COAL AGE

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"Consol"—and the New Tempo

THE HISTORY of the Consolidation Coal Co. mirrors the changes in economic structure and executive thinking which have come over the bituminous coal industry with the passing years. Product of a generation when mere size was the only criterion of bigness, when the number of operations controlled by one corporate purse bulked larger in managerial vision than the efficiency of the individual units making up the whole, Consolidation, in common with other combinations of the same type throughout industry, has had to overcome the inertia of size to effect the co-ordination and concentration demanded by the modern economic tempo.

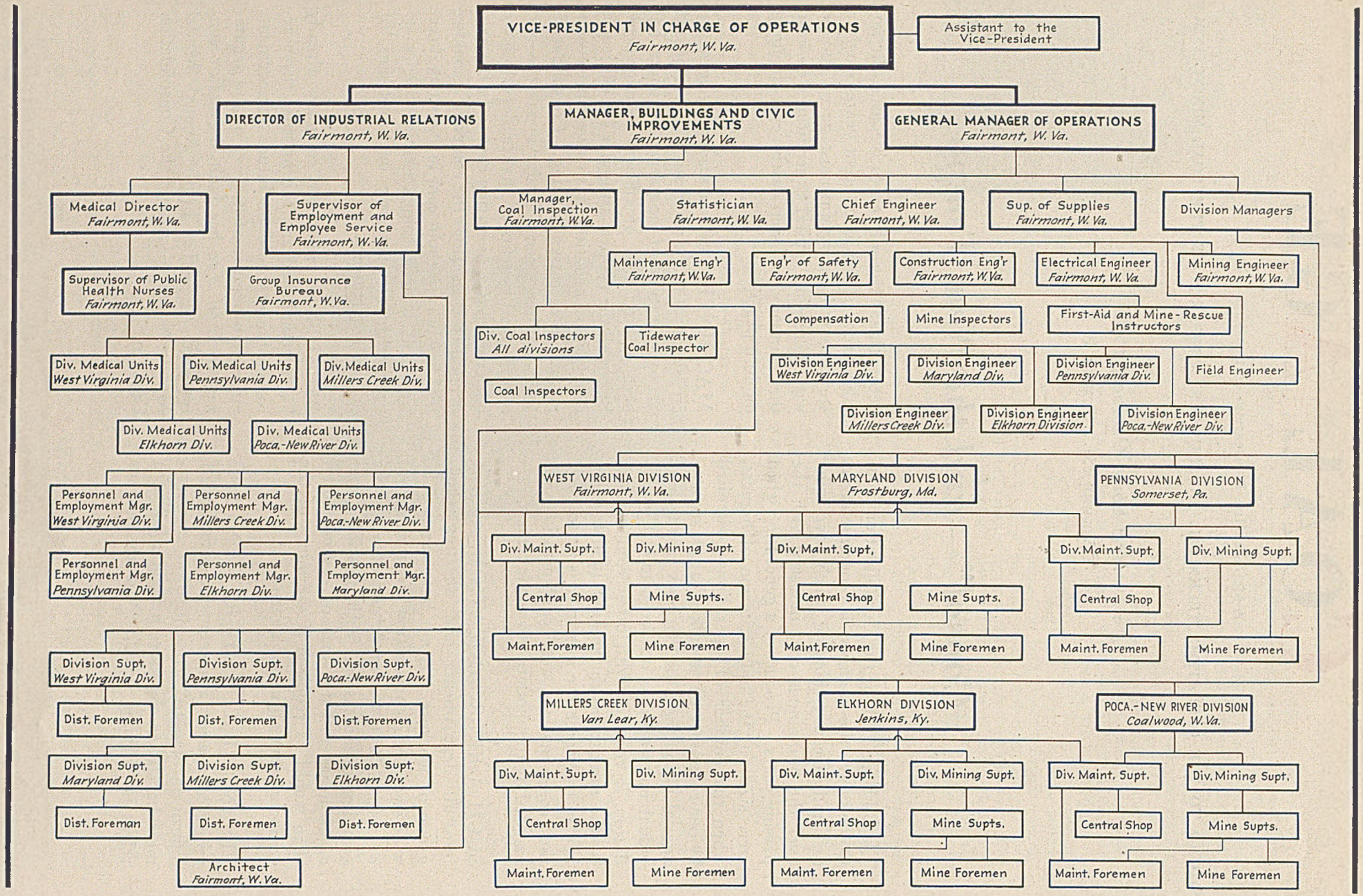
SUCH A REORGANIZATION, reaching into all departments and affecting every group of workers, has not been easy. The wide sweep of its production activities spread over four states has made necessary a more complex organization, with possibly finer adjustments and divisions of responsibility, than would be required if the mines of the company were all in one district.

FINANCIAL CONSIDERATIONS have militated against a spectacular program of improvements—to Consolidation management has fallen the more gruelling job of a relentless, driving grind. Nobody realizes better than "Consol" executives that the notable progress made in recent years is only a start, that the program must go on and on with increasing capital expenditures to keep the company in step with ever-changing modern practices.

MACHINERY, of course, is playing an increasing part in the program of the company. Standardization of operating practices has been made a tool of efficient management. But in all the ruthless struggles for efficiency, the human equation has never been submerged in executive thinking. Consolidation Coal has long been a leader in safety—and the practical benefits of that leadership have been reflected in operating costs. In the field of industrial relations the company is making real headway without cant in executive direction and with a commendable absence of paternalism in working out problems of human adjustments.

BECAUSE of what the company already has accomplished and the promise these accomplishments hold of future achievement, more than because of the size of the organization, *Coal Age* has built the major contents of this—the Tenth Annual Model Mining Number—around the Consolidation Coal Co.

Flowsheet of Management and Supervisory Responsibility in Operating Department—Consolidation Coal Co.



ORGANIZATION AND MANAGEMENT OF CONSOLIDATION COAL CO.

Take six companies spread over four states, with no group of plants in any one of the companies closer than 60 miles to the nearest group in another of the six and with some groups separated from their neighbors by more than five times that distance; put these six companies under common financial ownership and control, without in anywise changing their widely varying natural operating conditions—and you have a picture of the organization and management problem of Consolidation Coal Co.

INCORPORATED in Maryland in 1864 as a combination of several small companies in the Georges Creek district, the Consolidation Coal Co. confined its activities to that section until 1903, when it merged with the Fairmont Coal Co. and the Somerset Coal Co., themselves combinations, respectively, of several operations in the Pittsburgh seam in northern West Virginia and of a number of mines in Somerset County, Pennsylvania. By these mergers Consolidation, which started the first year of its corporate existence with an output of 37,678 tons, was able to enter the 10,000,000-ton producer class a few years after the Pennsylvania-West Virginia combination.

Consolidation entered the eastern Kentucky field in 1909 with the purchase of 30,000 acres in Johnson and Martin counties and the construction of the Millers Creek R.R. The next year the company increased its Kentucky holdings by buying 100,000 acres of Elkhorn coal in Knott, Letcher, and Pike counties; at the same time it began the construction of the Sandy Valley & Elkhorn R.R. and the development of fifteen mines in the territory thus opened up. There were no further major additions to its acreage until 1922, when Consolidation acquired the properties of the Carter Coal Co., consisting of ten mines and 38,000 acres of coal lands in McDowell County, West Virginia; Tazewell and Buchanan counties, Virginia; and Knox County, Kentucky.

As a result of these purchases, extending over a period of 20 years, Consolidation Coal Co. in 1924 owned approximately 348,000 acres of coal land, with a potential annual output of 14,000,000 tons and a reserve of 2,036,000,000 tons of unmined coal — making it one of the two largest companies in point of production and the first in reserve acreage. In addition, early in its history, the company acquired control of the Cumberland & Pennsylvania R.R., and, during the years, also became interested in a number of non-mining enterprises, wholesale distributing companies, and docks. Company holdings as of Dec. 31, 1929 (including acreage of the Carter Coal Co.), approximated 13,170 acres of mineral lands in Maryland, 54,109 acres in Pennsylvania, 80,178 acres in northern West Virginia, 36,250 acres in the Pocahontas-New River division, 31,521 acres in the Millers Creek district of Kentucky, and 100,780 acres in the Elkhorn field. The grand total approximated 316,000 acres. In addition, there was nearly 27,000 acres under lease.

The various mergers which resulted in the expansion of Consolidation Coal Co. prior to its entrance into Kentucky took on the color of the era in which they were effected. Like many other combinations of the 1890-1910 period, they attempted—not always with major emphasis upon the economic possibilities of each individual unit merged—to bring into the fold sufficient numbers of formerly independent units to dominate a field. Moreover, the period of greatest expansion took place during those years when railroad-car supply was a critical factor, and it was considered better policy to own a number of small mines—each in position to demand a share of existing transportation facilities — than to concentrate upon fewer and larger-capacity units. "Shipments from 108 mines" was featured by the sales department in its appeals for consumer patronage. Today, with less than one-third that number of mines in operation, Consolidation Coal Co. is averaging a greater annual production than during the war years.

With executive and sales headquarters in New York City; operating headquarters at Fairmont, W. Va.; operating division headquarters at Fairmont, Frostburg, Md.; Somerset, Pa.; Van Lear, Ky.; Jenkins, Ky.; and Coalwood, W. Va.; and district sales offices in twenty cities of the United States and Canada; London, England; and Genoa, Italy, organization to be effective must strike a nice balance between centralization to insure uniform control with wise standardization and decentralization to give proper play to initiative on local problems.

By a process of evolution, management of the Consolidation Coal Co. feels that it has worked out an organization set-up which gives this necessary balance. This set-up not only provides for a clear definition of the scope of each department and division, as well as its interrelation with other departments and divisions but also gives the staff organization of specialists direct influence and authority throughout the different operating divisions through divisional and local staff representation.

Heading the whole organization, naturally, is the board of directors, directly represented by the chairman of the board, with headquarters at New York. The president, who is not only the chief executive officer of the company but, by a peculiar feature of the old Maryland charter, the only officer

elected directly by the stockholders, also is located in New York. Here lies the authority for the formulation of major policies and decisions. The president has two executive assistants, one in Fairmont and one at New York.

For operating purposes, the work of the company is divided into four major groups: Operations, sales, control, and corporate affairs. Under corporate affairs comes the direction of all subsidiary and affiliated companies (with affiliated selling companies also tied in with the sales department), purchasing, real estate, tax and legal matters—with local real estate department representation in several operating divisions and also local counsel. Offices of the general purchasing agent are located in Fairmont, with division representatives in all operating divisions.

Direction of company stores comes under the control department, with a general manager of stores located at Fairmont and divisional managers in all operating divisions except Maryland. The treasury and auditing divisions, too, are part of the control department, which also acts as the finance, accounting, and treasury departments of all subsidiary companies. Statistical sections charged with the analysis of finance, operating and sales statistics constitute another important division in this department.

A vice-president in charge of sales, located at New York, heads up the selling end of the company. Sales in the United States and Canada are handled by twenty district sales offices located in the principal cities and reporting directly to the general manager of sales in the department. Sales to European and South American countries are handled through the London (England) and Genoa (Italy) sales offices, reporting to the manager of export sales in New York. An assistant to the vice-president is charged with general supervision over advertising and merchandising counsel. The general service engineer, located in New York, supervises the work of service engineers in the various district offices. Problems of distribution of orders between mines and consumers and co-ordinating the flow of all sizes and grades are handled by the director of distribution, reporting to the vice-president.

The work of the operating department, headed by a vice-president in charge of operations at Fairmont, embraces three groups: The production department, the department of industrial relations, and the department of building and civic improvements. Mines of the company, directed by the general manager of operations as head of the production department, are grouped into six operating divisions: (1) Maryland, (2) West Virginia, covering operations in the northern part of the state; (3) Pennsylvania, (4) Millers Creek, (5) Elkhorn, and (6) Pocahontas-New River. Virginia properties acquired from the Carter Coal Co. are no longer operated.

At present the company is operating 31 mines, located as follows:

Mine No.		Location
	MARYLAND DIVISION	
1	Ocean Mine	Frostburg, Md.
3	Hoffman Mine	Eckhart Mines
4	Consolidation No. 4	Eckhart Mines
9	Consolidation No. 9	Frostburg
10	Eckhart No. 10	Eckhart Mines
12	Borden Shaft	Frostburg
17	Consolidation No. 17	Frostburg
	WEST VIRGINIA DIVISION	
25	Consolidation No. 25	Clarksburg, W. Va.
26	Consolidation No. 26	Watson
32	Owings Mine	Owings
38	Consolidation No. 38	Fairmont
63	Monongah	Monongah
86	Carolina	Carolina
93	Jordan	Jordan
97	Rivesville	Rivesville
	PENNSYLVANIA DIVISION	
119	Consolidation No. 119	Jenners, Pa.
120	Gray Mine	Acosta
123	Consolidation No. 123	Boswell
	MILLERS CREEK DIVISION	
153	Consolidation No. 153	Van Lear, Ky.
154	Consolidation No. 154	Van Lear
155	Consolidation No. 155	Van Lear
	ELKHORN DIVISION	
204	Consolidation No. 204	Jenkins, Ky.
205	Consolidation No. 205	Jenkins
206	Consolidation No. 206	Dunham
207	Consolidation No. 207	Dunham
212	Consolidation No. 212	McRoberts
214	Consolidation No. 214	McRoberts
	POCAHONTAS-NEW RIVER DIVISION	
251	Coalwood Mine	Coalwood, W. Va.
253	Consolidation No. 253	Six
254	Consolidation No. 254	Caretta
261	Caretta Mine	Caretta

The staff of the general manager of operations at Fairmont includes a chief engineer, whose major function is the co-ordination of all staff engineering work; a mining engineer, in charge of mine projections, mining methods and mechanization studies; an electrical engineer, who studies all electrical power and transmission problems and is in charge of drawing up all specifications for new electrical equipment; a maintenance engineer, in charge of all maintenance matters, including the maintenance of electrical equipment; a safety engineer, whose authority also extends to compensation matters; a supervisor of supplies with direct supervision of all materials and supplies used in operating; a manager of inspection, supervising underground preparation and inspection of coal at loading points; a construction engineer, in charge of drawing plans for all new projects and of co-ordinating construction activities; and a statistician, who not only supervises all statistical work within the department but also develops the cost control figures used in budgetary control of expenditures. Staff officials spend about half their time in the field.

Each operating division is headed by a division manager. Under him is a division superintendent of mining and a division superintendent of maintenance with equal rank. Large mines have individual mine superintendents and smaller operations are grouped under one superintendent. Each mine has a mine foreman and a maintenance foreman. Mine maintenance foremen report to the mine superintendent and consult with the division maintenance superintendent. Each division has a division engineer reporting to the division manager and consulting with the chief mining engineer. Local mine inspectors report to division operating officials and also to the safety engineer.

This dual reporting system opens the way, in case of dispute between maintenance and operating staff, for an appeal which, if supported by higher rank officials in either group, eventually can be carried to the vice-president in charge of operations. For example, if the maintenance foreman at one of the mines differs with the mine foreman on a question of maintenance and the position of the mine foreman is upheld by the mine superintendent, the maintenance foreman can appeal to the maintenance superintendent of the division. The latter and the division superintendent of mining then may take up the case with the division manager.

ACCT. NOS.	OCCUPATION	QUOTA MEN	QUOTA MAN HOURS	TODAY MEN	TODAY MAN HOURS	TODAY AMOUNT
	HAND LOADING					
1A	Loaders on Pick Coal					
2A	" " Machine Cut Coal					
	Cutting and Loading Men					
	Coal Loaders—Day Labor					
	Special Coal Allowances					
3A	Cutters&Helpers—Ton Rate					
	Cutters—Day Rate					
	" Helpers—Day Rate					
4A	Yardage Men—Piece Rate					
	" " —Day Rate					
	Working Faults					
	Rock Drillers					
	" " Helpers					
5A	Coal Drillers					
	" " Helpers					
6A	Shot Firers					
	TOTAL HAND LOADING					
	CONVEYOR LOADING					
7A	Conveyor Loaders					
	" "					
	Special Coal Allowances					
8A	Cutters					
	" Helpers					
10A	Mine Car Trimmers					
11A	Labor Moving Conveyor					
12A	Yardage					
	TOTAL CONVR LOADING					
	MACHINE LOADING					
13A	Machine Operators					
	" Helpers					
	Trackmen (Face)					
	" Helpers					
	Timbermen (Face)					
	" Helpers					
14A	Cutters					
	" Helpers					
15A	Drillers					
	" Helpers					
16A	Shot Firers					
17A	Scrapers					
18A	Parting Cleaners					
	Yardage Work					
	TOTAL MACHINE LOADING					
	TOTAL TONNAGE MEN					
	MAINTENANCE					
Group Accts.	Repairmen					
Sub. Div. B	"					
8,8,8,9	"					
11,13,14	Repairmen Helpers					
16,20,21	" "					
22,23,29	" "					
30,31,32	Motor Change Man					
35,39,40	Plant Maintenance Man					
44,51,52	" " "					
56,57,58	" " "					
59,64,69	Bit Sharpener Operator					
71,72,74	Car Repairmen					
75,77 & 82A	" " Helpers					
	Carpenters					
	Blacksmiths					
	"					
	" Helpers					
	HAULAGE					
19A	Drivers					
20A	Gathering Motormen					
	" " Helpers					
21A	Main Line Motormen					
	" " " Helpers					
21A	Flagmen					

THE CONSOLIDATION COAL COMPANY
INCORPORATED
DAILY MINE FORCE REPORT

DIVISION | MINE No.
Date 19

ACCT. NOS.	OCCUPATION	QUOTA MEN	QUOTA MAN HOURS	TODAY MEN	TODAY MAN HOURS	TODAY AMOUNT
24A&B	Section Trackmen					
	" " Helpers					
25A&B	Track Foremen					
26B	Main Line Trackmen					
	" " " Helpers					
27A&B	Motormen or Drivers					
	Track Cleaners					
29A&B	Wiremen & Bonders					
	" " Helpers					
	VENTILATION					
34A	Bratticemen					
	" Helpers					
	Trappers					
35B	Timbermen					
36B	" Helpers					
	Rock Drillers					
	Rock Men					
	SAFETY					
38A	Rock Dust Men—Sprinklers					
40A	" " Helpers					
41B	Lamp Men					
42A	First Aid and Rescue Teams					
	DRAINAGE					
44A	Pumpers					
45A	Pipemen					
	" Helpers					
46A	Water Ballers—Sump Clean'rs					
	Ditchers					
	GENERAL INSIDE					
48A&B	Section Timbermen					
	" " Helpers					
49A	Main Line Timbermen					
	" " " Helpers					
50A&B	Slate Boss					
	Motormen or Drivers					
	Loading Machine Operators					
	" " " Helpers					
	Rockmen					
	Rock Drillers					
	" " Helpers					
	MISC. MINER'S ALLOWNCS					
	Drainage					
	Timbering					
	Rockwork					
54A	Inside Coal Inspectors					
55A						
	TOTAL INSIDE					
	HOISTING AND TIPPLE					
56	Hoist Engineers (Monthly)					
	Hoist Engineers (Day)					
	Car Haul Men					
	Roperiders					
	Rollermen-Slopemen					
	Trip Senders					
57A	Weightmaster (Monthly)					
	" (Day)					
	Car Feeders—Cagers					
	" " " Helpers					
	Load Droppers					
	Empty Catchers					
	Check Pullers					
	Pin Pullers					
	Dumpers					
	Empty Couplers					

ACCT. NOS.	OCCUPATION	QUOTA MEN	QUOTA MAN HOURS	TODAY MEN	TODAY MAN HOURS	TODAY AMOUNT
58A	Coal Inspectors					
	Screen Men					
	Basket or Boom Men					
	Pickers					
	Tipple Oilers					
	Conveyor or Tipple Operators					
59A	R. R. Car Cleaners					
	" " Droppers					
	" " Trimmers					
	Tipple Foreman					
	Domestic Bin					
	Coaling Sta. Dumpers					
	" " " Helpers					
	R. R. Track Cleaners					
	GENERAL OUTSIDE					
23A	Greaser—Oiler					
62A	Supply Hoist Engineers					
	Cagers					
	" Helpers					
	Supply Motormen					
	" " Helpers					
	Handling Supplies—Outside					
	" " "					
	" " Inside					
	" " "					
	Powder Man					
	Supply Clerk					
63A	Sandman					
64A	Rock Train Engineers					
	Larry Men					
	" " Helpers					
	Rock Dumpers					
	Rock Disposal Men					
65A	Watchmen					
66A	Office Clerks					
	Check-in Men					
19B,62A & 70A	Stable Boss					
	Teamsters					
	Truck Drivers					
	Laborers					
72A	Bath House Attendant					
73A						
85A	Fanmen					
74A& Lor M	Firemen					
	Engineers					
	Boiler Coal Men					
	Ash Wheelers					
	Sub-Station Men					
	Other Outside Mon'y. Men					
	Office Clerks					
	Stable Boss					
	Special Officers					
	Watchmen					
	Truck Drivers					
	Teamsters					
	Laborers					
	TOTAL OUTSIDE					
	TOTALS from ACCT. 3B					
	AUTHORIZED BETTERS					
	TOTAL AUTH. BETTERS					
	GRAND TOTAL from ACCT. 3B					

ACCT. NOS.	OCCUPATION	QUOTA MEN	QUOTA MAN HOURS	TODAY MEN	TODAY MAN HOURS	TODAY AMOUNT
	SUPERVISORT					
	Superintendent (Mo.)					
	Asst. " "					
	Mine Foreman "					
	Section " "					
	Maintenance " "					
47A	Haulage Foreman (Day)					
47A	Section " "					
	Dispatcher "					
37A	Fire Boss (Mo.)					
	" " (Day)					
61A	Outside Foremen					
	TOTAL SUPERVISORY					
	A. F. E. WORK					
	TOTAL A. F. E. WORK					
	OTHER OPER. EXPENSE					
	TOTAL O. O. E.					

PRODUCTION DATA	TONS
Hand Loaders—Pick Mined	
" " Machine Cut	
Cutting and Loading Men	
Conveyor Loaded (No. Operating)	
Machine Loaded (No. Operating)	
Company	
TOTAL	

Total Tons Pick Coal
Cars Coal Dumped Today To Date
Cars Rock Dumped Today To Date
Tipple Hours Today (Incl. Overtime)
Weather:—
Remarks:—

Available Working Places Places Working Today
Available Loaders Loaders Working Today

COST DATA	TODAY Amount	TODAY Per Ton	TO DATE Amount	TO DATE Per Ton
Hand Loaded Pick Coal				
Hand Loaded Machine Coal				
Conveyor Loaded Coal				
Machine Loaded Coal				
All Other Loading Labor				
OTHER LABOR				
Authorized Betterments				
Monthly Men				
Divisional Charges				
Power				
Supplies				
Gross Total Before Depreciation				
Credits				
Net Total Before Depreciation				

If this group is unable to settle the case, the division maintenance superintendent may then appeal to the maintenance engineer, and that official and the division manager can appeal to the general manager of operations.

In practice, this system has been found to be an important factor in reducing intradepartmental friction. While the system is invoked from time to time to carry disputes to the top, the very fact that such appeals can be made has a salutary effect, because neither mine foreman nor mine maintenance foreman desires to take a position that may not be supported by his superior officers. At the same time, giving the maintenance man equal rank with the mine foreman and carrying out that parity in the higher brackets of service has improved maintenance practices and control.

The department of industrial relations has direct supervision over questions of personnel, employment methods and records, medical service, group insurance, company publications, and such company service activities as club houses and boarding houses, and recreation. All company buildings and grounds, other than those used in actual operations, are under the control of the buildings and civic improvements department, which stands in the relation of landlord to the other departments, to outside lessees and to the men, and also is responsible for the construction of new buildings and the maintenance of old. Additions to building facilities are a subject of conference between production, industrial relations, and buildings and civic improvements departments. Maintenance of sanitary conditions outside the direct control of lessees is a responsibility of the buildings and civic improvements department, which acts jointly with the industrial relations and production departments in regular sanitary inspections of company property.

Divisional representation is maintained by the industrial relations and buildings and civic improvements departments. In the case of these two departments, however, there is only a direct-line system of reporting. But there is close co-ordination between these two departments and the production department and the stores department. All are concerned with fostering contented and efficient manpower at the mines, so that frequent interdepartmental conference between the department heads at Fairmont and local representatives in the operating divisions is the accepted rule.

Development work, as explained in more detail on p. 577 of this issue, is generally projected two or three years ahead. Forecast, or control, maps are drawn up by the engineering staff. Important developments call for a specific appropriation for expenditures, known as an A.F.E. (Authorization for Expenditure). Requests for an

A.F.E. must be accompanied by maps and detailed estimates of costs and anticipated savings in operation from the proposed outlay. Before an A.F.E. is finally adopted, it must receive the approval of division, staff, and executive officials from division engineer to president.

By the budgeting system in effect in the production department, all expenditures, both for current operating costs and for A.F.E. work and authorized betterments, are controlled by the day-to-day output of the individual mine. The mechanics of control are a "quota sheet" and a "daily mine force report." The quota sheet sets up just how much coal the mine should produce per day of operation and how many men are needed to perform each of the 178 classifications of mine-labor tasks. Quotas are based on men and man-hours, not on wage rates. These data are arrived at after consultation and conference which draws upon the knowledge and opinion of the supervisory and official force from mine foreman to general manager.

Although a quota so arrived at is fixed — barring unforeseen and exceptional circumstances—in so far as the total number of men authorized for a particular task, local mine management is at liberty to make such divisions of this total between different sections of the mine as judgment and special operating conditions dictate. Bad roof in one section may call for a disproportionate number of timbermen; track in wet places may mean more men to keep section transportation up to standard. These quota sheets give a ready means of comparing section with section, mine with mine, and division with division. How effective the stimulus of such comparisons has been is suggested by the fact that since the inauguration of the system the tonnage mined per day labor has increased approximately 25 per cent.

The daily mine force report sets out separately the 178 task classifications, the mine quota in men and man-hours and the number of men actually employed, the man-hours, and the cost. Separate schedules are prepared for idle days, so that the too-common tendency to employ too many men on days that the mine is not running is checked. In addition, curves have been drawn for each mine to show how costs per ton vary with regularity of operation. Detailed supply budgets setting out specific quantities of materials necessary under certain conditions also are part of the production department budgeting picture.

Control of expenditures for betterments chargeable to operating expenses is effected through a detailed annual budget for authorized improvements in which the estimated cost of the project is broken down into cents per ton on the basis of budgeted production for the period estimated necessary to complete the betterment project. If the tonnage during that period falls below the forecast, expenditures for betterments are correspondingly reduced. The only exception to this tonnage-control are emergency safety items.

While application of this system means delays in the completion of such betterments when tonnage falls, the system has the virtue of preventing abnormal inflation of monthly production costs. It also robs improvident mine management of "betterments" as an all-covering alibi when cost-sheet figures jump. No longer can the superintendent glibly say that "this month I had more cost than usual because I was trying to complete such-and-such a project that will save, as soon as finished, many times the expenditure."

With this budget system, costs of production can be and are projected despite uncertainties and irregularities of operation. The company has more than a hazy idea of what sales realizations must be under varying rates of production if these realizations are to yield a profit. Budget and cost records are real tools in promoting efficient operation, not merely interesting data for the historian. The best evidence of this statement is the fact that since the introduction of the present budget system there has been a steadily descending curve of costs and an ascending curve of efficiency.

Major improvements and additions chargeable in total to capital expenditures, as well as improvements and changes the cost of which is absorbed in whole or in part by the production department, originate in recommendations and plans of the operating department, submitted to headquarters and the board of directors for approval. Authorizations for improvements of this class are not controlled by the tonnage system, but, in the absence of special orders, are continued through to completion without regard to the rate of production during the period of their construction.

As part of the program to develop standardization where practices can be standardized over the company operations without reducing efficiency and safety, the staff organization of the production department has worked out detailed standards on safety, timbering, transportation, and maintenance. These standards are furnished the men in printed form.

Estimate of Savings Form Accompanying Request for A.F.E.

THE CONSOLIDATION COAL COMPANY
INCORPORATED

A. F. E. No. .....
DIVISION .....
Mine .....
Date .....
Made by.....

ANNUAL COST OF NEW PROJECT AS COMPARED TO COST OF OLD PROJECT

	New Project	Old Project	Saving
Original Cost ..... $			
Accrued Depreciation			
Present Depreciated Value	$	$	$
Fixed Expense:—			
Depreciation ..... %			
Taxes and Insurance ..... %			
Average Interest over life of project ..... %			
Total Fixed Expense			
Operating Labor and Supplies			
Maintenance Labor and Supplies			
Total Operating and Maintenance Expense			
GRAND TOTAL FIXED EXPENSE PLUS OPERATING AND MAINTENANCE EXPENSE			
Cost per ton—Based on tonnage affected by this project			
Cost per ton—Based on tonnage of entire mine			
Value of material in stock that will be made obsolete by this change			
Life of new project based on annual depreciation rate			
Schedule production affected by new project			
Schedule production of mine			

A.—Inventory cost should be cost of new project and original cost of old project.
B.—Depreciation should be figured at rate established for depreciation of the particular class of equipment of the company. This can be obtained from the Controller's Office or Division Local Auditor's Office.
C.—Any other essential element of cost in the particular equipment should be included under Operating.
D.—If there are any specific earnings created by the new project that are not received from the old project, this should be added to the estimated net annual savings.

MINE LAYOUT

+ At Consolidation Coal Co.

ALTHOUGH the Consolidation Coal Co. had its origin in the Georges Creek field, where for generations the mineral resources were wasted in the most lavish manner, conservation of coal has always been one of its leading principles. Perhaps it was precisely because the Georges Creek field seemed destined to an early end as a result of the wasteful methods practiced by the pioneers of that region that the company was so careful about its plans for operating the coal in the Fairmont district. The expense of remining the Georges Creek area, so great as at times to cause its discontinuance, kept constantly before the management the advantages of conservation, and of a conservation pursued now instead of later, by a carefully planned continuous operation instead of by an expensive reopening of old workings. Perhaps the coal in the Fairmont region could have been first-mined and later reopened and mined again, but not with advantage to anyone. The Consolidation Coal Co. early set itself to mine its coal out clean as it went.

Its properties laid themselves out for the most systematic methods of mining. It might be well to detail these favorable conditions. The grades were regular, for West Virginia never received the intense and irregular pushes that so greatly corrugated the Pennsylvania coal beds. The thickness of the Consolidation's coal around Fairmont varied little. On the west side of the West Fork of the Monongahela the coal was unbroken by ravines, though on the other bank there was enough erosion to provide occasional outcrops. Ownership of large tracts, not previously worked, still further simplified the problem. Nor were there any washouts or faults in this division. The only discouraging operating features were the gas wells.

Although conditions were favorable, the company proceeded and has proceeded ever since to make them more so by careful projection. Such forecast plans are known to the staff as maps for the control of mines. These are drawn by the engineering staff with the co-operation of the division engineer. They usually look ahead two or three years. Before adoption each control map must receive the approval of the general manager of operations. The forecasting of mining progress aids in the forecasting of costs and so is not merely an engineering but a budgetary aid.

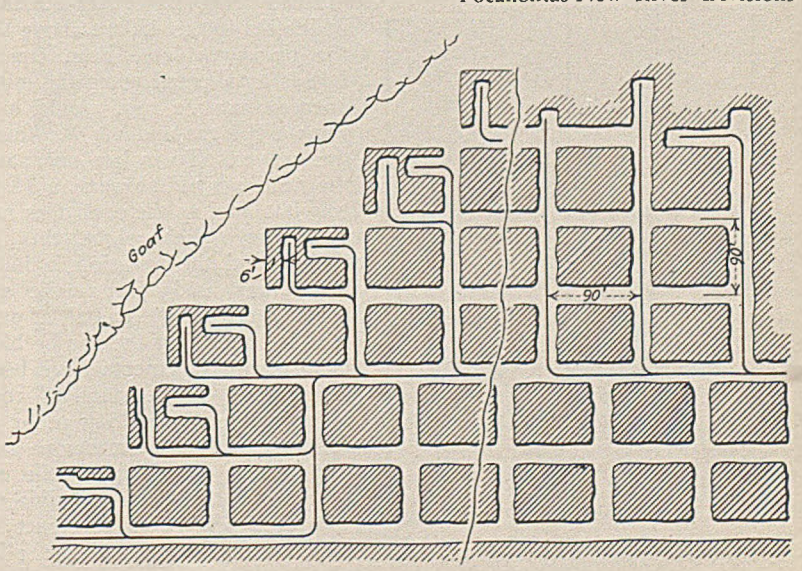
Whenever any important development has to be made an A.F.E., an Appropriation for Expenditure, is prepared, and this, before it is finally adopted, has to be signed by the division, staff, and executive officials; so it gets careful consideration from all angles. The preparation of maps for the control of mines and the filling of appropriation forms devolves in large part on the chief engineer of the company, who has such records of past performance as enable him to forecast with great precision just what the cost of the improvement will be and what economies will be effected by the expenditures thus made. Appropriations for expenditure are always accompanied by maps of the improvement, detailed estimates of cost and estimates of the savings to be anticipated as the outcome of the expenditure.

On all maps the contours are drawn at 5-ft. intervals. These lines in the Fairmont region, though by no means straight or parallel, designate everywhere a general trend and do not close on themselves, as in more disturbed areas. Formerly the room-and-pillar system with narrow rooms and wide pillars was in general use. Recently a change has been made to a system of dividing the coal area up into rectangular blocks which are almost square. The only way in which the headings which constitute entries can be distinguished on the map from those which are driven to break the coal into pillars is by the fact that entry headings extend through the barrier pillars and the other headings do not. Illustrations of the heading or block method will be found in Fig. 1. The break line goes completely over the room entries. In fact, in some cases break lines 2,500 ft. long are obtained.

In the Pennsylvania division all operation is by rooms and pillars. Those at Acosta are illustrated by Fig. 3. The rooms are 22 ft. wide and the pillars 28 ft. through. When the pillar is to be drawn a butt-through 18 ft. wide is cut by machine across the pillar, 6 ft. from its end, and then the 6-ft. butt-off is mined by hand. In Jenner, as a rule, the rooms are 30 ft. wide. A 30-ft. pillar is left between rooms. The maximum length of rooms in both Jenner and Acosta is standardized at 275 ft.

