consolidated Coal Co. of St. Louis, St. Louis, Mo., succeeds Mr. Thomas as institute vice-president, and B. E. Schonthal, president, B. E. Schonthal & Co., Chicago, was reelected secretary-treasurer.

Executive board membership for 1935-1936 is as follows: W. C. Argust, general superintendent, Peabody Coal Co.; W. J. Austin, Hercules Powder Co.; Carl Elshoff, president, Mine B. Coal Co.; Charles F. Hamilton, president, Pyramid Coal Corporation; John E. Jones, safety director, Old Ben Coal Corporation; Dr. M. M. Leighton, chief, Illinois Geological Survey; James McSherry, director, Illinois Department of Mines and Minerals; F. S. Pfahler, president, Superior Coal Co.; C. J. Sandoe, vice-president, Perry Coal Co.; H. H. Taylor, Jr., vice-president, Franklin County Coal Co., Inc.; H. A. Treadwell, general superintendent, Chicago, Wilmington & Franklin Coal Co.; Paul Weir, vice-president, Bell & Zoller Coal & Mining Co.

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Pointing out that the sulphur content of coal ranges from ½ to as high as 10 per cent, W. D. Langtry, president, Commercial Testing & Engineering Co., declared that its origin was not nearly as important as its elimination or modification of its effects. Sulphur affects the sale of coal; offers difficulties in the manufacture of coke and gas; is a factor in spontaneous combustion, disintegration of coal in storage and the formation of clinkers; causes changes in the appearance of coal in transit; forms sulphuric acid in the presence of water; and is a factor in the emission of "white smoke," which is decidedly sulphurous, corrosive and injurious to health.

Generally speaking, volatile sulphur is approximately one-half the total. It is, however, just as detrimental in many cases as fixed sulphur. In burning the coal, about 90 per cent of the sulphur also is burned, the remainder going into the ash, usually in combination with lime. The burnt sulphur passes off as the dioxide or trioxide, with some small part as hydrogen sulphide. Some of the sulphur is trapped by soot. Where the gas combines with water, forming sulphuric acid, corrosion of metal is a possibility. The trend of stoker development, however, seems to indicate a substantial decrease in sulphur difficulties in the future. From the standpoint of damage to plant equipment, said Mr. Langtry, all deposits in passages and openings are sources of danger, and therefore should be removed as soon as possible. Where the plant is kept clean, there is little difference in the rate of corrosion between coals regardless of their sulphur content.

The companies and institutions represented in the exhibits at the meeting were:

Air Reduction Sales Co., American Brattice Cloth Co., American Steel & Wire Co., American Cable Co., Atlas Powder Co., Automatic Reclosing Circuit Breaker Co., Carroll Chain Co., Central Mine Equipment Co., Chicago Pneumatic Tool Co., Clarkson Mfg. Co., Duncan Foundry & Machine Works, Eagle Iron Works, Egyptian Iron Works, Electric Railway Improvement Co., Evansville Electric & Mfg. Co.

General Electric Co., W. M. Hales Co., Hercules Powder Co., Illinois Department of Mines and Minerals, International Shoe Co., Keystone Lubricating Co., Koppers-Rheolaveur Co., A. Leschen & Sons Rope Co., Link-Belt Co., Macwhyte Co., Mine Safety Appliances Co., Modern Engineering Co., National Electric Coil Co.

Ohio Brass Co., Portable Lamp & Equipment Co., Post-Glover Electric Co., Frank Prox Co., H. H. Robertson Co., John A. Roebling's Sons Co., Simplex Wire & Cable Co., George W. Snarr Co., Socony-Vacuum Oil Co., Southwest Bolt & Nut Co., Standard Stamping & Perforating Co.

Timken Roller Bearing Co., Tyson Roller Bearing Corporation, U. S. Bureau of Mines, University of Illinois, Upson-Walton Co., Watt Car & Wheel Co., Westinghouse Electric & Mfg. Co., West Virginia Rail Co., I. B. Williams & Sons, Ayer & Lord division, Wood Preserving Corporation.

C. W. Watson Named Trustee

Clarence W. Watson, formerly U. S. Senator from West Virginia, was appointed temporary trustee of the Elk Horn Coal Corporation by Judge Nevin in the U. S. District Court at Cincinnati, Ohio, on Oct. 30. The appointment was made as the result of an application by the company filed in an answer to involuntary proceedings under the corporate reorganization amendment to the bankruptcy act. Seventy-five per cent of the company's bond and note holders are reported to be in favor of the reorganization. Mr. Watson was appointed receiver for the company in 1931.

Consumer Spokesmen Forecast Higher Demand At A.I.M.E. Coal Division Meeting

INCREASED DEMAND for bituminous coal in railroad-fuel service, general industry and public utility power-plant uses was forecast by spokesmen for those consuming groups at the fall meeting of the Coal Division of the American Institute of Mining and Metallurgical Engineers, Coronado Hotel, St. Louis, Mo., Oct. 28. If the coal industry is to capitalize fully on the possibilities and retain the position in power generation to which it is economically entitled, however, producers, it was argued, must show greater leadership in promoting more efficient combustion methods. In addition to this broad treatment, two of the seven papers presented dealt with Illinois marketing and preparation problems and a third with the geology of coals in the Southwest.

Despite a decline of 36.8 per cent in railroad consumption between 1929 and 1934, while total soft-coal production had decreased only 33.0 per cent and fuel-oil consumption by Class I carriers dropped 28.9 per cent, Eugene McAuliffe, president, Union Pacific Coal Co., visioned a slow upturn in railroad-fuel demands. "I believe," he said, "that railway transportation will now gradually expand in volume and character of service and that our bituminous coal supply, far exceeding our oil reserves in production life, will continue to fuel our American railways." With railroad management developing more comfortable, dependable and economical service to meet competitive forms of transportation, "the nation's traffic—freight and passenger—is even now turning back to the railways."

Must Conserve Oil Supplies

Changes in the relative costs of oil and coal or legislative measures, or possibly both, will develop a national tendency to conserve oil now used for steam making to protect the requirements of international-combustion engines and for lubricants. Too little attention, declared Mr. McAuliffe, has been given to demands for lubricants, which now far exceed any possible world supply of animal fats. Diesel locomotives as a serious competitor of the steam locomotive, he intimated, have been greatly overrated. To attain safety with speed means higher capital investments in equipment and possibly increased operating expenses in handling slower moving traffic. Moreover, "the maximum speed in miles per hour ever obtained by the very latest type of diesel-driven passenger train was equalled or exceeded forty years ago by non-streamlined locomotives and passenger trains built under the standards of that day." Reduction in unit fuel consumption in railroad service undoubtedly will continue, but probably on a somewhat smaller scale.

E. G. Bailey, vice-president, Babcock & Wilcox Co., expressed surprise that the speaker had ignored stoker-fired locomotives in discussing efficiency in railroad operation. Traffic, answered Mr. McAuliffe, frequently is a greater factor in purchases than firebox efficiency. Carriers serving the coal fields must strike a balance between the traffic requirements of the industry on their rails and what can be used in the locomotive firebox. Indirectly, he conceded, stokers had resulted in fuel economy by making it possible to use larger equipment and haul bigger loads; hand firing would be out of the question with some of the heavier tonnage trains.

Marked growth in tonnages for stationary power purposes seemed probable to E. H. Tenney, chief engineer of power plants, Union Electric Light & Power Co., St. Louis. This prediction was based upon increasing per capita consumption of power; limitations to the supply of oil and gas; "the apparent economic saturation, barring political subsidy, in hydro plant construction"; flattening out in the rate of increased efficiency in coal utilization and "the possibilities of reducing the cost of coal burning." Exploration of these possibilities by the coal industry, he said, will promote the use of more coal by the power industry.

In the face of depression declines in industrial and commercial sales, the public-utility domestic load, Mr. Tenney pointed out, has continued to increase "until now the total electric-power consumption has reached a new maximum." Although consumption of coal per kilowatt-hour has been cut from 3.2 lb. in 1919 to 1.45 lb. in 1934, the actual tonnage used by public utility power plants has been reasonably constant—35,000,000 tons in 1919 and 33,550,000 tons in 1934. Fuel-oil consumption, on the other hand, has shown a sharp decrease since 1924. Use of natural gas has been greatly increased since 1928, but this increase, in the opinion of Mr. Tenney, is "a depression and distress-market situation" which will not continue when more profitable outlets can be found by the wells.

Except possibly in the oil fields, stationary gas-engine developments, he stated, are practically at a standstill. No appreciable improvement has been effected in the economy of the diesel engine since the first one was built many years ago. "Steam plants increase rapidly in efficiency as they increase in size, but the small diesel is practically as economical as the large and the cost per unit of capacity is almost the same. It is unlikely that any but the smallest coal-fired steam plants should face any competition from the diesel plant."

Higher Oil Prices Forecast

In the case of oil, the user must face the specter of diminishing supply and higher prices. "The latest semi-authoritative study of the situation indicates known recoverable oil reserves in the United States to be 12,000,000,000 bbl.—enough for only thirteen years at the 1934 consumption rate." Still more significant is the slump in the annual rate of discovery of new pools: between 1931 and 1934, the new wells brought in produced an average of 580,000,000 bbl., against a discovery rate of 1,990,000,000 bbl. during the 1926-30 period. Economic development of new hydro-electric power is distinctly limited and since 1919 there has been little change in the relative positions of coal and hydro plants in the growth of electric generation.

The industry can assist materially in maintaining coal as a primary source of power in the future, declared Mr. Tenney, by a better technical understanding of power-plant problems. "For smaller plants in particular, the coal industry can actually take the initiative in showing operators how to operate more cheaply and to better advantage with coal, whether it be along the lines of continued use of old equipment, an increased rate of output through more effective methods of operation, or any other way that will tend to preclude the encroachment of competitive fuels. This will require a technical knowledge of the factors that determine not only fuel economy in boiler rooms but the operating expense, the maintenance, and the cost of the coal-burning equipment, all of which will determine the competitive position of coal.

"1. A factor that might well engage the attention of the coal men is the amount and composition of the ash content. Furnace heat liberations will vary from 12,000 B.t.u. per cubic foot per hour to 60,000 B.t.u., depending on the tendency of the ash to clinker on stokers or to plug up the gas passages between the boiler tubes in pulverized-coal firing.

"2. In plants using pulverized fuel another coal factor is that of the expense of grinding and the fineness of grind possible with a given fuel. This factor follows from coal hardness, the tonnage to be prepared for a given heat content (ash having no value) and the tendency of moisture combination with such material as clay to become sticky and plug up the pulverizing mills.

"3. Water treatment both before and in the boilers can effect considerable savings. Scale causes a loss in boiler capacity and is expensive to remove. This expense, as well as loss in efficiency, damage due to corrosion and priming, loss in running capacity and periodic outage of equipment, could all be avoided by properly treated and controlled boiler water.

"Finally, coal operators in meeting the pressure of other fuels and the burden of a higher price on their own can advisably watch developments in the art of firing and keep in mind the status of their own particular coals as it is affected by such developments."

Mr. Tenney's appeal to the coal industry to equip itself to give technical counsel to consumers was warmly indorsed by J. E. Tobey, manager, fuel engineering division,

Coal the Most Efficient

"NEITHER OIL NOR GAS can compete with coal on a cents per million B.t.u. basis in the greater part of the country. Their use under boilers is economically unsound except for unusual conditions, such as temporary arrangements where the steam-raising equipment is in too poor a condition to properly burn coal or where excess gas must be dumped pending more logical markets. It is also significant that, compared with modern coal-firing methods under all but very small boilers, oil and gas are inherently at a disadvantage because of the hydrogen losses in their combustion."—* *E. H. Tenney, at Coal Division Meeting of A.I.M.E.***

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Appalachian Coals, Inc. "If we don't," he remarked, "our competitors will." Mr. Tobey also made the point that development of off-peak loads would open the market to increased use of coal in electrochemical and electro-metallurgical processes. While the installed capacity of generating equipment in utility and private plants in the country is approximately 40,000,000 kw., from the standpoint of hours per year, this equipment is operated at only approximately one-third of its total capacity. With fixed charges already covered in original and peak-load periods, power generated in off-peak periods could be sold at little more than fuel cost.