Work in the Pittsburgh bed of the Georges Creek region consists wholly of removing the crushed pillars of early operations. Fortunately, in some cases

Fig. 1—Block Methods of Mining Coal Used in West Virginia and Pocahontas-New River Divisions



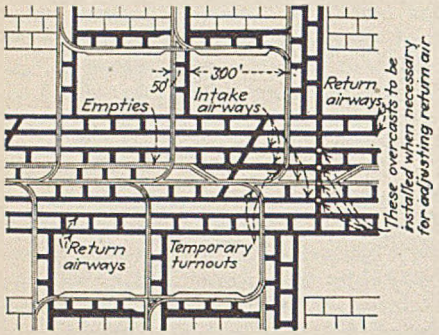
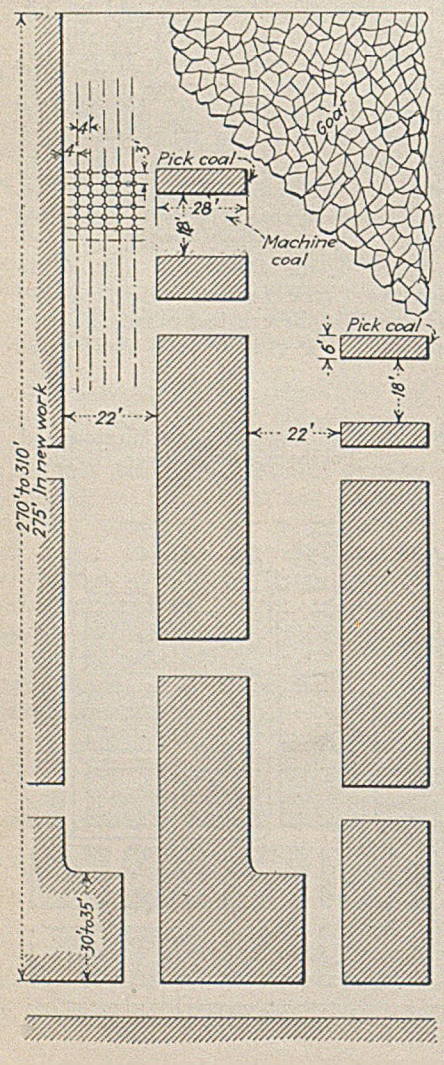


Fig. 2—Section of Panel Entry Designed for Coalwood and Caretta

the original mining was done by Consolidation Coal Co. All the mine foremen who supervised this early work understood the use of the compass, and they set sights for the rooms, the men being unusually good miners and, in the matter of driving to line, quite conscientious. Consequently, it is easy to locate the old rooms and to skip the pillars. The old Borden Mining Co.'s rooms were not so carefully aligned, and with them some difficulty was encountered. Another helpful feature is the fact that there were no crosscuts in the old rooms. The mania for putting in crosscuts at overshort intervals, a practice that has wrecked our mining systems, arose with the use of powder, especially with its flagrant use. When the wedge or lime cartridge was the recognized implement for bringing down coal or when light powder shots were used there was less need for frequent piercing of the pillar. In skipping the pillars it is a distinct advantage that no crosscuts have to be traversed, for all openings are completely filled with rashings.

Fig. 3—Room-and-Pillar Methods at Acosta Mine



The old rooms were at 90-ft. centers and were driven on what is known as the "room-and-one-half system"; namely, each room on being driven far enough to leave sufficient support for the heading was provided with a short heading to the right long enough to permit of the driving of another room which room paralleled the first, the coal from both rooms coming to the entry through the neck of the first room. In present pillar recovery work but little powder is used. The weight has seamed the coal with slippage planes, making it easy to dig. The ventilating of the reopened mines would be a difficult matter had smoky lamps and large quantities of explosive to be used and if the roof had not been creviced to the Tyson workings. Only a few men are employed at each mine, a small area being under process of recovery at each operation.

Workings in the Tyson seam present less difficulties, though the extraction of the thick Big Vein seam below has broken the floor and roof in places. The rooms are driven 40 ft. wide with pillars 10 ft. wide which are drawn back as soon as the rooms have reached their full length. Headings are driven 25 ft. wide with gob stowed on one side.

In the Pocahontas-New River division the coal has been extracted hitherto by the block system similar to that used in the West Virginia division, but as there has been up to the present no complete collapse of the roof, as is shown by the fact that no water has been drained from the water-bearing strata which lie 400 to 450 ft. above the seam, the pressures have been considerable. It was anticipated when the mines were opened that the roof would break and remove the gas and lift the weight from the goaves. To isolate one panel from the headings of the next, a 15-ft. pillar was left, but, as the roof does not break and relieve the weight, this pillar is broken and the isolation is incomplete. The pillar holds for awhile and then tends to release the gas all at one time.

It is better that the gas be bled regularly, so arrangements have been made to go back to the standard room-and-pillar method with long pillar lines in recovery and with continuous gas bleeding, just as was formerly the universal practice in the West Virginia division. The plan will be to construct four intakes in the center of the pillar and place two pairs of returns on either side of this quadruple intake. Then room headings will be driven off one side of the entry advancing.

If the gas makes it necessary to use all four returns, overcasts will be put over the four intakes at intervals to take part of the air over to the two returns on the far side of the entry. If production demands it, a few room entries will be started on the other side of the panel entry, but the general expectation is that those room entries will be started retreating. In other words, the room entries will be opened advancing and in turn on the right side till the end of the entry is reached, and then the room entries on the left side will be opened in turn, beginning at the end and proceeding to the mouth of the entry. The

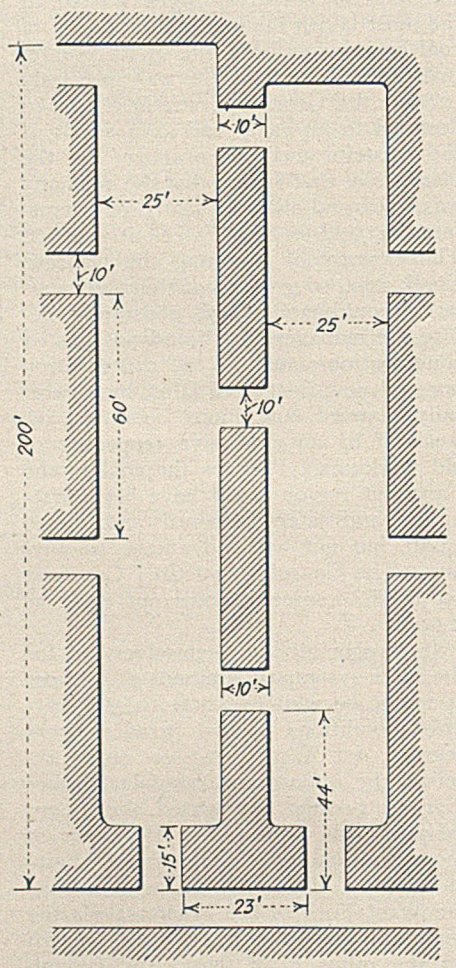


Fig. 4—Van Lear System of Room-and-Pillar With Narrow Ribs

former block panels involved too much tracklaying and were therefore not so economical as the room-and-pillar system will be. There will be a 15-ft. isolating block between every third room entry.

A section of such a panel entry with room entries and rooms is shown in Fig. 2. This shows the haulage and the overcasts, but, as it shows the left-hand side of the heading as greatly developed as the right, it misrepresents in a degree the intention, for the left should

(Turn to page 610)

FACE METHODS

+ At Consolidation Coal Co.

IN CUTTING coal, breast machines have given way to shortwalls, and the latter seem destined to be hard run by arcwalls, wherever, as with Consolidation Coal Co. in its West Virginia mines, the coal is sufficiently thick, the mine is on the room-and-pillar or on the block system, and the miners do not cut their own places. Under these conditions, the large number of places that have to be cut necessitates a thoroughly mobile track machine.

In the West Virginia division, 95 per cent of the coal kerfed—and this comprises more than half the coal produced—is cut by various types of arcwalls—eighteen Sullivan CLU'S, which cut and shear, nineteen Jeffrey arcwalls, and one Oldroyd machine. The other machines cut the remaining 5 per cent.

It is the same story in the Pocahontas-New River division, for 75 per cent of the coal cut is kerfed with seven Jeffrey arcwall machines. In this division, only the War Creek and Sewell beds are cut with machines of the shortwall type. The Elkhorn division also cuts the coal with the arcwall machine—32 machines are used, 30 of which are Jeffrey and 2 are Goodman. On the other hand, the Pennsylvania, Millers Creek, and Maryland divisions do not use any arcwalls, because the coal is too thin or, in the case of the Big Vein, because the seam is not kerfed.

In all there are 77 arcwalls in active operation. The shortwalls or longwall machines are unassailable wherever the extracted portion of the seam is thin, a longwall face is available, or where the miners cut their own coal faces mechanically. Of these latter types of machines the Consolidation Coal Co. has 96, 8 being longwall units.

Though the arcwall cutters have 9-ft. cutter bars, they do not, of course cut a 9-ft. kerf. The standard kerf is 7 ft., but more often it is only 6 ft. 9 in. deep. The former depth is not exceeded, and for good reasons. Though the natural strength of the coal and the level floor favor a deep cut, as also the thickness of the coal, which makes it easy to shoot, the tenderness of the drawslate in the West Virginia division makes deeper cuts than 7 ft. undesirable, for when the coal is undercut and shot down the distance from the front line of props to the solid face becomes excessive.

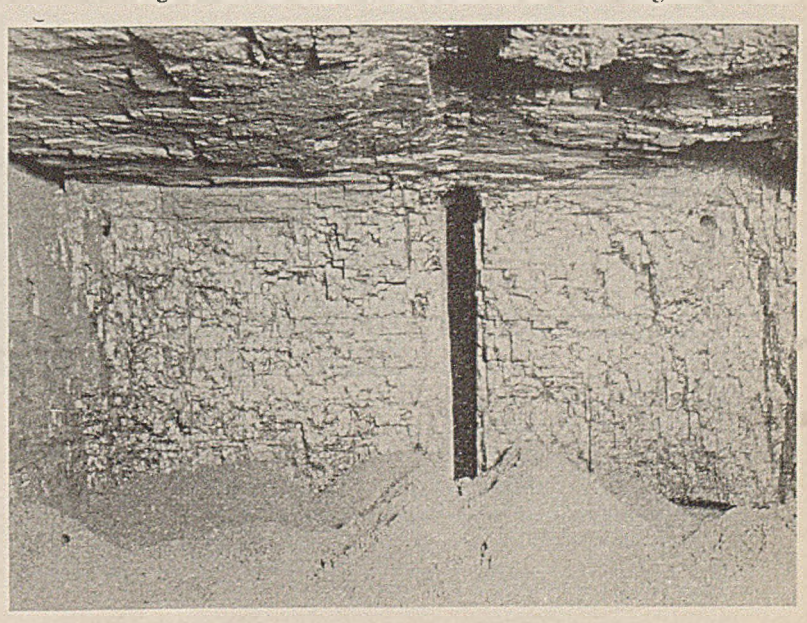
Moreover, when a long cutter bar is used, the machine tends to tilt forward and cuts downward instead of level, which, of course, is undesirable. In the West Virginia division, where the coal is cut near the floor, the machine would not cut into the clay, because bottom coal always is left in cutting. But that makes little difference. If the intention is to cut in an impure layer of coal, the machine should do so, or otherwise it will either leave dirty coal in the room product or it will put clean coal in a bugdust that is destined to be gobbed. The cutter must cut from the face of the coal to the back of the cut in the required coal layer. Consequently, it has been found best to keep cutter bars within reasonable length.

With the Sewell bed in the Pocahontas-New River division the coal tends to set down on the machine. Sprags could be put under the coal to prevent this in case greater depth of undercutting were desired, but sprags might not suffice in a really deep cut, and road ties would have to be used as "toe" blocks, which could not well be removed before shooting. Consequently, much of the undercutting would be nullified. A seam that, without the use of such ties, would need little shooting would have to be shot hard with them and there would be a decrease rather than an increase in the proportion of lump coal obtained.

Nowhere is the coal snubbed. Low pyrite, low ash, and medium- to low-volatile content make the West Virginia and Maryland coals extremely easy to shoot. Low volatile coals are normally weak in structure.

In the Pocahontas seam workings the coal is center-cut, as it is also in the Elkhorn mines. In the latter a somewhat weak sandy shale parting is cut out. It is cut back far enough near the ribs that none of it will fall and mingle with the coal when the coal is being shot. The cuts sometimes are 7½ ft. deep and at others only 6 ft. Owing

Fig. 1—Center Shear With Undercut in West Virginia Division



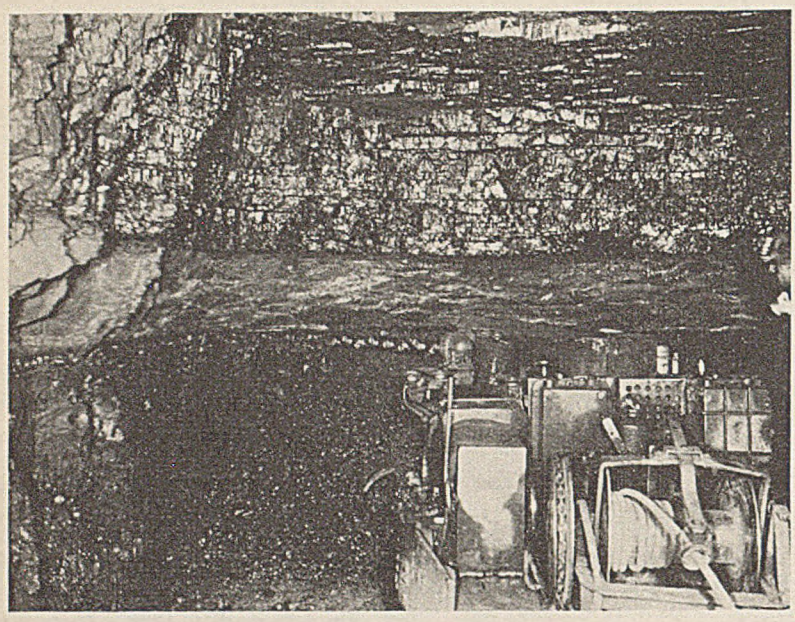


Fig. 2—Center Horizontal Cut Under Middle Parting, in Elkhorn Division

to the heavy cover, deep undercuts are undesirable. The upper coal is relatively weak and likely to fall if cut to unusual depths. The lower coal is stronger. In some cases where the rock parting is unsually hard, the coal is cut below it, as shown in Fig. 2.

At Jenner and Acosta, in the Pennsylvania division, the kerfs are about 6 ft. deep, though at the Gray mine, some of the cuts are made 7½ ft. deep, because of the needs of conveyor mining.

Wherever the machines are suited to shearing, the coal is sheared, sometimes in the center of the place and sometimes on one side only and then so far over to one side as to form a rib line. The practice of shearing is on the increase.

Location and depth of shotholes has come to be a matter to be discussed under the head of preparation, because it is directed mainly in the interests of clean and large coal. So in this article it will be treated largely as matter of the regulation of those by whom the shots are prepared and fired.

In all mines the miners take their powder to their working places in canvas army sacks, in slide-covered boxes, or in hinged boxes which close tight. These boxes should be free from internally exposed nail heads. This furnishes protection against stray currents in mine cars. Further, to prevent any current from being carried along the trip, insulated couplings are provided on man trips. The miners receive their powder from a distributing magazine such as is shown in the tailpiece of the article. No more than one day's supply may be left at any time in such a distributing point.

Only so much powder as he needs for a day's shooting is supplied to the miner. As, in a gassy mine, shotfirers shoot the holes, and the location, number, and charging of these holes is closely regulated, it is quite clear how much powder each man will need. The magazine attendant will give him no more. In this way he does not leave a lot of powder in the mine at the end of his shift. In both gaseous and nongaseous mines, permissible explosives are used and are fired by battery. In Maryland some black powder is used, but in these mines the shots are quite light.

Miners do not carry electric detonators with them in gaseous mines. The shotfirers supply these, taking them from a separate distributing point and transporting them in a leather case. The miners or machine runners drill the holes and the shotfirer loads them, the latter receiving a check for every detonator used. Thus he is able to turn in as many checks as he received detonators. Naturally, he is careful not to lose any of the latter in the mine, where they may be exploded by a fall of rock. The shots are tamped with moist clay. In most cases the clay is made up into dummies ready for the shotfirer's use.

Only one shot is fired at a time and no shooting off the solid is permitted. All shots are fired with detonators of No. 6 strength or greater, with a 100-ft. insulated cable without bare spots and by approved battery or magneto. The coal has to be undercut, top-cut, or center-cut at least as far back as the end of the hole, though when a stump is 6 ft. square or less a shot may be placed and fired in it without preliminary cutting.

Explosives may be stored underground only in closed wooden boxes without any other material of any kind and not less than 50 ft. from the face and over 10 ft. from any calcium-carbide can or detonator container.

Explosives Distributing Station

MACHINE LOADING

+ At Consolidation Coal Co.

FOUR of the major types of machines for the loading and transporting of coal are in use in the mines of Consolidation Coal Co. Mechanization of these two major activities, to supplement or displace the efforts of the hand loader, has taken place in both high and low coal in all of the six operating divisions. Conveyors and scrapers fill an operating need in low coal where mine-car transportation is difficult and costly. Loading machines and pit-car loaders are employed in mines in the thicker seams. In one division in particular, scheduling of loading and auxiliary operations resulted, in the short space of months, in a material increase in the output of the loading machines employed and in a considerable decrease in the cost of machine-loaded coal.

Greatest advances in supplementing the efforts of hand loaders with machines have been made in those divisions where thin seams are worked—notably the Pennsylvania and Maryland divisions. Low coal in certain mines in these divisions made either the removal of large quantities of rock or the installation of some means of transportation other than mine cars necessary. This condition was especially evident in Mine 123, Gray, Pa., and resulted in a change from hand-loading to 100-per cent conveyor operation. Also, low coal at Mine 17, Lord, Md., necessitated the installation of conveyors, and now about 75 per cent of the daily tonnage is carried from the face to the mine car with this equipment.

Several systems of working with conveyors in Mine 123 preceded the one now in use. The seam being mined is the "E," or Upper Freeport, and the portion extracted is 34 in. thick. Immediately above it is an 8-in. bone streak, which is, in turn, overlaid by 6 to 18 ft. of gray slate and 30 to 50 ft. of Mahoning sandstone. The total thickness of the overburden ranges from 200 to 400 ft. Below the 34 in. of clean coal is a hard bone parting, 1½ in. thick, followed, in descending order, by 4½ in. of clean coal, 1¼ in. of hard bone parting, and 9 in. of dirty coal, all of which is left in place. The bottom is a hard slate.

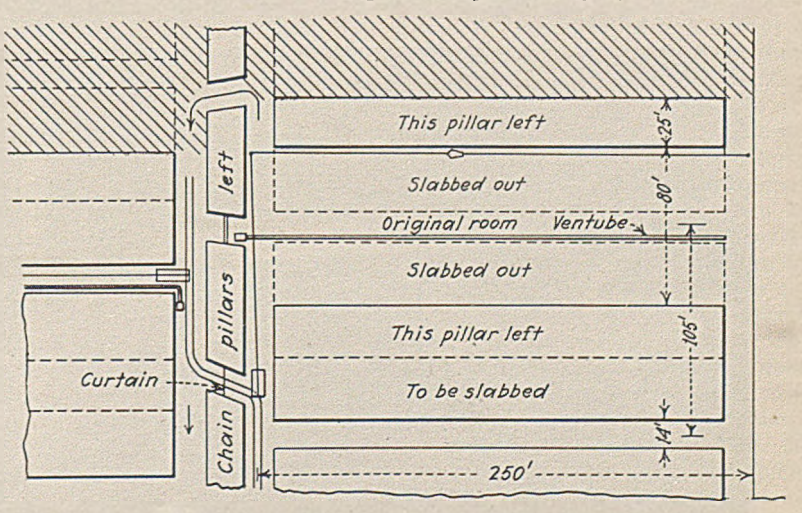
Conveyors used at Mine 123 are of three types. The first is the main conveyor, of either the Lorain or Gellatly type, which can be extended 300 ft. Second is a lighter, intermediate cross-conveyor (Gellatly, Type "B") with a maximum extension of 175 ft. Both the first and second are the chain-and-flight types. The third type, used along the working faces, is the Gellatly mat conveyor, selected because its lowness considerably reduces the exertion of the shoveler. Discharge elevators are used on both main and cross conveyors where necessary.

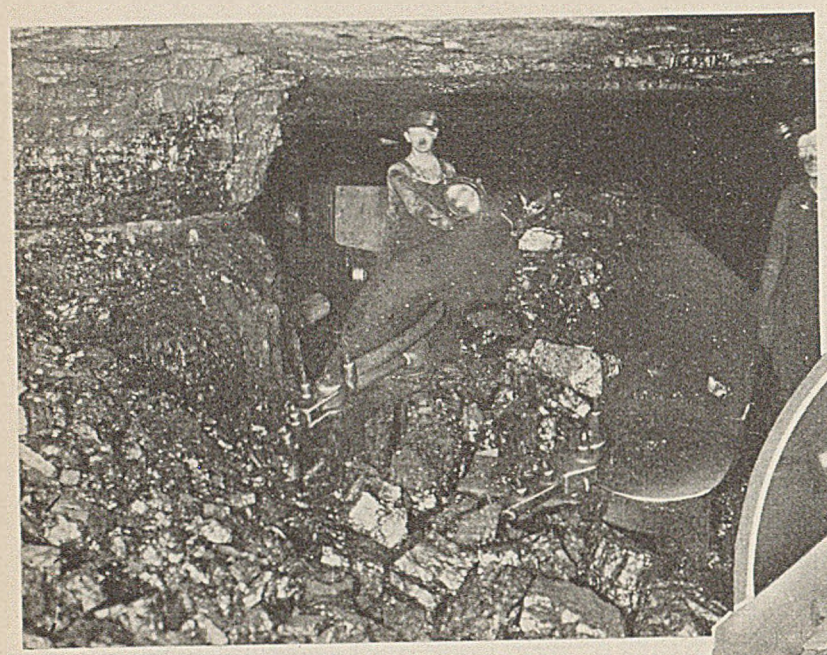
One of the first conveyor systems inaugurated at Mine 123 was based on mining a double room with one loading point. The rooms were driven 40 ft. wide, and were separated by a 15-ft. chain pillar. A 10-ft. barrier pillar was left between the double-room unit and the gob. No attempt was made to recover this barrier pillar, and considerable trouble was encountered in removing the 15-ft. chain pillar. Equipment necessary for the operation of this system consisted of one main conveyor with discharge elevator, one intermediate conveyor, one cross conveyor, and two mat conveyors. The mat conveyor in one room discharged directly into the main conveyor; the mat conveyor in the other room discharged into the intermediate conveyor. The intermediate conveyor, in turn, dumped the coal into a cross-conveyor, which was laid through a crosscut to the main conveyor.

Two crews were employed under the leadership of one man. One crew did the preparatory work, cutting, timbering, extending conveyors, while the second loaded coal, moving from room to room. Advantages of the twin-room system were: more concentration and larger tonnage per boom man. Disadvantages were: extension of the main conveyor shut down the intermediate conveyor and stopped loading in the auxiliary room; considerable equipment was idle and production from two working places was lost in case of delay; supplies could not easily be delivered to the auxiliary room, because the intermediate conveyor was not reversible; and, last, the size of the pillar between the two rooms necessitated an extra slabbing cut to remove it, with the result that coal had to be shoveled twice in removing the second cut.

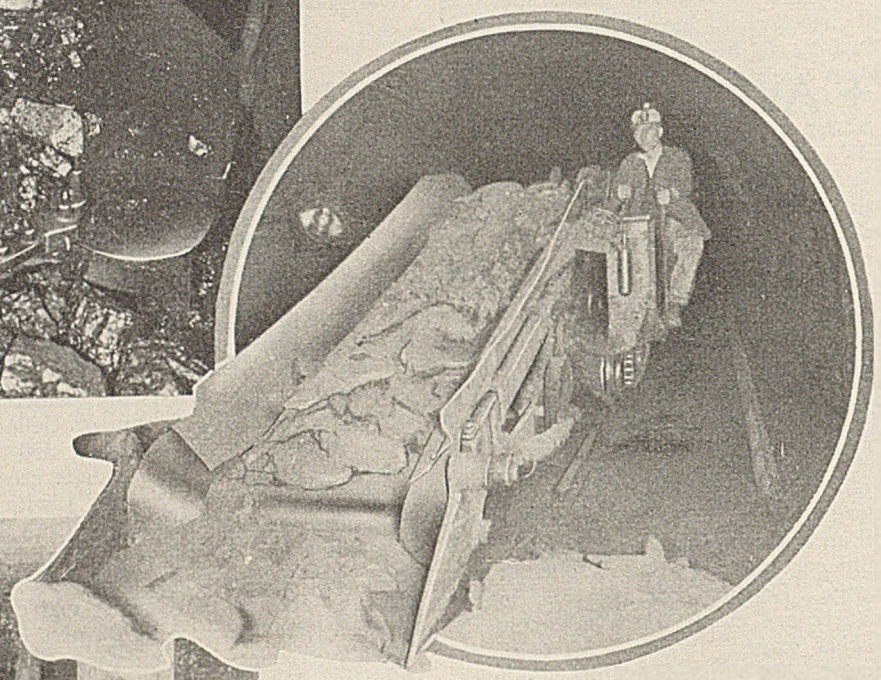
Another system tried but soon discarded was to drive a 15-ft. room and draw 35-ft. pillars back on each side. However, a brattice was required up the center of the place, and the open-end extraction of pillars created an addi-

Fig. 1—Scraper-Loading System, Mine 154

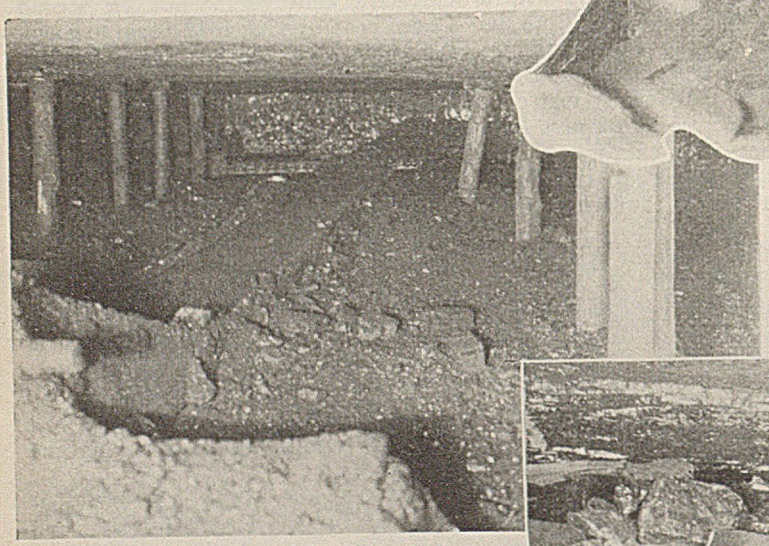




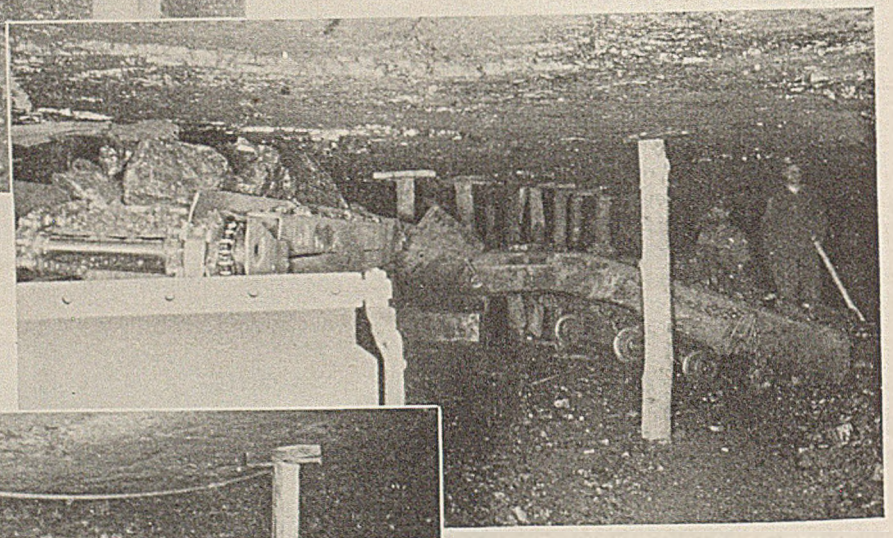
Joy Loader Loading Lift on End of Pillar, Mine 206



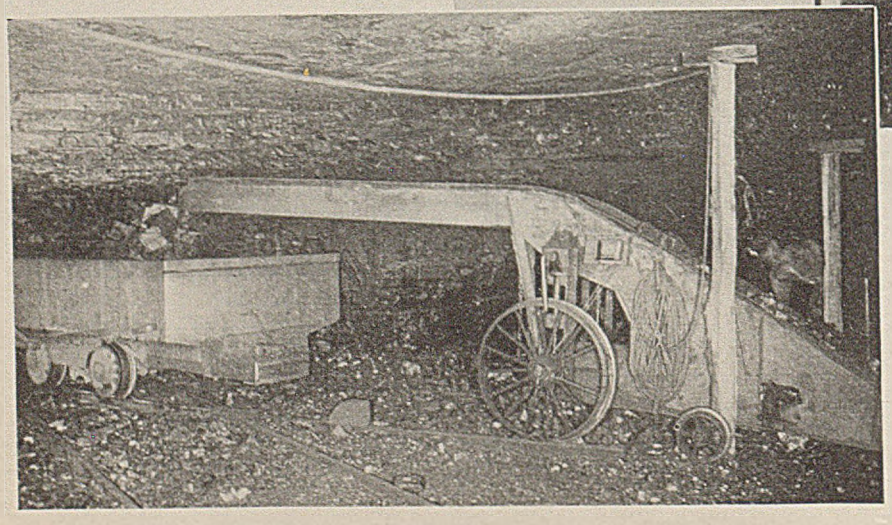
Myers-Whaley Shovel Loading Rock in Grading for Track, Mine 206



Gellatly Mat Face Conveyor Ready to Move Up After Face Is Cut, Mine 17



Coloder on Pillars, Mine 206



Brown-Fayro Pit-Car Loader Starting Pocket in Pillar, Mine 32

tional mining hazard. Mat conveyors were not used until pillar drawing was started. With both pillar faces working, the two mat conveyors discharged into the one main conveyor, giving a very satisfactory tonnage from a single conveyor set-up. However, the increased concentration inherent in the system was overbalanced by the amount of narrow work required to drive the room. Also, as the next room had to be driven while the pillars were being extracted in the preceding one, haulage congestion at the two loading points, which were only 95 ft. apart, caused considerable delay at times.

The method of mining in use at present is known as the "single-room system." In other words, only one room is driven on any one butt entry. The rooms are driven 300 ft. deep on 50-ft. centers. Width is 40 ft., leaving a 10-ft. barrier pillar on the gob side. Equipment required consists of one main conveyor, one discharge elevator, and one mat conveyor, the latter discharging directly into the main conveyor. When the room is driven to the limit the mat conveyor is removed and 40-ft. slabs are taken out of the 10-ft. pillar next to the gob. As the slabbing cuts are made with a 7-ft. cutter bar, nothing but a thin shell of coal is left. The main conveyor is shortened as each slab is loaded out. Approximate time of driving up one 40-ft. room and removing the slabs is two weeks. The working crew consists of five men who, on the average, load four cuts in two days. Thus, in a day of two shifts, the average extraction is four cuts.

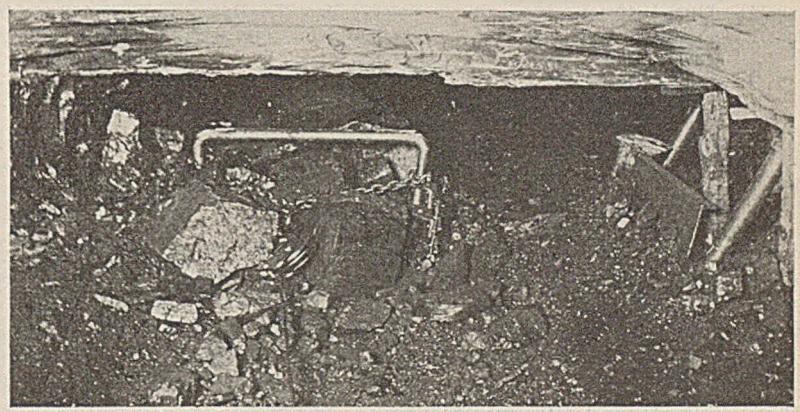
All entry-driving in the mine, with exceptions to be noted in the following, is done with conveyors. Two places are advanced with one common loading point. The discharge elevator is attached to a cross-conveyor which receives the coal from two main conveyors, one in the center of the aircourse and the other along the chain pillar in the haulage heading. No mat conveyors are necessary. Where the chain pillars are of such a width as to require excessive shoveling, a second cross-conveyor is used in driving crosscuts.

In the haulage headings, or wherever brushing is done, the face is cut in the bottom 9 in. of coal. In the aircourses, where the extra height is not needed, the cut is made in the 1½-in. bone parting directly under the clean coal. The clean coal is the only part of the seam loaded in the aircourses. Machine cuttings in the haulage headings are loaded out as refuse, and the coal is then shot down. Drillholes must be placed horizontally and close to the top bone to prevent the coal from sticking to it. Each loading crew therefore is provided with a light electric coal drill to insure proper alignment and placing of the holes. After shooting, the coal is loaded off the 1½-in. bone parting directly underlying it. As the bone parting frees itself easily, little difficulty is encountered in keeping it out of the loaded product. After the coal has been loaded, the top bone is either pulled or shot down and, together with the material below, including the bone parting under the clean section, is loaded out as refuse. Final clear height obtained is about 5 feet.

Ordinarily, a five-man crew is employed in driving entries, two in the aircourse, two in the haulageway, and one at the loading boom. Usually, such a crew loads out two cuts in each place in a shift. One of the men acts as a leader and is directly responsible for the work of the crew. Each man is paid the same rate, with the exception of the leader, who receives slightly more but is required to furnish all explosives and small tools. This system, it is found, results in the use of a smaller quantity of explosives and, consequently, increases the percentage of larger sizes.

Experience resulted in the conclusion that three eight-hour shifts cannot successfully be worked in a day, as some time is required for proper inspection and maintenance of equipment. Also, it is sometimes necessary to work slightly more than eight hours to finish up a cut. Competition among crews is encouraged by posting tonnages at the mine and by making special mention of high-tonnage producers in the monthly company publication.

In the Maryland division, in order to eliminate the cost of brushing rock for cars in the Tyson (Sewickley) seam, which varies in thickness from 28 to 36 in., conveyors were installed in most of the working sections in Mine 17, Lord, Md., and in a few sections in Mine 10, Eckhart, Md. Conveyor development in the Maryland division passed through practically the same cycle as in the Pennsylvania division.



Goodman Scraper Working on Face, Mine 151

Both headings comprising the entry are driven 300 ft. ahead of the loading point before it is advanced. The loading point is then advanced 200 ft. to a previously prepared crosscut. The remaining 100 ft. between the loading point and the face then serves as a storage place for empty cars, and is increased as the heading advances. No brushing is done, except in the haulageways, unless sidetracks to facilitate the handling of cars are deemed necessary.

In the rooms, the coal is cut in the 1½-in. bone parting directly under the clean coal, and the cuttings are gobbed in the room. Drilling and shooting are done as previously related in the description of entry-driving with conveyors. The 8-in. of bone above the clean coal is not taken down in room workings, as it is strong enough to stay in place when timbered and the extra height is not needed.

In portions of the mine where hand loading formerly prevailed, a combination of two light intermediate conveyors is used in drawing the remaining pillars. Blowers and Ventube are used in all places to speed up production. Room hoists and car retarders are employed for shifting cars under the discharge elevator or holding them on grades.

The present system of operation corresponds with that in Pennsylvania, except that rooms are turned off square instead of at an angle, as is sometimes done in Pennsylvania to lessen the grade. Shaker conveyors were originally installed in the Maryland division, and some are still in use in Mine 10. However, heavy grades occur, and the pitch in dip places usually is so great as to reduce materially the tonnage delivered. Consequently, shaker conveyors were abandoned for the positive-acting chain-and-flight types.

Scrapers are employed in low coal in the Millers Creek division. Of the three in use in the division, two are in Mine 154 and one is in Mine 153. All are Goodman entry loaders, of the triple-drum type, and were originally employed in driving entries. They are now used in working out rooms, as shown in Fig. 1. Room entries are advanced to the limit and the rooms are driven on 105-ft. centers and slabbed out on the retreat. The depth of room is dependent upon the thickness of the coal. For 36-in. coal, the depth is 200 ft.; in 40-in. or thicker coal, the depth is increased to 250 ft. Upon completion of the slabbing, which is carried both ways from the original 14-ft. opening, the barrier pillar next to the gob is abandoned. No at-

tempt is made to recover the chain pillars on the entry.

Each place is supported, pending completion of the slabbing, by timbers on 3- to 4-ft. centers. One row of timbers is set for each slabbing cut, the distance from the face being about 8 ft. The roof is supported until the place is finished. No attempt is made to cause it to fall, as a break would fracture the drawslate over the coal and create a hazardous condition along the working face. Ventilation during both the driving of the room and its subsequent widening by slabbing is supplied by a blower and Ventube. The slabbing face, which is cut 6 ft. deep, is blasted down by holes spaced 8 ft. apart. Seven men are employed for each scraper. Four of them work during the day loading out the cut, and three are employed at night in cutting and timbering the place. In 40-in. coal, the production from slabbing cut is 120 tons.

The use of large, mobile-type machines which perform the whole of the loading operation is not as extensive in Consolidation mines as that of conveyors. In the Elkhorn division, loading at Mine 206, Dunham, Ky., is 50-per cent mechanized. Four machines, of which two are Joy 5BU loaders and two are Jones "Coloders," load 1,400 tons of the average daily production of 2,800 tons. Two Myers-Whaley machines are used for loading rock at Mine 205, Jenkins, Ky. The coal loading machines in Mine 206 are each assigned to a section and both drive rooms and draw pillars.

At the beginning of April, the two "Coloders" were selected for study, with the object of scheduling operations to increase the tonnage loaded. Results over the four months period ended Aug. 1 were very gratifying. The total mining cost with machine loading, including maintenance and other charges, was reduced 30 per cent and the production per man employed on the machines was raised from 15 to 21 tons.

Conditions in two of the machine territories of Mine 206 are not of the best. These territories will be finished in the very near future, but the coal now being mined is along the outcrop, and many little fingers stick out from the main body. Consequently, the places are scattered and considerable tramming must be done to cover a section. Efficiency of the auxiliary operations also is decreased by the wide area which must be covered. Drawslate necessitates the leaving of top coal and close timbering. Difficulty occasionally is encountered in keeping an adequate car supply, due to the long haul—three miles—to the outside.

A mechanization supervisor is employed who reports directly to the division office, and is personally responsible for all phases of the machine loading. His duties are instructing foremen and crews; supervising production to insure the full daily quota; keeping daily cost and tonnage sheets; overseeing co-operation between day and night shifts; and recommending changes, if necessary, in supply system or machines and equipment for greater efficiency.

Education of foremen and crews is considered of major importance in increasing the production per loading machine. Closely allied with bettering the workers' understanding of their job was the problem of arousing and sustaining their interest and competitive spirit. These objectives were achieved by laying the facts before the men. Results of time studies, the trend of costs, and other information on operation and production are given the crews for their use.

Scheduling is relied upon to insure the maximum performance of the two "Coloders." Under the provisions of the schedule, each machine must have at least twelve working places in room sections or six to eight places on pillars. This number insures a full shift's production, even if one or two places should be unworkable for any reason. Loading machines are not allowed to work haphazardly, but must proceed from place to place in accordance with a carefully planned routine, in which both the loading and auxiliary activities are coordinated. This routine, for both room and pillar sections is shown in Fig. 2.

A full crew for a Jones "Coloder" section, the machines driving both entries and rooms, is as follows: 1 shotfirer, 1 operator, 1 helper, 1 driller, 1 trackman, 1 motorman, and 1 brakeman. Each man of the crew is assigned a definite place in the production plan, as shown in Fig. 2. In the place or places ahead of those ready for loading are found the drillers and shotfirer. Preceding these men are the "bugdusters," in charge of the preparation assistant. "Bugdusting" is part of the strict face preparation program of the company, and the men employed on this job in the machine sections clean up the places after they are cut and load out the machine cuttings. (Face preparation in the Elkhorn division is described on page 597 of this issue of *Coal Age*.) Cars for the "bugdusters" are handled by the supply locomotive. Just ahead of the "bugdusters" is the cutting machine, which is preceded, in turn, by the trackman, timberman, and "scrappers." The latter pick up the bottom left by the machine and load it out in accordance with the face preparation standards laid down for the Elkhorn seam.

Scheduling was installed to eliminate operating difficulties brought on by lack of information formerly prevailing as to the condition of the places in the section. To eliminate idle minutes while the crew is finding out what is to be done first, as well as possible delays due to poor co-ordination of the auxiliary activities, a "start" report has been adopted, one of which is shown in Fig. 3. This report is made out by the section foreman at the end of the shift and entered in a book provided for the purpose. A copy is left for the boss on the next shift, who, by reference to the "start" report, can assign his men to their places before they leave the outside, thus assuring that they will lose no time hunting their jobs when they arrive at the section.

Accompanying the "start" report in the foreman's book is a report on the daily tonnage loaded and the number of places "bugdusted." The latter item is for checking purposes, as poor coordination of this activity means an unequal division of work as between shifts. All delays, even those of only five minutes, also are reported in detail, together with their causes, whether breakdown of machinery, preparation, haulage, moving machine, or miscellaneous happenings. When the delay is

(Turn to page 596)

	Room Work
1	Loading
2	Ready for Loading
3	Ready for Loading
4	Ready for Loading
5	Shooting
6	Drilling
7	Bug-Dusting
8	Bug-Dusting
9	Cutting
10	Tracklaying and Timbering
11	Scrapping
12	Scrapping

	Pillar Work
1	Loading
2	Ready for Loading
3	Shooting
4	Drilling
5	Bug-Dusting
6	Cutting
7	Tracklaying and Timbering
8	Scrapping

Fig. 2—Schedule for Operation in a Machine-Loading Section, Mine 206

Room No.	
1	Track Needed (T)
2	Track Needed (T)
3	Scrapping Needed (Sc)
4	Half Loaded (L½)
5	Ready to Load (L)
6	Ready to Load (L)
7	Shooting to be Done (Sh)
8	Drilling to be Done (Dr)
9	Cutting Needed (C)
10	Bug-Dusting Needed (B)
11	Bug-Dusting Needed (B)

Fig. 3—"Start" Report
Actual Symbols Used by the Foreman Shown in Parentheses

TRANSPORTATION

+ At Consolidation Coal Co.

TRACK to the amount of 725 miles, nearly 15,000 mine cars, and over 300 locomotives of various types are included in the transportation system of the Consolidation Coal Co. Since 1926, when the company embarked on a program of modernization embracing all its properties, and selected haulage as one of the major activities promising the greatest returns for the money expended in improvements, transportation has steadily been built up to a high state of efficiency. Though the program has not yet been carried through to ultimate completion, haulage, track, and maintenance have been standardized and equipment overhauled and renewed to increase efficiency and reduce the number of types. Elimination of delays and breakdowns has greatly increased the output of the rolling stock, and improved maintenance methods have made it possible to keep it constantly in service.

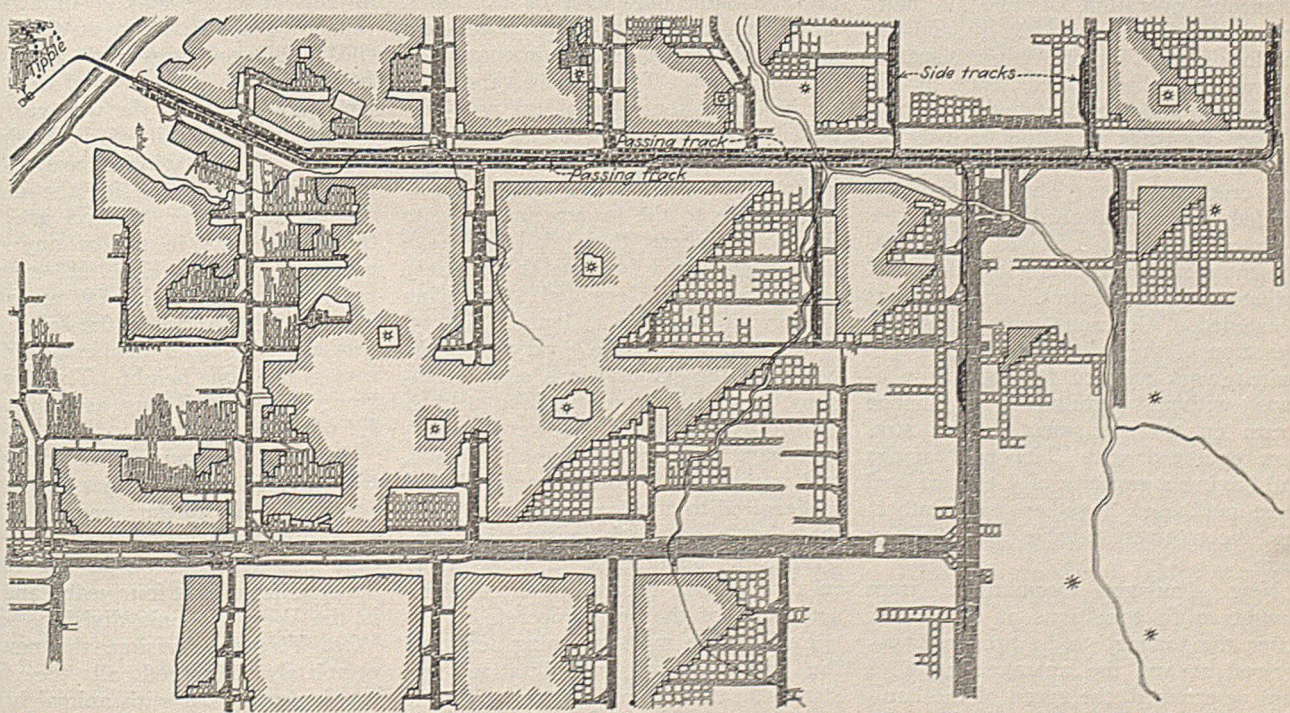
The first step in the general program of haulage modernization was a study of the haulage layout in all mines in all the six divisions of the company. This study included the selection of sites for passing tracks, with particular attention to the territory they would have to serve, grades encountered on the main haulage road, and the mean distance between them for maximum efficiency. At the same time, it was decided that single tracks on main haulageways, with traffic controlled by block signals and dispatching, would be faster, safer, and cheaper than double-tracking, with its increased first cost and multiplied upkeep.

Second in the program of rehabilitation was the standardization of materials used in the construction of track and roadbed, methods of construction and, as far as possible, rolling stock to be used. New and larger mine cars were purchased, which, particularly in the West Virginia and Elkhorn divisions, brought about the elimination of animal haulage, not because any economies resulted from its replacement with gathering locomotives but because the new cars, when loaded with coal, were too heavy for animals to handle.

Rehabilitation of the haulage system is most strikingly exemplified at Mine 63, Monongah, W. Va. In 1926, the daily production was 1,800 to 2,000 tons. Three tandem and three single main-line haulage locomotives were in use, several in secondary or relay service. Average length of haul, one way, for the main-line locomotives was 1.8 miles, and the average grade against the loads was 1.5 per cent, with a maximum of 4.5 per cent.

Forty-pound rail was used on the main haulageways, and the roadbed was improperly drained, poorly aligned, and continually dirty and muddy. No particular plan existed as to the layout of sidetracks and passing tracks, though about 1.4 miles of the main line was double-tracked. Maintenance cost of haulage locomotives was very high, while production was irregular and subject to many daily fluctuations. Service to the loaders was very poor and their daily productivity was very low —about 9.92 tons per man, including pick miners and a larger percentage of pick coal. Main-line trips consisted of

Fig. 1—Main Haulage Routes and Sidetracks at Mine 63, Monongah, W. Va.



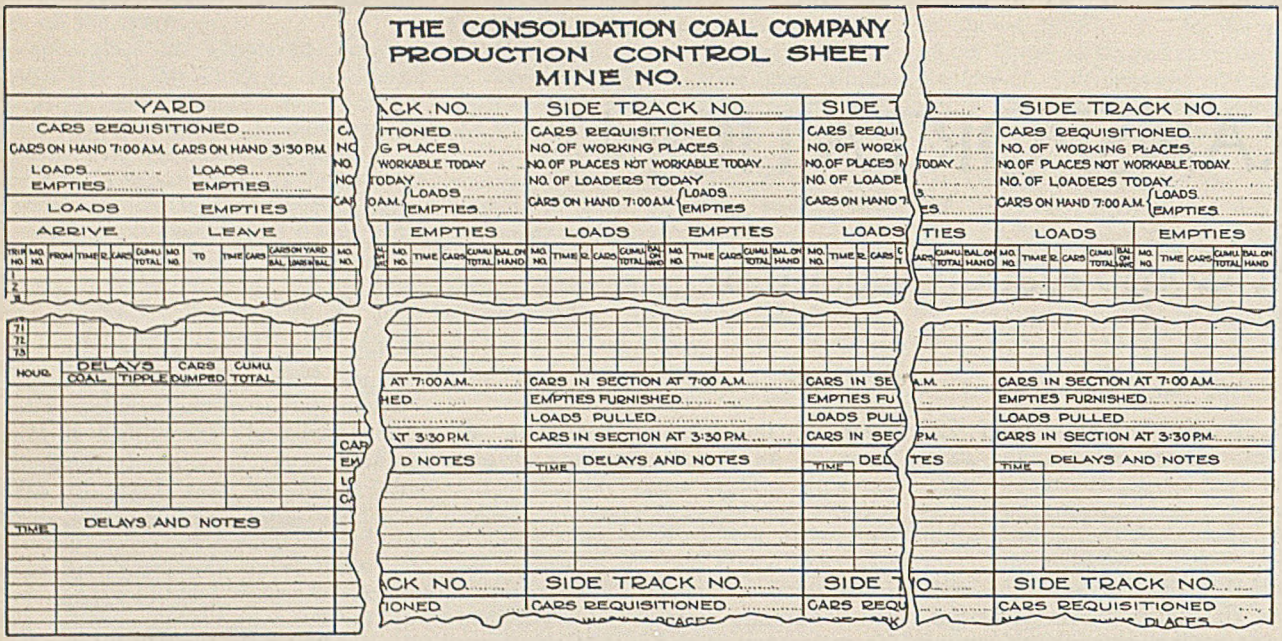


Fig. 2—Production Control Sheet

fifteen cars each holding 3 tons of coal.

Revamping of the haulage at Mine 63 resulted in the selection of a single-track system with passing tracks advantageously located with reference to grades and side entries. Block signals were installed for the protection of single-track stretches. These signals are manually operated by the motorman or brakeman and protect a trip from others approaching or following it until it goes into the clear at the next side-track or passing track. Selection of the single-track system was influenced by the following factors: lower first cost, lower maintenance cost, and the facility with which heavy power demands could be eliminated by the prevention of simultaneous operation of two or more trains on a heavy grade. In addition to block signals for protection, dispatching was installed for efficiency in trip movement and car distribution.

The old track at Mine 63 was replaced with 60-lb. steel laid on tie plates and creosoted ties. The roadbed was graded, drained, aligned, and ballasted with crushed rock. Rooms and development work were laid with 30-lb. rail on steel or wood ties, as conditions demanded. Generous curves, super-elevation of the rails, and railroad-type switch work allowed fast operation of trips without derailments or undue strain on the equipment. New steel cars equipped with Timken bearings and having a capacity of 4 tons of coal were purchased, together with gathering locomotives capable of handling them.

New haulage locomotives were bought to fit conditions at the mines. After the tonnage to be produced was arrived at and the average length of haul determined, the speed of the haulage locomotives was set at 10.5 m.p.h., and the effective running time established by allowing for switching and normal delays. With these data, the number of trips the locomotive must make per day was calculated, as well as the number of cars per trip. On the basis of this information two units, each consisting of two 20-ton locomotives in tandem, were selected for the haulage job.

At the present time, the daily production of Mine 63 ranges from 2,800 to 3,000 tons, all of which is pulled by the two units mentioned and one miscellaneous unit. All secondary or relay units have been taken out of service, and the present equipment is working at only 85 per cent of capacity over an average haul, one way, of 2.3 miles. The average grade is now 1.5 per cent against the loads, with a maximum of 3.75 per cent. Trips of 44 cars, each car holding 4 tons of coal, are regularly pulled. Maintenance cost is now only one-fourth the previous amount. Regularity in production has been realized, and service to the loaders increased to the point where their daily average production is now 14.5 tons though some of the increase is credited to shearing the coal in addition to bottom cutting.

With seams of widely varying thicknesses in the six divisions of the company, standardization of rolling stock is manifestly impossible. However, standards have been set up in each division, and equipment is being replaced and modernized to conform with them. On the other hand, track construction, materials, and maintenance methods apply in all divisions, regardless of the characteristics of the seams operated.

Perhaps the most sweeping action in the campaign of rehabilitation and standardization of rolling stock was the purchase since 1926 of 4,925 new steel and steel-and-wood mine cars equipped with Timken bearings as standard equipment. Of the total of 14,874 cars in use at the 30 active mines, the 4,925 new cars displaced an equal number of the old types. The new cars are designed to carry more coal with a decrease in height, and are constructed to stand up under the strains of high-speed haulage.

Decrease in height without shrinkage in capacity is most noticeable in cars purchased for the Pennsylvania division. To allow entrance into the very low parts of Mine 120, Acosta, Pa., where, in hand-loading sections, the coal frequently thins to 30 in., the new steel cars, of which 200 were bought for this mine, are only 26 in. above the rail, with a 4-in. drop at the loading end. This compares with a height of 30 in. for the old steel-and-wood type. On the other hand, the new cars, with an additional width of 1 ft., have a capacity of 2.75 tons of coal, as compared with 2.50 tons for the old. In the Millers Creek division are found the lowest cars in use at any of the company's mines. Here, 280 new steel cars were purchased, with an over-all height of 23 in. above the rail. These supplanted an equal number of old wood cars of the same height. The new cars, however, hold 1.5 tons, as compared to 1.2 tons for the old.

By far the larger number of new cars were purchased for mines in divisions operating the thicker seams of coal. Twenty-four hundred new cars have been put in operation in the Elkhorn division in the past four years, and 1,695 in the West Virginia division. In the West Virginia division, the new cars completely displaced all the former wooden cars used with animal haulage. By this move, the company increased

the capacity of each individual car from 2.25-2.50 tons to 3.50 tons. At the same time, the average height was reduced from 48 in. to 40 in. As a result, shoveling height was cut 8 in. at one stroke, considerably easing the burden of the miner. At the same time, the number of cars necessary to obtain a given production was reduced 40 per cent, with a consequent cut in investment cost, maintenance, and repairs, as well as the number of gathering units which would have been required had the old-type car been retained when animals were dispensed with.

Additions to motive power were made in all but the Maryland and Millers Creek divisions. Haulage equipment in all divisions consisted largely of 10-ton trolley locomotives, with one 26-ton tandem unit. Gathering was done with 6-ton cable-reel locomotives, except for a few 4-ton units in the Millers Creek and Maryland divisions, where low coal was mined. Millers Creek is the only division using crab reels. Two mines in the Pocahontas-New River division and one in the West Virginia division are equipped with permissible battery-type haulage and gathering locomotives.

Due to long hauls and grades against loads, or both, heavier haulage locomotives were provided. Revamping of the main-haulage equipment in the West Virginia division resulted in the installation of the largest haulage units in the industry at Mine 63. These consist of two 20-ton Jeffrey locomotives in tandem. Two of the units haul the daily production of about 2,900 tons. Details of the length of haul, grades encountered, and factors considered in their selection have been set forth in previous paragraphs. The locomotives are unique in that Timken bearings are used throughout. Westinghouse air brakes are part of the auxiliary equipment, as are air sanders. The rated speed of the locomotives is 10.5 m.p.h. and each has a drawbar pull of 20,000 lb. on a clean, dry rail. Each of the two locomotives comprising a unit is equipped with two 150-hp. motors with blowers for cooling. Maintenance cost was one of the primary considerations in the choice of the 40-ton units. With the nine locomotives formerly in use, it was practically impossible to prevent the cumulative wear on all the working parts from resulting in an excessive cost of upkeep.

The policy of reducing the number of main-line units to cut operating and maintenance costs also has been followed in other divisions. At Mine 120, Acosta, Pa., for example, where an ultimate production of 3,000 tons per day is planned, two 40-ton tandem units also have been installed. These are identical with those at Mine 63. At Mine 253, in the Pocahontas division, a 26-ton tandem unit, consisting of two 13-ton locomotives, is in service. In all cases, particularly in the West Virginia division, old main-line equipment supplanted by new was, if suitable, transferred to other mines where it could be of service. If found to be unusable, it was scrapped. In the Elkhorn division, six 10-ton locomotives were combined into three tandems of 20 tons each. Also, a 20-ton, high-speed locomotive is being provided for this division.

The principal changes made in gathering locomotives were in the West Virginia, Elkhorn, and Pocahontas-New River divisions. In the West Virginia division, the elimination of animal haulage necessitated the purchase of new gathering equipment for all operations except Mine 86, already equipped with battery units. In all, twelve flameproof, 7-ton, 7-m.p.h. locomotives and eight 6-ton, 6-m.p.h. cable-reel locomotives were purchased, and nine cable-reel locomotives were transferred for the seven mines not already equipped. Thirteen additional 6-ton, cable-reel locomotives were purchased for the Elkhorn division. In the Pocahontas-New River division, two slow-speed, permissible, battery, gathering locomotives were purchased. These new locomotives use less ampere-hours for gathering and gather more cars per shift than the older locomotives, and without change of battery. Based on experience to date with the new equipment, the company believes that it may expect a 50-per cent increase in cars gathered with the same battery capacity. Changes are being made in the old locomotives now in this division, in order to make their efficiency comparable to the two new locomotives.

Comparative figures indicating what was accomplished in increasing gathering and main-line haulage efficiency are given in Tables I and II, respectively. It should be noted in Table I that the figures given under the West Virginia division are for Mine 86, where the original battery equipment has not been changed since its installation. As stock was used in the other mines prior to the installation of gathering locomotives, no opportunity of comparing gathering averages is offered for operation under non-gaseous conditions. However, under the old gathering system, an average daily record per horse over a period of a month was 25 cars, each holding 2 tons of coal. This was just before the haulage modernization program was inaugurated. In other than the West Virginia division, figures are given for typical non-gaseous mines.

Three of the Consolidation company's mines are of the "wireless" type, with all underground equipment, including both main and gathering haulage, operating on storage batteries. These operations are: Mine 86, in the West Virginia division, Carolina, W. Va., producing 3,400 tons per day, and Mine 251, Coalwood, W. Va., and Mine 261, Caretta, W. Va., both in the Pocahontas division. Mine 251 produces 2,800 tons per day and Mine 261, 3,500 tons per day. All three are shaft mines, each making a large amount of gas. For this reason, battery operation was adopted for safety.

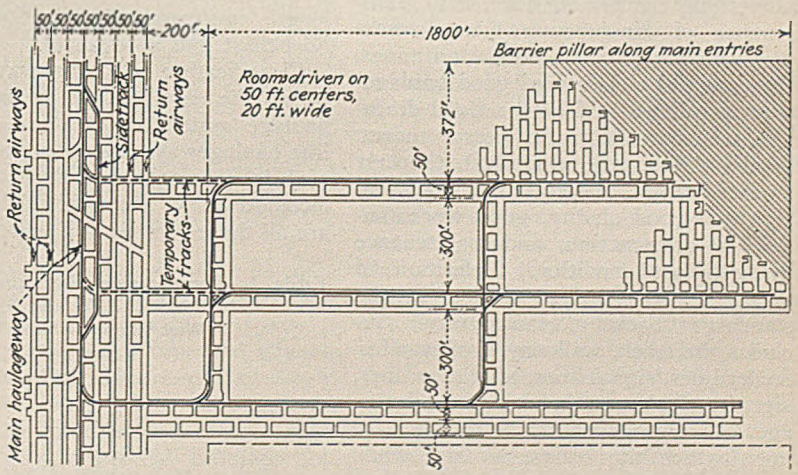


Fig. 3—Mining Plan in the Pocahontas Division, Showing Location of Sidetracks With Reference to Working Sections

Battery haulage locomotives in all three mines are the largest of that type in the industry. Each has a 10-ton chassis, and the total weight, including the battery, is 23½ tons. Batteries are made up of 110 39-plate cells. The locomotives operate at 4 m.p.h., and the batteries are changed twice a shift. Gathering units in all three mines weigh, with battery, 9 tons, and have a speed of 4½ m.p.h. Except as previously noted, batteries on the gathering locomotives are changed once a day.

Mine 86 furnishes a typical example of efficiencies obtained from battery haulage. Average length of haul is 7,500 ft. one way, and each of the haulage locomotives handles 16 to 35 cars per trip, each car weighing 3,750

lb. and carrying 3.5 tons of coal. In April of this year, an exhaustive haulage performance test was made in each of the gathering sections. One locomotive, equipped with an odometer to measure the mileage traveled, was transferred from section to section until each of the fifteen in the mine was covered. The record, given in detail in Table III, showed that the total mileage covered by all locomotives in a day's run was 313. The average distance each car traveled while on the section was 1,562 ft., and the ampere-hours required to move it was 7.5. Average ampere-hours used per mile of locomotive travel was 25.5.

While improved equipment played a most important part in the increase in haulage efficiency, the major part of the credit goes to improvements in track and roadbed, proper systematization to insure trip movement at the highest speed with a minimum of interruptions, and a haulage plan that gives gathering locomotives an opportunity to pull the maximum number of cars in a shift. One of the first moves of the company was to standardize the former, this step resulting in the publication of a book of standard practices.

In the foreword of "Instructions Governing the Construction and Maintenance of Haulageways," the trackman's authority in Consolidation mines, the essential elements of good haulageways are listed as follows: Good drainage, economical grades, easy curves, good roadbed, good alignment, properly surfaced track, material of correct design and good quality, good workmanship in construction, and maintenance in first-class condition. Definition of terms heads the first section in the standards book. "Haulageway" includes the track, walkway, trolley wire, feeder lines, signal lines, telephone lines, signals, telephones, timbering, and drainage. "Subgrade" pertains to the base upon which the ballast is laid, while "roadbed" means the ties and ballast upon which the rail is laid. "Surfacing" is defined as the leveling, tamping, and final ballasting of the track.

Naturally, mine tracks will be of different degrees of permanence and also will be subjected to different kinds of traffic. As a guide in construction, Consolidation tracks are divided into classes, as follows: Class "A"—60-lb. rail, treated ties, tie plates, lock washers on bolts, crushed stone, gravel, crushed slag, mine rock or ashes for ballast, switch ties in set, and accessories; Class "B"—60-lb. rail, untreated ties, lock washers on bolts, mine rock or ashes for ballast, standard length untreated ties for switch ties, and accessories; Class "C"—40-lb. rail, untreated ties, lock washers on bolts, mine rock or ashes for ballast, standard length untreated ties for switch ties, and accessories; Class "D"—30-lb. rail, untreated ties, mine rock or ashes for ballast, standard length untreated ties for switch ties, and accessories; Class "E"—30-lb. rail in 15- and 30-ft. lengths, untreated wood ties or steel ties, standard length untreated ties for switch ties, no ballast and accessories; Class "F"—20-lb. rail in 15- or 30-ft. lengths untreated wood ties or steel ties, standard length untreated ties for switch ties, no ballast and accessories; Class "G"—16-lb. rail in 15- or 30-ft. lengths, untreated wood or steel ties, standard length untreated ties for switch ties, no ballast and accessories.

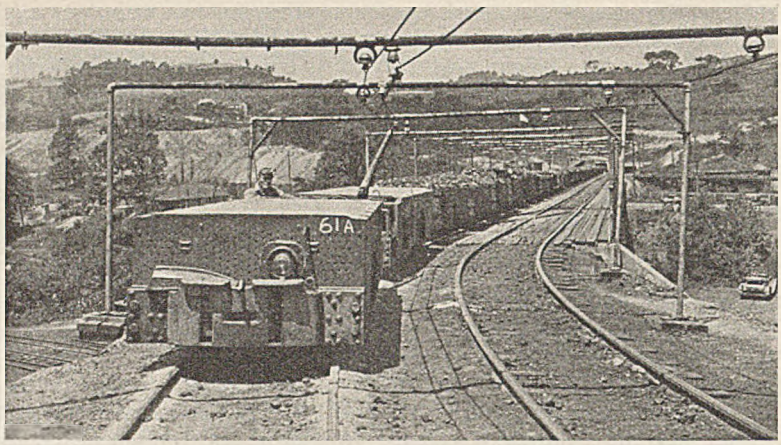


Fig. 4—40-Ton Tandem Haulage Locomotive, Mine 63

Classification of haulageways is based upon "the service they perform in the haulage system of the mine." Main-line haulageways are those "over which coal is regularly hauled by main-line locomotives." Secondary haulageways are all those "connecting with the room-entry haulageways." Room-entry haulageways are "all haulageways on entries from which rooms are turned." All haulageways "within the rooms," and also all those "close to the working faces of entries" are classed as room haulageways.

Class of track to be used in haulageways is based upon the traffic. Where it is heavy and the life of the haulageway justifies the use of treated ties, Class "A" track is used. Where traffic is heavy but the life of the haulageway does not justify treated ties, Class "B" track is used. In small isolated sections or in nearly exhausted mines where traffic is light, Class "C" track suffices. Selection of track for secondary haulageways is governed by the same factors as that for main-line haulageways. Class "D" track is used in room-entry haulageways, except in special cases. Class "E," "F," and "G" track is specified for rooms.

No Class "A," "B," or "C" track may be laid without the center line being located by spads, and no permanent track of any description may be put down without being properly located in the entry. Clearance between the widest part of the widest piece of equipment is: Wide side, old entries—2 ft.; new entries—2½ ft.; close side, 1 ft. A minimum of 4 ft. over the rail is maintained in all entries where the roof is brushed. Where the coal permits, a minimum height of 4 ft. 7 in. is maintained over the top of the rail.

Before any Class "A" or "B" track is laid, profiles of the entry must be made and the most economical grade established, taking into consideration the tonnage to be hauled, drainage required, and character of the top and bottom. Grades on curves are reduced as much as possible to cut down tractive resistance. Minimum depth of subgrade is standardized as follows: Class "A," 15 in.; Class "B" and "C," 12 in.; Class "D," 10 in.; Class "E," "F," and "G," no ballast required.

As the company believes it impossible to maintain tracks where the roadbed

Table I—Comparative Gathering Haulage Efficiencies, 1926 and 1930

West Virginia Division

	1926		1930	
	Loads Pulled per Locomotive per day	Car Capacity, Tons	Loads Pulled per Locomotive per day	Car Capacity Tons
*Mine86	49	3.50	67.0	3.50
Maryland Division				
Mine 10	91.0	1.48	97.0	1.48
Pennsylvania Division				
Mine 119	92.0	1.50	109.0	1.50
Millers Creek Division				
Mine 154	81.0	1.20	103.0	1.20
Elkhorn Division				
Mine 214	52.0	2.00	58.4	2.94

*Battery haulage

Table II—Comparative Main-Line Haulage Efficiencies, 1926 and 1930

West Virginia Division

	1926		1930	
	Loads Pulled per Locomotive per day	Car Capacity, Tons	Loads Pulled per Locomotive per day	Car Capacity, Tons
Mine 63	108	2.00	244	3.95
Mine 32	177	2.25	220	3.64
Elkhorn Division				
Mine 206	125	2.25	153	3.25

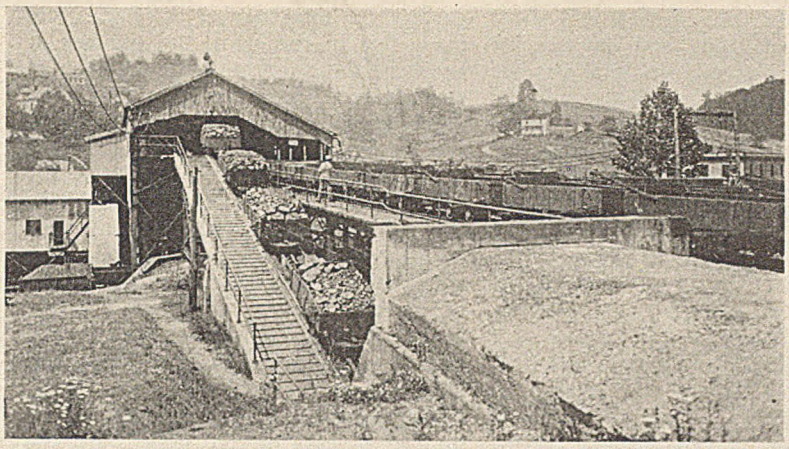


Fig. 5—Chain Car Haul, Mine 32, Owings, W. Va.

is saturated with water, adequate drainage must be provided for before any new track is built. Wherever possible, main drainage ditches are made in parallel headings. If it is impossible to remove drainage ditches from the haulageways, the track is kept above the level of the water and the ditches are protected from stoppage or loose coal which might cause them to overflow. Seepage water along the haulageway, if any, is carried away by small ditches through crosscuts to the main ditch in the parallel heading. Where drainage ditches cross a haulageway, the water is carried under the track in a tile or concrete trough.