Mr. Tobey voiced the opinion that the use of fuel oil in stationary power plants was on the wane and gas was only a passing threat. The increase in the domestic load during the past few years, he said, presaged an accelerated demand in the post-depression period. While a slight increase in coal prices seemed inevitable, the increase, he said, would be largely offset by improved quality of the product shipped from the mines. This conclusion, he felt, was justified by the activity in the building of new preparation plants.

Ninety per cent of the pay load for power consumption, asserted a written discussion of Mr. Tenney's paper by Allen J. Johnson, director, Anthracite Institute Laboratory, lay east of the Rocky Mountains, but only 30 per cent of the available hydro possibilities are in that Eastern area. He saw almost unlimited possibilities for growth in the use of coal in the manufacture of producer gas. Some gas engines, he said, had produced power with a coal consumption of 1.35 lb. per kilowatt-hour. Developments in gas engines had been particularly notable in Europe.

What Determines Fuel Values?

The value of any coal for steaming purposes, declared Henry Kreisinger, research engineer, Combustion Engineering Co., Inc., in a paper on that subject, depends upon four factors: (1) the quantity of steam made per pound of coal, (2) attention which must be given the fire in burning the coal, (3) cost of maintenance of steam-generating equipment, and (4) outage of that equipment for external cleaning and repairs. In determining the value of a given coal in relation to these factors, the author listed B.t.u. content; percentages of moisture, ash and sulphur; ash fusibility; grindability and friability; and the percentage of fines in commercial shipments as the most important chemical and physical properties. Since no standard methods of determining grindability or friability have been established, however, these properties may be disregarded in setting up comparative price bases.

As a tentative method of price adjustment, Mr. Kreisinger assumed a base coal with the following specifications:

B.t.u. per pound	14,000
Moisture (per cent)	2
Ash (per cent)	7
Sulphur (per cent)	1
Fusibility (deg. F.)	2,600
Fines (per cent)	25
Price, f.o.b. mines	$2.00

In fixing relative prices on other coals, he proposed a formula under which there would be (1) a deduction from or addition to the mine price of the amount proportional to 2½ times the difference in B.t.u. content between the base coal and the coal to which the formula was applied; (2) a deduction of 2c. per ton for each per cent of ash above 7 per cent, with no premium for coal with an ash content under 7 per cent; (3) a deduction of 2c. per ton for each per cent of sulphur above 1 per cent; (4) a deduction of 3c. per ton for each 100 deg. in ash fusibility under 2,600; and (5) the deduction or addition of 2c. per ton for each 5 per cent in the percentage of fines over or under the 25 per cent base. Any changes due to differences in moisture content, he stated, would be taken care of by the adjustment for differences in heat value.

Application of this formula to the price determination for a 13,000-B.t.u. coal, it was shown in the author's paper, would penalize the shipper of that coal 35.7c. per ton for the difference of 1,000 B.t.u. between the heat content of his coal and that called for in the base-coal specifications. This penalty would be arrived at by the following calculation:

$$\frac{1{,}000\times 100}{14{,}000}=7.14\times 2.5\times \$2.00=35.7\text{c.}$$

Use of this formula, which, Mr. Kreisinger later explained, had been submitted to one of the subdivisional code authorities as a basis for price correlation of mine quotations under the NRA bituminous code, was sharply attacked by Gerald B. Gould, president, Fuel Engineering Co. of New York, and J. B. Morrow, preparation manager, Pittsburgh Coal Co. The author, asserted Mr. Gould, apparently was confusing price with value. If, for example, plant conditions are such that a particular industry must use coal with a minimum ash-fusion temperature of 2,600 deg., fuel with a lower ash-fusion point has no value for that plant regardless of the price at which it may be offered. Price, he added, simply reflects consumer preferences and consumer requirements.

Any attempt to set a value on coal is difficult, said Mr. Morrow, because coal itself is so varied and variable. While Mr. Kreisinger's formula might work fairly well for coal used on underfeed stokers, it would not be applicable to coal used with many other types of burning equipment. The ash-fusion point alone, insisted Mr. Morrow, does not tell the whole story on clinkering. Much depends upon the character of the ash; coal with a limey ash fusing at 2,200 deg., for example, may give results equal to those secured from a coal with a high-iron ash fusing at 2,500 deg. Where slag-tap furnaces are used, coal with a low-fusing ash is in demand. Some industrial plants sell their ashes, while others must pay to have them hauled away. High-sulphur Pittsburgh coals, he pointed out, are harder in structure and carry a smaller percentage of fines than some of the low-sulphur coals.

Although "the bituminous-coal industry faces a real problem if it desires to retain the position in the power-generation field to which it is economically entitled," producers and coal-carrying railroads as a group, declared Mr. Bailey, have been very backward in cooperating with the power-plant owner. Their record on the score of contact and acquaintanceship with the manufacturer of steam-generating equipment and his problems is still worse. The manufacturers themselves, he admitted, only recently have undertaken "the coordination and joint development of fuel-burning and steam-generating equipment on an extended scale."

Need Cooperative Campaign

The most constructive policy the coal industry can follow, said Mr. Bailey, "is to minimize competition within itself, both as to individual companies and different districts, and face the common problem with the equipment manufacturer and the power-plant owner for a better solution. All bituminous coal has enough volatile, tar and smoke-producing matter, and enough ash, so that the fundamental problems that are common to all coal should be worked out collectively. The ultimate goal should be a universal furnace in which any coal, of whatever rank or grade, can be so efficiently burned that other fuels will be able to compete only when their price and B.t.u. value justify their use."

In most cases, coal should enjoy an initial advantage over rival fuels because "energy can be transported more cheaply in coal cars than in electrical transmission lines, gas or steam pipes." Choosing the wrong grade or size of coal, improper combustion methods, and equipment that is obsolete or unsuited to the particular job, however, all help to deprive coal of this advantage and to build up a prejudice against its continued use. In addition, said Mr. Bailey, coal also labors under three distinct handicaps in the competitive race: (1) It cannot be handled as conveniently as fluid rivals; (2) the composition of its combustible is more complex and, therefore, efficient and smokeless combustion is more difficult than with gas or oil; (3) the ash is a serious deterrent to high ratings and efficient heat absorption.

While readily admitting that reduction

Mine Power-Plant Sales Laboratories

"COAL-MINE POWER PLANTS offer excellent opportunities for the producer to install modern, or even experimental, equipment to advance the art of burning coal and a place to which he could take his customers to learn how their plants could be improved. Such opportunities are seldom recognized or utilized. Prospective customers of coal-burning equipment often travel great distances to see some new type of equipment in operation, perhaps burning a coal different from the coal they will burn. Sometimes they even ship to other plants, at great expense, some of the coal that normally they burn or wish to burn to make sure that it is suitable to the equipment they contemplate purchasing. How much simpler and how much more effective in his sales effort it would be if the coal producer could demonstrate his own coal at his own mine power plant on the most modern burning equipment best suited to it."—*From an address by E. G. Bailey before the Coal Division of A.I.M.E.*

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in ash and sulphur content and an increase in B.t.u. content raises the value of the coal, Mr. Bailey expressed the belief that some expenditures for preparation plants have been carried beyond their economic limit. The increased cost of sizing and cleaning, he said, is "often out of proportion to the added utility of the product." Present-day combusion equipment, it is true, places distinct limitations on the character and quality of the coal which may be successfully used with it, and the producer cannot ignore this situation. But, he added, the coal operator also "should remember that every economic trend will be in the direction of getting away from such limitations and toward getting better efficiency out of low-grade, low-cost fuel."

General agreement with Mr. Bailey's presentation was voiced by Mr. Tenney, who thought that the lack of cooperation between coal producers and consumers which both had stressed in their papers had been due to a failure to realize the great importance of the subject. While agreeing that the basic problem of the industry was to deliver heating value as cheaply as possible, John Griffen, Koppers-Rheolaveur Co., said that he could not see eye to eye with Mr. Bailey on preparation trends. Through mechanization and improved mining practices, he pointed out, pit-mouth costs had been reduced, but these methods also had resulted in increasing the quantity of impurities which must be removed in surface preparation.

Must Consider Ultimate Use

Design of a modern preparation plant, stated Henry F. Hebley, Allen & Garcia Co., in a paper on coal cleaning in Illinois, must give consideration to the ultimate use to which the product handled through it is put. A certain quantity of ash, for example, is desirable to cover the rear end of a chain-grate stoker to shield the metal links from the heat of the furnace. Too great a percentage of fines may cause excessive fly ash and uneven combustion in underfeed and chain-grate stokers. The best size for domestic stokers is still a subject of debate. In the case of coal to be burned in pulverized form, the effect of moisture, ash and pyrite on grindability becomes a factor in the cleaning problem.

In many modern washing plants, it has been thought advisable to treat finer sizes, such as 5/16-in. x 0, on air tables because, if water is used, it will become contaminated with fine coal dust, disintegrated clay and other fine impurities. With wet cleaning, continued Mr. Hebley, water in sufficient quantities is often difficult to obtain. In strippings, where water may have collected over many years, some of the old excavations can be used as reservoirs and settling basins. Presizing the feed and putting the various sizes through the different jigs only once may be necessary in order that refuse and impurities which "slime" quickly may be in contact with the wash water the shortest time possible. Such a system, however, requires a much larger quantity of water per ton of coal than when an unsized feed is treated.

If the water in the settling equipment is rendered alkaline—with a pH value of about 11—by the addition of caustic soda and starch, the thickened sludge will be deposited rapidly. This treatment permits the use of smaller settling equipment and yields a product less coated with coal dust and clay. Such coatings detract from the appearance of the coal and increase sales resistance. One Illinois stripping operation, said Mr. Hebley, has successfully overcome this drawback by selling on a "performance only" basis, but that cannot always be done in the domestic market where appearance is rated so highly.

Eugene McAuliffe
Nominated for Chairman of Division

Make-up water is frequently introduced in the fine sprays over screens at pressures up to 25 lb. per square inch. As a rule, however, explained Mr. Hebley, only the last bank of sprays can be so supplied because enough water is not available. The rest of the water can be obtained from a pond fed by circulation water which is allowed to clarify by settlement. If the raw feed has been freed of its minus 48-mesh material, a 5/16-in. x 48-mesh material can be obtained by passing the coal over ½- or ¼-mm. dewatering screens. This coal can be dried to 8 per cent moisture on a centrifugal and can be shipped in freezing weather without causing much trouble. Although there is some degradation, the quantity is relatively unimportant in so fine a size.

Although sampling is indispensable as a source of data upon which cleaning plants are designed and furnishes the basis for the performance record of plants built, its complexities, asserted Mr. Hebley, are little understood or considered by most coal operators. How the sample is taken and its "representative" character are extremely important. In the quartering and requartering of even a large sample, a wholly unrepresentative piece of rock may find its way into the small quantity of selected material used in the final analysis and cause that analysis to show an excessive percentage of ash. Coal is not a simple structure and "the chances that one sample will show the true value of the coal are remote."

Analysis gives the final measure of the results of the coal-cleaning equipment. Most modern installations, said Mr. Hebley, include laboratories with float-and-sink stations for checking the washery results. Continual proximate analyses, however, are expensive, and if, in addition, the calorific value of samples is required, the testing costs will be high. Part of this cost, he stated, may be avoided by the use of the Parr formula in conjunction with the proximate analysis, since unit-coal calorific values have been worked out under the Parr formula for most of the producing districts of Illinois.

Illinois Faces Stiff Competition

In discussing the economic and competitive position of Illinois coals, Walter H. Voskuil, mineral economist, Illinois State Geological Survey, presented a detailed analysis of fuel movements into the Upper Mississippi Valley States. This area—Illinois, Missouri, Iowa, Minnesota, Wisconsin and parts of the Dakotas, Nebraska and Kansas—absorbs 90 per cent of the Illinois output. At every point, however, Illinois must meet the competition of other coals and rival fuels. In the Southwest, fuel oil and gas dominate; in trans-Missouri territory, Illinois must sell against coals from Colorado, Wyoming and Montana. Appalachian coals move in large volume to Wisconsin and Minnesota and also vie with Illinois in the Chicago area.

Future developments in marketing Illinois coal in the Upper Mississippi Valley, he concluded, will depend upon trends in general fuel demand, coal shipments from the Appalachian region and the trends in oil and gas production and marketing. While coal demand doubtless will show a substantial recovery from depression levels, increased efficiency in utilization will militate against a return to the peak figure of former years. Wage-rate advances and price control may check further increases in shipments from the Appalachian fields into Illinois market territory. Emphasizing the sharp decline in the rate of discovery of new oil pools in the past four years, Mr. Voskuil expressed the opinion that fuel-oil competition "is likely to become less critical as the problem of finding a new supply equal to the annual demand becomes more costly." Natural gas, on the other hand, promises to be a disturbing factor for some years. Discussion of Mr. Voskuil's paper was deferred

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Coal Division Nominees

EUGENE McAULIFFE, president, Union Pacific Coal Co., was nominated for chairman of the Coal Division of the A.I.M.E. for the 1936-37 term at the annual fall meeting of the division at St. Louis, Mo., on Oct. 28.

J. B. Morrow, preparation manager, Pittsburgh Coal Co., was nominated for the post of vice-president, and H. E. Nold, professor of mining engineering, Ohio State University, was renominated for the position of division secretary.

E. A. Holbrook, dean of the school of engineering and mines, University of Pittsburgh; Edmund L. Dana, mining engineer, Haddock Mining Co., and Otto Herres, Jr., vice-president, United States Fuel Co., were the choice of the nominating committee for membership on the executive committee of the division.

The candidates named will be voted on by letter ballot.

until the annual meeting of the A.I.M.E. in New York next February.

Cyclothems—groupings of strata repeated again and again in the same order—occur in the coal measures of the Pennsylvania period, stated C. M. Young, professor of mining engineering, University of Kansas, in a paper on the Pennsylvania coals of Iowa, Missouri, Kansas, Oklahoma and Arkansas. Quoting Wanless and Weber ("Correlation and Extent of Pennsylvanian Cyclothems," Bulletin, Geological Society of America, Vol. 43, p. 1004), he divided these cyclothems, numbering them from the lowest strata upward, as follows: Continental sediments, (1) sandstone unconformable on lower beds, (2) sandy shale, (3) limestone without Marine fossils, (4) underclay, (5) coal; marine sediments, (6) black sheety shale with large concretions, (7) limestone with marine fossils, and (8) shale with "ironstone" nodules and bands. The repetition of such groups of rocks, he said, indicates subsidence followed by deposition of sandstone, then shale and limestone, then re-elevation and so on up to the final shale that emerged to be eroded until it in turn was submerged and covered with sandstone.

How Old Are Southwestern Coals?

Coals of the Western Interior Province, continued Dr. Young, might be of the same period as coals in other provinces or in other parts of the same province, but it does not follow that they were deposited in continuous coal beds, though the areal extent of some beds is truly remarkable. The Williams coal of Missouri, which is the Whitebreast of Iowa, is probably the same as the No. 2 seam in Illinois. The Mystic coal, which in Iowa extends over an area of at least 275,000 acres except where removed by old erosion channels, is notable both for its consistent thickness, which does not vary more than a few inches either way from 30 in., and for the persistence of a clay parting ½ to 2 in. thick in the middle portion of the bed. One can hardly doubt, observed Dr. Young, that this parting "is our old friend the 'blue band' of Illinois No. 6 coal."

The meeting closed with an informal banquet at which Howard N. Eavenson, past president, was toastmaster and talks were made by H. A. Buehler, president; John T. Ryan, retiring chairman of the Coal Division; E. H. Robie, assistant secretary, A.I.M.E.; Eugene McAuliffe; and K. H. McNeill, agent, Fife Coal Co., Kelty, Scotland. The next day, a bus tour of the southern Illinois coal field was made, with stops at the New Orient mine of Chicago, Wilmington & Franklin Coal Co.; Fidelity mine of the United Electric Coal Cos., Pyramid mine of Binkley Coal Co., Zeigler mines of Bell & Zoller Coal & Mining Co., and the low-temperature carbonization plant of the Radiant Fuel Corporation at West Frankfort.

Horace Hammond Is Dead

Horace Hammond, president of the Alabama By-Products Corporation, died Nov. 7 at a Birmingham (Ala.) hospital after a long illness. He was 58 years old.

Born in Shelby County, he became clerk of the Probate Court there at the age of 16. Five years later he went to Birmingham and became associated with Col. T. G. Bush, president, Alabama Coal & Iron Co. In 1905 he was appointed assistant to the president and general sales manager of the Alabama Consolidated Coal & Iron Co., serving in that capacity for several years. In 1918 he helped organize the Birmingham Coal & By-Products Co., which was merged two years later with the Imperial and Majestic coal companies under the name of the Alabama By-Products Corporation. The Pratt Consolidated Coal Co. and the Globe Coal Co. were acquired in 1925, giving the company control of 110,000 acres in the Warrior coal fields.

The late Horace Hammond

In February, 1932, Mr. Hammond was elected president of the Alabama By-Products Corporation, which is the largest commercial coal producer in the State and the largest operator of coke ovens on a strictly commercial basis in the South.

Industrial Notes

ARTHUR A. ARANSON has been appointed assistant to the president of the Crucible Steel Co. of America, effective Nov. 1. Previous to accepting the new post, Mr. Aranson had been associated for 30 years with the International Harvester Co.

HARRIS-GREEN Co., Farmers Bank Building, Pittsburgh, Pa., has been appointed district sales agent in western Pennsylvania, eastern Ohio and West Virginia by ROLLER-SMITH Co., New York, manufacturer of electric measuring and protective apparatus.

LINCOLN ELECTRIC Co., Cleveland, Ohio, has opened offices at 923 South Washington St., Peoria, Ill., under the direction of W. I. Miskee, and in Memphis, Tenn., under the direction of O. B. Farrell.

Executive offices of LINK-BELT Co., for many years located at 910 South Michigan Ave., Chicago, have been moved to the Bell Building, 307 North Michigan Ave.

ROBERT J. WORKING has been appointed district sales manager at Birmingham, Ala., for the REPUBLIC STEEL CORPORATION, succeeding Kenneth D. Mann, who resigned to become executive vice-president of the Truscon Steel Co. PAUL R. JOHNSTON succeeds Mr. Working as district sales manager at Cincinnati, Ohio. CHARLES W. EAST, formerly of the Birmingham office, has been named assistant manager of sales in Republic's pipe division, succeeding George E. Clifford, recently appointed district sales manager at Los Angeles, Calif. C. A. CHERRY has been appointed district sales manager at Buffalo, N. Y., replacing THOMAS R. DAVIES, who has been transferred to the alloy steel division in Massillon, Ohio, as special representative.

FRED MATHEIS, for many years in charge of department routine in the mechanical rubber goods division of the Thermoid Rubber Co., Trenton, N. J., has been elected assistant vice-president and will manage the office of that division, vice Lloyd Leaver. S. H. LYONS has been appointed Eastern manager of the sales department of the same division.

COMBUSTION ENGINEERING Co., INC., New York City, announces that Otto de Lorenzi has been appointed assistant general sales manager. Wilson Machinery & Supply Co., Inc., Lexington, Ky.; William Franklin, Buffalo, N. Y., and Industrial Combustion Co., Philadelphia, Pa., have been appointed representatives of the industrial stoker division.

Mine Fatality Rate Declines

Coal-mine accidents caused the deaths of 78 bituminous and 12 anthracite miners in October, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 36,697,000 tons, the bituminous death rate in October was 2.13 per million tons, compared with 2.85 in the preceding month, when 24,944,000 tons was mined, and 2.35 in October, 1934, in mining 32,807,000 tons. The anthracite fatality rate in October was 2.81, based on an output of 4,271,000 tons, as against 5.27 in the preceding month, when 4,172,000 tons was produced, and 5.50 in October, 1934, when production was 4,729,000 tons. For the two industries combined, the death rate in October was 2.20, compared with 3.19 in the preceding month and 2.60 in October, 1934.

Mechanical Stoker Sales Mount

Sales of mechanical stokers in October, 1935, totaled 10,038, of which 8,777 were small residential-size units, according to statistics furnished the U. S. Bureau of the Census by 108 manufacturers. This compares with sales of 9,919 units in the preceding month and 6,004 in October, 1934. Figures for the first ten months of 1935 show that 39,262 units of all types and sizes were sold, compared with 22,739 in the corresponding period of 1934. Sales by classes in the first ten months of this year were as follows: residential (under 100 lb. of coal per hour), 33,761; apartment house and small commercial heating jobs (100 to 200 lb. per hour), 2,522; general heating and small high-pressure steam plants (200 to 300 lb. per hour), 1,075; large commercial and high-pressure steam plants (over 300 lb. per hour), 1,904.

Government Wins First Guffey-Act Skirmishes But New Attacks on Law Multiply

INITIAL SKIRMISHES in the legal attack upon the constitutionality of the Bituminous Coal Conservation Act of 1935 were won by the government defenders of the Guffey-Snyder law last month. The right of Congress to enact regulatory measures was upheld in a sweeping decision handed down Nov. 14 by Judge Elwood Hamilton, U. S. District Court for the Western District of Kentucky. In an oral opinion given at the close of a late night session Nov. 27, Justice Jesse Adkins, Supreme Court of the District of Columbia, upheld the price-control provisions of the statute, but declared the labor sections invalid under the ruling of the Supreme Court of the United States in the *Schechter* case.

New attacks against the statute have been launched with increasing frequency since the National Bituminous Coal Commission promulgated its code and set the wheels in motion for district organization of the soft-coal industry (*Coal Age*, November, 1935, p. 475). Up to the end of November, 18 separate actions involving 63 companies seeking relief from the imposition of the tax and asking that the law be declared unconstitutional had been reported. Several additional suits were filed early this month. A temporary restraining order was issued by the federal court at Kansas City staying the imposition of the tax against a number of Southwestern producers pending a hearing set for Dec. 9.

Opponents Challenge Constitutionality

Most of the companies attacking the act challenge its constitutionality, charging that it violates the Fifth and Tenth amendments, unlawfully attempts to delegate legislative power and is in conflict with the commerce clause in attempting to regulate intrastate commerce. The Pittsburgh Coal Co. also alleged that compliance with the act would deprive it of competitive business advantages it now enjoys by ownership and operation of its private water and rail transportation facilities and that it would lose many of its lawful existing contracts, at prices named therein, which the "act and code purport to render invalid and unenforceable." Several Kentucky companies set up as a plea for non-compliance that if they accepted the code they would violate the federal anti-trust laws.

The Adkins decision came at the end of two days' final arguments in proceedings instituted by James W. Carter, president, Carter Coal Co., to prevent that company from accepting the code and the government from collecting the 15 per cent tax (*Coal Age*, October, 1935, p. 429). The court on Oct. 30 declined to enjoin the internal revenue agents, but did issue an injunction *pendente lite* against the coal company. At the same time, however, Mr. Carter was required to post a bond for $15,000 to indemnify the company for any loss it might suffer as a non-code member. Immediate action on appeal from this decision was refused by the Supreme Court of the United States.

In the trial of the cause on its merits, which lasted ten days, the government, over repeated objections by counsel for the plaintiff, presented an array of witnesses and exhibits to establish the interstate character of the bituminous industry, labor conditions, the effects of disparate wage rates on competitive marketing and how strikes had interfered with the free flow of commerce. F. G. Tryon, U. S. Bureau of Mines, was the first government witness. He was followed by Charles O'Neill, president, Eastern Bituminous Coal Association; H. L. Findlay, vice-president, Youghiogheny & Ohio Coal Co.; George W. Reed, vice-president, Peabody Coal Co.; C. W. Watson, trustee, Elk Horn Coal Corporation; E. C. Mahan, president, Southern Coal & Coke Co.; W. P. Tams, Jr., president, Gulf Smokeless Coal Co.; W. A. Richards, president, Sovereign Pocahontas Co.; Philip Murray, international vice-president, United Mine Workers; Isador Lubin, commissioner of labor statistics; F. E. Berquist, NRA; George H. Ashley, Pennsylvania State geologist, and several social workers. Mr. Carter was the principal witness for the plaintiff's side.

No Labor Standards Set

In rejecting the labor features of the act, Justice Adkins held that since Congress had set up no standards to govern the administration of paragraph (g), Part III, Sec. 4 (which provides that when two-thirds of the employers and a majority of the employees have agreed upon hours and wages such agreements shall be binding on all producers), the provision is invalid under the decisions in the *Schechter* and *Oklahoma Refining Co.* cases. Moreover, the former decision specifically held that such power could not be delegated to private individuals and that wages paid in local commerce do not have a direct influence in interstate commerce and, therefore, do not come under the control of Congress.