The standards book specifies seven as the number of men per crew for laying Class "A," "B," or "C" track. Their equipment is outlined and the responsibility for its upkeep is delegated to the foreman. Methods of ordering, inspecting, handling, and storing material are set forth in detail. Specifications for rails, ties, switches, turnouts, and accessories are made a part of the standards. Supplementing the specifications, tables for use in superelevating curves and for laying crossovers are included. Radii for curves for different turnouts are tabulated. Drawings showing the construction of roadbeds for the different classes of track, disposition of bonds, placement and construction of guard rails, crossovers, and switches are included for the guidance of the construction man.

For Class "A," "B," and "C" track, oak, chestnut, and locust are approved for untreated ties. For the remaining classes of track such woods as may be obtainable locally are used. Oak, chestnut, locust, pine, tamarack, and spruce are approved for treated ties. Treating is done by the Reuping, or empty-cell process. Final retention must be 8 lb. of creosoted oil (complying with American Railway Engineering Association specifications) per cubic foot.

Before beginning the construction of haulageways, the drainage is first taken care of, as outlined above, and the entry is cleaned from rib to rib of all débris and loose material. In grading through fills, the fill for Class "A," "B," and "C" track to subgrade may be made of mine rock, with proper allowance for shrinkage if the rock tends to disintegrate. Where it is not necessary to maintain ditches through a fill, the sides from the ballast to the rib may be filled to the top of the ties with mine rock, and the clearance side covered with ashes or granulated slag. Where no water is encountered in grading through cuts, the bottom may be taken out to subgrade for a distance of about 6 in. from the ends of the ties, and the sides cut down level with the top of the ties. If water is encountered, the bottom is taken out on the wide side to the rib, and about 2 to 4 in. below subgrade to allow for drainage. On the close side, the bottom is taken down level with the top of the ties.

All grading to subgrade must be complete before any permanent track is laid. Best results are obtained when only a few rails are laid at a time and aligned and surfaced before more are put down. Aligning is done before the track is filled in with ballast. The foreman, who is provided with a special headlight for the purpose, first stands about 300 ft. away to take out any long swings. He then comes up to within 75 ft. of the crew to work out small irregularities. After aligning, the track is filled with ballast, brought to grade and leveled.

Good tamping is deemed of special importance. Spikes are first tightened in the ties, which are then tamped solidly from the ends toward the center. Tamping picks are used with stone, gravel, or hard slag ballast, and square-pointed shovels for ashes. Air tools also are used in ballasting track (see page 593). About 18 in. in the center of the track is left when tamping the ends of the ties. This space is later filled in and tamped lightly. Under the switch points, ballast is kept 2 to 3 in. below the level of the ties, to prevent coal and dirt from blocking the switch. Ballast also is kept well below the switch rods and connecting rods, to allow free action of the switch. On curves, the inner rail is brought to grade and tamped, after which the outer is superelevated the proper amount and tamped.

Permanent track and switches are bonded immediately after construction. Temporary track is bonded with channel pins and solid tinned copper wire. Trolley wire, if hung, is placed outside the rail, at a distance of 6 in. from the gage line. Hangers are placed 20 ft. apart on the straight track and closer on curves. The wire is kept as nearly level as possible, extensions of the proper length being used when irregularities are present.

In the maintenance of haulageways, cleanliness is deemed of first importance by the company. Tracks are kept clean and free from loose coal, rock, old ties, and other débris at all times. It is not sufficient that adequate drainage be provided when the track is first laid, but it must be cared for continuously. Particular attention is devoted to keeping rail joints in good condition at all times—that is, with all bolts tight, ties properly ballasted, and both rails level.

Principal causes of the track getting out alignment after it is in service are: Center pack, when the roadbed becomes packed in the center of the track and soft under the rails; one low rail, frequently at the joints, causing equipment to lurch and move the track; roadbed saturated with water, frequently resulting in the first two conditions, and heaving bottom. In cases of center

Table III—Battery-Locomotive Gathering Performance, Mine 86
Consolidation Coal Co.

Date	Section	Miles Traveled	Ampere-Hours Used	Empties Pulled	Loads Pulled	Slate Pulled	Ampere-Hours Per Load*	Haulage Conditions	Battery Condition End of Run
Mar. 28	1	18.2	460	99	79	6	5.4	Short haul	Almost dead
31	2	14.2	520	75	65	0	8.0	Heavy grades	Fair
Apr. 1	3	20.4	530	74	68	6	7.2	Long haul	Fair
3	4	24.8	580	103	102	0	5.7	Good	Fair
4	5	23.6	510	54	48	6	9.4	Heavy grades	Fair
7	6	18.6	530	66	54	1	9.6	Heavy grades	Fair
8	7	22.0	580	80	63	0	9.2	Heavy grades	†Dead, 2:10 p.m.
10	8	22.1	580	113	90	2	6.3	Fair	†Dead, 3:10 p.m.
11	9	17.6	460	76	71	5	6.1	Fair	Fair
12	10	20.4	550	78	73	4	7.1	Fair	Fair
15	11	18.9	520	66	71	3	7.0	Heavy grades	Fair
16	12	23.3	540	58	55	2	9.5	Heavy grades	Fair
17	13	27.0	560	67	55	7	9.0	Long haul	Fair
18	14	21.1	560	67	58	4	9.0	Long haul	Fair
19	15	21.5	520	60	56	4	8.7	Long haul	Fair
Total		313.0	8000	1134	1008	50			

Average ampere-hours per load* 7.5
Average ampere-hour per mile 25.6
Average distance traveled per car, ft.* 1,562
*Includes both coal and slate. †Shift ends, 3:30 p.m.

pack, the ballast is loosened in the center of the track and it is aligned, leveled, and properly resurfaced. Low joints are raised to the proper level and resurfaced. When water is present, the roadbed is drained, and the track aligned, leveled, and resurfaced. If heaving bottom is encountered, the subgrade is lowered to compensate for it and filled with crushed stone or other material. The track is then aligned, leveled, resurfaced, and left 2 to 3 in. below grade.

Switches are kept free from coal and ballast, oiled frequently, and adjusted for wear at the proper time. All bonded tracks are frequently inspected for loose or broken bonds, and repaired at once.

The Consolidation Coal Co. relies on the above outlined construction and maintenance methods for fast operation of rolling stock, with a minimum of delays from wrecks and similar accidents. But with a roadbed in perfect condition, unnecessary delays may result from inefficient movement of trips. For this reason, dispatching is in use in the majority of the company's lines, and passing tracks (necessary in the single-track system, which is the standard in Consolidation mines) and sidetracks have been built at strategic points to cut down waiting time.

Passing tracks are located from 1,800 to 3,000 ft. apart, depending upon the grades and mine layout. Ordinarily, the company attempts to locate them 2,000 ft. apart, as shown in Fig. 1. This, it was found, is the most convenient distance for operation of trips with a minimum of waiting time. Dispatching is dependent, of course, upon communication. In mines where the system is used, the dispatcher's office, at the shaft bottom or on the outside, is connected to each sidetrack and passing track by telephone. While control of trip movement is the primary object of the telephone system, it also is used to conduct other mine business, and telephones are placed at other strategic points throughout the mine and on the surface. The dispatcher has complete control over distribution of the car supply to the different sections and the movement of empty and loaded trips. His operations are governed by a "Production Control Sheet." Fig. 2.

On this sheet are spaces for sixteen sidetracks and the main yard or dumping point. If coal is loaded on more than one shift, the first act of the dispatcher when he comes on duty in the morning is to post his sheet, using reports left by those in authority at night. These reports show the number of cars loaded at night and the section where they were loaded; the disposition of cars which the night force may have placed in the different sections, and also the disposition of such cars as may be taken from different sections or the outside for handling material or transporting rock or refuse. When the posting is done, the control sheet will show the number of loads and empties on the yard at 7 a.m. and the total number of cars which it is estimated will be loaded during the day. This information appears in the "Yard" column.

For each section, the information shown is an estimate of the number of cars which will be loaded during the shift, number of working places in the section, number of places not cut or unworkable for other reasons, and the empties and loads in the section at 7 a.m. With this information before him, the dispatcher begins to direct the movement of cars. The first main-line trip ordinarily is sent to the section where loads are standing and empties are needed. If no loads are standing, the first section to report a trip sees a main-line locomotive first.

As the gathering locomotives come to the sidetracks, they call the dispatcher and report the time of arrival and the number of cars of rock and coal there are in the trip. They leave the loaded trip and take a number of empties designated by the dispatcher. The dispatcher then enters on his control sheet, under the proper heading, the time the loaded trip arrived, the number of cars of rock, the number of cars of coal, the cumulative total of loaded cars from the section, the number of loads standing, the time the gathering locomotive left the sidetrack on its way back to the section, the number of empties it took with it, and the number of empties left at the sidetrack. When a sufficient number of loads is assembled on the sidetrack, the dispatcher directs a main-line haulage locomotive there to remove them and leave more empties.

Movements of main-line trips are recorded under both the "Yard" and section heads on the control sheet. When the locomotive leaves the yard its number, its destination, the number of empties it is pulling, its time of departure, the total number of empties and loads left in the yard, the number of loads in the yard, and the number of empties in the yard are recorded. Upon reaching the sidetrack, the motorman reports his arrival to the dispatcher, as well as his leaving time, and the number of loads he takes with him. Whereupon the dispatcher enters upon his control sheet, under the proper sidetrack head, the locomotive number, time of arrival, number of empties in the trip, cumulative total of empties delivered to the section, balance of empties standing on the sidetracks, time of departure, number of cars of rock pulled, number of cars of coal pulled, and the number of loads left on the sidetrack. Entries pertaining to the main-line haulage are recorded in red under the section headings to differentiate them from entries pertaining to the gathering locomotive on the section. Upon the return of the main-line locomotive to the yard, its number, what section it came from, the time of arrival, the number of cars of rock, the number of cars of coal, and the cumulative total of loads received at the yard are recorded.

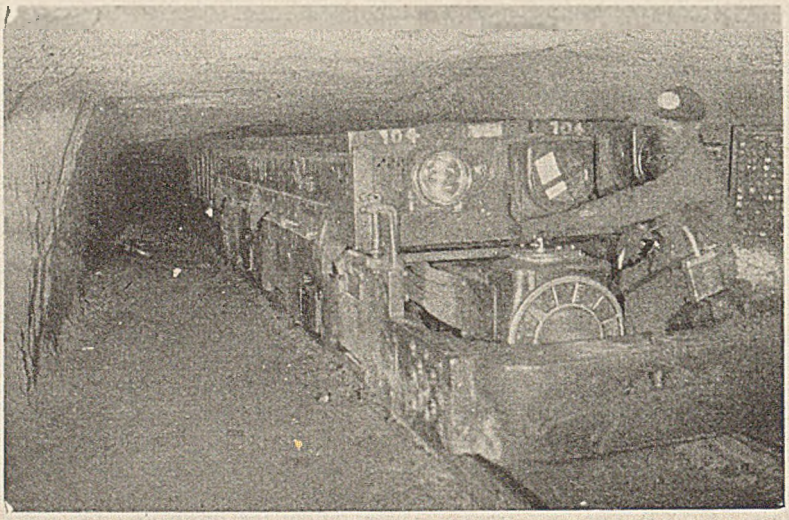


Fig. 6—23½-Ton Battery Haulage Locomotive Leaving the Shaft Bottom at Mine 86, Carolina, W. Va.

The objective of production control is to see that each loader has the opportunity of loading the maximum number of cars each shift. When this result is accomplished, each piece of equipment is working at its maximum efficiency. Use of the control sheet enables the dispatcher to direct the movement of locomotives so that there is a minimum of delay in picking up loaded trips or supplying empties to a section. It also enables him to avoid the adverse effects of an oversupply of cars in one section at the expense of the others. Any delays, either on the sections or in the yards, also are entered on the control sheet, together with their cause, so that steps may be taken for their elimination.

At the end of the shift, the dispatcher enters under each section heading the number of empties furnished the section, the number of loads pulled, and the cars in the section at 3:30 p.m. From his control sheet he then makes up his reports to be left for the men in charge of activities at night. From the information contained in these reports, the night foreman in charge of loading knows where he can secure the necessary cars, and the same applies to the night men in charge of the distribution of supplies, cleaning up rock, and other activities. In a number of the Consolidation mines where production control is in use, the dispatcher also is responsible for the condition of main and secondary haulageways. Maintenance activities are all under his control, and he directs the work of the track gangs from reports of the motor crews and/or foremen.

In gathering cars in the mines of the Consolidation Coal Co., they are handled, with some exceptions, to and from the face by the gathering locomotive. All working places are laid up with a single track, and one car is loaded by the miner at a time. Consequently, one complete change must be made for each loaded car. To assist the gathering units in their functions, the working places are concentrated, as far as possible, in one area. Also, sidetracks are kept as close to the working section as possible. These steps assist both by reducing the distance a locomotive must travel per car and by increasing the total tonnage hauled. Sidetrack location and sections covered by gathering locomotives in a typical mine are shown in Fig. 1. The same information for a new working system adopted in the Pocahontas division is given in Fig. 3.

To carry out the idea of handling the car to and from the face, special equipment is needed when the coal is low. In the Millers Creek division, the problem was solved by the use of crab-reel locomotives. But in the Pennsylvania division, where similar conditions exist, the loaders, except where grades prohibit their doing so, handle the cars by hand from the room entry to the face and back. Where grades are heavy, however, such a procedure is impossible, and the miners are supplied with room hoists. A number are in use in the Pennsylvania division in sections where cars cannot be trammed by hand.

Supplementing the regular haulage layout at Mine 32, in the West Virginia division, Owings, W. Va., is a new bottom designed to handle a large tonnage with a minimum of labor. Features of the bottom include a reserve capacity to compensate for stoppages on the tipple, derailed trips, or other conditions which may interrupt the flow of coal, and simplicity of equipment, with attendant low first cost. The mine workings are reached by a slope. At a point just inside the portal, the loaded cars are engaged by a chain haul which takes them up an 80-ft. incline, on a 20-per cent grade, to the tipple.

One man stationed at the bottom handles the daily production of about 3,000 tons, and could, if necessary, handle 5,000 tons with little extra effort. His principal duty is to uncouple the cars as they pass over a chain feeder. This feeder, which is 20 ft. long, is installed with the center line of its outby sprocket but 6 ft. away from that of the sprocket at the foot of the chain haul to the tipple. Feeder and chain haul are driven by the same motor. The feeder chain, by a system of gearing, operates at just half the speed of the chain haul, so that the loads are spaced one car length apart as they move up the incline.

There are five tracks on the bottom, shown in Fig. 7. Two of these are for loads, two are for empties, and the fifth track is a locomotive runaround. This distance from the main feeder at the portal to the 90-deg. curves is approximately 700 ft. Loaded tracks are graded to 0.5 per cent, a gradient almost permitting cars to continue to roll by gravity, for a distance of 600 ft. inby of the two booster feeders back of the main feeder. The locomotive runaround is bridged where it crosses one of the loaded tracks.

Preferably, the loaded trips are brought in on the No. 1 loaded track and allowed to drift to the booster or against the end of a string of loads under its control. The locomotive leaves the trip through one of the slants provided for it, while the brakeman follows the trip to the booster feeder or couples it to the rear of the preceding trip. If the No. 1 track is full, the dispatcher orders the trip to come in on No. 2 track. A slant between the No. 2 loaded track and one of the empty tracks allows empty trips to be taken in over the No. 2 loaded track in case the main empty track is blocked for any reason.

Through windows in the opposite sides of his office, the dispatcher can see if there are loads at either booster. Whether or not the string of loads back of the booster is long enough to reach from the booster to the main feeder is automatically indicated to the dispatcher by signal lights. Details of the rail mechanism actuating the signal lights are given on page 636 of this issue of *Coal Age*.

Ordinarily, there is a long string of loads, all coupled, extending from the main feeder back to some point on the No. 1 track on or near the 90-deg. curve. This is the ideal condition. A long string of cars is under the control of a feeder, with additional trips being connected to the ends of the preceding ones before they pass over the booster. If No. 1 track is full, so that it is necessary to bring a trip in on No. 2 track, the cars on No. 2 are moved ahead by the booster as soon as those on No. 1 have passed the switch just inby the main feeder. The boosters are started and stopped from push-button stations near the main feeder. Empties coast from the tipple into the mine and stop on the empty yard. The empty tracks will accommodate about 80 cars.

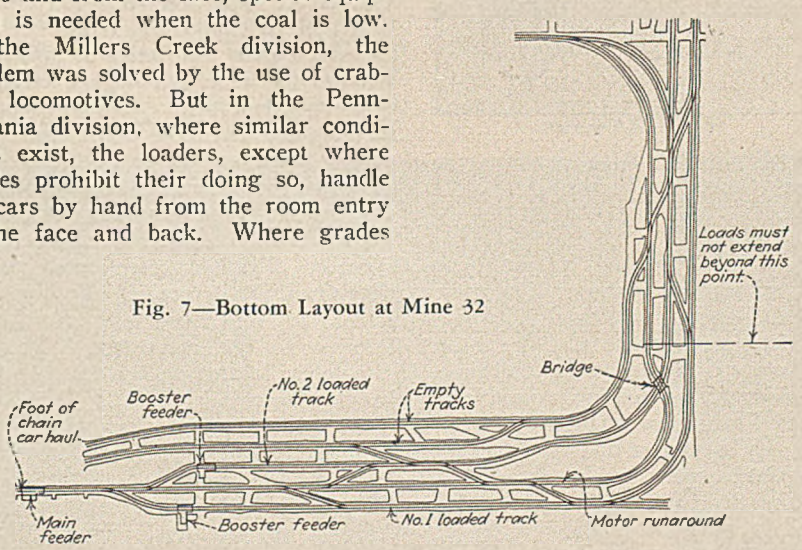


Fig. 7—Bottom Layout at Mine 32

UNDERGROUND PHONES

+ At Consolidation Coal Co.

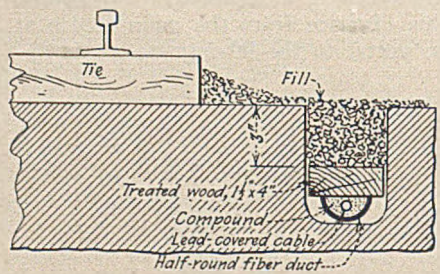
ALL Consolidation mines are equipped with telephones. When installation of a "permissible" telephone system was first considered for the three "wireless" mines, such an instrument was not available. But the Western Electric Co. developed a telephone with gas-tight cover, packing gland entrances for the line crank, and the receiver cord, which was given a Bureau of Mines permissible plate. In general appearance this telephone is not different from that of the ordinary mine telephone in cast metal case.

While telephones are used principally for car dispatching and transacting the business of normal operation, management also desired to insure, if possible, a reliable means of rapid communication in case of emergencies. To guard against the possibility of mechanical or heat damage to the system in case of a wreck or other local disturbance, the conductors are buried in ducts in the mine bottom. The lead-covered telephone cable containing from 6 to 41 pairs, depending on the location, is surrounded by waterproof insulating compound contained in a 2-in. half-round Bermico fiber duct which is covered with wood. The top of this wood plank is 3 in. below the bottom of the ties.

The lead sheath of the cable is a protection for the conductors against moisture, but this sheath itself must be protected against mechanical damage, chemical action, and electrolysis. All three are taken care of by the design. There should be little or no tendency for electrolysis, however, because the mines are battery operated and the tracks are not used as electrical conductors.

Cables are laid close to the rib, on the clearance side, preferably in main haulways. Half-round, 2½-in. fiber sleeves were placed under the butt joints of the 2-in. half-round conduit. The lengths of conduit were filled with compound to a depth of ¼ in. before being taken into the mine, so that the cable would be entirely surrounded. Engineers for the Graybar Electric Co., which furnished most of the materials, suggested specifications for the installation.

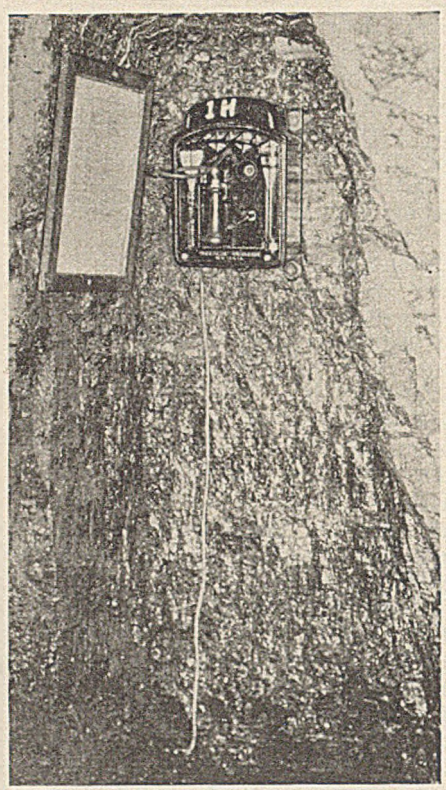
Everprotect compound, having a melting point of 185 deg. F., was used. For filling the conduits this compound was heated to 235 deg. outside of the mine and taken inside in 600-lb. batches on a car of special construction carrying a sand warming oven. Pouring was done at the lowest practical temperature—about 215 deg. F. While the compound was still hot, the plank was laid on top and pressed down. When properly centered the plank laps ¾ in. over each side of the conduit. This planking is "Kayanized"—i.e., impregnated with a bichloride of mercury solution. In spite of the poisonous nature of the treatment, it is said that there is no danger in handling the lumber. Where water was encountered in the trench the conduit was assembled on the ends of the ties, the compound poured, the plank pressed on, and the assembly then shifted into the trench before the compound cooled.



Cable Is Protected From All Ordinary Causes for Failure

Wiping of joints in the multi-conductor cables was done only at times when all persons excepting the wipers and safety men were out of the mines. A fireboss was in attendance at all times. The solder was melted in an electric pot connected to a permissible battery tank by an approved plug and receptacle.

Terminal boxes are mounted 4 ft. from the floor in sections 12 in. deep and 12 in. wide cut in the rib. Where the cable stubs come up out of the mine bottom they are protected by 2½-in. conduit bends filled with compound. After the telephone connections were made the terminal boxes were filled with melted paraffin.



Permissible Telephone on a Haulway in No. 86 Mine

The single-pair lead cables leading from terminal boxes to outlying telephones are not protected by the fiber and plank ducts but are simply buried close to the rib. They are located along main haulageways, and on the clearance side where practicable. These cables were spliced on the outside in those instances where splices were necessary.

Telephones are mounted on the rib face when located in crosscuts, but when located on haulways they are mounted in manholes or in sections 24 in. wide and 12 in. deep cut in the rib face. When the telephone is on the rib face the single-pair lead cable is protected between the mine bottom and telephone by being placed in a trench about 1½ in. deep cut vertically in the rib.

Mine 86, Carolina, in northern West Virginia, and Mines 251, Coalwood, and 261, Caretta, in the southern part of the state, are equipped with these telephone systems. The first mentioned has 23 telephones; the second, 20; and the third, 13. To a large extent private lines serve each telephone. The car dispatcher located at the main bottom handles the switchboard.

The following bill of cable materials required for Mine 86 indicates the extent of the installation: 1,630 ft. 41-pair lead cable; 3,190 ft. 21-pair lead cable; 4,515 ft. 16-pair lead cable; 4,015 ft. 6-pair lead cable, and 20,000 ft. single-pair lead cable.

Two years' use of these telephone systems indicates that the design provides all that was attempted in ruggedness and trouble-free service.

PNEUMATIC TOOLS

+ At Consolidation Coal Co.

AIR TOOLS of three types, in addition to the usual complement of jackhammers, play a prominent part in inside construction and in track maintenance at Consolidation mines in the Fairmont district. A stopehammer is used for drilling rock to make way for overcasts; a paving breaker is employed for loosening bottom for track grading; and a tie tamper is used for tamping ballast on main haulage tracks. The stopehammer speeds the drilling and lightens the job, and the paving breaker and tie tamper mechanize two "strong-back" track jobs.

Fig. 1 shows a type CC-11 Ingersoll-Rand stopehammer in use drilling for an overcast in Mine 97, Rivesville. This tool weighs 78 lb. and uses 1-in. solid hexagonal steel. It is 51¼ in. long with the feed not extended, and the travel of the air feed is 22 in. The bit is rotated by hand as the drilling progresses.

The other tools are both non-rotating, hand-hammer air drills of special design for the duties involved. The paving breaker, however, as its name implies, was developed for use on city streets where sections of surfacings, such as asphalt or weak concrete, have to be removed for repairing or installing pipes and conduits. The tie tamper has been used for several years by a number of steam and electric railway companies.

Fig. 2 shows the paving breaker in use taking up 28 in. of bottom for a new main haulage track in Mine 97. This mine is in the Pittsburgh seam and the bottom is a fireclay which is topped with a harder skin of shale 3 to 4 in. thick. In material of this character one man operating the paving breaker can loosen as much bottom as four or five can shovel into a pit car. Putting it another way, five men equipped with one paving breaker can accomplish work which would otherwise require ten men.

The portable compressor in the background of Fig. 2 is a standard 5x5-in. two-cylinder vertical unit. This has sufficient capacity to operate two of the paving breakers, but, because the tool will loosen as much material as several men will shovel, there is little need for operating more than one. The paving breaker weighs 86 lb.

Experimentally at least, the tool has also been used to break up the hard skin of the bottom as a preventive of tie breakage induced by heaving of the fireclay. It has been observed that this layer of harder material tends to crack and rise along the center of the heading, thus supporting the ties at the wrong point. It is thought that if the hard layer is broken up, the bottom will heave more uniformly. Also, the broken pieces seem to work up between the ties instead of raising the track to the former extent.

The tie tamper in use in the main butt heading of Mine 32, at Owings,

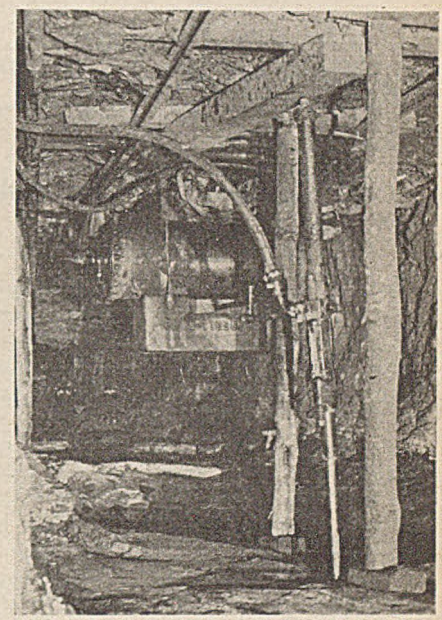


Fig. 1—Stopehammer Set to Drill for Shooting an Overcast

Fig. 2—One Man Loosens as Much Material as Four or Five Men With Picks

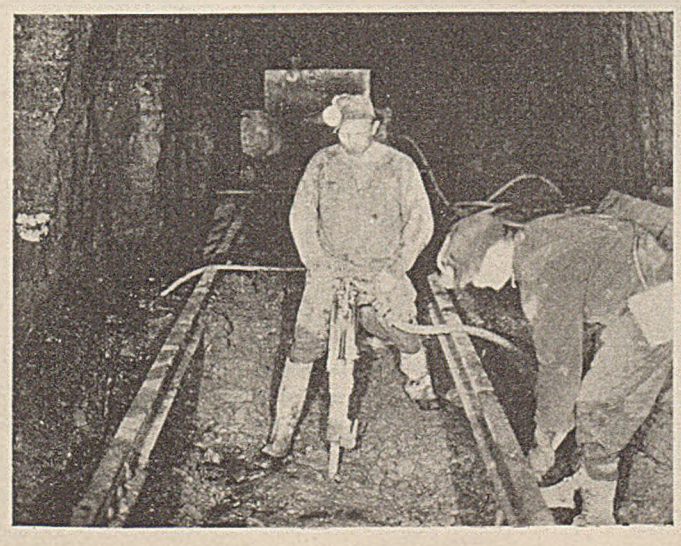
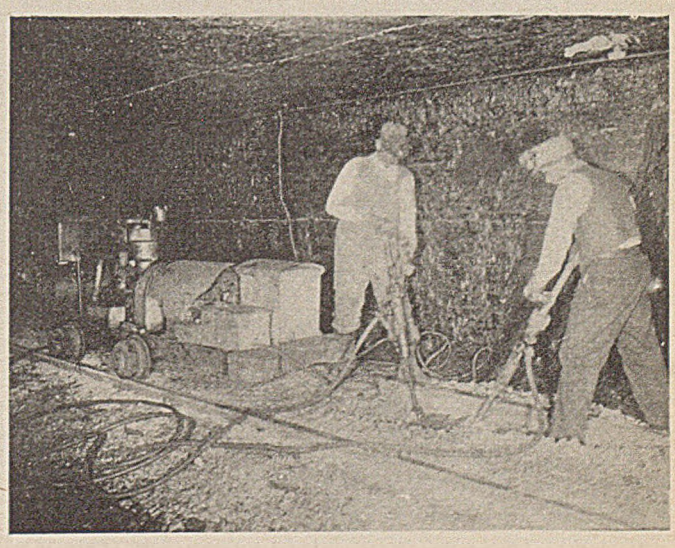


Fig. 3—Tamping Is Done Twice as Fast and Far More Easily



is shown in Fig. 3. This air tool has two handles and weighs 50 lb. The tamping bit commonly used has the end upset to provide a striking surface area ¾x3 in. The strokes are light and rapid.

On this track the ballast is ¾x1½-in. limestone. The tampers are worked in pairs and opposite each other on each side of the tie. Sufficient ballast is forced under the tie to insure a dependable foundation and bring the track to grade. No tamping is done near the center of the tie. The track illustrated is "Class A," by the company standards. This calls for 60-lb. steel, 5x7-in. wood ties creosoted to 8 lb. per cubic feet final retention, tie plates, and prepared ballast. As compared to using shovels and tamping picks, the use of the pneumatic tie tampers cuts the labor cost at least in half. A 5x5-in. two-cylinder portable compressor furnishes abundant air for two of the tampers.

The adoption of these tools is another step in providing the better tracks that heavier rolling stock and higher speeds demand. Suitable ballast properly tamped is essential for insuring permanent alignment.

▼ ▼ ▼

MACHINE LOADING

+ At Consolidation Coal Co.

(Continued from page 584)

due to a breakdown, the foreman must specify whether the gathering locomotive, supply locomotive, cutting machine, drill, or loading machine was affected. Analysis of the causes is then the basis for remedial steps.

A report is made each day on completed and desired repairs to the loading machines. This report differentiates between repairs which can be made by the machine operative and those requiring the attention of the electrician. Such differentiation is necessary with the loading crew working on the hourly basis, as otherwise there would be a tendency to wait for the electrician to make repairs properly within the province of the machine operative, thus causing costly delays. Loading machines are inspected between shifts and repairs which did not necessarily have to be made during working hours are completed at that time. Machines are completely overhauled whenever it is necessary to take them outside.

A small stock of minor repair parts is kept in a tool box on each section. The box also serves as an overnight storage place for tools used by the machine crew in the machine section. As it is placed near the man-trip stop, each workman can get his tools as he goes to work. The tool box, then, in addition to serving as a depot for spare parts, eliminates delays incidental to hunting tools.

In the West Virginia division, two Joy 5BU loaders are in use in Mine 32, Owings, W. Va. The seam mined is the Pittsburgh, which averages about 8 ft. in thickness, of which 1 ft. is left to support the roof. Each of the Joy loaders has its own section, where it drives the rooms and pulls the pillars. Nine men are employed in a crew, as follows: loading machine operative and helper, two haulage men, two trackmen, two timber men, and one shotfirer.

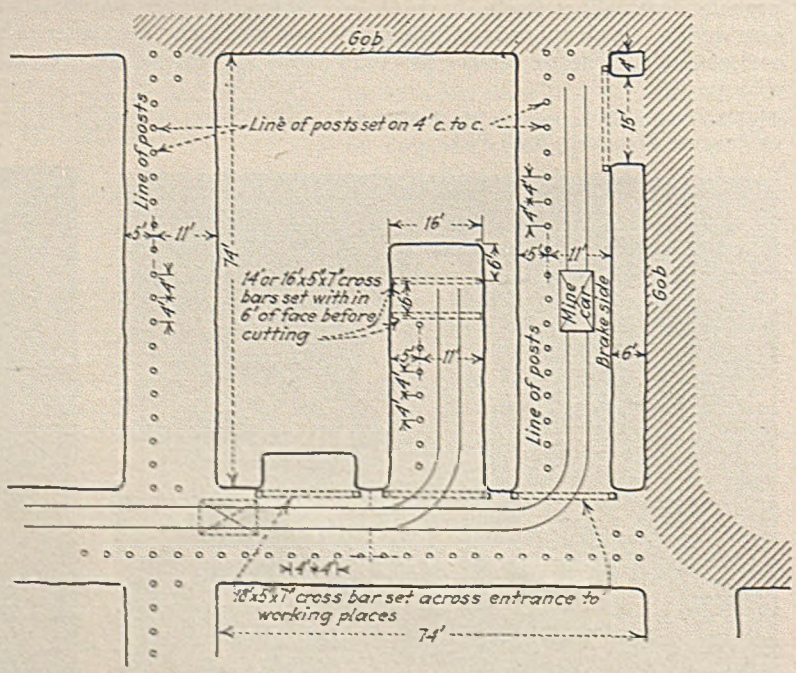
The block system of mining is used in Mine 32. Entries outlining the machine sections are driven to the limit of working. Rooms are then driven 16 ft. wide on 82-ft. centers and the blocks extracted on the retreat. In removing a pillar, it is split as shown in Fig. 4. The 6-ft. slab of coal between the completed pocket and the gob is then taken out in 15-ft. lifts, each lift being separated from the preceding one by 4x6-ft. stump, as shown. A "scrapper" recovers the bottoms left by the undercutting machine and removes the stumps by hand.