Although conceding that the right of Congress to fix prices is shadowed by some doubt, "it seems to me," said Justice Adkins, "that the power is within the power delegated to Congress by the commerce clause and it is my duty to sustain it in this particular case." Bituminous coal, he pointed out, is found in 26 States and shipped to practically all. Coal from one State competes with coal mined in other States; about 50 per cent of the output moves across State lines and about 25 per cent is used by interstate carriers. It also is agreed that sales of coal in interstate commerce are themselves interstate commerce. Prices have been subject to wide fluctuations, and threats of stoppages, with attendant interference with commerce in coal and commerce in general, have been frequent. These are the conditions facing the industry, and "the question is, Has Congress the right to regulate interstate commerce in coal because of these conditions?"

"It seems to me," said Justice Adkins, "that there is a real analogy between the right of a State to regulate a local commerce and the right of Congress to regulate the national commerce." Decisions in several States have held that coal is affected with a public interest and, therefore, comes within the regulatory power of the States. As to how far this power can extend, Justice Adkins cited the opinion in the *Nebbia Milk* case, which he analyzed to show the similarity in conditions in that industry to those in the bituminous coal industry, as brought out by the findings of facts. In that case, "the court concludes that the legislature need not stop at acts which will indirectly affect the price, but that if, in the opinion of the legislature, the particular industry so affects the vital economic life of the State as to make price-fixing necessary, then the legislature has the right to do it."

Price-fixing provisions of the Guffey-Snyder act also are valid from the standpoints of delegation of authority and the establishment of standards by Congress. Justice Adkins, however, refused to agree that under Sec. (a) of Part II (Marketing) "stabilization of wages and working conditions and maximum hours of labor is inextricably tied in to the fixing of prices." While admitting that Congress had in mind the stabilization of the industry in addition to the regulation of commerce, Justice Adkins pointed out that he had already ruled that the latter was within the power of Congress and declared his understanding that the law provided that the expression of any other purpose did not invalidate the statute. Since the price-fixing portion of the statute is held valid, "it follows that the tax is valid."

Hamilton Sustains Statute

The Guffey act was adjudged constitutional by Judge Elwood Hamilton, in federal District Court at Louisville, Ky., Nov. 14, in the suit of the R. C. Tway Coal Co. and eighteen other companies in the Harlan field of Kentucky which challenged the validity of the act. The decision also applied to two other cases, wherein C. H. Clark, a stockholder and director of the Tway company, sued to compel the company to comply with the act, and the Nortorn Coal Mining Co., in receivership, sought the advice of the court as to whether it should join the code.

Declaring that Congress has power to regulate wages and prices in any industry which it may decide bears on interstate commerce, Judge Hamilton held that the courts were without power to review such a conclusion if supported by facts. Considering the objects to be accomplished in adoption of the Constitution, he said, it is clear that "the people of the States intended to surrender all the rights they had to promote the general welfare that could not be done by the States acting independently. . . . The facts clearly prove that the States acting alone are unable to

Coming Meetings

- Southern Tennessee Coal Producers' Association: annual meeting, Jan. 16, 1936, Chattanooga, Tenn.
- Fourth International Heating and Ventilating Exposition: Jan. 27-31, International Amphitheater, Chicago.
- American Institute of Mining and Metallurgical Engineers: annual meeting, Feb. 17-20, 29 West 39th St., New York City.

rehabilitate the bituminous coal industry as it affects the people generally, the capital invested in the business, and the wage earners employed therein. Joint action of the States is imperative."

In dismissing the suit and directing the companies to comply with the provisions of the act, the court granted a stay against the 13½ per cent penalty imposed for noncompliance with the act, pending determination of an appeal by the companies. They were directed to pay to the court the 1½ per cent tax levied on complying companies, plus 1 per cent of the latter amount as costs, until the constitutionality issue is settled.

"I have assumed that this court is without power to hear evidence or find facts upon the constitutionality of the Congressional act here in question," said Judge Hamilton. "Every inquiry into a legislative act is approached with the presumption that the Congress observed the Constitution, and when the validity of an act depends upon the existence of certain facts, the legislative determination will be conclusive on the courts, unless the contrary is shown by facts which the court may judicially notice."

As indicative that bituminous coal mining is affected with public interest, the court pointed out that, with the exception of agriculture, it employs more men than any other single industry in the United States. Disorders in the industry, he said, have vitally affected interstate steam transportation, and their repercussions have been felt in other industries, since coal is used not only for the production of power but its byproducts are utilized in the manufacture of many articles that are absolutely essential to the comfort and convenience of the American people. Distress shipments and "pyramiding" were cited as unsettling influences brought about by overexpansion and subsequent frozen assets.

Wisdom of Congress Not in Issue

Hearings before Congress, said the court, are some evidence of its declaration that the bituminous coal industry affects interstate commerce, "and, this being true, the court is without power to substitute a different judgment for that of Congress, regardless of its opinion as to the wisdom of the legislation." As the basis for the conclusion in Sec. 1 of the Guffey act that the production and distribution of bituminous coal bear upon and directly affect interstate commerce and render regulation thereof necessary for its protection, the court said: "When the coal operator contracts his coal in advance of production, to be transported in interstate commerce, and the miner begins to dig the coal and lift it to the surface of the earth, there to be put in the car on the loading tracks and a part of it to be used to move the locomotive that carries the coal, it would seem reasonable that under the power to regulate commerce the Congress would have power to legislate concerning the industry at the beginning of the movement that was to continue uninterrupted until ultimate delivery to a consumer or purchaser. Unless this be so, Congressional power to regulate commerce is confined exclusively to the vehicle that moves the product. . . .

"If the act covers a joint field, a part of which the federal government could exercise, and a part the States, under such circumstances the federal power becomes supreme. . . . To say that the production of products distributed on a national scale can be effectively controlled by the States is both constitutionally and economically absurd. To deny power in such a field to the national government is tantamount to saying there shall be no legislation concerning them."

The court cited as a need for conservation the fact that "our supply of bituminous coal is not inexhaustible. The use of it and its byproducts becomes more important daily in our lives. We are rapidly exhausting the more accessible deposits of the mineral, and the future of mining means diminishing returns and higher prices. . . . The framers of the Constitution did not intend for the government to wait until its natural resources were practically exhausted before taking any steps to conserve them."

In refutation of the contention that the act violated the Fifth Amendment, the court said that in view of the fact that the interstate commerce clause of the Constiution is applicable, and the coal industry is affected with public interest, Congress has power to make reasonable regulations relating to wages, production and marketing. "The prevention of price cutting in the sale of bituminous coal in interstate commerce below the average minimum cost of production in the several districts is a matter on which Congress has the power to legislate." He also said it had the power to provide for the regulation of wages and hours, and denied that the administrative provisions of the act delegated legislative power.

Since judicial review of all administrative orders and decisions is accorded under Sec. 6 (B) of the act, the court ruled that there is no denial of judicial process and the exercise of arbitrary power is not lodged in any person charged with the administration of the act.

Ruling that the tax provisions of the act are not an unconstitutional exercise of taxing power, the court pointed out that taxation has been used for many purposes other than the raising of revenue since the Constitution was adopted. As bituminous coal mining "is a business affecting interstate commerce, the Congress has the power to levy the taxes solely for the purpose of regulating and controlling the industry. To the extent of 1½ per cent on the sale price per ton the tax is uniform as to all of those within the class, and the classification fair and equitable. Thirteen and one-half per cent of the sale price per ton is a penalty, although called a tax."

In concluding his opinion, Judge Hamilton said: "If we cling to the doctrine of States' rights in the matter of commerce as it existed in the early days of the Republic, a palsied hand holds the power and decay will set in in our nation before its time. If commerce is to be regulated and controlled, it must be by the national government, because the States lack the power to make effective their own regulations."

INSURGENT ANTHRACITE UNION IS DISBANDED

A LONG STEP toward lasting peace in the anthracite field of Pennsylvania took place on Oct. 26, when the United Anthracite Miners of Pennsylvania, insurgent union, disbanded. This development leaves the United Mine Workers, headed by John L. Lewis, the sole union organization of mine workers in the hard-coal region.

The decision to disband was made known in a letter from the executive board of U.A.M. to James A. Gorman, umpire, Anthracite Board of Conciliation, in which it was stated that the move was due to dwindling membership and lack of finances. The two years' existence of the rival union was marked by open warfare which brought death and injury to many as well as loss of millions of dollars in property damage.

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New Preparation Facilities

ARKWRIGHT COAL CO., Mona mine, Morgantown, W. Va.; reconstruction of tipple to increase capacity to 350 tons per hour and number of sizes loaded to four completed under direction of Fairmont Machinery Co., which supplied new shaker screen, loading boom, domestic coal loading facilities, mixing conveyors and auxiliary equipment.

DRIFTED ANTHRACITE COAL CO., Bowmanstown, Pa.; installation of two Deister-Overstrom Diagonal-Deck coal-washing tables, supplied by the Deister Concentrator Co., completed in November. The installation will clean minus ⅜-in. material. Capacity is 12 tons of feed per hour per table.

JAMISON COAL & COKE CO., Mine No. 9, Farmington, W. Va.: contract closed with Fairmont Machinery Co. for complete pea screening and coal-crushing plant with facilities for remixing and recirculating; capacity, 400 tons per hour.

JAMISON COAL & COKE CO., Mine No. 20, Pleasant Unity, Pa.; contract closed with Fairmont Machinery Co. for complete new shaker screen, loading boom equipment and coal-crushing facilities; capacity, 300 tons per hour.

MOFFAT COAL CO., Minooka, Pa.; contract closed with Koppers-Rheolaveur Co. for two 8-ft. diameter Menzies cones; capacity, 50 tons per hour each.

PAGE POCAHONTAS COAL CO., Grundy, Va.; contract closed with Jeffrey Mfg. Co. for dump hopper, mine-run conveyor and five-track tipple equipped with primary and secondary screens; egg, stove and nut picking tables and loading booms; mixing, recirculating and auxiliary conveyors; car retarders and 36x45 single-roll crusher; capacity, 400 tons per hour.

RALEIGH COAL & COKE CO., Raleigh, W. Va.: contract closed with Jeffrey Mfg. Co. for coal-washing plant for 3x1¼-in. coal, including three-compartment Baum-type jig; water-clarifying tank and fine-coal recovery conveyors, dewatering screens, vibrating screens, conveyors and belt-type loading boom; capacity, 150 tons per hour.

ST. CLAIR COAL CO., St. Clair, Pa.; contract closed with Deister Concentrator Co. for four Deister-Overstrom Diagonal-Deck coal-washing tables for 3/16x3/64-in. material. Capacity is 8 tons of cleaned coal per table per hour.

Miners Resume Work in Many Fields As New Pacts Are Signed

ALTHOUGH outbursts of violence and bloodshed in Alabama and in western Kentucky marked labor developments during the last month, there was notable progress in resumption of operations at mines rendered idle by deadlocks over wage advances based on the new Appalachian agreement. New contracts with the United Mine Workers have been signed in Alabama, the Southern Appalachian field, southern Tennessee, southern Colorado and northern New Mexico and Indiana. Nevertheless, the miners' union has levied an assessment of $1 per month per member for November and December as "insurance" against endangering benefits already won and as a provision for any "emergency" that might arise.

A compromise agreement ended the eight weeks' stalemate affecting 17,000 men in Alabama. Under the terms of the new contract, effected Nov. 17 and running until March 31, 1937, day and monthly men receive an increase of 20c per day; tonnage rates are advanced 4½c. and dead-work rates are raised 5 per cent. The agreement was reached largely through the instrumentality of Governor Graves, who entered the negotiations following a shooting affray near the Acmar and Margaret mines of the Alabama Fuel & Iron Co. on Oct. 28. Resentment against non-union operation of these mines took shape in a march by union miners, who are alleged to have been greeted with rifle and machine-gun fire and dynamite blasts. One of the marchers was killed and six others were wounded.

The Southern Appalachian Coal Operators' Association signed a contract with the U.M.W. on Oct. 31 granting wage advances commensurate with the Appalachian agreement. About 9,000 men in eastern Tennessee and eastern Kentucky, who had been idle nearly six weeks, returned to work at the new scale. William Turnblazer, district union president, said that all but three southeastern Kentucky operators signed up. The contract is effective until March 31, 1937, although the duration of the pact as originally proposed was the stumbling block to an earlier agreement. Less than two weeks previous, more than 5,000 miners in southern Tennessee resumed work under an agreement with the Southern Tennessee Coal Producers' Association embodying the same relative wage increases.

Following announcement of the compromise agreement in Alabama, the Southern Appalachian Coal Operators' Association initiated efforts to bring about a downward revision of wages to match those of the Alabama district. L. C. Gunter, executive vice-president of the association, pointed out that the contract signed in his district, though effective until March 31, 1937, stipulated that "should a more favorable wage contract be negotiated by the U.M.W. in any other district, then this district shall receive full benefit of such more favorable contract." Hazard (Kentucky) operators also have notified the U. M. W. that they expect similar treatment.

At the Fordson Coal Co. mines in Pike County, Kentucky, former employees began to return to work Nov. 18 on a $7 daily minimum scale, although no contract was signed. Despite the company's refusal to recognize the union, Van A. Bittner, district union president, is said to have advised the men to report for work, since the wages are higher than the scale.

Operations in western Kentucky, which continue on a non-union basis, the mines working five days a week, were disturbed by gun play on Oct. 29. More than 600 union sympathizers who marched on the Williams Coal Co. mine at Mannington were met with gas bombs, pistol shots and submachine-gun bullets when they refused to halt. Ten of the marchers were wounded by shots or gas burns, two of them seriously. The Western Kentucky Operators' Association has renounced further negotiations with the U.M.W., but E. J. Morgan, district union president, retorted that he had assurances from the miners that they would not return to work until their demands were met.

An agreement between southern Colorado and northern New Mexico operators and the U.M.W. was signed late in October. The contract, which affects about 11,000 men, carries the same provisions in regard to working hours and wage advances as the Appalachian agreement.

Though the Progressives continue to contest the supremacy of the Lewis organization in Illinois, the *United Mine Workers Journal* reports a steady defection of the insurgents seeking membership in the old union. A victory in a recent skirmish by the Progressives was short-lived. Late in October, Federal Judge Wham declined to grant an injunction to the United Electric Coal Cos. restraining the Progressives from interfering with the company's operations at Freeburg, but on Oct. 28 the U. S. Circuit Court of Appeals reversed that decision, directing Judge Wham to issue the injunction. The appellate court took under advisement on Nov. 15 a petition of the Progressives for a rehearing.

In announcing an assessment of $1 per month per member for November and December, an "official circular" in the *United Mine Workers Journal* of Nov. 1 emphasized the need of funds in carrying on its fight in western Kentucky and urged the need of provision for "any emergency that might arise" in the anthracite field. "In addition to these factors," the circular stated, "we expect that we will be compelled to carry an appeal to the U. S. Supreme Court on the Guffey-Snyder Law, now being contested in the courts."

A new scale was agreed upon Nov. 2 by Indiana shaft-mine operators and U.M.W. officials, after three weeks of negotiation. It provides for wage increases in conformity with the new Appalachian agreement. The agreement will be submitted to a wage-scale convention for ratification. A new stripping scale is in process of negotiation.

The joint committee of 56 operator and U. M. W. representatives provided for in the Appalachian agreement to deal with differentials between districts and within districts met in Washington, D. C., Nov. 6, but took no definite action on any of the differentials. A number of subcommittees were appointed, however, each to make a study of the complaints in one particular district. The subcommittees will all make a report, with recommendations, to the full committee of 56 at a meeting in Washington on Jan. 6.

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ANTHRACITE MINERS DEMAND SHORT WEEK AND PAY RISE

A SIX-HOUR DAY and five-day week, "with a substantial increase in the wage scales affecting all rates," and a two-year agreement to expire March 31, 1938, will be demanded by anthracite miners in the new wage contract to replace the five-year agreement which expires next March 31. These are part of 27 specific demands presented by the scale committee and approved at the tri-district anthracite convention of the United Mine Workers on Dec. 6 at Washington, D. C. Other demands include equalization of working time to curb bootleg mining; creation of a system of seniority to prevent discrimination; abolition of the individual or special contract system; complete instead of partial check-off of union dues; elimination of such practices as charging for air for drills and safety appliances; abolition of physical examination of employees when rehiring after a lay-off; time and a half for overtime and double time for Sudays and holidays.

John L. Lewis, U.M.W. president, told the convention that, if possible, there would be no resort to a trike to enforce the demands. This statement was made in response to an attempt by a delegate to bind the convention to a walk-out if all the demands were not granted. "Such an ultimatum would have disastrous effects on efforts to negotiate a contract," said Mr. Lewis. "We don't want a strike if we can avoid it."

Personal Notes

DR. FOSTER J. CURTIS, Salt Lake City (Utah) physician, has been elected president of the MacLean Coal Co., producing firm of that city, succeeding the late Charles F. Worley, who died suddenly Oct. 18 following a heart attack. Dr. Foster had been a business associate of Mr. Worley, who was general manager of the company as well as president, for many years. The new general manager is LAWRENCE C. MCFARLANE, heretofore secretary of the company, who also was elected vice-president. The father of Dr. Curtis, the new president, was a Salt Lake City coal producer.

S. J. DICKENSON, general manager, Mary Helen Coal Corporation, was elected president of the Harlan County Coal Operators' Association at the annual meeting, late in November. CHARLES GUTHRIE,

vice-president, Harlan Fuel Co., was named vice-president, and GEORGE S. WARD, secretary-treasurer.

BARTON R. GEBHART, assistant to the president, Appalachian Coals, Inc., has been appointed vice-president in charge of sales of the Chicago, Wilmington & Franklin Coal Co., Chicago, effective Nov. 16. Prior to becoming assistant to Mr. Huntress, about a year and a half ago, Mr. Gebhart was secretary of the Illinois Coal Bureau and subsequently secretary of the Illinois NRA coal code authority.

ROBERT C. HILL was elected chairman of the board and president of the Consolidation Coal Co. coincident with the reorganization of the company, announced during the last week of November. J. NOBLE SNIDER was named executive vice-president and H. H. SNODERLY was chosen vice-president in charge of corporate affairs.

CALVIN HOLMES, president, Holmes-Darst Coal Corporation, Cincinnati, Ohio, has been elected president of the Harvey Coal Corporation, Knoxville, Tenn., succeeding Col. C. H. Harvey, who died recently. MERRILL ARNOLD, president, Fidelity Bankers Trust Co., Knoxville, succeeds Mr. Holmes as vice-president.

RALPH H. KNODE, president, Stonega Coke & Coal Co., has been elected a member of the board of directors of Appalachian Coals, Inc., to succeed R. E. Taggart.

R. S. MARSHALL, formerly vice-president and general manager of the Sloss Sheffield Steel & Iron Co., has been elected secretary-treasurer of the Woodward Iron Co., Woodward, Ala., succeeding Herbert Smith, resigned.

D. D. MUIR, JR., vice-president and general manager of the United States Fuel Co., Salt Lake City, Utah, has been elected president of that company. OTTO HERRES, for the last ten years assistant general manager of the company and president of Utah Coal Producers' Association, has been promoted to vice-president and general manager. O. J. EGGLESTON also has been elected a vice-president.

DR. A. L. MURRAY, surgeon for the U. S. Bureau of Mines in Salt Lake City, Utah, from 1919 to 1933, has been appointed surgeon at the Pittsburgh (Pa.) branch of the Bureau. Dr. Murray served as a captain in the Army Medical Corps in the World War.

N. H. ORR, lately with the American Iron and Steel Institute, has been appointed general manager of sales of the Colorado Fuel & Iron Co., with headquarters in Denver, Colo. The company's sales, which formerly were separated into three classes, are to be consolidated.

W. G. POLK, president, Tennessee Jellico Coal Co., was chosen president of the Southern Appalachian Coal Operators' Association at its November meeting. J. B. GATLIFF, president, Gatliff Coal Co., was made first vice-president, and H. K. COOK, Diamond Coal Mining Co., second vice-president.

J. W. PORTER, since 1926 vice-president in charge of sales of the Alabama By-Products Corporation, Birmingham, Ala., was elected president of the company Nov. 12, succeeding Horace Hammond, deceased. ERSKINE RAMSAY was reelected chairman of the board.

Barton R. Gebhart

EMMETT S. PUGH has been elected president of the Raven Red Ash Coal Co., Red Ash, Va., vice J. B. Clifton resigned. Mr. Pugh's business career began as stenographer and clerk for the Tidewater Coal & Coke Co., Vivian, W. Va., and he has devoted much time to public accounting and tax work for coal companies.

KIRK RENNER, of Connellsville, Pa., has been elected president of the United Pocahontas Coal Co., operating in McDowell and Wyoming counties, West Virginia. He succeeds the late George W. Kilpatrick.

FRANK S. SCOTT, formerly on the fuel engineering staff of Appalachian Coals, Inc., has been engaged by the New River Coal Co., Charleston, W. Va., to direct its fuel engineering service. A graduate mechanical engineer, Mr. Scott has done extensive field and "clinical" work for ACI.

A. E. SILCOTT has been elected secretary of the Hazard Coal Operators' Association, vice C. B. Rose, resigned.

CHARLES N. TEMPLETON, president, Templeton Coal Co., was elected president of the Indiana Coal Operators' Association at its annual meeting, in Terre Haute. He succeeds H. M. Ferguson. HARVEY CARTWRIGHT was reelected secretary-treasurer and commissioner for the eighth time. B. H. SCHULL, general manager, Binkley Mining Co., was named vice-president.

JOHN L. TIERNEY was elected president of the Powhatan Coal & Coke Co., Powhatan, W. Va., late in October, vice E. C. Luther, deceased. Mr. Tierney, who had been treasurer and general manager of the company since 1925, was formerly connected with the Sharon Coal & Coke Co., Sharonville, Ky., and still holds directorships in a number of other producing companies.

J. B. WARRINER, president, Lehigh Navigation Coal Co., has been elected a director of the Consolidation Coal Co., recently reorganized.

R. T. WEST has resigned as superintendent of the Lost Run Coal Co., Pomeroy, Ohio, after 21 years' service in that postion. He became superintendent of Holden No. 22 mine of the Island Creek Coal Co., on Nov. 1.

Financial Reports

Cannelton Coal & Coke Co.—Net income for year ended June 30, $10,570 after depreciation, depletion, interest and other charges, compared with income of $29,732 in the preceding year.

Colorado Fuel & Iron Co. and subsidiaries—Net income for quarter ended Sept. 30, $10,235 after depreciation, expenses, interest and other deductions, compared with net income of $47,527 in preceding quarter and loss of $446,836 in third quarter of 1934.

Crow's Nest Pass Coal Co., Ltd.—Net income for quarter ended Sept. 30, $46,641 after depreciation and depletion but before taxes. Net income for first nine months of year, $138,823 before taxes.

Hazle Brook Coal Co.—Net loss for seven months ended July 31, $87,099 after expenses, interest and other charges.

Island Creek Coal Co. and subsidiaries—Net income for three months ended Sept. 30, $168,791 after depreciation, taxes and other charges, compared with $305,070 in third quarter of 1934. Net income for nine months ended Sept. 30, $762,232, as against $1,188,216 a year ago.

Lehigh Coal & Navigation Co.—Consolidated net income for twelve months ended Sept. 30, $367,220 after interest, depreciation, depletion and reserves and including company's proportion of undistributed earnings and losses of subsidiaries whose stock is either owned or controlled. This compares with income of $1,630,036 in twelve months ended Sept. 30, 1934.

Lehigh Valley Coal Corporation—Net profit for nine months ended Sept. 30, $297,080 after interest, depreciation, depletion, federal taxes and other charges, as compared with $244,339 for the corresponding period of last year.

Pennsylvania Coal & Coke Corporation and subsidiaries—Loss for quarter ended Sept. 30, $94,289 after ordinary taxes, depreciation and depletion but before federal taxes, compared with loss of $9,577 in the third quarter of 1934. For the nine months ended Sept. 30, profit computed from quarterly reports was $11,237, contrasted with loss of $56,523 a year ago.

Pittsburgh Terminal Coal Corporation—Net loss for quarter ended Sept. 30, $139,043 after depreciation, depletion and other charges, compared with loss of $37,554 in third quarter of 1934. Net loss for nine months ended Sept. 30, $342,864 after same deductions, against $209,176 loss in first three quarters of 1934.

Pittston Co.—Consolidated net loss for nine months ended Sept. 30, $1,848,844 after provision for doubtful notes and accounts receivable, interest, depreciation, depletion, amortization, federal taxes, loss on sale and demolition of property, minority interest and other charges, compared with net loss of $615,783 a year before.