Individual posts and headers are used to hold the roof during mining operations. In driving rooms or pockets, a header is kept 5 ft. back of the face. After loading out each cut, the line of posts is advanced and the back header taken down and moved up front. In case the roof becomes bad, the 6-ft. pillar next to the gob is not loaded by the Joy machine. Additional posts are set and the slab is loaded out by hand.

Four Brown-Fayro pit-car loaders also have been installed in Mine 32. Each has its own territory, and the system of working is the same as for the Joy loaders. Two men, who do all the shoveling, drilling and shooting, lay track, and perform all the other necessary deadwork, comprise a crew. The average production per man per shift is approximately 20 per cent greater than that of the hand loaders in the mine. In Mine 86, in the West Virginia division, Carolina, W. Va., a Myers-Whaley battery power loader is used in development work. A crew is composed of four men and they drive about 27 ft. of the heading, 12 ft. wide and 7 ft. high, a shift. Another Myers-Whaley machine is used in this same mine for loading rock. Production is necessarily dependent upon the quantity of material to be loaded, but in June of this year the machine loaded 184 cars of rock in nine days, each car holding about 4 tons. Power is supplied by a power tank, made up of 110 cells, each with 31 plates. One charge lasts throughout the shift.

Aside from the rock machine in the Mine 86, one Myers-Whaley (open-type) is employed in Mine 12, in the Maryland division, Frostburg, Md., in cleaning up headings and room crossings in second and third mining of the Big Vein Seam. Three men ordinarily comprise a crew, and the average loading per shift is 12 cars of rock, each holding about 2.5 tons. Myers-Whaleys are used also for loading rock in the Elkhorn division, as outlined above.

Fig. 4—Mining Plan, Machine Loading in Mine 32



PREPARATION

+ At Consolidation Coal Co.

THE preparation program of the Consolidation Coal Co. is based upon efficient sizing and thorough removal of impurities, so that each coal in its size and grade may attain the uniformity of quality which the company has established for its trademarked coals. Special attention is given to impurity removal in the mine, methods of breaking down the coal face, and screening practice in the tipple as aids in the campaign of producing a product to meet satisfactorily consumers' requirements.

Hand-loading, whether into mine cars or onto conveyors, prevails in all divisions, and consequently the mining system readily lends itself to face preparation as a means of removing impurities. Even at the Mine 120, Acosta, Pa., where a mechanical cleaning plant has been installed, hand-loading prevails and face preparation still receives close attention. With hand-picking as the standard, Consolidation relies on rigid supervision over the man at the working face for the removal of the greater part of the impurities in the coal. Here, also, efforts are centered to increase the quantity of large sizes produced. Consequently, face preparation dominates in the preparation program of the company.

Because of the varying conditions in the different divisions of the company, it is only natural that face preparation methods should differ widely throughout the many operations, but in all cases the same general principles govern. The most elaborate system is in use in the Elkhorn division. Here the Elkhorn seam, 72-144 in. of high grade coal, is worked in six active mines. About the middle of the seam is a parting of shale, varying in thickness from a trace to 30 in. In general, the parting is soft and is cut out by the mining machine, but where rock is encountered, a cut is made in the coal underneath, and the parting is shot to break it up.

After the cut is made, the miner takes a scraper, similar to a coke scraper, and rakes cut the parting. This is loaded into a car and sent to the outside. Then the entire face is swept with a broom to remove all particles of the shale parting. As a further precaution, the miner lays a flooring of 1-in. boards in front of the face to form a shoveling surface. After laying down the boards, the top or bottom bench is shot, at the option of the miner, and the coal is loaded out.

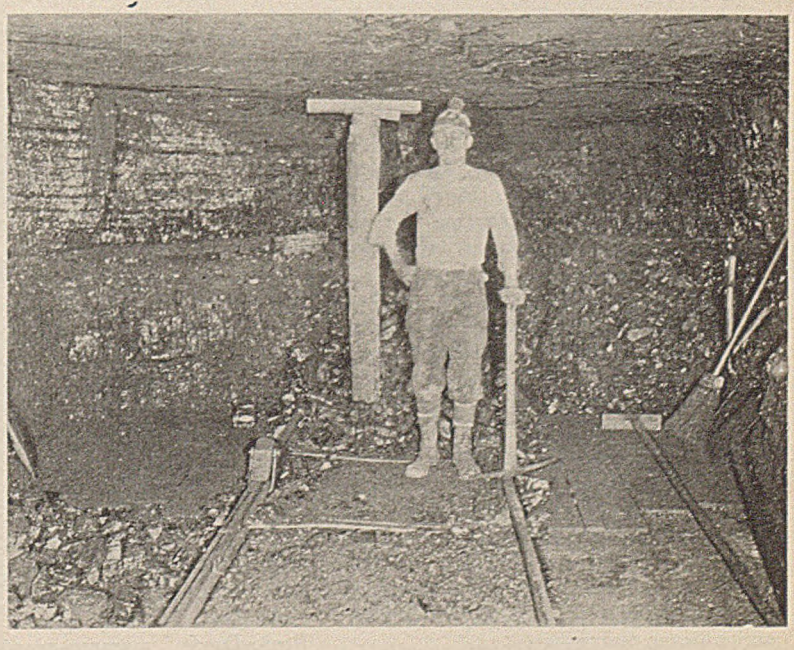
Special care is taken in blasting up the bottom bench. Holes are bored along the rib 4 to 6 in. above the bottom. When they are shot, the coal underneath them is left in place to serve as a shoveling surface in removing the last bench, whether it be the top or bottom. The final operation in loading out a cut consists of picking up the bottom layer of coal, which, because of its softness, is comparatively easy. Lumps are thrown into the mine car by hand and the smaller material, in which might be mixed flakes from the bottom, is discarded.

In the West Virginia division, where the Pittsburgh seam is mined, the face preparation is just as thorough. In these mines, a foot of the top coal is left to support the roof. The undercut is made just above the bottom, which is left in place. Shotholes are bored just under the top coal. Subsequent shooting frees the clean coal and leaves the bottom coal in place.

Shooting also is regulated to insure maximum production of hard, unshattered lump from the Pittsburgh seam. In general, where places are not sheared, three holes are employed to bring down the coal. One of these, known as the "block shot," is bored about 12 in. from the one rib and 30 in. above the bottom. The other two holes are bored along the ribs. The "block shot" is fired first and the coal loaded out. When this operation is completed, the rib hole just above the "block shot" is fired, followed by the hole on the other rib. Loading is then resumed. The "block shot" supplies an additional free face and increases the lump from the other two blasts. In places where the coal is sheared, only two shots are fired, as an additional free face exists in the shearing cut.

In the Pocahontas-New River division, where the Pocahontas No. 4 seam is worked at Mines 251 and 261, face preparation consists in the removal of a 1-in. hard band, 10 in. below the top of the seam. The coal face is cut in the center by an arcwall machine. Two holes, one at either rib, are bored in the top coal just over the rock band,

Fig. 1—Face Preparation in the Elkhorn Seam (Note the Miner's Tools)



and two other shots are placed in corresponding positions in the bottom. When the top bench is broken down by the shots, the miner loads out the coal above the rock band with a flat shovel and then removes the rock band and finishes loading the top bench. The bottom bench is then shot and loaded.

While the major part of the refuse removal at Consolidation mines takes place underground, surface plants serve in the important auxiliary capacity of putting the finishing touches on the job the miner does. In addition, the tipples perform the task of sizing and loading the coal into railroad cars, their primary function in the company preparation scheme. Only at Acosta does the surface plant assume a major part in cleaning.

Since the inception of its modernization program in 1926, the company has made rapid strides in expanding its surface facilities, and the movement is being continued. In the West Virginia division, two tipples—at Mine 25, Clarksburg, and Mine 97, Rivesville—have been built in the last four years. In addition, the tipple at Mine 32, Owings, has been modernized for the production of sized coal or any combination thereof.

Outstanding jobs of the surface plant construction have been undertaken in the Pennsylvania and Pocahontas-New River divisions. In Pennsylvania, a Peale-Davis air-cleaning plant was completed at Mine 120, Acosta, Pa., early this year. In the Pocahontas field, a new tipple of modern design has been completed at Mine 251, Coalwood, W. Va., and the surface plant at Mine 261, Caretta, W. Va., has been further modernized by the addition of a Bradford breaker and mixing conveyors.

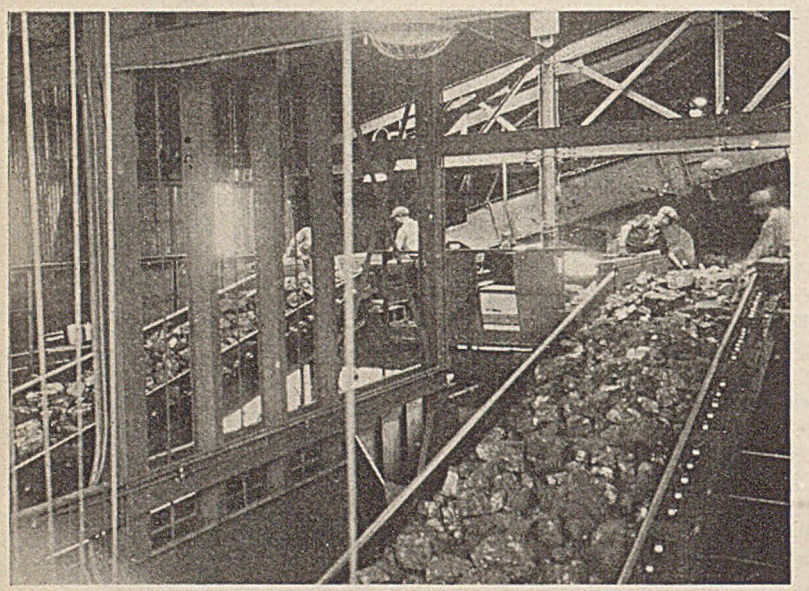


Fig. 2—Picking and Loading Coal at Mine 32

All divisions of the company are equipped to make shipments of sized coal, with the exception of the Maryland division. The West Virginia, Pocahontas, Millers Creek, and Elkhorn divisions lead in shipments of sized coal for domestic markets. While a considerable percentage of the Maryland coal is sold for domestic use, coal from this division ordinarily reaches the market as mine-run. The Pennsylvania division ranks next to the Maryland division in the shipment of mine-run coal, as the product is especially adapted to power plant and general steam use.

The majority of mines in the West Virginia division are equipped with shaker screens for the production of industrial or domestic coals, although some mines retain bar screen with which they serve the established market for that size. Standard grades in the West Virginia division are: Mine-run, lump, egg, nut, nut-and-slack, and slack. Pennsylvania is primarily a mine-run division, the separation at Acosta being mostly for cleaning purposes. The Millers Creek division, shipping a blocky coal primarily for domestic use, is fully equipped with shaker screens. Mine-run shipments are in the minority in this division. Standard sizes are: Block, lump, furnace (egg), nut-and-slack, and stove (nut). Practically all of the mines in the Elkhorn division are equipped with shaker screens, and the standard grades here are: Mine-run, lump, furnace, egg, nut, and modified mine-run. All the mines in the Pocahontas-New River division also are equipped with shaker screens, and the standard Pocahontas grades are: Mine-run, lump, egg, stove, small nut, nut-and-slack, and slack.

Acosta cleaning plant, using the Peale-Davis pneumo-gravity system, was built for the Consolidation Coal Co. by the Fairmont Mining Machinery Co. Its construction was in accordance with the Consolidation program of giving the customer a better grade of coal. The specific object in mind was reduction in ash with the production of a product correspondingly higher in B.t.u. content. Secondary objectives were reduction in sulphur and a higher fusing temperature of the cleaned product. The Acosta plant is designed to take care of a future production of 3,750 tons per day.

One primary table (rated at 300 tons per hour) and one re-treatment table (rated at 100 tons per hour) are used in cleaning the minus 2½-in. coal. Refuse from the primary table is crushed to free it further from impurities and is then run over the re-treatment table. Middlings from either table are recirculated. Refuse from the secondary table goes to the slate dump.

Mine-run coal at Acosta passes over a shaker screen, which splits it into plus and minus 2½-in. sizes. The lump goes to the picking table. Refuse from the picking table is classified to cut down the loss of marketable coal. Rock is sent to the dump, while impurities with coal attached go to a crusher and then to the primary table. Provision also has been made to crush the entire output, if desired, for treatment in the cleaning plant.

Flexibility and ability to load mixtures of any of the five standard sizes are the principal features of the new tipple at Mine 251, designed by the Fairmont Mining Machinery Co. Provision also has been made for loading four of the five sizes over loading booms, and for treating refuse and tipple spillage to reclaim any marketable coal. As shown in the flow sheet in Fig. 5, the coal from the shaft is dumped into a weigh basket. By throwing a fly gate in the chute, rock is bypassed directly to the aerial tram loading station for disposal on the dump. From the weigh basket the coal passes to two apron feeders, which feed it onto a bar screen for removing the minus ⅝-in. slack. In emergencies, the mine-run from the shaft may be chuted from the weigh basket direct to the railroad cars.

From the bar screen following the apron feeders the plus ⅝-in. coal goes to the main shakers, where it is separated into the various sizes desired. These go to the picking tables and from there to the rescreens and the railroad cars, though either or both the egg and nut may be diverted to the rescreen conveyor for mixing purposes. Degradation coal from the rescreens goes to the lower strand of the rescreen conveyor and is carried back to a bar screen with a ⅝-in. opening. Plus ⅝-in. coal from this screen joins the main flow of coal just before it enters the rotary feeders, while the smaller size is fed into the slack from the main

bar screen preceding the shakers. Refuse from the tables is thrown onto the refuse conveyor and taken to a Bradford breaker. Clean slack from the breaker is fed onto the top strand of the rescreen conveyor and sent to the boiler house, or, in some cases, it may be elevated from the conveyor to the bar screen preceding the apron feeders. Refuse from the breaker goes to the dump.

Slack from the bar screens and the two slack screens on the main shakers ordinarily goes to the battery of five vibrating screens, though it may be bypassed in emergencies direct to the railroad car. The vibrating screens make small nut and slack. The small nut goes to the loading boom, though the product from one screen may be chuted to the top strand of the rescreen conveyor for domestic sales. Slack from the vibrating screens goes direct to the railroad car or, if desired for mixing, to the slack mixing conveyor.

Provision has been made in the design of the tipple for the future installation of a crusher for crushing the lump, if desired. The present plant includes as one of the newer features in tipple design a clean-up conveyor under the railroad tracks. Spillage is shoveled onto this conveyor and taken back to the Bradford breaker for reclamation of the marketable coal or direct to the refuse-disposal equipment. In furtherance of the idea of salvaging all spillage, a dribble chute has been installed under the slack feeder. A maximum of natural illumination for picking and other operations in the tipple has been provided by making the tipple roof of corrugated wire glass. Controls for the entire plant are centralized on a platform overlooking the loading booms and chutes.

In the Pocahontas-New River division, the tipple at Mine 251 is equipped for thorough chemical treatment of all grades, except slack, to render the coal "dustless" on arrival at destination, if desired by the customer.

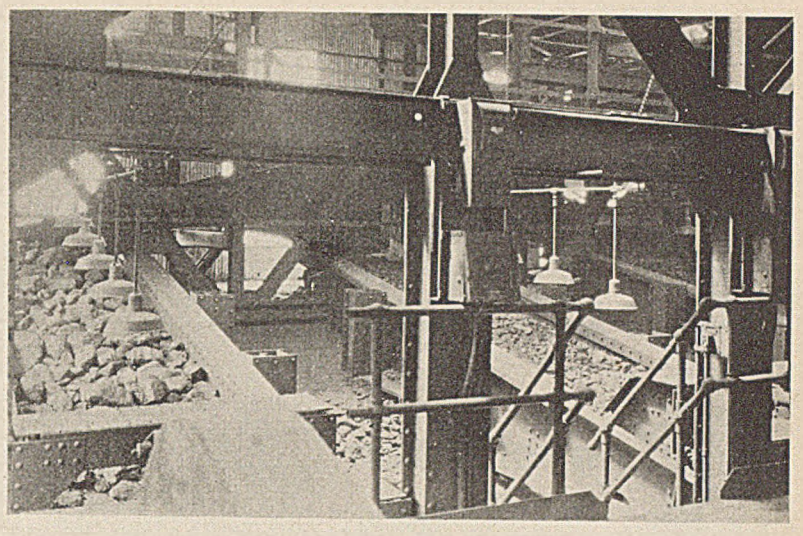


Fig. 4—Picking Tables, Mine 251, Coalwood, W. Va.

Control of preparation to insure uniformity of quality and sizing is deemed as important as preparation itself by the company and is vested in a separate organization under the general operating department. Each operating division has its own inspection force, consisting of one chief coal inspector and as many inspectors as are necessary, ranging in number from one to five. Inspectors usually are chosen from among practical mining men, so that their knowledge of mining conditions and the impurities in the coal will be first-hand. These inspectors operate both inside and outside the mines.

A portion of each mine in each division is inspected once or twice a week, the inspector visiting every working place. Inspectors visit all working places in the mine and are charged particularly with the duty of seeing that the coal is properly cleaned at the face, but they also oversee shooting and cutting, with the object of keeping lump production at a maximum. After an inside inspection, the inspector reports whether regulations pertaining to cutting, cleaning of the cuts, disposition of the cuttings, drilling and shooting, handling of soft bottom, disposal of the "scrappings," and cleaning of the coal are being followed or disobeyed. He also reports any observable factors affecting the sizing and preparation of coal, and whether the miners are equipped with the necessary tools for efficient preparation. Lastly, he makes any recommendations he thinks are necessary.

In making an outside inspection, the inspector observes compliance with regulations governing the dumping of the coal, operation of the screens, screening methods, and cleaning of the coal. He also notes the condition of the tipple and equipment, slate and refuse handling equipment, and whether slate and supply cars are clean when returned to the mine for loading, coal is free of foreign matter, chips, bark, etc., machine cuttings are properly handled, railroad cars are properly cleaned and loaded, contents of loaded cars properly inspected and a record made, and if there are sufficient lights in and around the tipple. Space also is provided on the report for recommendations. Copies of reports on both inside and outside inspections are forwarded to the production manager, division inspector, and mine officials.

The tipple force supplements the efforts of the coal inspector. A report is required of the man in charge of loading the railroad cars under the tipple, which includes the car number and initial; its capacity; the kind of coal loaded into it; screening, cleanliness and size of the coal; whether, if

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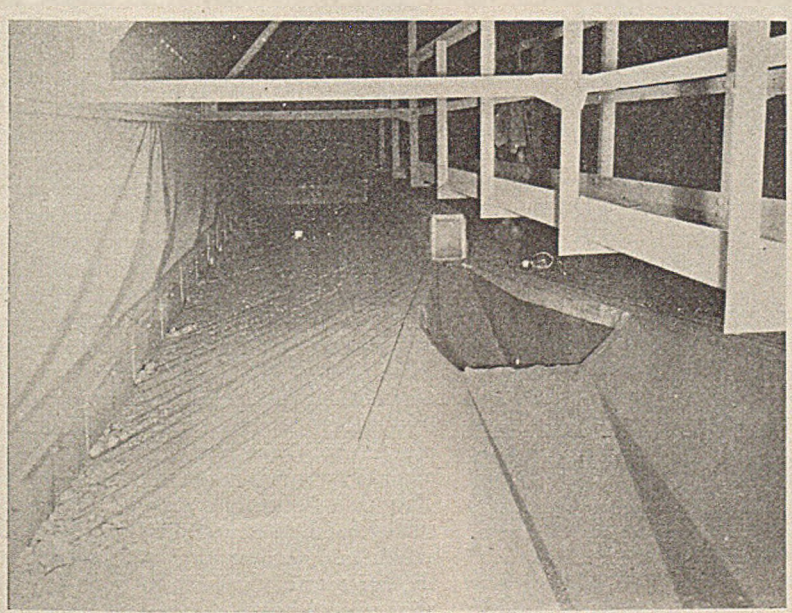
Fig. 3—Primary Table, Acosta Cleaning Plant



REFUSE DISPOSAL

+ At Consolidation Coal Co.

MANY years ago Consolidation Coal Co. began the installation of refuse-disposal equipment to get away from mule-and-dump-cart methods. This company was one of the pioneers in the extensive use of aerial trams. It now has six types of refuse-handling equipment ranging from the skip and plain self-propelling larry to the ultra-modern continuous-type aerial tram and throwing larry.

Local topography is the chief factor governing the choice of equipment. Where the ground is not too hilly or where refuse-disposal space is available in the valley by a grade not exceeding 6 to 8 per cent from the tipple, the self-propelling electric larry of the throwing type is the latest choice. For mountainous locations where the mine opening is in a narrow valley or on the side of a hill, where direct dumping would likely cause the refuse to slide and result in damage, the continuous aerial tram is the preferred equipment. Lower first cost is the deciding factor in favor of the throwing larry as compared to an aerial tram for the first-mentioned condition.

Three of the mines in the Maryland division are equipped with Connellsville electric larries having hoppers which can be rotated to dump at the end or on either side. Refuse disposal in this division is confined exclusively to the larry method.

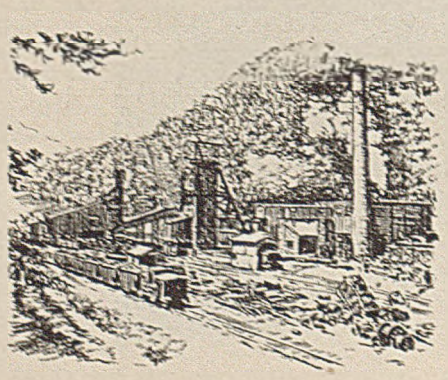
In the West Virginia division, three types of equipment are used: the side-dump larry, the Link-Belt "goose-neck" portable mine car dump, and the Heyl & Patterson throwing larry. The latter is at Mine 86, Carolina, and handles 450 tons per day, depositing it at a distance of 3,500 ft. from the loading bin at the tipple. During 1929 this throwing larry disposed of 30,045 mine cars of slate and rock. The motors of this larry were specified to be interchangeable with those on main haulage locomotives in the mine.

One throwing larry and one side-dump larry are used in the Pennsylvania division. The throwing larry handles all refuse from the picking tables and new air cleaning plant at Mine 120, Acosta, and is the latest purchase of refuse-disposal equipment that the company has made. The hopper holds 11 tons, and the machine is equipped with four 275-volt motors. Two type HM811 motors drive the truck, one of the same type drives the high-speed conveyor which throws the rock, and a smaller motor operates the feed gate.

Each of the mines in the Millers Creek division is equipped with single-rope hoists for pulling the refuse up inclines along the hillside in larry cars. The cars load from bins at the tipples and carry from 7 to 12 tons. At Mine 153, where the refuse averages 50 tons per day, the hoist is driven by a 50-hp. motor. At Mine 154, handling 100 tons, and at Mine 155, handling 185 tons, the hoists are powered by 75-hp. motors.

At the mines of the Elkhorn division, there are five aerial trams, one skip hoist, and three Link-Belt "goose-neck" dumps in use. In each case the aerial trams are of the double-bucket reciprocating type, and empty into a bin from which the refuse is distributed by a self-propelling larry.

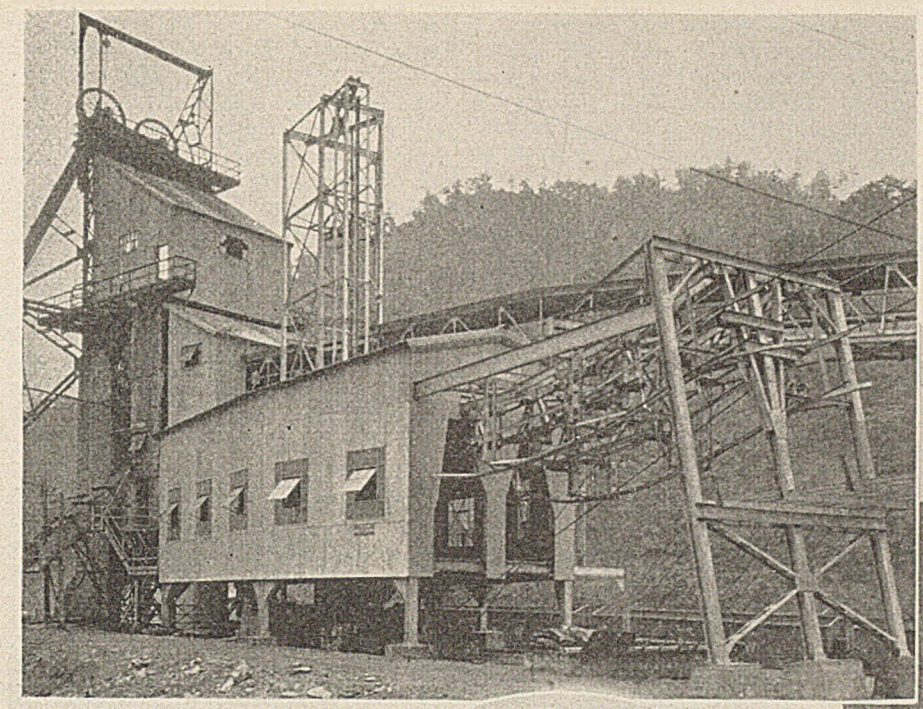
The same plan is followed where the skip hoist is used; i.e., it dumps into a bin at the top of the hill, and from there the refuse is taken by an electric larry. The hoist, operating two skips in balance and powered by a 50-hp. motor, is located at the top of the hill and is fitted for remote control from the dump bin at the bottom. The lower half of the incline is single-tracked and the upper half double-tracked. The skips dump through open ends by reason of auxiliary wheels on the rear axles running up steep guides or tracks above the dumps.



The "goose-neck" dumps are used to best advantage on hill-sides which are sufficiently steep to allow dumping material for a week or so without moving. They have the advantage that the refuse is handled but once; i.e., dumped directly from the mine car to the waste pile. If a fill is to be made with mine rock or slate for additional tracks on a side hill, this can be handled conveniently with the "goose-neck" dump, because the fill is built parallel to the track.

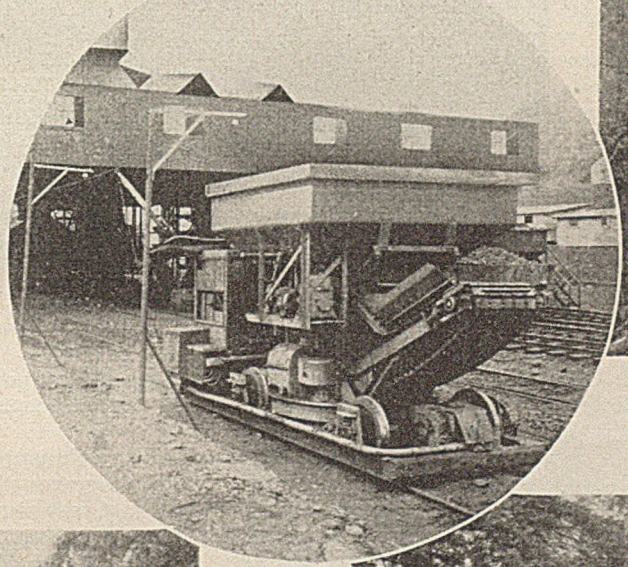
Refuse disposal equipment at the mines of the Pocahontas-New River division comprises a skip hoist, a Link-Belt dump, and two long aerial trams. These trams, one at Mine 251, Coalwood, and the other at Mine 261, Caretta, are refuse-disposal plants which require but one operator. The Coalwood tram, installed by A. Leschen & Sons Co. in 1924 (*Coal Age*, Vol. 27, p. 249), carries refuse 600 ft. up a steep slope and dumps it in a hollow crossed by a 1,400-ft. span. It is of the two-bucket reciprocating type with bottom dumping buckets holding about 1½ tons, and has a capacity of 25 to 30 tons per hour.

A Trenton-Bleichert type continuous tram was put in operation at Caretta in 1928 (*Coal Age*, Vol. 33, p. 723). This installation by the American Steel & Wire Co. is 3,400 ft. long and is capable of handling 50 cu.yd. per hour. On this tram, buckets of the gravity dump overturning type are dispatched automatically to proper spacing on the ropes. They are dumped as they pass through a tripping frame suspended on the track cables and the empties continue on to the tail terminal, where they go around a large horizontal sheave and begin the return trip to the loading terminal.

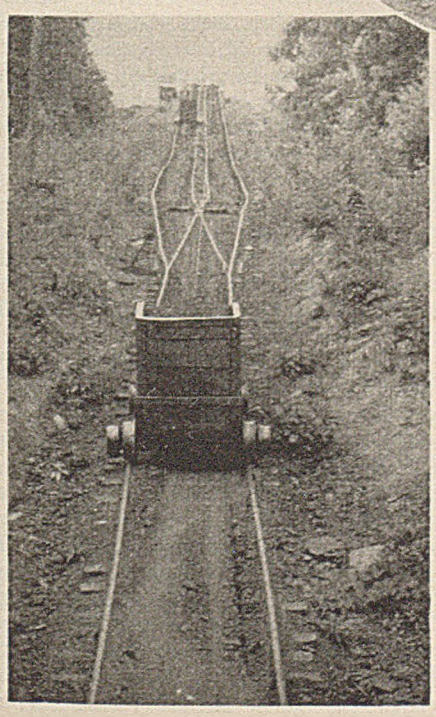


Loading Terminal of Continuous Tram at Auxiliary Shaft, Caretta

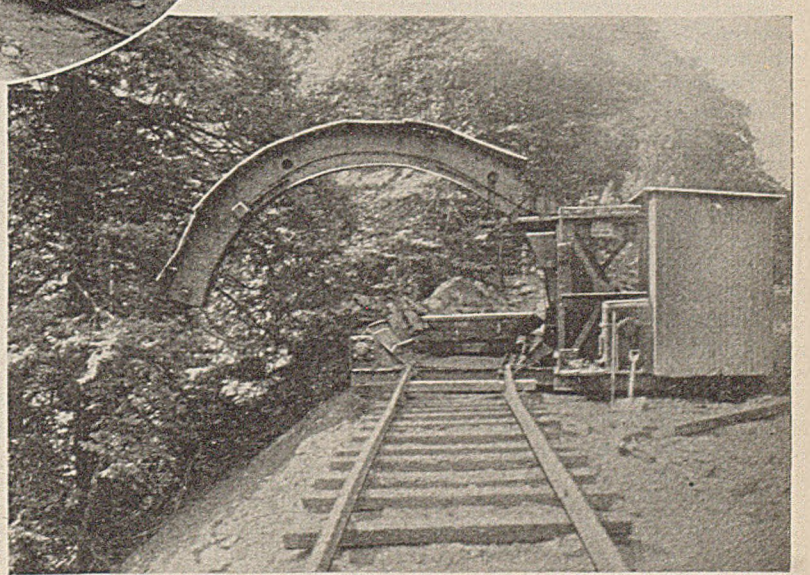
Dumping in 1,400-Ft. Span at Coalwood



Last Year This Throwing Larry Disposed of Over 30,000 Mine Cars of Slate and Rock at Mine 86, Carolina, W. Va.



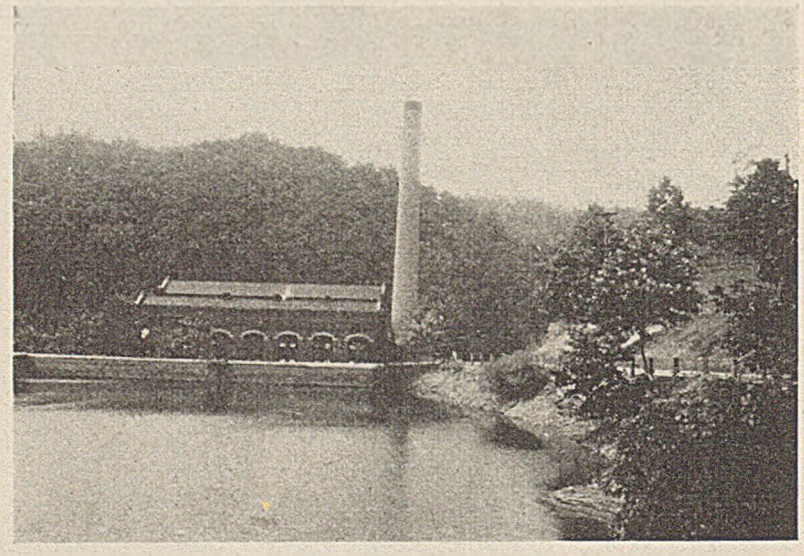
Skip Hoist in the Elkhorn Division



Goose-Neck Dump Making a Refuse Fill for a Track Which Will Displace an Inside Haul, Mine 253, Six, W. Va.

ELECTRIFICATION

+ At Consolidation Coal Co.



Jenkins Power Plant

CONSIDERING that the company has 30 active mines and that many of these are old operations, Consolidation Coal is highly progressive from a standpoint of electrification. Two divisions—Elkhorn and Millers Creek—are 100 per cent electrified. Three hoists and three fans represent the sum total of steam-driven equipment at the other four divisions. In 1923, approximately 53,000,000 kw.-hr. was consumed. For the year 1929 the figure was practically 70,000,000.

Approximately 45 per cent of the electrical energy is purchased, and the rest is generated at plants owned and operated by the coal company. Due to the widely varying mine conditions, including differences in pumping loads, and the fact that steam hoists and steam fans are used at certain mines, the kilowatt-hours consumed per ton of coal produced ranges from 1.5 to 14 for the list of mines. In the two divisions 100 per cent electrified, and in both of which the mines are drifts and a relatively small quantity of water is encountered, the consumption, excluding power for town lighting, is 3.5 to 4 kw.-hr. per ton.