Pond Creek Pocahontas Co.—Net profit for nine months ended Sept. 30, $246,119 after depreciation, depletion, taxes and other charges, against $347,867 for the first three quarters of 1934.

Truax-Traer Coal Co. and subsidiaries

—Profit for three months ended Oct. 31, excluding discount on debentures bought for sinking-fund requirements, after all charges, $36,250, based on interim figures subject to audit as shown by the books of the company, and its subsidiaries, except for provision for federal income tax, which is computed on the basis of tax returns for previous years rather than on income according to the books. In the corresponding period of last year the profit was $80,992.

United Electric Coal Cos.—Net loss for quarter ended Oct. 31, $8,575 after depreciation, depletion, interest, federal taxes and other charges, against $14,782 loss in October quarter of 1934.

Virginia Iron, Coal & Coke Co.—Net loss for third quarter, $36,283, contrasted with net profit of $141 for third quarter of 1934.

West Virginia Coal & Coke Corporation —Net loss for third quarter, $21,803 after all charges and provision for federal income tax, compared with net profit of $44,981 for the like period in the preceding

A.M.C. to Meet in January

The annual meeting of the American Mining Congress will be held in New York about the middle of January, instead of in December, as in previous years. Planned as a business and policy session, the forthcoming meeting will be devoted to the presentation of reports, with discussion; appointment of a resolutions committee, with action upon resolutions submitted; election of five directors, and a meeting of the full board to elect officers for the coming year.

Fairpoint Hits New High

All tonnage records for Fairpoint No. 9 mine of the Hanna Coal Co., Fairpoint, Ohio, were exceeded in October, when 62,636 tons of cleaned coal was produced. This was several thousand tons more than the best previous record.

Coal was run over the new all-steel tipple at Piney Fork No. 2 mine of the company for the first time early in November. The new structure, which was to be completed in a few weeks, has a capacity of 4,000 tons per day and will accommodate four railroad cars at one time, turning out four different sizes of coal.

Appalachian Coals to Continue

Appalachian Coals, Inc., will continue as an active organization. At a meeting of stockholders held in Cincinnati, Ohio, on Oct. 30 it was voted to continue in modified form, functioning along all but pricing lines. By Dec. 7, producers representing more than 28,000,000 tons had approved a modified form of contract, which will become effective June 1. Five new companies have subscribed to the new plan, as follows: Autocrat Elkhorn Coal Co. and New Jellico Coal Co., of which C. G. Hall is president; Elk Creek Mining Co., Rudy Draughn, president; Tennessee Jellico Coal Co., W. G. Polk, president; and H. T. Wilson Coal Co., H. T. Wilson, president.

Coal Conservation Act Begins to Function; Classification and Sizes Considered

WASHINGTON, D. C., Dec. 9—Organization of all but one (North and South Dakota) of the 23 district boards provided for in the Bituminous Coal Conservation Act of 1935 having been completed, an industry advisory board chosen and the problem of coal classification and number of sizes having been taken up by the National Bituminous Coal Commission, the machinery of the new law has begun to function. At the first public hearing held by the commission, on Nov. 21-22, consideration was given to the feasibility of prescribing uniform methods of classification and limiting the number of sizes for Minimum-Price Area No. 1. According to latest available information, 3,600 soft-coal producing companies in all districts have accepted the code. Acceptances on a tonnage basis on Nov. 22 totaled approximately 253,000,000 tons, or slightly more than 70 per cent of 1934 output. Four more general orders also have been issued by the commission, as follows:

General Order No. 5, issued Oct. 24, names the United Mine Workers as representing the preponderant number of employees in the bituminous coal industry and designated the district president in each of the 23 districts as the representative of the employees on the district board. Their names are included in the list of board members shown on the following pages. General Order No. 6, released Nov. 7, deferred the reporting of spot orders to district boards and other agencies and the filing of copies of coal sales contracts, invoices, credit memoranda and other information required by the Guffey act until the commission shall have prescribed rules and regulations for maintaining the confidential character of such information.

Rules on Statistical Bureaus

Establishment of a statistical bureau by each district board is provided for by General Order No. 7, promulgated Nov. 22. Each bureau is directed to receive, file, analyze, collate and preserve the confidential character of all information required by the coal control act. General Order No. 8, issued Nov. 23, prescribe rules for qualification of district board directors and employees and statistical bureau workers.

Rules of procedure in presenting complaints, protests and petitions for relief before the commission, released Nov. 23, outline in detail the manner of holding hearings, reviews and the nature of evidence that may be accepted or admitted. Complete specifications governing the form of applications, complaints, answers, petitions, briefs, etc., are covered.

In response to a request by the commission that each district board submit the names of three candidates from which one member and an alternate would be chosen to form an industry advisory committee, most of the boards presented names, from which the following were chosen (the second name in each instance is the alternate):

District 1—Charles O'Neill, president, Eastern Bituminous Coal Association; L. G. Ball, vice-president, J. H. Weaver & Co.

District 2—Ralph E. Jamison, Jamison Coal & Coke Co.; H. L. Findlay, vice-president, Youghiogheny & Ohio Coal Co.

District 3—R. A. Courtney, Pine Bluff Coal Co.; D. T. Buckley, New England Coal & Coke Co.

District 4—Ezra Van Horn, executive vice-president, Ohio Coal Control Association; William Emery, Jr., president, Cambridge Collieries Co.

District 5—George C. Eastwood, vice-president, Consolidated Coal Co.

District 6—E. G. Mathiott, vice-president, Valley Camp Coal Co.; R. L. Berry, vice-president, Wheeling Valley Coal Corporation.

District 7—W. A. Richards, president, Pemberton Coal & Coke Co.; O. M. Deyerle, president, Flat Top Fuel Co.

District 10—J. R. Henderson, executive secretary, District 10 Producers' Board; E. F. Stevens, general manager, Union Colliery Co.

District 11—Jonas Waffle, managing director, Coal Trade Association of Indiana; B. E. Lundblad, vice-president, Central Indiana Coal Co.

District 12—M. G. Youngquist, secretary, Iowa Coal Trade Association; K. C. Carney, Scandia Coal Co.

District 13—H. S. Salmon, president, Alabama Coals, Inc.; David Roberts, Jr., president, Brilliant Coal Co.

District 14—R. A. Young, president, R. A. Young & Son; J. F. Lake, vice-president, Charleston Coal Co.

District 15—F. M. Eviston, vice-president, McAlester Fuel Co.

District 16—R. W. Shumway, Denver, Colo.; J. P. Peabody, president, Rocky Mountain Fuel Co.

District 18—V. R. McKnight, Defiance Coal Co.; Dan P. Harris, Jr., Albuquerque, N. M.

District 19—T. J. O'Brien, president, Kemmerer Coal Co.; L. T. Dee, vice-president, Lion Coal Co.

District 22—Albert Gately, Republic Coal Co.

District 23—D. R. Swem, Northwestern Improvement Co.; George Watkin Evans, general manager, Fords Prairie Coal Co.

Announcement of their intention not to sign the code by the Pittsburgh Coal Co., Consolidation Coal Co., Pocahontas Fuel Co., Berwind-White Coal Mining Co. and the Island Creek Coal Co. on Oct. 24 brought a sharp retort from Chairman Hosford of the commission. Organization of district boards would proceed and every provision of the law would be vigorously enforced, said Mr. Hosford. "It will be the duty of the commission in approving and promulgating regulations and minimum prices under the act," the chairman stated, "to safeguard the interests of those producers who in recognition of sound public policy are accepting the code and preparing to conduct their business in conformity with the act and the regulations of the commission."

Would Bar Non-Code Mines

The commission announced on Oct. 29 that careful study was being made of provisions of the Guffey act dealing with coal purchases made by government departments or agencies and with contracts made by such departments and agencies with contractors for public works or service. In the opinion of counsel for the commission, it was said, Sec. 14 of the act made it mandatory that in such cases purchases of bituminous coal be made only from producers who are members of the code. This ruling, it was pointed out, would apply to railroads carrying mail. This provisional opinion became a definite ruling on Nov. 16, when the commission declared, in a letter to the Acting Director of Procurement, Treasury Department, that in determining the origin of coal purchased by the government where a dealer or mid-

dleman is the contractor, the government's contracting officer must require evidence that all coal delivered under the contract has been produced at a mine complying with the code. The letter pointed out that the term "contractor" as used in Sec. 14 also applies to subcontractors.

Mr. Hosford issued a statement Nov. 19 assuring consumers that they have no reason to fear higher coal prices by reason of enforcement of the Guffey act. The law vests authority in the commission, he said, to "establish minimum and maximum prices for coal in order to protect the consumer against unreasonably high prices. . . . While it is not anticipated that the establishment of maximum prices will be necessary, the powers of the commission in this respect are specific. In addition, the commission has authority, upon substantial complaint that bituminous prices are excessive to consumers, to hear such complaint or initiate an investigation." The commission, he said, will make every effort to end the practice of selling slack sizes at prices below actual cost of production.

Reviewing the activities of the commission, Mr. Hosford announced on Nov. 23 that "from the standpoint of tonnage represented by producers assenting to the code, and the cooperation of all elements of the industry, as well as commission activities, it may be said that the first 60 days of actual operation of the bituminous coal code has been most promising. And the outlook for stabilization of the coal industry is encouraging."

To Investigate Living Conditions

Investigation of conditions among mine workers with the object of rehabilitating those displaced from employment and relieving those partially employed, will be given early attention by the commission, according to an announcement Dec. 5 by Commissioner Tetlow. The commission is empowered by the Guffey act, he pointed out, to transmit its findings and recommendations to the proper government agency for relief, rehabilitation and subsistence homesteads. "The Bituminous Coal Act," he said, "is in many respects a new bill of rights for workers in bituminous mines. It means that in addition to efforts to stabilize the industry, which in itself will be helpful to workers, the federal government will extend to miners the direct assistance being given to others who have been the victims of economic changes."

An investigation of the effect of the importation and exportation of bituminous coal on the domestic market will be made under the direction of Commissioner Acret. The inquiry, which is authorized by Sec. 16 of the coal control act, will proceed as rapidly as possible, it was announced on Dec. 6. Commissioner Acret said "it is the purpose of the commission to study conditions in foreign markets and to determine the effect on our home markets of importations, with the purpose of recovering markets which have been lost during recent years and finding new outlets for coal produced in the United States."

One of the principal tasks confronting the commission is to protect the coal industry from itself, declared Chairman Hosford in opening the first public hearings of the commission, held at the Carlton Hotel, Nov. 21-22, to consider the propriety of establishing a maximum number of size groups and standard methods of classification for Minimum-Price Area No. 1. Arbitrary methods are farthest from the commission's thoughts; at every step it planned to seek counsel of the industry and to appeal for the submerging of selfish individual interests for the general good, as far as that may be "humanly possible." But, if such cooperation is not forthcoming, was the blunt warning, the commission will not hesitate to exercise its powers under the law and take positive action. "We may be 47½ per cent wrong in what we do under those circumstances," he added, "but that will be better than no answer."

Suggests Eight Size Groups

On behalf of the producers' advisory committee, Charles O'Neill, chairman, said that it had been suggested that the maximum number of size groups should not exceed eight. Spokesmen for the Northern fields generally were ready to accept this limitation; Illinois thought it could go along on a maximum of nine, but Indiana insisted that the number for that State should not be less than eleven. Both the Southern high-volatile fields and western Kentucky were sympathetic toward the Indiana position. Because Southern low-volatile coal moved both east and west, W. A. Richards, spokesman for that area, felt that it might be necessary to have two different groupings. Central Pennsylvania, with little domestic business, could work with four groups, said Mr. O'Neill; while it did not object to a greater number in other districts, it argued that when those districts shipped into territory largely served by central Pennsylvania coals, the competing districts should be subject to the same limitations as central Pennsylvania with respect to the number of sizes.

Since the size groups also would establish price groups, some of the witnesses expressed apprehension lest the groupings would destroy the markets for certain smaller sizes. If, for example, 3-in. lump is in the same size group as 4- and 6-in. lump, they argued, consumers will not buy the smaller size. Under the NRA set-up, said Hugh B. Lee, chairman of the Indiana district board, Indiana mine prices on 60 sizes were combined into 24 groups. Barring certain individual exceptions, however, all of these prices were definitely related to base prices on 6-in. lump and 2-in. screenings. Some such basing system, he thought, might be applied now.