Power is generated by the company at Jenners, Pa., and Jenkins, Ky. The power from these two plants is being delivered to the mines which they serve at appreciably less than the cost of purchased power, although these plants use more coal per kilowatt-hour than the largest and most modern public utility plants and there is the expense of distribution to be added to the cost of the generated power. The Consolidation power plants are 17 to 20 years old, and the depreciation of the equipment is not as great as on the average power plant.

The Jenners plant supplies all electrical energy for the three mines in the Pennsylvania division. Three General Electric turbines, one a 3,000-kw. operating at 3,600 r.p.m., and the other two, each 1,250-kw. but operating at 3,600 r.p.m. and 1,800 r.p.m. respectively, make up the plant capacity. Barometric condensers are used and cooling is effected in a spray pond.

Steam is generated at 150 lb. pressure by six 300-hp. B.&W. boilers equipped with Combustion Engineering type "E" underfeed forced-draft stokers and operated at 150 to 200 per cent above rating. While a large percentage of the fuel is high-grade coal, road cleanings, machine cuttings, and off-color coal are used so far as available. From a crusher under the tipple the coal is delivered to the plant bunkers by a belt conveyor. Ashes are handled from the pit to an overhead bin by a steam jet conveyor. Feed water, which comes from deep wells, is treated in a Scaife intermittent type purification plant having a capacity of 12,000 gal. per hour.

In addition to steam for operating the turbo-generators the boiler plant also furnishes steam for a slope hoist and mine fan. The hoist, which is a 26x48-in. Connellsville and carries 10,000 ft of haulage rope and 2,000 ft. of tail rope, has been operating at the mine for 22 years.

The boiler plant evaporates 8 lb. of water per pound of coal, and the fuel consumption, deducting that used for supplying the fan and hoist, is 3.4 lb. of coal per kilowatt-hour generated.

Generated voltage of 2,300 is transformed to 22,000 volts for transmission about 7 miles to the farthest point of feed. The line is on wood poles, is 13 miles long, and forms a loop to insure service to any point from either direction. It is sectionalized where taps are taken off.

The Jenkins plant in the Elkhorn division serves that division and the Millers Creek mines; it is 52 miles by transmission line from Van Lear, headquarters of the Millers Creek division. This plant has two 1,800-r.p.m. General Electric turbo-generators originally rated at 2,000 kw. at 80 per cent power factor, but now considered as 3,000-kw. units. On the eight-hour day shift these two machines turn out 36,000 kw.-hr., which is an average load of 2,250 kw. each. The plant output per year has shown a rather uniform increase from 6,000,000 kw.-hr. in 1913 to 32,500,000 kw.-hr. in 1929.

Steam is at 175 lb. pressure and 100 deg. F. superheat generated by six 420-hp. Rust-type boilers and Detroit overfeed stokers using natural draft only. Track cleanings, tipple spillage, crop coal, and, at times, full carloads of machine cuttings are sent to the plant. Coal is dumped from hopper-bottom railroad cars and, after being passed through a crusher if necessary, is elevated by bucket conveyor to the bunkers. The same conveyor is utilized to carry the ashes up to a bin above the dump track. Some of the ash is used in the

mines for ballast and on manways, and the rest is hauled away by the Chesapeake & Ohio Ry.

Boiler feed is from a 16-acre artificial lake which holds about 70,000,000 gal. and is fed from surface water, from springs, and from mine drainage. The water is treated by pumping "Algor Colloids" into the feed line.

Wheeler surface condensers are used and the water is cooled by circulation through the lake, the level of which stands 45 ft. above the condensers. The circulation is a closed system with the condensers under pressure and, therefore, circulating pumps need to work only against the friction head. Although the cooling water is discharged into the lake at a point 700 ft. from the intake, the temperature of the intake goes as high as 97 deg. during hot and dry seasons. At this temperature the vacuum drops to 20 in. During the winter a vacuum of 26 to 28 in. is maintained.

The plant is operated with a total of eleven eight-hour man-shifts per 24 hours. Each shift carries a fireman and an engineer; on the day shift there also are two men handling coal and ashes and three men on repairing and miscellaneous work.

Coal consumption is 3.16 lb. per kilowatt-hour and the boilers evaporate 8 lb. of water per pound of coal as fired. The generated voltage of 2,300 is stepped up to 40,000-Y for transmission. The transformers are connected delta-Y at the plant and Y-delta at the substations so as to benefit by a grounded neutral for transmission. Wood poles are used on the lines. The transmission system is tied in with a power company line, and some power is purchased, as the maximum demand is in excess of the capacity of the generating plant.

Where auxiliary power is deemed advisable for mine fans, steam engines are used, and at the three mines where such is the case complete spare fans are provided. A steam engine is connected to one fan and an electric motor to the other. Because of the high power requirements for ventilation from the standpoint of reliability and economy of operation, the steam fans are operated regularly and the electric fans are spares. At each of the two shaft mines in the Pocahontas-New River division a power plant is maintained solely for this purpose. In both instances electric power is purchased.

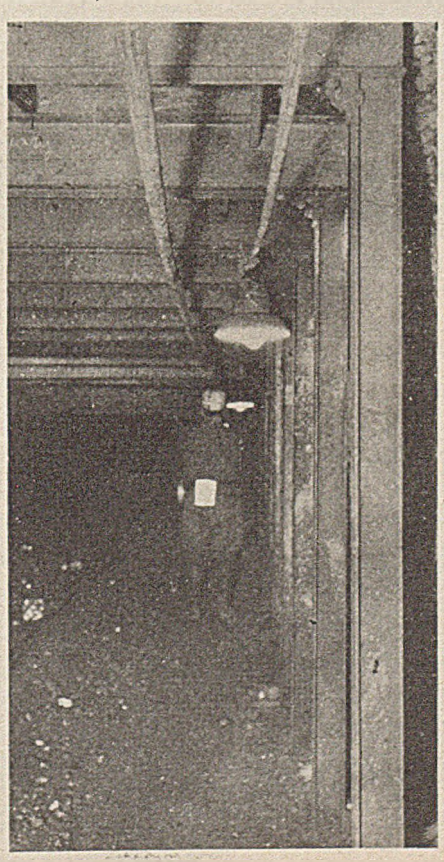
At Mine 261, Caretta, W. Va., which has the heaviest fan load, a new boiler plant was erected two years ago. This contains four 250-hp. Erie City water-tube boilers moved from a plant which was shut down in another division. These boilers, which generate 130 lb. pressure, are fired with type "E" underfeed stokers and are equipped with Copes feed-water regulators and with automatic control of the turbine-driven forced-draft fans. Slack coal and track cleanings are used at this plant.

One of the four boilers is held in reserve. The plant is equipped with a feed-water heater and steam-jet ash conveyor. Coal is delivered to the bunkers from a track drum-hopper by an elevator and conveyor. The ash bin, made of curved hollow tile, spans a track leading from the material yard to the auxiliary shaft. The stack is 135 ft. high and is constructed of radial chimney brick.

The fan engine is a Harrisburg 30x32-in. uniflow rated 575 hp. at 160 r.p.m. and 100 lb. pressure. In the auxiliary hoist house is a 250-kva. 2,300-volt engine-driven alternator which can be started for furnishing power to operate the man and rock hoist in case of a failure of purchased power. This electric hoist is equipped with two motors, one a 400-hp. and the other a 250-hp., one driving, and the other idling. The 400-hp. motor is geared to run the hoist at a higher speed, which speed, however, the smaller motor will stand when idling. The smaller motor is disengaged by a sliding pinion when the larger motor is used.

At the other shaft mine, 251, Coalwood, W. Va., there is an equally modern boiler plant for operating the steam-driven fan. This contains three 300-hp. boilers of the Stirling type and equipped with type "E" stokers. Fuel is carried direct from the tipple to the plant by a belt conveyor, the gallery of which has a 220-ft. span over tracks leading from the tipple loading booms.

Vapor-Proof Wiring and Lighting Around Shaft Bottom in Mine 261, Caretta, W. Va.



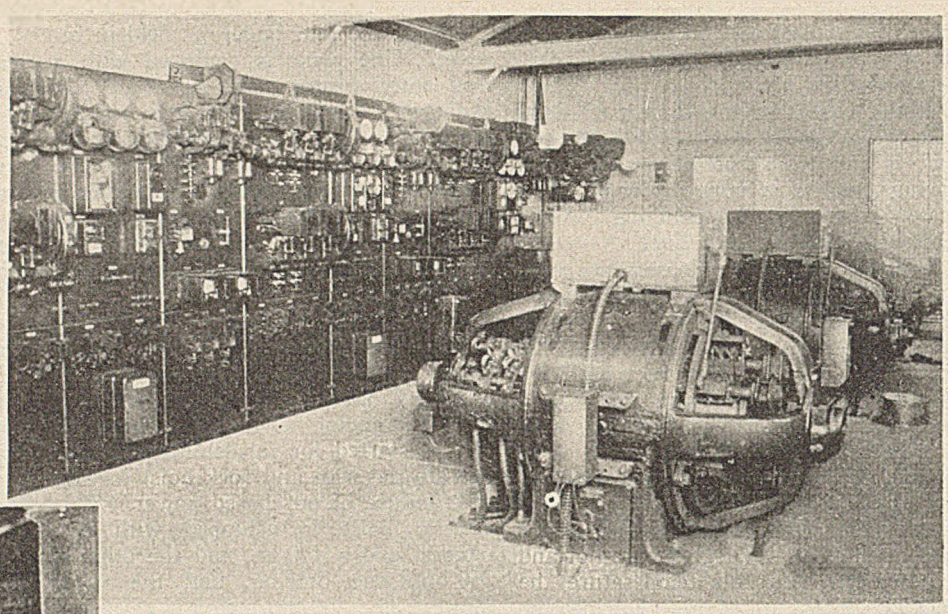
In addition to the four plants described, the company has two small hand-fired plants. One operates the fan at Mine 86, in the West Virginia district of the Fairmont field, and another furnishes direct current to a small operation of short life in the Maryland division. None of the four plants of consequence is lacking in the latest labor-saving devices.

It is the policy of Consolidation to use either 220-volt or 2,300-volt a.c. motors for stationary duty. A few old motors rated 440-volts are in service, but for reasons of safety this voltage is not favored. As a general rule, 2,300 volts is used for motors of 25 hp. and above, but wide deviations are made for specific conditions. Another general rule is that induction motors up to 40 hp. be of the double-wound rotor squirrel-cage type and started across the line. At the 30 mines there are 4,537 stationary motors, including d.c. and a.c. but not including motor-generators, and they aggregate 83,719 hp.

Push-button or full-automatic control is used on all but a small percentage of the motors. All permanent mine pumps driven by a.c. motors are equipped with ammeters. Four tipples or preparation plants are equipped with sequence control. These include the air cleaning plant at Mine 120, Acosta, Pa., and the picking and screening plants at Mines 25 and 32, in the Fairmont field, and at 251 and 261, near Welch, W. Va. By operation of a single push button the motors start one after the other or by groups and with the proper time delay between the starting of individual motors or groups.

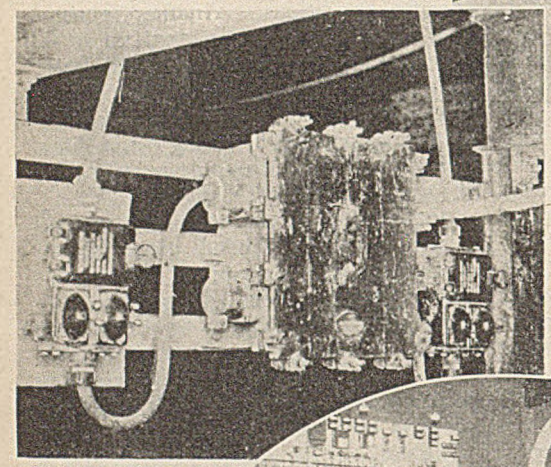
Substation equipment for supplying direct current for inside operations comprises 77 rotary converters and 10 synchronous motor-generator sets, with a total generating capacity of 12,700 kw. All are 275-volt units. No 500 volts d.c. is used in any mine. For average conditions, converters are favored because of the lower cost installed complete, and because of higher short-time peak-load capacity, which in most cases is the controlling factor determining the size unit required. Even the power-factor performance of the converter has been found to compare favorably with that of the synchronous motor-generator. The latter, of course, can supply at ordinary loads, but the converter has a high power factor at peak load.

Of the converters, 69 are 150 kw., 2 are 200-kw., and 6 are 300 kw. There are three sizes of motor-generators: 100, 150, and 170 kw. Full-automatic control is used in several substations. One, installed November, 1921, with a 150-kw. converter in Mine 154, Van Lear, Ky., and still giving good service in the original location, represents one of the early applications of full-automatic control to coal-mine substations. Another substation—this on the outside and containing two 150-kw. converters—was installed in the Maryland division

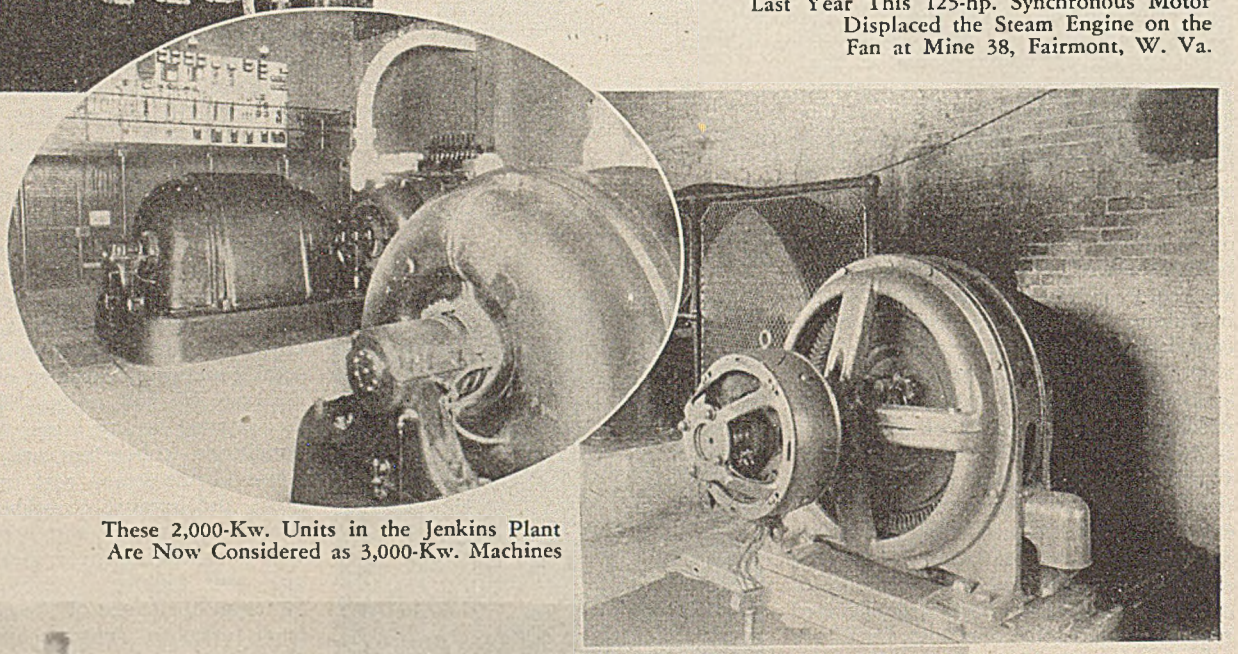


Three Old Converters Fitted for Full-Automatic Control in the New Substation at Mine 120

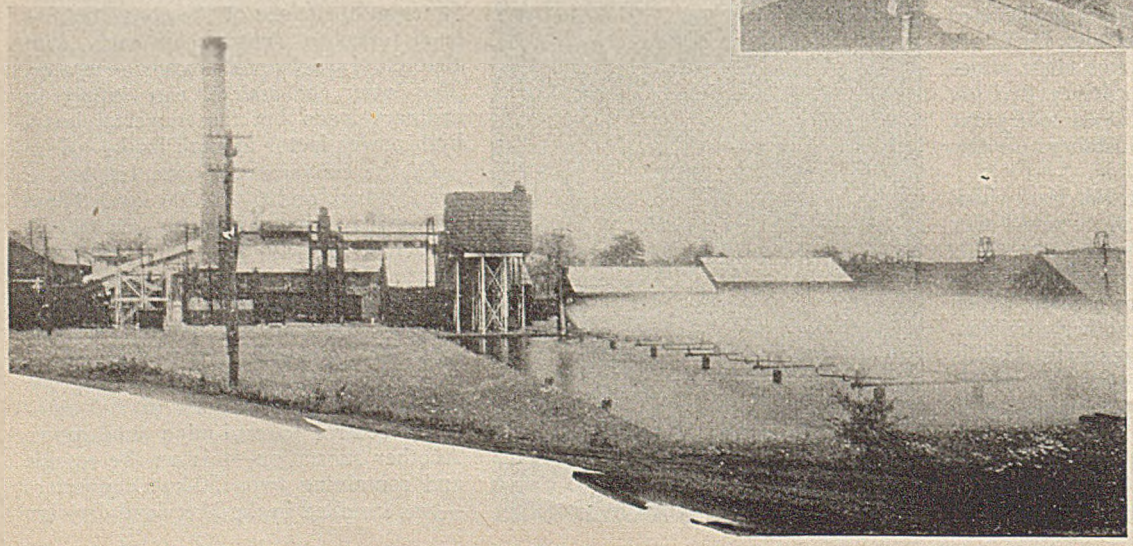
Vapor-Proof Junction Box and Vapor-Proof Fused Switches in Parkway Cable Circuits in Mine 261



Last Year This 125-hp. Synchronous Motor Displaced the Steam Engine on the Fan at Mine 38, Fairmont, W. Va.



These 2,000-Kw. Units in the Jenkins Plant Are Now Considered as 3,000-Kw. Machines



An Efficient Spray Pond Makes It Possible to Carry a High Vacuum at the Jenners Plant

less than a month later. Both are Westinghouse equipment and are among the first ten of any make installed at coal mines. Of all the substations, only two are inside and these were installed some years ago. Most of the distribution is at 22,000 or 40,000 volts; inside substations, therefore, would mean double transformation or the use of borehole cables of these voltages.

During the past year a new outside substation with full-automatic control was built in Pennsylvania. This utilizes three 150-kw. converters moved from a station that had manual control. They were equipped with brush-raising attachments and bearing thermostats as a part of the new control. Use of Rectox rectifiers simplifies the control equipment. The "Edwards" steel building housing the equipment contains sufficient floor area to accommodate a fourth unit. Transformers are mounted outside. Machines are not arranged to come onto the line according to load because the peaks do not occur in regular periods. Time delay relays prevent starting all three machines simultaneously.

The new substation is now located near the center of load distribution for a territory that was formerly worked by two mines. The change in location was practically a necessity, but the saving by elimination of substation operators will pay the cost of the installation and new equipment in four years. Feed to the mine is through an 8-in. borehole 352 ft. deep. In it are two positive circuits, each a 1,500,000-circ. mil single-conductor armored cable, and two 1,500,000 bare copper negatives.

In addition to synchronous motors used in substations, the company recently installed a 125-hp. 80 per cent power-factor synchronous motor on a mine fan which was changed from steam drive. This was at Mine 38, Fairmont, where hoisting also was electrified by the installation of a new hoist driven by a 200-hp. induction motor. The mine fan motor is designed for 140 per cent starting torque, 125 per cent pull-in torque, and 250 per cent pull-out torque. A 200-hp. 80-per cent power-factor synchronous motor was installed on the blower in the cleaning plant at Acosta, Pa. These are the only places where, because of a large induction motor load, it has appeared advantageous to install synchronous motors other than those driving substation equipment.

Two of the electric hoists are driven by d.c. motors supplied from flywheel motor-generators. At Mine 86, Carolina, W. Va., the motor is 1,400 hp., and at Mine 251, Coalwood, W. Va., the motor is 1,100 hp. An excellent comparison of the quantity of power required to hoist by skip and with an a.c. motor, as compared to cage hoisting with a d.c. motor is available in the Pocahontas-New River division. Mines 261, Caretta, total lift 685 ft., and 251, Coalwood, total life 660 ft., are equipped with these types, respectively. Skip hoisting with the 1,000-hp. slip-ring motor averages 0.72 kw.-hr. per ton and the cage hoisting with d.c. motor and flywheel set averages 1.41 kw.-hr. per ton.

In three mines—Nos. 86, 251, and 261—cutting, gathering, and main haulage are done exclusively with storage batteries. It is interesting to note the comparison of d.c. kilowatt-hours per ton in these mines with that in a mine of about the same conditions and operated from a trolley and feeder system. The average for several months of practically full-time operation at the battery-operated Mines 251 and 261 was 1.22 kw.-hr. per ton. An average for 14 months at Mine 32, Owings, which is trolley-operated, was 1.51 kw.-hr. per ton. The average haul at Owings is approximately 10,000 ft., as compared to an average of about 6,000 ft. at the battery mines. Although not conclusive, the figures indicate that the battery efficiency loss by having to haul the batteries is less than the loss by transmission through ordinary feeder and track circuits. Softer coal and about one-fifth as much pumping load at the battery-operated mines work to the advantage of batteries in the comparison.

In Mine 86, where the batteries are 48-cell and 117-cell lead type, charging current at two voltages is supplied by a substation on the outside containing two 275-volt synchronous converters and by a 126-volt motor-generator on the inside. In the other two mines, where the batteries are 54-cell, 100-cell, and 110-cell, charging is by 275-volt synchronous converters on the outside and balancer sets inside of the mines at the repair barns near the shaft bottoms. The balancer sets provide the half voltage for the smaller batteries. Each set consists of two dynamos direct-connected and having their shunt fields connected across the armature of the other machine. The load on either side of the three-wire circuit determines whether one of the dynamos acts as a generator or motor, and takes power from, or drives, the other.

In Mines 251 and 261, which use only permissible mining and haulage equipment and no trolley wires, the lighting around the main bottom is designed for the same class of service. Circuits are three-wire 110/220-volt a.c. carried in three-conductor No. 12 parkway cable fastened on the roof. Vapor-proof junction boxes, switches, fuse boxes, and reflector lighting units are used. Stuffing boxes form tight joints around the cable at all entrances to fittings. Lamps are 100-watt, 120-volt, and are placed 50 ft. apart along headings. In the parkway cable the lead sheath containing the insulated conductors is covered with jute, then with a ribbon steel armor, and with jute again on the outside.

Last year the steam fans at Mines 153 and 154, Van Lear, Ky., were converted from steam to electric drive. The main bearing of the steam engine was left in place and a V-belt pulley added to the shaft, providing a short-center drive. Type FTR motors and full-automatic General Electric control are used. A 40-hp. motor is used on the Mine 153 fan and a 75-hp. on the Mine 154 fan. In the Millers Creek division all tipple motors were changed recently from d.c. to type FTR alternating current.

Because old practice was to use long-center flat belt drives for mine fans, a number of this type of drive are still in use. All of the late installations are the short-center multiple-V-belt. Obtaining reduced fan speeds by employing two-speed motors or by operating slip-ring motors on resistance is not favored. As a rule, pulley ratios are adjusted to make changes in fan speed.

Complete Battery Operation of Mines Has Proved Economical of Electrical Power

SAFETY

+ At Consolidation Coal Co.

ORDINARILY a safety department is an organization featuring first aid to the injured and mine rescue work. The department of safety of the Consolidation Coal Co. goes far beyond this, its personnel consisting of an engineer of safety, who is chief of the department; director of compensation, in charge of all injury compensation; an assistant to the engineer of safety; chief gas inspector, in direct charge of all ventilation matters; statistician, in charge of statement work; five mine inspectors, who make physical inspection of mines, plants, etc.; six gas inspectors, whose duty is to control ventilation, dangerous gases, etc.; two compensation investigators, engaged in field work on compensation cases; three full-time instructors in mine rescue and first aid; and three stenographers for general office duties.

In addition to such regular features as safe practices, first aid, and mine rescue the department has jurisdiction from the general plans to the last detail in all ventilation problems; preliminary and final projection control maps, matters of haulage (including signal systems, dispatching, etc., electrical wiring, new construction and new equipment, all bear the approval of the engineer of safety, and he is consulted on the purchase of merchandise such as goggles, caps, shoes, gloves, overalls, etc., before they are put in stock. In fact, there is no branch of the operating department where the engineer of safety is not consulted or where he does not have jurisdiction over equipment and practices.

When the department was reorganized several years ago, one of its first jobs was the formulation of a set of rules (later known as the Safety Standards) which would apply to the various activities of the operating department and would provide for procuring and maintaining efficient, safe equipment and rules by which the various employees would carry on their work in a capable and safe manner. These Safety Standards were put together with a great deal of care and cover all the various activities incident to coal mining. They deal with such features as ventilation, drainage, the operation of all kinds of machinery, and down the line to such details as the proper kind of hand tools, lamps, cap, and shoes, all for safe and efficient production.

One vexing problem is the eye accidents from flying particles. In one operating division there is a broad band of coal which flies when struck. The Safety Standards now require the use of goggles in mining this coal. When this particular drive was started, in 1928, cup goggles were first used, but dust collected in them and they steamed to such an extent that the men would not wear them. A spectacle goggles is now used and, while it does not afford the protection of the cup goggles, it is probably 90 per cent effective, is more comfortable, and really safer, because the visibility is greater. For shop work another type of goggle is used, and for welding and foundry another. Because the men own their own goggles, they are better cared for. Where natural vision needs correction, goggles are worn over the worker's ordinary spectacles. Wire-screen goggles were tried, but were not satisfactory, since they appear to shut off some light and impair vision.

In the operating division referred to the following table represents what the goggles have done in accident prevention.

Table I—Eye Accidents—With and Without Goggles

	ACCIDENTS			
Year	Temporary	Permanent	Total	
1927	110	1	111	No goggles
1928	87	3	90	Cup goggles
1929	25	0	25	Spectacle goggles
1930 to 9/15	11	0	11	Spectacle goggles

The Safety Standards are printed, bound in loose-leaf book form, and supplied to all operating officials and bosses of every class who have supervision of work of any nature. Following the initial distribution, schools of instruction were organized and all concerned were required to attend a regular course, at the end of which each man was required to pass an examination—there were practically no failures. Superintendents, foremen, and other supervisors having been made thoroughly conversant with the Standards, they in turn gave instruction to each employee.

Within each mine, and as near the entrance as conveniently possible, a standard working place is maintained. Each new employee is taken into this place and given instruction as to how he is expected to carry on his particular duties. Methods of timbering, caring for tools, shooting, handling cars, use of slate bars, goggles, etc., are graphically described to the prospective worker. (A standard clevis block for blocking cars, and a standard slate bar are equipment required at all points where cars are blocked or slate taken down.)

All equipment and work had to be brought up to the new requirements. For this the inspection work was reorganized, a system of monthly inspections arranged, and the mines were graded in a definite manner according to their meeting, or failing to meet, the requirements. The mine inspectors are field men, making inspections of all underground and surface work. They investigate every activity in and about the mines, methods of timbering, shooting, haulage, drainage, ventilation, etc. They report bad wiring or a man with a defective hand tool. They may remove a man they find working in a dangerous place, shut down what they consider a dangerous piece of machinery, or in emergency shut down an entire mine. They may go into a merchandise store and report dangerous conditions; a powder magazine may draw their attention or defective conditions at a recreation building or a home. No one knows when they will appear and it is not possible to prepare conditions for their benefit.

The mine inspectors also make investigations of the nature and causes for such accidents as occur which result in more or less serious injury. In such cases they not only report the cause of the accident but also definitely place the responsibility—they may state that it was due to a lack of proper supervision, to a violation of rules, that it was unavoidable or caused by carelessness, but to the best of their ability they place it.

The chief gas inspector might more

properly be called chief of ventilation service. No ventilating equipment nor any system of ventilation may be put into effect or changed without his approval; in fact, most of the ventilation arrangements originate in his office. At such mines as generate dangerous gases it is largely within his province to indicate how the work shall be carried on to avoid disaster. This includes not only the amount of air which shall be supplied to any split, but where explosive gas is generated in quantity, the amount of coal which may be mined from such split within a given time and the type of equipment which shall be used. He has direct supervision of the gas inspectors and is an assistant to the safety engineer in other matters.

The gas inspectors are charged with the detection and removal of dangerous gases within the mines and the proper ventilation of the mines. These men are capable of making chemical analyses of atmosphere; they regularly sample the various air splits within the mine and run analyses of these samples to determine the presence of explosive or lethal gases. They examine daily all ventilation equipment, and take immediate steps to correct any defective feature. Aside from their regular duties they make reports on any special features which may come to their attention.

While the formulation and practical application of the Safety Standards required considerable thought and care, no particular difficulties or objections were encountered, except in a few instances. With the Timbering Standards, however, when they were suggested, objection was immediately made; first that as a general practice more timber would be required than was necessary and, second, that timber would be set simply as required by the standards even though safety might require more.

However, timbering standards were developed, and the results so far have fully justified them, while the objections mentioned have not proved true. These timbering standards went into effect in May, 1928, and the following table of fatal accidents (from falls of roof and coal only) illustrate vividly their value:

Table II—Fatalities Due to Falls of Roof and Coal in Working Places, All Mines

Year	Fatalities	Year	Fatalities
1926	18	1928	6
1927	17	1929	6

Moreover, it has been found that systematic timbering has not increased the operating expense; under the old methods as much timber was used, but it was either misplaced or not placed until too late.

Standardized timbering shows to greatest advantage with treacherous roof; in one division horse-backs, rolls, and pots have to be supported. The following table gives an idea of what standard timbering has done for that division:

Table III—Fatalities and Permanent Disability Injuries in One Division From Falls of Roof and Coal

Year	Injuries—Fatal	Injuries—Permanent
Before Standard Timbering		
1923	2	2
1924	1	1
1925	0	1
1926	1	1
1927	4	4
With Standard Timbering		
1928	0	0
1929	0	0
1930 to Sept. 24	0	0

No stronger arguments in favor of the standard method of timbering need be advanced at this time.

In 1908, the company started a series of investigations and put into effect what were then considered radical practices. Draeger oxygen apparatus for mine rescue work was purchased in Germany, rescue crews were organized and trained, making the company among the pioneers, if not the first, to install such apparatus on a large scale. Various methods of combatting coal dust were tried out, including water sprays and the introduction of live steam into the intake airways. The process of introducing live steam into the intake air was developed and carried on at all the mines of the company from early in 1908 up to the time when rock-dusting was introduced. At this time rock-dusting has entirely superseded the live-steam method as being more effective.

Rock dust is applied in all the dry or gassy mines up to the last crosscut, being placed in every room by machine, and also in otherwise inaccessible places by long lines of special hose from the dusting machines. Such dust not only prevents the propagation of an explosion but also frequently shows up bad roof and enables proper precautions to be taken to prevent a fall. Company regulations provide that the inert matter in the mine dust must exceed 55 per cent in practice, in most cases it comes nearer 70 per cent.

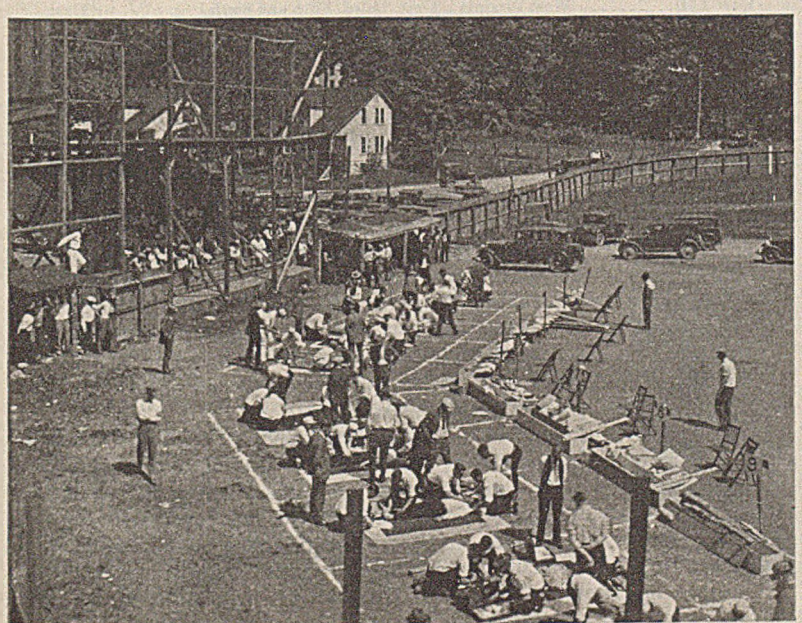
Return airways are dusted by high-pressure blowers, through holes cut in the stoppings. These holes are tightly closed and plastered after the rock-dusting has been done. Trough barriers, which once were believed adequate to stop an explosion, are still maintained, but the rock-dusting of the roadway itself is now the standard method of protection.

Rock dust is used also as supplementary material for fire fighting, and a certain quantity is kept on hand in butt headings for that purpose. Rock dust is placed also on the tops of overcasts, where in case of an explosion, it will be effective in either intake or return.

For many years Consolidation has maintained chemical fire-fighting equipment inside the mines. These are regular soda-acid chemical engines of from 40 to 120 gal. capacity, mounted on trucks suitable to the track of the particular mine where they are located, or on the trucks with adjustable wheels that can be used on any gage track. The Standards now require that chemical extinguishers (suitable for electrical fires) be kept on all portable electrical equipment and in the immediate vicinity of all fixed electrical equipment, both surface and underground. Regular water equipment, such as fire plugs, hose, and reels, etc., is maintained at all surface plants. Supplies of rock dust and other materials for fire fighting are kept at designated points underground. Sets of regulations for action to be taken in case of fire are posted conspicuously about all plants. All-service gas masks and oxygen breathing apparatus are readily available in case of serious fire.

While every facility for fighting fire is maintained, the real effort along this line is for fire prevention. It has taken

First-Aid Meet at Jenkins



years of effort and considerable expense to reduce the fire hazards to a minimum, but nearly all such work has proved an economy in other ways than that originally intended—many saved power and facilitated transportation; makeshifts gave way to more permanent installations. Among these changes were better trolley wiring; better insulated trolley hangers; better ventilation, which prevented gas ignition; more reliable bonding, which prevented floor fires; closer inspection, more adequate roof support for the protection of electric circuits; the use of automatic reclosing circuit breakers; and the removal of combustible matter.