Only two of the eleven districts of Minimum-Price Area No. 1 represented at the hearings would concede that it was possible to arrive at any fixed, uniform basis for classification. Northern West Virginia and Ohio were ready to indorse the formula devised by the Technical Board of Division I of the NRA code, but this basis was sharply assailed by other districts. This formula, explained C. J. Potter, Continental Coal Corporation, speaking for District 3, was based primarily upon the ash, B.t.u., sulphur and fusion-temperature factors, evaluated for coal burned on underfeed stokers. In so far as Indiana considers a formula, declared O. L. Scales for that State, it is based on the theory that coal has no value except as it may be used in a given plant. "If the Technical Board formula were to be applied literally," he said, "it would wreck the coal industry."

Physical characteristics, use and consumer preference all must be considered in classification as a basis for price making, insisted several witnesses. And these factors cannot always be definitely measured in the way the chemical constituents may be determined by analysis. After all, remarked H. L. Findlay, vice-president, Youghiogheny & Ohio Coal Co., it is the consumer who really fixes the classification by his purchases. The problem, according to Charles A. Owen, president, Imperial Coal Corporation, differs little from that which confronted the code authorities under NRA. The start must be made in each district, followed by coordination between different districts based upon agreement as to comparable base coals.

Determination of a yardstick for competitive relationships, observed Commissioner Tetlow, is the real problem—not classification. The commission must consider these relationships in adjusting prices. Unless there is some basis for agreement in advance, price fixing will only raise the question anew. Moreover, he continued, any formula evolved must be guided by experience. He did not believe that any district would be willing to adopt a position until it knew what competitive districts planned. Grouping of competitive districts, he thought, might simplify the problem. Mr. Owens, however, would not agree that a combination of several districts in Minimum-Price Area No. 1 would help because "you can't get any over-all formula."

District Board Membership

The personnel of the district boards set up under the act is as follows:

District 1 (Eastern Pennsylvania)—Charles O'Neill (acting chairman), president, Eastern Bituminous Coal Association; James H. Allport, president, Rock Hill Coal Co.; L. G. Ball, vice-president, J. H. Weaver & Co.; James Caseley, president, Buffalo & Susquehanna Coal & Coke Co.; Heath S. Clark, president, Rochester & Pittsburgh Coal Co.; G. Dawson Coleman, president, Ebensburg Coal Co.; James A. Connelly, Jr., sales manager, Barnes & Tucker Co.; John D. Dickson, president, Shawmut Mining Co.; A. F. Kempe, sales manager, Logan Coal Co.; Telford Lewis, president, Jasahill Coal Mining Co.; Charles A. Owen, president, Imperial Coal Corporation; Mark W. Potter, president, Pennsylvania Coal & Coke Corporation; D. T. Price, general manager, Lochrie-Price Coal Co.; Arthur B. Stewart, president, Davis Coal & Coke Co.; J. W. Wetter, vice-president, Madeira, Hill & Co.; R. W. Wigton, secretary-treasurer, Morrisdale Coal Co.; James Mark, employee representative.

District 2 (Western Pennsylvania)—R. R. Bowie, Pine Township Coal Co.; A. R. Budd, vice-president, Hillman Coal & Coke Co.; Frank Coleman, mining engineer, Westmoreland Mining Co.; O. E. Eberly, Old Home Fuel Co.; H. L. Findlay, vice-president, Youghiogheny & Ohio Coal Co.; F. R. Harper, Thomas Harper Coal Co.; R. E. Jamison, sales manager, Jamison Coal & Coke Co.; R. H. Knode, vice-president, Westmoreland Coal Co.; O. C. Larsen, secretary-treasurer, North American Coal Co.; George H. Love, president, Union Collieries Co.; John B. Moore, vice-president, Reliance Coal Mining Co.; A. K. Renwick, Ligonier, Pa.; R. E. Sprenkle, general manager, Butler Consolidated Coal & Coke Co.; J. T. M. Stoneroad, president, Carnegie Coal Co.; C. S. B. Ward, president, Pleasant Valley Mining Co.; Robert Wood, assistant to president, W. J. Rainey, Inc.; Patrick Fagan, employee representative.

District 3 (Northern West Virginia)—W. C. Dobbie (chairman), general superintendent, Jamison Coal & Coke Co.; T. J. Ashcraft (secretary), assistant secretary, Northern West Virginia Subdivisional Coal Association; A. C. Beeson, Four States Coal Co.; S. D. Brady, Jr., president, Osage Coal Co.; D. T. Buckley, Koppers Coal & Transportation Co.; Ralph Courtney, president, Courtney Coal Co.; George D. Curtin, vice-president, Pardee & Curtin Lumber Co.; William Findlay, general superintendent,

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Bituminous Coal Commission gets down to business

Left to right, seated: Walter H. Maloney, C. F. Hosford, Jr. (chairman), and George F. Acret; standing: C. E. Smith and Percy Tetlow.

Simpson Creek Collieries Co.; T. E. Johnson, vice-president, Hutchinson Coal Sales, Inc.; T. J. Johnson, president, Guston Run Mining Co.; Harry B. Martin, general manager, Miller-Todd Coal Co.; C. J. Potter, Continental Coal Co.; Samuel Pursglove, general manager, Purgslove Coal Mining Co.; Charles W. Ream, president, Stanley Coal Co.; E. H. Reppert, president, Reppert Coal Co.; H. W. Showalter, president, Monongahela Rail & River Coal Corporation; A. Lisle White, general superintendent, Virginia-Maryland Coal Corporation; Frank Miley, employee representative.

District 4 (Ohio)—Ezra Van Horn (chairman), executive vice-president, Ohio Coal Control Association; E. H. Davis (vice chairman), chairman of board, New York Coal Co.; Whitney Warner (secretary), president, Warner Collieries Co.; E. S. Willard (treasurer), general manager, United States Coal Co.; F. N. Barnes, president, Barnes Coal & Mining Co.; William Emery, Jr., president, Cambridge Collieries Co.; Clifford Hawk, secretary, Long Hollow Coal Co.; D. P. Loomis, general manager, Ohio Block Coal Co.; John H. Miles, vice-president, Akron Coal Co.; Walter L. Robison, president, Youghiogheny & Ohio Coal Co.; H. B. Salkeld, president, Tasa Coal Co.; George K. Smith, president, Sunday Creek Coal Co.; John Owens, employee representative.

District 5 (Michigan)—George C. Eastwood (chairman), vice-president and general manager, Consolidated Coal Co.; H. W. Bean (vice-chairman), general sales manager, Robert Gage Coal Co.; Fred. Heinemann (secretary-treasurer), president, St. Charles Garfield Coal Co.; Alex Jeffrey, president, Chippewa Coal Co.; William Jones, president, Monitor Coal Co.; John Milano, president, Aurora Coal Co.; Ernest Stevenson, employee representative.

District 6 (West Virginia Panhandle)—Arthur W. Dean (secretary), president, West Virginia-Pittsburgh Coal Co.; Mrs. Fern S. Arnold, president, J. J. Arnold Co.; R. L. Berry, vice-president, Wheeling Valley Coal Corporation; George D. Caldwell, president, Retail Coal Producers' Association of Brook County; W. B. Casey, president, City Coal Co.; Frank Costanzo, president, Costanzo Coal Mining Co.; R. J. Cotts, president, Standard Mining Co.; E. G. Mathiott, vice-president, Valley Camp Coal Co.; W. D. McKeefrey, president, McKeefrey Coal Co. of West Virginia; M. J. McQuade, president, Moundsville Coal Co.; John W. Sands, president, Hitchman Coal & Coke Co.; William Taylor, vice-president, Valley Camp Coal Co.; George Savage, employee representative.

District 7 (Southern No. 1)—P. M. Snyder (chairman), president, Castner, Curran & Bullitt; John L. Steinbugler (vice-chairman), president, William C. Atwater & Co.; William G. Caperton (secretary-treasurer), president, Scotia Coal & Coke Co.; J. W. Bell, general manager, Imperial Smokeless Coal Co.; R. E. Brockman, general manager, Atlantic Smokeless Coal Co.; O. M. Leyerle, president, Flat Top Fuel Co.; H. D. Everett, vice-president, Smokless Fuel Co.; H. C. Faust, general manager, United Pocahontas Coal Co.; J. A. Hunt, general superintendent, Lillybrook Coal Co.; R. H. Morris, general manager, Gauley Mountain Coal Co.; S. S. Nichols, vice-president, New River Co.; G. H. Nowlin, Jr., president, Premier Pocahontas Collieries Co.; W. A. Richards, president, Pemberton Coal & Coke Co.; Holley Stover, Holley Stover & Co.; W. P. Tams, Jr., president, Gulf Smokeless Coal Co.; William Blizzard, employee representative.

District 8 (Southern No. 2)—Irvin Davis (chairman), president, Hatfield-Campbell Creek Coal Co.; N. D. Bachman (vice chairman), Peabody Coal Co.; Hugh Buford (secretary), president, Knott Coal Corporation; S. B. Hosmer (treasurer), president, Elkhorn Collieries Corporation; N. G. Alford, purchasing agent, Clover Splint Coal Co.; G. H. Esser, Norton, Va.; H. E. Jones, president, Logan County Coal Corporation; R. H. Kelly, president, Four Seam Coal Corporation; W. R. Kernohan, president, Glen Alum Fuel Co.; E. C. Mahan, president, Southern Mining Co.; H. A. McAllister, president, McCall Coal Co.; C. M. Moore, general manager, Moore Coal Co.; D. H. Morton, president, Winifrede Collieries Co.; G. A. Reese, president, Clinchfield Fuel Co.; C. W. Watson, trustee, Elk Horn Coal Corporation; L. E. Woods, president, Crystal Block Coal & Coke Co.; Samuel Caddy, employee representative.

District 9 (Western Kentucky)—S. S. Lanier, Jr. (chairman), co-receiver, Norton Coal Mining Co.; W. W. Bridges (temporary vice chairman), receiver, Black Diamond Coal & Mining Co.; S. L. Jewell (temporary secretary), vice-president, Trio Coal Co.; E. J. Hartenfield, president, Green River Valley Coal Co.; E. J. Morgan, employee representative.

District 10 (Illinois)—George W. Reed (chairman), vice-president, Peabody Coal Co.; Hubert E. Howard (vice chairman), president, Binkley Mining Co.; G. D. Cowin (secretary-treasurer), president, Bell & Zoller Coal & Mining Co.; D. W. Beggs, general manager, Macon County Coal Co.; D. W. Buchanan, president, Old Ben Coal Corporation; W. F. Davis, president, St. Louis & O'Fallon Coal Co.; George B. Harrington, president, Chicago, Wilmington & Franklin Coal Co.; W. J. Jenkins, president, Consolidated Coal Co. of St. Louis; E. R. Keeler, vice-president, Franklin County Coal Co.; L. F. Lumaghi, Jr., president, Lumaghi Coal Co.; Robert H. May, sales manager, Northern Illinois Coal Corporation; C. J. Sandoe, vice-president, Perry Coal Co.; Glenn A. Shafer, president, Pana Coal Co.; Louis Ware, president, United Electric Coal Cos.; A. L. Wilcoxson, president, Sangamon Coal Co.; Henry C. Woods, vice-president, Sahara Coal Co.; Ray Edmundson, employee representative.

District 11 (Indiana)—H. B. Lee, chairman), vice-president, Maumee Collieries Co.; B. E. Lundblad (vice-chairman), vice-president, Central Indiana Coal Co.; Jonas Waffle (managing director), managing director, Coal Trade Association of Indiana; William R. Bootz, secretary, Crescent Coal Co.; George A. Enos, president, Enos Coal Mining Co.; Arch V. Grossman, vice-president, United Collieries, Inc.; C. G. Hall, vice-president, Walter Bledsoe & Co.; George J. Leahy, vice-president, Republic Coal & Coke Co.; R. H. May, sales manager, Sunlight Coal Co.; Earl Oliphant, general manager, Standard Coal Co.; John Shirkie, president, West Clinton Coal Co.; H. P. Smith, president, Shelbourne Mining Co.; R. E. Snoberger, president, Binkley Coal Co., Inc.; M. M. Soule, vice-president, Coal Sales Corporation; C. N. Templeton, president, Templeton Coal Co.; William J. Tipton, president, Tipton Coal Co.; W. M. Zeller, Jr., president, Knox Consolidated Coal Corporation; Frank Barnhart, employee representative.