The Safety Court idea has been introduced at the mines by the department of safety and is sponsored by that department, but it is distinctly an organization by, for, and of the non-official employees. The court is organized along the lines of a regular circuit court, but not so complicated in procedure. The men elect a judge, clerk, sheriff, prosecuting attorney, and an attorney for the defense. Safety police are appointed and are supposed to be known only to the officials of the court. Court is held evenings as often as may be necessary to keep the docket clear. Penalties are small fines, the proceeds being placed in a fund, and the fund is disbursed for charitable purposes among the employees as the employees themselves may direct.

Men are brought before the court for violations of the Safety Standards or for such cause as the employees may deem "dangerous or improper practice," but they are not brought before this court for any offense in violation of any state law, mining or otherwise, or for any action for which they have been punished by the regular disciplinary action of the company officials. These courts are quite popular; the men take to them in good spirit and they are undoubtedly doing an excellent work in promoting the safety idea.

In addition to carrying on an active and vigorous campaign for the prevention of accidents, an elaborate program for taking care of those who are so unfortunate as to be injured is being constantly carried out. There are three full-time instructors in first aid and mine rescue, who are assisted in part by the mine inspectors. Training work is carried on also by part-time instructors —men picked from the various operations after having shown an aptitude and capability for the work. In addition, each year the U. S. Bureau of Mines supplies a number of instructors and carries on a series of courses at the various operations.

With these two sources of instruction, the company endeavors to see that every person in and about the mines, not only directs employees of every kind but also non-employees, such as the local school teachers and, in a number of cases, children's classes, receive once or twice each year a full course of instruction in first-aid work and later in advanced first-aid work. Company regulations now provide that no employee who does not have a first-aid (instruction) certificate will be retained beyond a reasonable length of time. In other words, at all operations the endeavor is to have what is known as 100 per cent first-aid training.

A surface receiving station is maintained at each plant. Injured employees are brought to these stations for such immediate treatment as may be necessary beyond the first-aid given at the point where the accident occurred, or to await transportation to home or hospital. Inside the mines, at convenient designated spots, emergency first-aid supply stations are maintained on each section. These are fully equipped to handle any kind of accident that may occur.

In so far as the actual care of the injured is concerned, jurisdiction of the safety department ceases with the delivery of patients to the local doctor; from that point they are under the care of the doctors and nurses who are part of the industrial relations department. Aside from the actual treatment of the patient, however, each case remains under the jurisdiction of the safety department until the injured person has completely recovered and has returned to work at his or her regular occupation.

As previously stated, the company started training in mine rescue work with oxygen-breathing apparatus, early in 1908. The equipment of the first station at Fairmont, W. Va., comprised five sets of Draeger apparatus and six Hubbel electric storage-battery lamps. Consolidation now has four mine-rescue stations (Fairmont, Somerset, Coalwood, and Jenkins), fully equipped with the most improved oxygen breathing apparatus and all the necessary accessories, supplemented with a supply of all-service gas masks and other equipment. The Fairmont station also has a mine rescue truck built and equipped along the most modern lines. Each mine carries its quota supply of all-service gas masks, lamps, etc., and there is a large supply of such equipment kept at the central supply buildings in each operating division. Certain mines require every man who goes inside to be equipped with a self-rescuer, and an extra supply of these is available at all times.

Mine rescue equipment is of no value unless there are trained men to use it. The company, therefore, constantly keeps in the field two men on this work. In addition, the U. S. Bureau of Mines gives training at intervals each year. Each mining plant must have at least two trained crews (holding certificates of mine rescue training and advanced mine rescue training issued by the U. S. Bureau of Mines), and many of the mines have five or more crews so trained.

How well this training work has been done is shown in the standing of various Consolidation teams in competitive events in which they have recently taken part (See Table IV).

Of all such events, however, interest is most keen in the company's own annual first-aid contests. Divisional meets are held in June and the winning team in each division attends a final meet held in July. The winners of the divisional meets are entitled to attend the various state meets and compete in the company's final meet; the winner of the company final meet is sent to the international meet sponsored by the Bureau of Mines. Some idea of the interest in these company events can be gained from the fact that this year about 150 teams were entered in the various division meets.

Further evidence of excellent training is had from the fact that on a number of occasions Consolidation rescue teams have been called out for actual service at some neighboring plant, and have done work which brought praise from both federal and state officials, as well

(Turn to page 611)

Table IV—Standing of Consolidation Teams in First-Aid and Mine Rescue Meets

Meet	Division	Standing
1927		
West Virginia State, Morgantown (First aid)	West Virginia	First (Score 100%)
1928		
U. S. International, Butte, Montana	Pennsylvania	First in Penna. in First Aid First in Penna. in Mine Rescue Third in Finals in Mine Rescue Third in Finals in combined Mine Rescue and First Aid
West Virginia State, Bluefield (First Aid)	West Virginia	First
1929		
U. S. International, Kansas City, Mo.	Maryland	First in Mine Rescue
Maryland State—(First Aid)	Maryland	Second
West Virginia State—(First Aid)	West Virginia	Second and Fourth
Pennsylvania State—(First Aid)	Pennsylvania	Second
Kentucky State—(First Aid)	Elkhorn	Second
1930		
U. S. International, Louisville, Ky.	West Virginia	First in Mine Rescue Second in Combined Mine Rescue and First Aid
Maryland State—(First Aid)	Maryland	First, Third and Fourth
West Virginia State Divisional Jackson's Mill—(First Aid)	West Virginia	First, Third, Fifth and Sixth
Kentucky State Divisional, Pikeville, (First Aid)	Millers Creek	First
	Elkhorn	Second
	Millers Creek	Sixth

VENTILATION

+ At Consolidation Coal Co.

VENTILATION problems play a large part in planning Consolidation mines, because of the extended area covered by the workings, the large output of some of the mines, the quantity of gas a few of them generate, and the complications that arise from the presence of gas wells with which the field in the West Virginia division is riddled.

At Mine 261, Caretta, W. Va., in the Pocahontas-New River division, a Jeffrey 14x6-ft. fan is delivering approximately 500,000 cu.ft. of air per minute at a water gage in excess of 5 in. The fan at Caretta circulates more air and at a higher water gage than any other operated by the company. From the point of view merely of air circulated, the next largest is a Lepley 20x6-ft. fan at Mine 86, Carolina, in the West Virginia division. This circulates approximately 340,000 cu.ft. of air per minute with a water gage around 2¼ in. The Jeffrey fan at Mine 251, Coalwood, in the Pocahontas-New River division, is the third fan on the list, and it is more powerful than that at Carolina, though its air output is only 300,000 cu.ft. per minute, at approximately 4 in. of water gage. At Mine 63, Monongah, in the West Virginia division, a newly installed 12x6-ft. Jeffrey fan is delivering 285,000 cu.ft. of air per minute with a water gage of only 1.8 in. The other fans are smaller, varying all the way down to a 5-ft. disk fan operating at 0.1-in. water gage.

Wherever there is gas, either a second ventilating source is provided or two sources of power, in case one should fail. Usually, the second ventilating source is electrically driven, for the main units are in general driven by steam. At Monongah, electricity reaches the fan from two entirely separate sources, and there is but one unit, that already mentioned, in operation. At the Carolina mine the main fan is driven by steam, with an electric drive available that can be connected at any time. There is also a 20x6-ft. Lepley fan.

A separate standby unit is provided at Coalwood, an electrically driven 12x6-ft. Robinson fan, capable of circulating 300,000 cu.ft. at 4-in. water gage, thus providing as much air as the main fan. The standby at Caretta is a 12x6-ft. electrically driven Jeffrey fan. At Mine 97, Rivesville, W. Va., the 10x4-ft. Jeffrey fan, with a capacity of 100,000 cu.ft. and with a 1.25 in. water gage, has no standby, as it is so close to the Monongahela-West Penn Public Service Co. as not to be subject to line troubles. Frequent analyses are made to determine the percentage of gas in the returns as a basis for the regulation of the ventilating current.

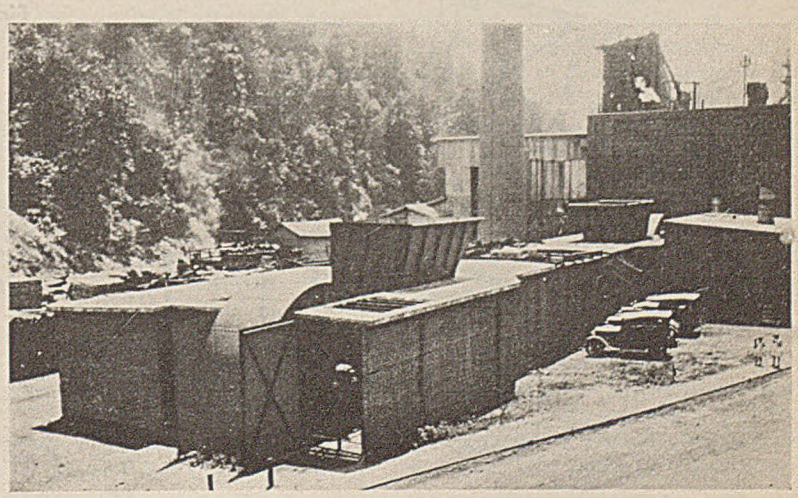
The Monongah fan is set 43 ft. from the shaft collar to give needed travel in which to slow down the air gradually on its way to the 149-ft. shaft.

This installation has a unique feature which is likely eventually to find a place at the head of all shafts and at the foot of many of them: the air in passing from the fan to the airshaft must be turned at a right angle; consequently, the company has introduced deflector diffuser vanes to divide the air into horizontal segments, to deflect it and at the same time expand it so that a 12-in. layer of air as it comes from the fan will be a 15¼-in. layer as it goes down the shaft and will have converted much of its velocity pressure into static pressure.

It will be apparent from the illustration that the radius of deflection is 19 in. instead of 14 ft., yet the air will make the rapid turn under control without as much loss as it would sustain with the easier turn when not under control. The various deflection vanes pick up the air wherever it may be in the cross-section of the fan duct, and they keep it from crowding the neighboring air as it turns around the corner. Otherwise, it would tend to continue on its way toward the casing until it met too much resistance from other air similarly bent, when it would be thrust rudely back or turned into the vacuum created on the inside of the curve or angle, thus causing turbulence and the conversion of the energy of motion into heat. This vane system has been used extensively in the ventilation of buildings and in ducts for the supply of air to turbo-generators, but it is a new idea in mine ventilation.

Unfortunately, this airshaft has been so steadily needed for mine ventilation since the fan was erected that there has been no opportunity to test the fan with and without the installation of vanes, so as to measure the increase of air traversing the mine as the result of their installation or the decrease in power use possible if, with the vanes installed, the fan were run at a speed to give the same quantity of air as it would supply at a higher speed with the vanes omitted. However, the company is well satisfied

Fig. 1—Fan at Caretta Mine



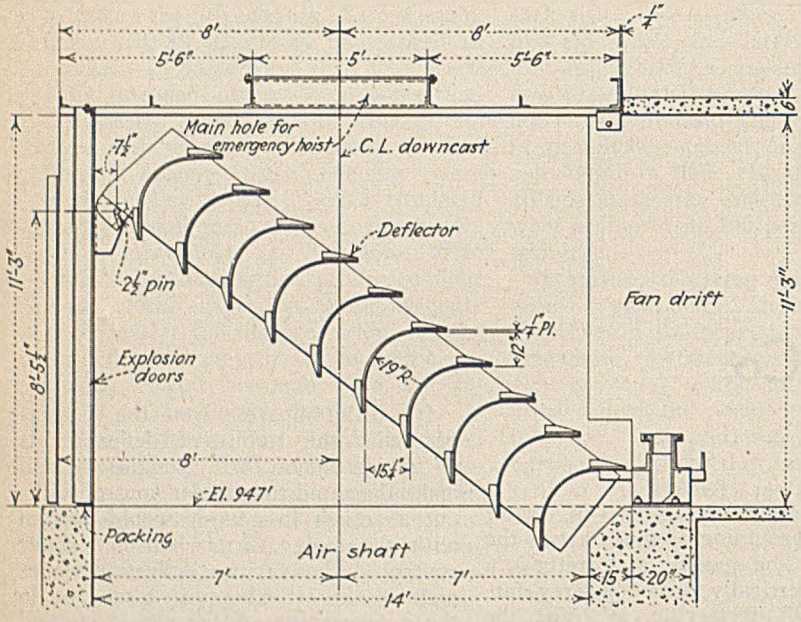


Fig. 2—Deflection-Diffuser Vanes for Turning Right Angle and Expanding Air, Monongah Fan

with the value of the innovation, and expects to use the vanes at the top of the shaft at Caretta to turn air down the shaft, from either of two fans. There the ventilating current is about 80 per cent greater and the water gage 3.2 times as great.

Arrangements have been made at the Monongah shaft for the lifting of the deflection diffusion vanes by the sheave on the headframe at the rear of the fan house. That done it will be possible to use the shaft temporarily for hoisting in case of emergency or repairs.

Proximity of large-capacity gas lines is a potential hazard to coal mining. Careful consideration must be given to this in coal fields where such lines exist. This is an important consideration when deciding between an exhaust or a blowing fan for ventilating a mine. More gas might be expected to lead into the mines if the pipe lines over the area being excavated and under active subsidence were kept buried, as pipe lines usually are, but the gas companies in the Fairmont district remove the ditch fillings wherever such working is about to commence.

In one division of the Consolidation Coal Co. one man in the engineering department watches all gas wells and arranges that all new borings shall, if possible, pass through entry pillars, actual or projected; thus the wells interfere as little as possible with operation and one pillar is made to serve alike for gas-well and entry protection. This man watches all the wells on abandonment to see that the gas is properly sealed, yet adequately vented to the surface, and plugged with concrete above, through, and below the Pittsburgh coal bed. When a new well is drilled he is present during its passage through this coal seam, and he takes care to see that the casing is properly packed.

Most of the mines to the east of the West Fork of the Monongahela River are practically non-gaseous, for the farther they leave the river the higher they rise above water level. Those on the west side are at or near water level at the river, and as they dip into the hill they get farther and farther below that level and so have gas. Most of the gas generated appears when the roof fractures up to the Sewickley seam. The upper beds in the Coalwood district have hardly any gas, but the deeper mines, being below water level and never having creviced to the surface, have much gas and all of it has to be brought out of the mine by the return entries. There is a lot of water in a stratum 125 to 200 ft. above the coal. This water has never been liberated by crevicing, and it acts as a water seal to the seam below.

All gobs have been ventilated except one which was closed with a stopping to study the effects. This gob has never developed much pressure. It seems to breathe similar to a human being, exhaling and inhaling, air periodically. Some drillholes have been sunk into gob areas, and where they were set halfway between the center of the gob and the working face, they bled the gas satisfactorily. When the holes were drilled in the center of the gob they failed to serve their purpose, probably because at that point the roof has sagged to meet the pile of rock formed by caves.

Mine 261 is ventilated by a force fan for the purpose of aiding in the expulsion of the dust caused by the dumping of coal into the skip. The fresh air is introduced into the haulageway at the airshaft bottom. Consequently, the haulage is entirely in fresh air. A little air leaks past the revolving dump by which the mine cars are discharged and through the gate leading to the skip whenever that gate is open. Thus the skip shaft is in the return air, and any dust made in dumping at the foot of the skip shaft travels upward to the surface and not into the mine, as in some installations.

The man shaft also is on the return;

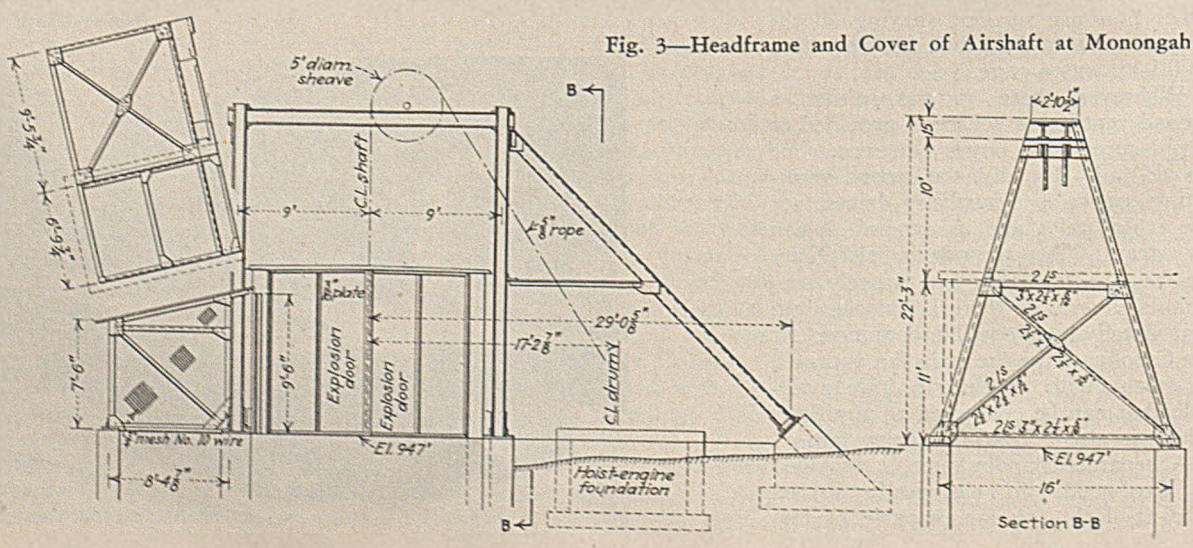


Fig. 3—Headframe and Cover of Airshaft at Monongah

the men entering the mine reach intake air by passing through two doors—an ordinary steel door of small dimensions set in a heavy stopping and a revolving door with four segmental compartments similar to the doors used in winter in apartment and office buildings. This arrangement prevents much leakage. There is no possibility of leaving the revolving door open. It is closed even when men are passing through it. It leaks a little, but this leakage is cut down considerably by the second door. Supplies are taken into the mine by an air lock at the bottom of the shaft.

Every effort is made to take all the air made by the fans to the face. At Coalwood from 83 to 86 per cent of all the air delivered by the fan attains that goal. The longest air travel in any mine is about four miles, but this is quite unusual.

Secondary ventilation is not being employed by the Consolidation Coal Co.

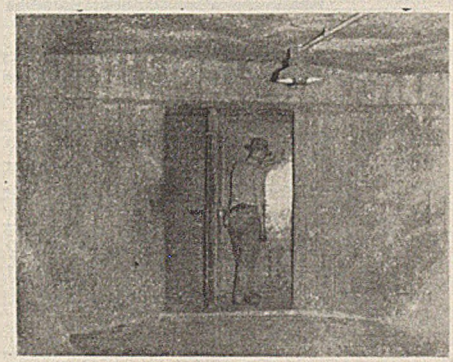


Fig. 4—Revolving Door Leading to Caretta Intake

in gassy mines, but in some places where mechanical loading is done, Ventube is used for the ventilation of the face. Except in Coalwood, where secondary ventilation is not used, each split in the main ventilating current circulates past several working places, so that a large volume of air has to be, and is, provided in every split.

Consequently, plenty of air always is available as a source from which a small secondary fan can draw without danger of recirculation. Not more than one-tenth of the air in the split is taken by the fan and only a few fans are used. These take the air forward 200 ft. As there is no gas where they are installed the motors are of open type. The fans are set 10 ft. back of the crosscut, in fresh air.

Ventilation inspectors are regularly employed at each gassy mine. Daily samples are taken from faces, gobs, and all returns in rubber containers. Analyses of samples are reported in writing to mine officials the same day that the samples are taken, every effort being made to know the exact facts regarding the percentage of gas throughout the mine and to regulate the ventilation so as to maintain a high factor of safety.

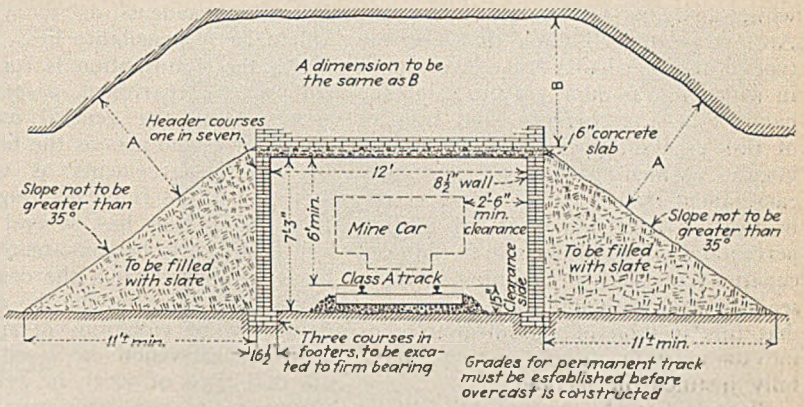


Fig. 5—Cross-Section of Standard Overcast

In most cases air stoppings are made of single tile measuring 5x8x12 in. and set well into the coal rib on either side. The tile are laid in cement mortar, but where such stoppings are temporary, lime is added to the mixture, in order to make it possible to tear down the stopping without destroying the tile.

Fig. 5 shows a standard overcast, which sometimes is built of concrete in place of brick with a minimum thickness of 9 in., the concrete being composed of one part cement, two parts sand, and four parts crushed stone. The top of the overcast has scrap rails at 18-in. centers set at right angles to the cross-section shown; that is, in line with the overcast airway. The overcast is made about 12 ft. long, in the direction of the traveling road; that dimension is not definitely fixed, but the height, *B*, over the top of the overcast is such as to make the area at least 70 sq.ft. When a double overcast is constructed, its length along the haulageway is, of course, increased and the minimum area above it is raised to 120 sq.ft.

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SAFETY at Consolidation

(*Continued from page 606*)

as others capable of judging this kind of work. These teams are available for service anywhere that misfortune has entered.

The compensation section of the safety department devotes itself exclusively to matters in connection with remuneration of injured employees. Its first duty is to see that each injured employee receives the compensation to which he is justly entitled and that all proper doctors, hospital, and other bills of like nature are put promptly in line for payment. Its second duty is to weed out and combat unjust and illegal claims.

The compensation section has justified its existence by the satisfied employees, and it is their boast and slogan that no employee needs a lawyer or any other help to get his full, just compensation. On the other hand, it has been known for years that industrial compensation is constantly feeding persons who received no injuries, or injuries from which they have long fully recovered. In cases of this kind the section has again fully justified itself, having saved the company thousands of dollars.

The director of compensation not only looks after the payment of compensation to the injured employee but he investigates and follows each case through to entire recovery or rehabilitation. Where an injury is such that the local physician recommends special treatment, or where there is any doubt in connection with a case, the director sees that the patient goes to a proper clinic or to the larger hospitals or specialists for treatment, sees that he has necessary treatment and appliances, and is generally taken care of.

The director of compensation handles all correspondence and reports of every kind to the various state compensation commissions; establishes proper relations with them; sees that their forms are filled out to their satisfaction; and furnishes them all information required. He also furnishes the statistician with all necessary information for making up reports, so that the executive officials of the company may know at all times just what the situation is and what compensation is costing the company.

All lost-time accidents are classified by the department, first as to cause, and, second, as to responsibility. To classify by cause a classification sheet having about 400 subdivisions is used. By this means basic causes for accidents can be determined. For example, it was found that a number of accidents were appearing under the head of hand injuries

while applying brakes on mine cars. An investigation disclosed that a certain type of mine car had a brake lever guard in which it was quite easy to catch the hand; this was corrected and injuries of this type disappeared. The use of goggles, which has been mentioned, came about from the fact that a classification of accidents disclosed a high percentage of eye injuries in certain occupations, such as pick mining in some seams. At first thought it would appear that this method of classification goes into too much detail but the results have fully justified the method.

Classification by responsibility falls under: (1) Substandard conditions; (2) violation of rules (poor discipline); (3) lack of proper supervision; (4) carelessness (on the part of the individual); (5) unavoidable. Each lost-time accident is placed in one of these classes and in order to avoid any possible injustice a rather detailed plan is followed out:

(1) When the accident is reported (on a form specially for that purpose) to the engineer of safety, it is classified, in one of the five classes, based on the information contained in the report. (2) As previously mentioned, the mine inspector makes an investigation (except for minor and trivial injuries) and places responsibility where he thinks it should be. (3) There is a committee of three at each mine, composed of employees but not officials, who investigate all accidents involving a loss of ten days time or more, and they place the responsibility as they see it. (4) Once each month a division committee, comprising the division manager and various other division officials, meet and classify all lost-time accidents as to where they think the responsibility lies.

All this information is forwarded to the safety department, assembled, and presented to the general manager of operations, who acts as the final referee on any disagreements as to responsibility. There is no dodging this system. If a man has several accidents and is shown to be consistently careless, he is eliminated from the organization. If some official is having too many accidents due to violations of rules or to lack of supervision, he is either taken off that type of work or relieved entirely as the case may warrant. For minor offenses a system of discipline is in force, by which a man who endangers his companions or himself is laid off for a period of time, depending on the offense. Of course an employee who consistently endangers the lives of his fellow workmen or himself is not retained in the service.

It is a difficult, if not impossible, proposition to set a definite value on the work of the department of safety. The department's many ramifications are so involved with other departments; there are so many features on which a definite value cannot be set, and there are also the large savings in compensation. These considerations all tend to make it difficult to place a definite money value on the various activities. As an indicator, however, the reduction in fatal accidents probably illustrates the value of the department as well as any one feature can.

Table V—Consolidation Fatality Record

Year	Fatalities	Year	Fatalities
1926.....	46	1928.....	24
1927.....	37	1929.....	21

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MINE LAYOUT at Consolidation

(Continued from page 578)

not be developed till the right-hand side is worked out. The old panels lasted six years; this panel should last ten.

At Van Lear (Millers Creek division), where the roof refuses to break to the surface, bending instead down to the floor, the pillars are left standing. In order to reduce the loss of coal to a minimum, the rooms are driven of such width that the pillars are only 10 ft. through, the rooms being 25 ft. wide (see Fig. 4). To reduce the loss of coal, long-face workings have been tried, but the roof broke in forward-hading breaks over the coal (see Fig. 5), and the face was lost. In the Elkhorn division the room-and-pillar system is used.

Because the various operations of the Consolidation Coal Co. are at varying distances from the Appalachian disturbance, the tendency toward the development of cleats varies widely. The seams nearer the disturbance have no distinct cleat and can be worked as well in one direction as in another. The properties, in relation to their perpendicular distance from the Allegheny front run in about the following order: Maryland, Pennsylvania, Pocahontas-New River, West Virginia, Elkhorn, and Millers Creek. In the first three areas the coal will work with ease in any direction. The gradients determine the direction of the entries and rooms. The room headings are placed on a fairly steep grade and the rooms on as easy an upgrade as possible. In the West Virginia division the rooms run north 12 deg. 30 min. east and the cleavage at north 77 deg. 30 min. west, with great regularity. Elkhorn, perhaps because of the Pine Mountain fault, has somewhat uncertain cleat. It has been found easy to drive in any direction, as the coal is of medium hardness, softer than Pittsburgh coal and harder than Pocahontas. In Millers Creek the cleats are well defined and are closely followed in laying out the mines.

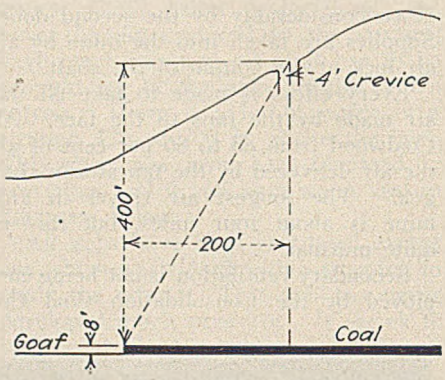


Fig. 6—Conditions Under Which Breaks Occur in West Virginia Division

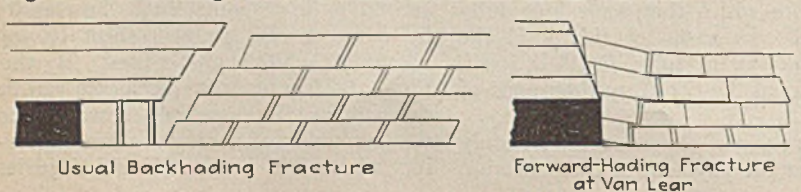
The behavior of the roof also varies. In Maryland, the rashings fall and more or less fill the workings, preventing the roof from caving to the surface, though permitting of light crevicing. In Pennsylvania, the roof does not show any visible signs of subsidence, possibly because the seams are thin.

In the West Virginia division, where the pillar lines retreat in the direction of a high hill, the extraction of coal will cause a crevice to form on the side of the hill back of the pillar line over the coal pillars. This crevice, with coal 400 ft. deep at the crevice, may be 200 ft. back of the pillar line. It may be as much as 4 ft. wide.

As stated, the Pocahontas No. 4 roof does not fracture. The coal lies 580 ft. below the surface at Coalwood and more than that under the hills. That there is much water that would have been released by heavy caves is proved by the fact that diamond drillholes when tapped by mining operations poured large volumes of water into the mine. In fact it was necessary to plug them.

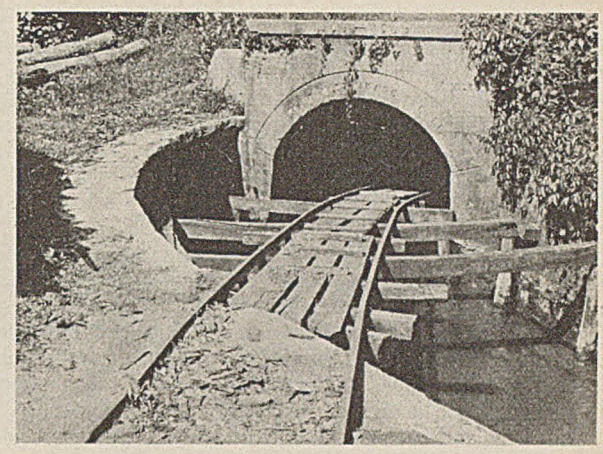
Big breaks on the surface have been caused by the Sewell and War Creek operations. The strata overlying the Elkhorn seam, like those over the Millers Creek cave, bend but do not break.

Fig. 5—Roof Breakage Under Normal Conditions and at Van Lear



DRAINAGE

+ At Consolidation Coal Co.



Portal of the Two-Mile Hoffman Tunnel Which Has Drained Mines of the Maryland Division for 24 Years

FEW companies have such a wide variety of mine drainage conditions as Consolidation Coal Co. By operating divisions the pumping varies from a minor problem represented by a total of 3,000 gal. per minute of permanent pumps at the four mines in the Pocahontas-New River division to a total of 20,800 g.p.m. at three mines in the Pennsylvania division, where the yearly average for one of these mines is 20 tons of water pumped per ton of coal produced. Drainage ditches are used extensively to eliminate pumping stations of the relay and surface-discharging classes. In the Maryland division a rock tunnel over two miles long has been handling most of the water from the division for 24 years.

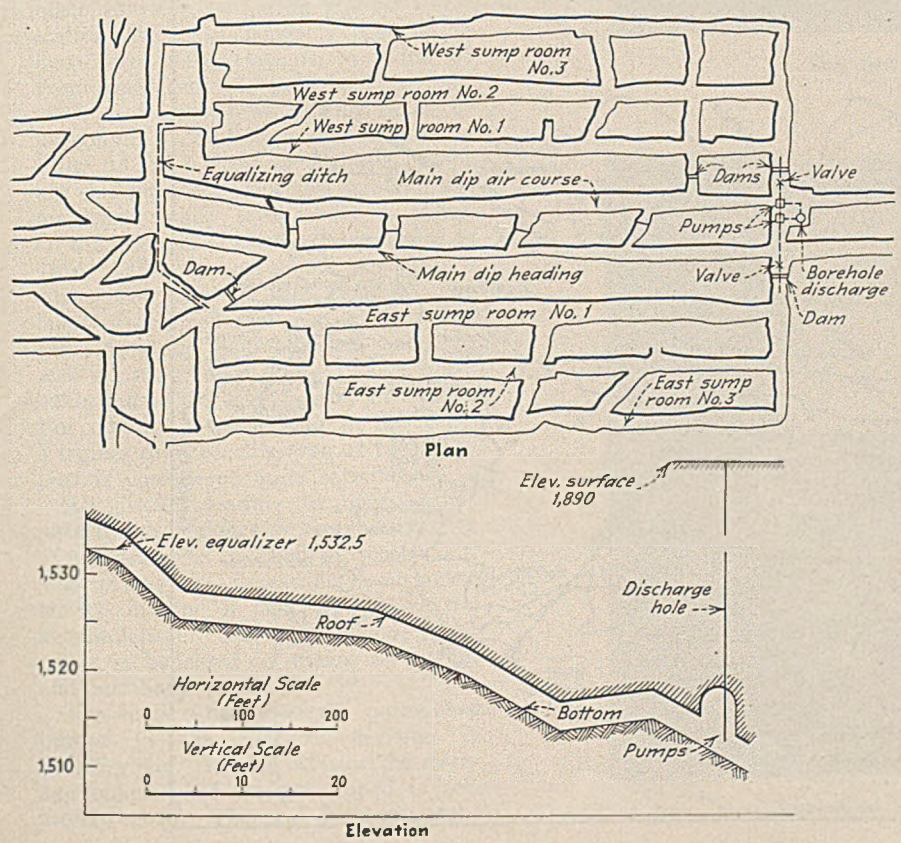
Equipment at the active mines includes approximately 600 gathering pumps and approximately 130 permanent pumps. Over 400 of the gathering pumps are of the Fairmont type and for the most part these are powered with 2-hp. motors. Other gathering pumps are powered with motors up to 10 hp. The largest permanent pump, from the standpoint of horsepower, is rated 1,500 g.p.m., 524 ft. head, and is driven by a 300-hp. induction motor. One station in Mine 119 Jenners, Pa., contains two of these units. From the standpoint of flow the largest pump is a 2,500-g.p.m. 150-hp. unit located in Mine 26, West Virginia division. In both cases the pumps are of the centrifugal type. The total capacity of permanent pumps at all mines is 65,950 g.p.m. Steel, wood, or cast-iron pipe is used for suction and discharge lines on pumps. An installation has been made using cement-lined cast-iron pipe equipped with the Simplex stuffing-box type of joint.