District 12 (Iowa)—William Abram, Colfax Coal Co.; K. C. Carney, sales manager, Scandia Coal Co.; S. V. Carpenter, vice-president, Sunshine Coal Co.; John G. Evans, president, Smoky Hollow Coal Co.; A. E. Hollingsworth, president, Central Iowa Fuel Co.; Robert E. Lee, president, Consolidated Indiana Coal Co.; W. D. Johnson, president, Boone Coal Co.; M. B. McConville, secretary, McConville Coal Co.; W. O. Moore attorney, representing City Fuel Co.; E. O. Moss, president, Liberty Coal Co.; Joe Muelhaupt, president, Central Service Co.; B. J. Powers, general manager, Dallas Fuel Co.; John H. Ramsay, general manager, Economy Coal Co.; Jacob Ritter, vice-president, Old King Coal Co.; John D. Shuler, president, Shuler Coal Co.; W. W. Wilson, purchasing agent, Norwood-White Coal Co.; Frank Wilson, employee representative.

District 13 (Southeastern)—Herbert S. Salmon (chairman), president, Alabama Coals, Inc.; D. A. Thomas (vice chairman), president, Montevallo Coal Mining Co.; N. E. Cross (secretary-treasurer), secretary, Alabama Coals, Inc.; W. Carson Adams, vice-president, Porter Coal Co.; C. S. Bissell, president, Black Diamond Coal Mining Co.; H. T. DeBardeleben, president, DeBardeleben Coal Corporation; E. L. Hampton, president, Tennessee Consolidated Coal Co.; P. H. Haskell, Jr., vice-president, A B C Coal & Coke Co.; A. R. Long, president, Brookside-Pratt Mining Co.; C. N. Milam, owner, Acton Basin Coal Co.; John E. Patton, president, Sewanee Fuel & Iron Co.; George F. Peter, president, Southern Coal & Coke Co.; David Roberts, Jr., president, Brilliant Coal Co.; B. F. Roden, president, Roden Coal Co.; H. J. Weeks, general manager, Durham Land Co.; William Mitch, employee representative.

District 14 (Arkansas-Oklahoma)—J. F. Lake (chairman), vice-president, Charleston Coal Co.; Earl Cobb (vice chairman), president, Southwestern Coal Co.; B. H. Bedwell (secretary-treasurer), vice-president, Bedwell Coal Co.; M. D. Bedwell, president, Bedwell Coal Co.; Robert Boyd, Jr., president, Boyd Excelsior Fuel Co.; A. D. Clark, vice-president, Tahona Coal Co.; George Colville, Jr., superintendent, Jewell Mining Co.; Heber Denman, president, Paris Purity Coal Co.; W. B. Hillery, general superintendent, Covington Coal Co.; W. J. Prendergrass, president, Acme Semi-Anthracite Coal Co.; B. C. Reed, president, Dixie Fuel Co.; Earl Wells, vice-president, Starr Coal Co.; R. W. Winn, vice-president, New Shockley Coal Co.; H. W. Young, vice-president, R. A. Young & Son; David Fowler, employee representative.

District 15 (Southwestern)—J. C. Reid (chairman), secretary, Oklahoma Coal Marketing Co.; W. E. Blucher (secretary-treasurer), secretary, Southwest Coal Bureau; Ira Clemens, president, Commercial Fuel Co.; R. S. Leavitt, Robinson Coal Co.; J. C. Reighard, Ol' Elliott Coal Producers' Association; W. E. Widmer, president, Elmira Coal Co.; J. B. Wilson, secretary, McAlester-Wilburton Coal Operators' Association; George J. L. Wulff, president, Western Coal & Mining Co.; David H. Watkins, employee representative.

District 16 (Northern Colorado)—J. P. Peabody (chairman), president, Rocky Mountain Fuel Co.; P. H. Powers (vice chairman), president, Shamrock Coal Co.; W. S. Iliff (vice chairman), vice-president, National Fuel Co.; David Allan, general manager, David Allan; James Brennan, president, Imperial Coal Co.; H. B. Crandall, secretary, Clayton Coal Co.; Buddy Early, owner, Buddy Coal Co.; H. F.

Nash, president, Leyden Lignite Co.; P. M. Peltier, president, Bear River Coal Co.; Floyd R. Pool, vice-president, McNeil Coal Corporation; W. E. Russell, president, W. E. Russell Coal Co.; Carson W. Smith, president, Consolidated Coal & Coke Co.; Frank Thurman, secretary-treasurer, Black Diamond Fuel Co.; W. D. Wade, treasurer, Pikes Peak Fuel Co.; George Watson, proprietor, Domestic Coal Co.; Frank Yakes, president, Louisville-Lafayette Coal Co.; O. F. Nigro, employee representative.

District 17 (Southern Colorado)—Douglas Millard (president), vice-president, Colorado Fuel & Iron Co.; H. E. MacDonald (vice-president), president, Victor-American Fuel Co.; Herbert Marshall (secretary-treasurer), president, Pryor Coal Mining Co.; N. C. Anderson, general manager, Huerfano Coal Co.; J. S. Bowie, general manager, Juanita Coal & Coke Co.; H. H. Bubb, general superintendent, American Smelting & Refining Co.; G. B. Dick, president, Jewell Collieries Corporation; F. C. Ewing, president, Crested Butte Coal Co.; D. L. Hansen, president, American Independent Coal Co.; H. H. Harris, vice-president, Hayden Brothers Coal Corporation; Moroni Heiner, president, Utah Fuel Co.; John Kirkpatrick, president, Aztec Coal Mining Co.; J. C. Larkin, sales manager, Swastika Fuel Co.; G. C. Manly, trustee, Alamo Coal Co.; B. W. Snodgrass, president, Moffat Coal Co.; F. R. Wood, president, Temple Fuel Co.; Frank Hefferly, employee representative.

District 18 (New Mexico))—Oscar Huber (chairman), general superintendent, Albuquerque & Cerrillos Coal Co.; G. H. Larson (secretary), Albuquerque & Cerrillos Coal Co.; C. M. Botts, attorney; John Hart, owner, Hart mine; A. B. Juliana, owner, Juliana mine; Robert Montgomery, employee representative.

District 19 (Wyoming)—T. J. O'Brien (chairman), president, Kemmerer Coal Co.; J. E. Lee (vice chairman), general manager, Sheridan-Wyoming Coal Co.; L. T. Dee, vice-president, Lion Coal Co.; Andrew Kuzara, manager, Star Coal Co.; Eugene McAuliffe, president, Union Pacific Coal Co.; N. A. Swennson, president, Nugget Coal Co.; W. J. Thompson, vice-president, Colony Coal Co.; R. J. Warriner, sales manager, Owl Creek Coal Co.; James Morgan, employee representative.

District 20 (Utah)—L. R. Weber (chairman), president, Liberty Fuel Co.; W. C. Stark (vice chairman), general manager, Blue Blaze Coal Co.; L. T. Dee, vice-president, Lion Coal Co.; Moroni Heiner, president, Utah Fuel Co.; Paul F. Keyser, president, Independent Coal & Coke Co.; D. D. Muir, Jr., general manager, United States Fuel Co.; J. B. Smith, president, Spring Canyon Coal Co.; C. N. Sweet, general manager, Standard Coal Co.; John M. Ross, employee representative.

District 21 (North Dakota and South Dakota)—No board organized.

District 22 (Montana)—T. C. Russell (chairman), general manager, coal department, Anaconda Copper Mining Co.; William Anderson, Anderson Coal Co.; F. V. H. Collins, president, Bair-Collins Co.; J. M. Freeman, vice-president, Montana Coal & Iron Co.; Albert Gately, general superintendent, Republic Coal Co.; H. F. Tilton, general manager, Cottonwood Coal Co.; William Riddell, employee representative.

District 23 (Washington)—Charles F. Larrabee (chairman), president, Roslyn Cascade Coal Co.; William Strain (vice chairman), owner, Strain Coal Co.; Richard Francis (second vice chairman), employee representative; James Bagley, president, Bucodo Coal Mining Co.; Fred Bianco, owner, Bianco Coal Mines; George Watkin Evans, general manager, Fords Prairie Coal Co.; Harry Mehrbach, sales manager, Bellingham Coal Mines; N. D. Moore, president, Pacific Coast Coal Co.; E. R. Peoples, owner, West Coast Fuel Co.; George Rockefeller, general manager, Des Moines Coal & Coke Co.; John I. Springer, vice-president, Dale Coal Co.; D. R. Swem, manager, coal operations, Northwestern Improvement Co.; H. C. Williams, sales manager, Fords Prairie Coal Co.

Alabama Coal Tax Reduced

The severance tax on coal in Alabama has been cut from 2½c to 1½c per ton by Governor Graves. This action was taken under authority granted by the last session of the State Legislature. Under the provisions of the law, the Governor has power to reduce or increase the tax, as he may deem advisable.

Wide World Photos

Screening and sacking coal at a bootleg mine.

Producers Urge State to End Bootleg Mining

Thoroughly aroused by the losses to the anthracite industry from outlaw mining, hard-coal producers climaxed a newspaper campaign against the evil with an appeal to the State Attorney General at Harrisburg, Pa., on Nov. 19. Charles F. Huber, coordinator of the anthracite industry; Louis C. Madeira, 3d, executive director of the Anthracite Institute, and Walter Gordon Merritt, attorney for the institute, acted as spokesmen for the delegation of operators in demanding action by Attorney General Margiotti against bootleg mining. Operating interests in the party included J. B. Warriner, president, Lehigh Navigation Coal Co.; N. D. Stevens, president, Stevens Coal Co.; T. T. Toole, director of marketing, Philadelphia & Reading Coal & Iron Co., and several attorneys.

The delegation pointed out that more than 1,000 outlaw pits are being worked, with an annual output of about 4,000,000 tons. Although the bootleg coal is sold at less than legitimately produced anthracite, it was said that its sales totaled $32,000,000 yearly.

Several days previous, the Anthracite Institute staged a personally conducted tour of 38 newspaper men through the Southern anthracite field to present a first-hand view of bootleg operations. Much impressed by the inroads of the invaders, the news writers spread themselves with feature stories in their home papers describing the outlaw operations.

Meantime, letters of protest against coal thievery and appeals to put a stop to the evil continued to pour in upon Governor Earle of the Keystone State. C. Claflin Young, president, National Retail Coal Merchants' Association, wrote on Oct. 31 urging that "the necessary action be taken to protect the interest of the miner, the operator and the retailer." Much of the stolen coal, he said, reaches the market poorly prepared and contains much foreign substance, including explosives. The market for anthracite is rapidly shrinking, the letter adds, as shown by constantly reduced production, and condoning theft of the product will result in further curtailment of output and loss of revenue.

The [illegible] Board of Trade, representing business interests in the northern borough of New York City, appealed by letter Nov. 5 to Governor Earle and to Mayor LaGuardia to take steps to halt "illegal and unfair competition" from bootleg anthracite. The letter to Governor Earle pointed out that the under-cover shipments not only affected the regular coal business adversely but also failed to give to the buyer any assurance of honest weight and good quality, and asked the Pennsylvania executive to stop the distribution at its source.

An appeal from the Merchants' Association of New York, several days later, informed Governor Earle that local coal distributors were suffering financial loss through unfair competition from the illegal producers and urged him to help stop "this menace to legitimate business."

After a series of speeches picturing the inroads of bootleg coal on legitimate trade, at Hershey, Pa., on Nov. 14, the Pennsylvania Retail Coal Merchants' Association besought Governor Earle to provide police action to halt what it termed "organized unlawful mining of anthracite."

The Fuel Merchants' Association of New Jersey, at their annual convention, Nov. 22, at Asbury Park, adopted a resolution addressed to Governor Earle urging "the necessity for drastic action to safeguard property rights and to protect legitimate producers and distributors of anthracite from the product of illicit labor." The resolution stated that the retail coal markets in New Jersey are being flooded with coal deliberately stolen from the anthracite fields of Pennsylvania, and that the business of legitimate retail coal merchants is being severely impaired by the marketing of pilfered anthracite.

George R. Wood Dies

George R. Wood, 47, vice-president of Coxe I rothers & Co., anthracite producers, and former superintendent of the Lehigh Valley Coal Co. at Centralia and in the Hazleton district, died Nov. 11 in the University of Pennsylvania Hospital, Philadelphia, Pa., after an illness of several weeks. A graduate of Lehigh University, Mr. Wood began his mining career in Kentucky immediately after leaving college, later returning to the anthracite field.