For gathering service reciprocating pumps are used, but practically all of the permanent pumps are centrifugal. For these centrifugal pumps the standard drive is a 2,300-volt squirrel-cage induction motor fed by a wire-armored lead cable suspended through a borehole. So far, no conditions have been encountered to warrant the installation of any full-automatic pumping stations.

In three battery-operated mines—Carolina, Coalwood, and Caretta—most of the pumps, except the main pumps at the shaft bottom, are operated from 250-volt power supplied from 110-cell or 117-cell 31-plate batteries transported on self-propelling trucks similar to those used for battery cutting. These pumping units are of the permissible type. Beginning recently, however, parkway cable is being installed in these mines to operate the pumps from substations at the shafts. In Coalwood, a permissible pump located 4,000 ft. from the shaft is now being operated from parkway cable as a feeder line.

In the Maryland division, the mines are in a tract approximately $3\frac{1}{2}$x$6\frac{1}{2}$ miles, covering a synclinal trough. The mining is in two seams, the Big Vein and Tyson, the latter lying about 150 ft. above the other. Up to 1906, a steam-operated pump station, having a capacity of 7,500 g.p.m. and discharging through a 244-ft. shaft, was maintained at the Hoffman mine. This drained the Big Vein mines lying in the basin. The steam station was displaced by the Hoffman drainage tunnel, an 8x8-ft.

By an Unusual Layout the Pumping Station in Mine 123, Boswell, Pa., Is Located on a Center Line of the Sump and Below the Water Level



heading driven from the bottom, Hoffman slope 10,646 ft. on a 0.355 per cent descending grade to the surface near Clarysville. The total fall is but 39.7 ft. In 1907, the measured flow through this tunnel was 14,000 g.p.m. Today the average probably is two or three times that quantity.

Although the tunnel saves a large expense for pumping, maintenance costs are necessarily high. An average crew of five men is required to renew timbering and clean falls. Only locust timber is used in the work. A narrow-gage track supported on crossbars above the water level forms a walkway and a means for transporting material, which is carried on small cars pushed by hand. About 5 miles of drainage ditch in the Big Vein bed discharges to the Hoffman tunnel. Another project known as the Allegany water ditch, consisting of 6,000 ft. of ditch and 3,000 ft. of tunnel, drains an area at one end of the field. Only seven permanent mine pumps, having a combined capacity of 2,200 g.p.m., are operated in this division. Much of the water of the Tyson workings is drained down into the Big Vein and goes out through the Hoffman tunnel. The boreholes connecting the two are drilled from the surface.

In Pennsylvania, the company holding is roughly a rectangular tract 5½x7 miles, with the Johnstown basin extending through the center on the long dimension. Although the pitch of the coal on each side of the basin averages about 12 per cent, concentration of drainage to one point is impractical, because of a 2,000-ft. rock fault between the two larger mines. Because of irregularity of contours due to local swags, a number of relay pumps are required. Workings are in two seams: in the "C" Prime, and in the "E" seam, which is 90 ft. above the other. Pillars are taken.

In Mine 123, in the "E" seam, the main sump and pump are located 1,500 ft. from the hoisting shaft and at the lowest point in the mine. A few relay pumps are required to raise water out of local swags as it gravitates to the sump. The main pumps are 20 ft. below the normal water level. The sump consists of six parallel headings 700 ft. long, driven to the dip, and connected at the lower end by a crosshead ing off which, and at the center of its length, the pump room is located.

Dams divide the sump into two sections and hold the water back from the pumproom and from a pair of communication headings between the halves of the sump. At the low point of the sump there is an equalizing pipe which serves also as the suction for the two 1,100-g.p.m. centrifugal pumps. At the high end of the sump, diversion dams and a connecting ditch form another equalizer which comes into use if through chance or intention the lower equalizer is closed; for instance, in case of repairs to the suction to either half of the sump.

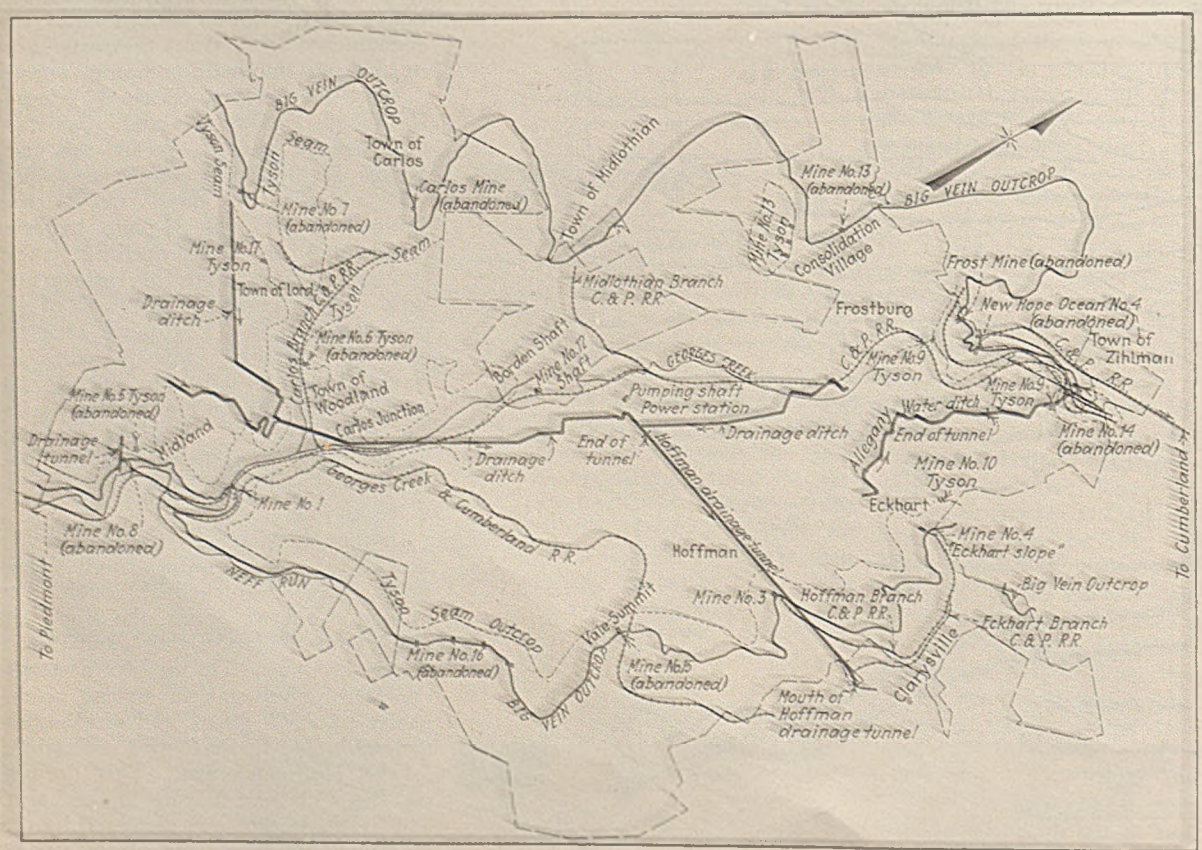
There are two large pumps in this station, and, as this is true also in most other main pumping stations of the company, line strainers in the suction pipe are used instead of strainers on the ends of suction pipes in the sumps. The line strainer has the advantage of being open to inspection, and it eliminates the danger that may be connected with the repair or renewal of the other type.

In Mine 123, the two pumps at the main sump are the only ones pumping to the outside. Last year the pumping for the highest month was 17 tons of water per ton of production, and for the twelve months the average was 12 tons.

Mine 120, Acosta, Pa., consists of two main sections each having its own central pumping plant. The original main section is on the eastern side of the Johnstown basin and the other portion, which until recently was a separate mine, is on the western side. Development is now in progress which will connect the sections at another point so that drainage can be concentrated to one main pumping station. Discharge heads on the present stations are about 300 ft. Eight of the pumps used in the mine are pumping to the outside. Last year the maximum for a month was 19 tons of water per ton of coal, and the average was 12 tons.

Most of Mine 119 lies on the eastern side of the Johnstown basin, but development has been carried about 4,000 ft. on the western side, where little water has been encountered. On the eastern side, the development from 750 ft. of cover in the basin to the outcrop produces a large quantity of water, be-

Hoffman Tunnel and Drainage Ditches Inside the Mines of the Maryland Division



cause of the proximity of the outcrop to the Quemahoning Creek. Water from the outcrop is caught in a drainage ditch 4,000 ft. from the outcrop, and along this ditch it gravitates to a sump where two 1,500-g.p.m 300-hp. centrifugal units discharge against a 425-ft. head to the surface. Water originating below the drainage ditch is relayed back against a 220-ft. head to the main station.

Of the several pumps in the mine, six discharge to the outside. The maximum pumping during the highest month last year was 34 tons per ton of coal, and the average was 20 tons. The two 300-hp. pumps were installed in 1920, and effected a saving of 100,000 kw.-hr. per month.

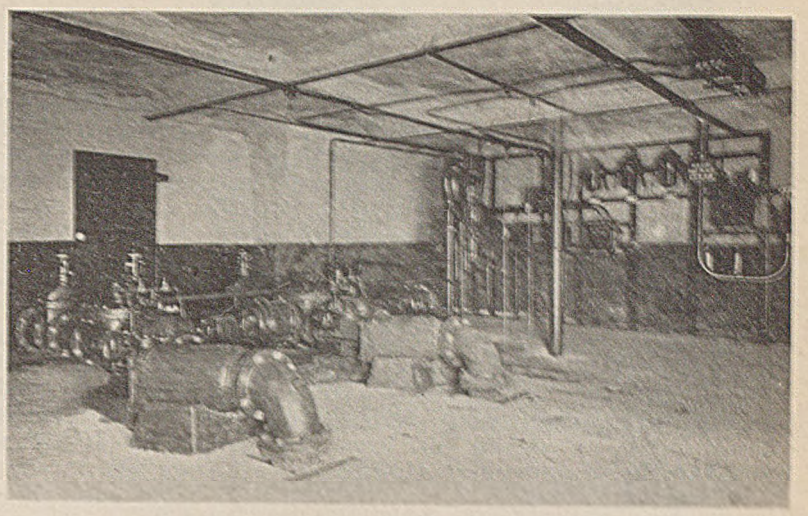
Some years ago in the West Virginia division a drainage ditch costing over $100,000 was excavated in Mine 25, which at the time made it possible to dispense with all pumps in that mine and in an adjacent mine now closed down. Development since, however, has made it necessary to install a few small pumps. Of the 7,800 ft. of ditch inside of the mine, all is open except 700 ft. This and about 1,500 ft. on the outside is protected by sewer tile, which in the latter section is 48 in. in diameter.

In Mine 86, 250,000 gal. of sump capacity was added recently to the 15,000 gal. at the shaft bottom, which formerly required pumping every three hours. Now the pumping is done on off shift, effecting a saving of over $100 per month on the power bill.

Plans are about completed for a new pump station to drain parts of Mines 63 and 86 and which will displace fourteen gathering pumps. This station also will make it possible to keep two main stations in Mine 63 from operating on peak-load periods, as is necessary now during times of maximum water. Two new stations in Mine 63 are located so that the pumps are self-priming. Six feet is about the maximum sump level above a pump. In a station 12x20 ft. and completed in July, 1928, a corrugated steel arch forms the fireproof roof support. The labor of erection of the arch, including roof dressing, packing, and painting, was approximately $50. The sections, being but 16x30 in., are easy to handle. For conditions prevailing in the West Virginia division this type of roof support is considered quite satisfactory.

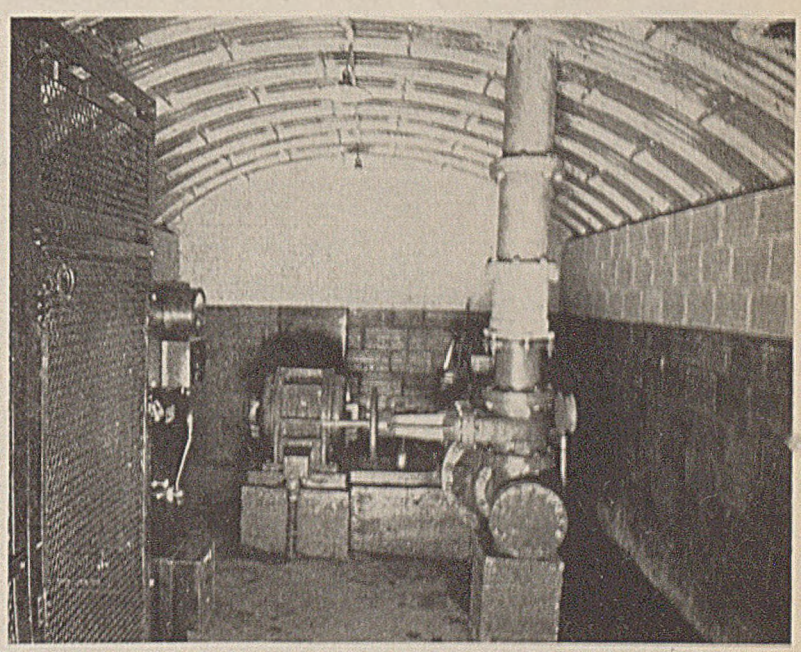
All ditches leading to main sumps pass through places where the velocity of the water is checked to deposit silt. The places are accessible from mine tracks, making it easy to remove the accumulation. During cleaning, the water is bypassed by means of a dam and auxiliary ditch.

The total capacity of the permanent pumps in the Elkhorn division is 23,425 g.p.m. In this division the average quantity of water pumped is relatively small. The real drainage prob-



Eight-Inch I-beams and Gunite on a Coal Roof Form the Ceiling of This Pumping Station in the West Virginia Division

This Section of Line in Mine 120, Acosta, Pa., Contains 2,000 Ft. of 8-In. Cement-Lined Cast-Iron Pipe



Steel Roof Support, Pumping Station Sixth North, Mine 63

lem here consists of providing against flooding of portions of the mines during a rainy season. Pillars are taken in the mining, and pillar breaks usually extend to the surface. The mine openings are drifts 10 to 120 ft. above the railroad tracks, and the cover is mountainous. The seam has a general dip of about 2 per cent to the northwest, but there are a great many local swags of 3 to 4 ft. and some of 15 ft. This accounts for the numerous pumps.

Last year in Mine 206 a ditch 3,500 ft. long and with a maximum cut of 12 ft. was completed. It has eliminated a 1,200-gal. pump and the annual anxiety of whether that pump would handle the peak water. Material from the ditch, which in deep places was excavated in several lifts, was loaded with a Myers-Whaley power shovel. In Mine 205 a 1,600-ft. ditch of 8 ft. maximum cut and which has eliminated three pumps of 500 g.p.m. each has recently been completed. Special effort is being made to displace pumps by ditches wherever practicable.

In the three mines of the Millers Creek division, there are several gathering pumps and seven permanent pumps. The total capacity of permanent pumps is 2,850 g.p.m. In this division, as in all other divisions, all pumps are motor-driven. The Consolidation Coal Co. got rid of its last steam pump several years ago.

▼ ▼ ▼

PREPARATION at Consolidation

(Continued from page 597)

mine-run, the coal was fine or lumpy, and the appearance of the car when finally loaded.

A separate tipple report, filled out by the weighmaster, contains a record of every mine car loaded into a railroad car. The procedure is as follows: When a railroad car is brought under the tipple for loading, the boom-man reports to the weighman, giving the car number and initial and the size of coal with which it is to be loaded. The weighman then enters this information in his report, opposite the columns where the check number of each mine car and its weight are set down. Subsequent mine cars dumped are then credited to the railroad car.

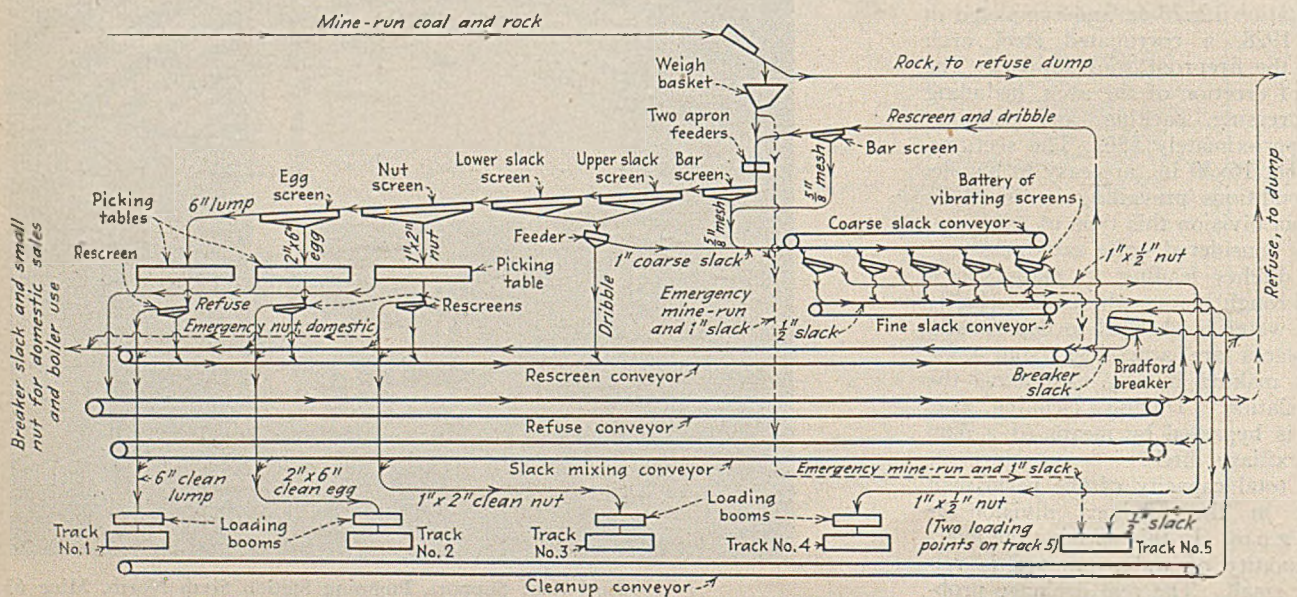
As five sizes are occasionally loaded into railroad cars at one time, it is clear that the contents of one mine car may be split five ways, and that fewer mine cars will be required to fill a car with one size than with another. However, as all mine cars are credited to a particular railroad car until it is filled, the dumper's report will show the check numbers of the loaders whose coal, whether of one size or another, went to fill each of the individual railroad cars. In this way, any complaints on the coal may be traced back to the check numbers of the loaders. As the check numbers of the men on any particular section are known at all times of the year, this method makes it possible to trace coal on which a complaint has been made back to the section from which it came and, by reference to inspection reports, determine the conditions under which it was loaded.

A systematic program of regular sampling (special, when necessary) and analysis is depended upon for information on the coal in the mine and for a check on the preparation. In the mine, face samples are taken at regular intervals on entry advance and analyzed. Railroad car loadings are sampled on a monthly and quarterly schedule, and at other times if deemed to be necessary for close control of product. Screen tests also are made at the different mines from time to time for information on percentages of sizes in product shipped and as a check on screen performance. Four 1-ton samples are taken over the course of two days' loading at the mine. These are separated by hand screening, the division points being as follows: 10, 6, 4½, 4, 3½, 3, 2½, 2, 1½, 1, ¾, ½, ¼, and ⅛ in., varying with the grades of coal tested. Cumulative size curves are plotted to show the probable percentage recovery of the various sizes.

Tests on mine shipments are made regularly in all divisions. Every mine in each of the divisions is sampled once during the sampling period, covering a whole day's loading of whatever sizes are being loaded. These are analyzed as a check on preparation and quality, and the results show, among other things, whether the preparation and quality are uniform.

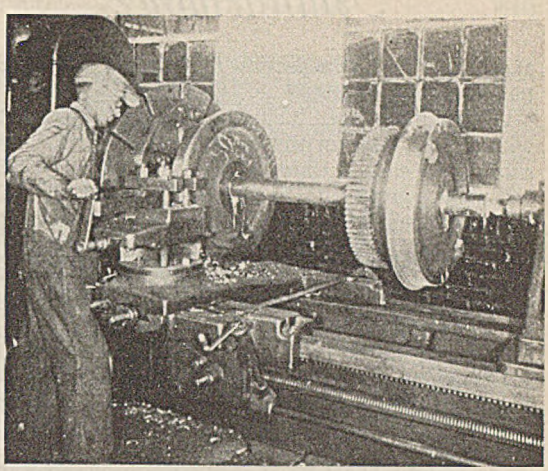
Deviations from the routine sampling are made as may be advisable. When such a condition arises, men are sent out from the inspection headquarters immediately to sample the loadings at the mine in question. Coal inspectors in the division also sample shipments from time to time as a check on the preparation, and samples of coal sent in by service men also are analyzed in the company's laboratory at Fairmont, W. Va.

Fig. 5—Flow Sheet, Mine 251 Tipple. Usual Routes Followed by the Coal Are Shown by Solid Lines; Certain Alternative Routes by Broken Lines



MAINTENANCE

+ At Consolidation Coal Co.



Turning Rolled Steel Wheels Without Annealing, Jenkins, Ky.

EFFICIENT production is achieved only when workmen are properly trained and supervised and when equipment is kept in such condition that time cannot be charged against machine delays. In turn, low-cost maintenance is dependent in no small degree on the intelligent handling of mine supplies. In contrast to the old practice of leaving maintenance to shift for itself even to the point where the head repairman of the mine must report to the inside foreman, superintendence and maintenance are given equal rank in the management scheme of Consolidation Coal Co. Under the Consolidation system, equipment delays have been reduced to a figure which no longer causes concern, and the total per-ton maintenance cost of all equipment, including material and labor, has been materially decreased.

Direction of maintenance activities is under a maintenance engineer, located at Fairmont and reporting to the chief engineer. Each operating division has a maintenance superintendent who ranks with the division superintendent of mining and reports directly to the division manager and indirectly to the maintenance engineer. The maintenance engineer works with the manager of each division in agreeing upon the maintenance policy for that division and upon the competency of the division maintenance superintendent. At each mine there is a maintenance foreman who might ordinarily be termed a chief electrician and master mechanic. He reports directly to the mine superintendent and indirectly to the maintenance superintendent. The maintenance foreman of a mine has charge of all mechanical and electrical maintenance, inside and out, except that of mine tracks. In case of disagreement on maintenance questions between local mining and maintenance officials, the issue in dispute may be carried up on appeal to the higher officials, in the manner outlined in a preceding article in this issue (see pp. 573-576).

Printed standards of instructions covering maintenance and inspection of mine equipment and approved by the general manager of operations and vice-president are issued by the maintenance engineer. These standards, pertaining only to practices which can be the same in all divisions, are projected like the maintenance organization, keeping foremost the idea of inspection to prevent breakdowns. When repairs are necessary, it is the policy to do a thorough and lasting job. There is little sympathy at Consolidation headquarters for the patch method.

Highlights of the maintenance standards are as follows: Once every six months the maintenance superintendent, in company with the local maintenance foreman, must make a complete inspection of all equipment and wiring inside and outside of each mine. All operating locomotives must be inspected at the end of each day's run, and once a week by the maintenance foreman or one of his assistants. For mining machines this class of inspection is required semi-weekly, and for stationary motors, monthly. The standards detail the parts to be examined at the various inspections.

Stationary motors and the motors of mining machines must be opened once a year, the rotors taken out, and the motor windings cleaned and painted. Bearings also must be cleaned, repaired if necessary, and repacked with grease or oiled, as the case may be. Every two weeks the maintenance foreman must make an inspection of all pumps. Each day this foreman or one of his assistants is required to inspect each hoisting rope in use on shafts or slopes. Ropes must be resocketed every six months, cutting off 6 ft. of rope at the socket and using pure zinc for resocketing. Ropes in use for hoisting men are removed from service when inspection indicates a reduction of 20 per cent in strength. For other ropes the figure is set at 35 per cent. When, upon a weekly inspection, the wheels of a locomotive show a wear of $\frac{1}{8}$ in. on the tread, these wheels must be removed from service.

The printed maintenance standards include instructions for operation of the principal classes of equipment. Brevity is a commendable feature of the manual. The whole is printed on 33 pages, $3\frac{1}{4}$x$6\frac{3}{4}$ in., and many of the pages are but partly filled, for the reason that section heads are placed at tops of pages only.

As a check on maintenance, considerable use is made of printed report forms, but the number of such reports is held below the point where practical usefulness would be submerged by quantity. Pumpers, cutters, and motormen, each make daily reports of performance and condition of equipment. The maintenance foreman makes various daily reports of cost, delays, and performance, sending copies to the division maintenance superintendent, mine clerk, and division auditor for use in compiling monthly cost reports. Only in case of specific studies are daily reports sent to the maintenance engineer. At the end of the month the maintenance superintendent sends summarized reports of performance and cost to the maintenance engineer. These include separate reports of performance and costs of mining machines, locomotives, and mine cars.

Each item of equipment is permanently recorded on a letterhead size loose-leaf sheet the front of which is a form suiting the particular class of equipment and the back of which is used for miscellaneous data. The maintenance superintendent fixes company number plates to new items of equipment, makes out the record sheet, and sends a copy to the office of the maintenance engineer.

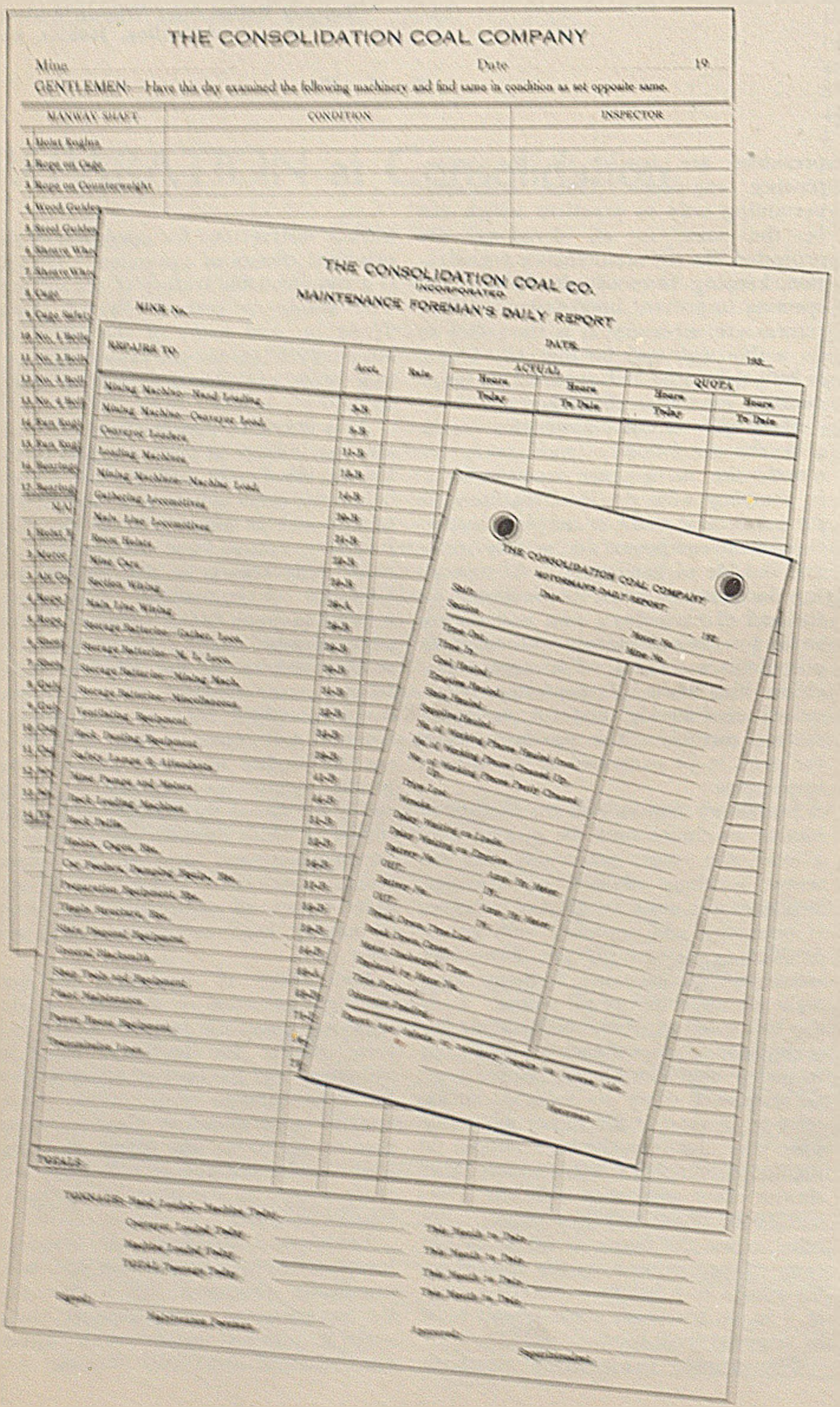
Erroneous charging of tonnage losses to equipment failures has been practically eliminated by a rule that the maintenance superintendent must make a personal inspection of equipment charged with such tonnage loss

and report on his inspection to the maintenance engineer.

All maintenance, including electrical winding, is done in the company's own shops. In each division there is a central shop equipped to handle the volume and character of work in that district. In four of the six divisions there is a central warehouse adjacent to the shop. Most of the equipment coming in for repairs is handled to and from the mines by motor truck.

Electrical shops are equipped with induction-type field coil testers, high-voltage transformers for making potential tests, and with armature "bugs." It is the general practice to check locomotive field coils once a year with the induction tester to insure against operation with a number of shorted turns. A practice of using asbestos insulated coils for motors which normally roast coils is now being inaugurated. Certain locomotive and mining-machine motors fall into this class. All other d.c. motors are wound with hot-pressed mica-insulated coils.

In every case an intensive effort is made to determine and correct the cause of short life of equipment parts. One of the most difficult problems has been to find a way to increase the life of ball bearings on the armatures of certain locomotives. Better seals were provided to exclude dirt, but this failed to solve the difficulty. Now it is thought that the trouble is due to heat destroying the lubricant; consequently, blowers are being installed on certain 10-ton locomotives which operate at high temperatures and have a high failure rate for armatures and armature bearings.



The use of one heavy locomotive in place of two smaller units in tandem is favored as a step toward reducing maintenance cost. This means but two armatures and four tires to maintain instead of four armatures and eight tires. Haulage-locomotive maintenance per ton was cut to one-fourth the former figure at one mine by replacing the old 10-ton locomotives with 20-ton tandem locomotives of advanced design. Labor cost of crews for operating the equipment is cut in half by use of the larger locomotives. It is the practice with all locomotives to limit the trips to the point where but little sand is required. In some instances imposing this limitation increased the tonnage per day.

About five years ago, the company discarded all cast-iron wheels in favor of steel tires for locomotives. Three years ago, experiments were begun with rolled-steel wheels in place of using wheel centers and tires. The cost of a rolled-steel wheel was found to be about the same as that of a tire, and observation indicated a 25-per cent longer wear, due perhaps to higher carbon content. Moreover, the steel wheel provides its own wheel center, as compared to the other practice, under which periodically a new cast-iron center must be purchased. The steel wheels, and gears also, are now installed without keys. On a 4½-in. axle, wheels and gears are fitted to a 60-ton press fit. Considerable saving is effected by not having to cut and fit keyways and keys.

Two years ago, a new standard was adopted for sizes of all tires and steel wheels. One inch was added to the diameter to allow a life of three runnings and two turnings, as contrasted to the former life of two runnings and one turning. This increases the life by four months to a year, depending upon the severity of service. Wheels are now purchased with special tread diameters of 25, 27, 29, 31, and 34 in. instead of in corresponding sizes 1 in. smaller. Tires in stock are being used up by turning the worn steel wheels to form wheel centers for these tires.

It is the opinion of maintenance officials that annealing a tire or steel wheel softens and greatly reduces the life. For that reason, all turning is done without annealing. In a heavy engine lathe with one cutting tool, the average time for turning 25- to 34-in. tires or wheels is four hours per truck. When hard spots are encountered, they

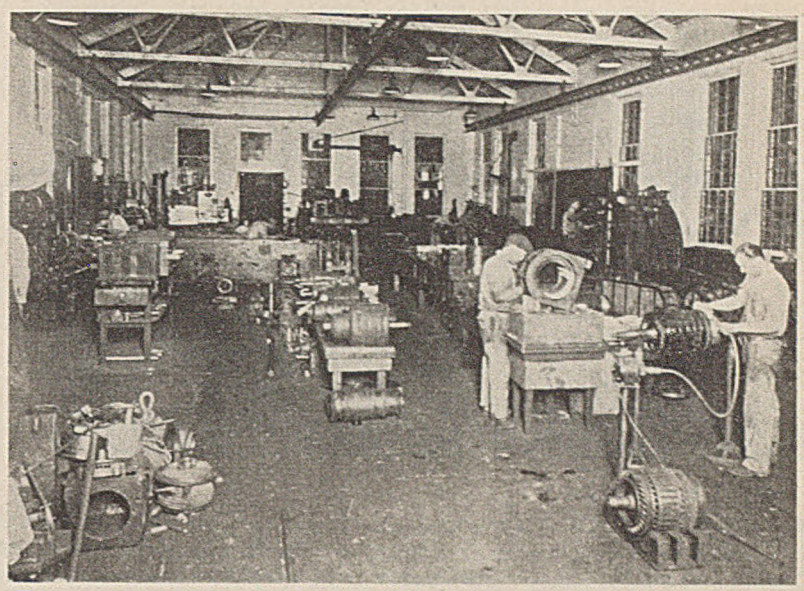
are cut by reducing the lathe speed or are eliminated by chiseling or grinding. Ordinarily, a 1x2-in. tool of Rex AA or Novo steel is used and chatter is prevented or minimized by forming the tool with as little clearance as possible. When turning the rolled-steel wheels in an engine lathe, two lugs are "tacked" by electric welding onto the outside edge of each tire to engage the dogs on the faceplate for driving.

Maintenance of batteries is handled in a way not employing any unusual methods. It has been found that proper maintenance of lead batteries is only following the manufacturer's recommendations of not overcharging, not overdischarging, keeping clean, keeping the cells filled with distilled water, and not letting the cell temperatures exceed 110 deg. F.

All substations are equipped with small air compressors for use in blowing dirt out of the windings and other electrical parts. Full-automatic substations are visited every two days or oftener, depending on the location. Once a week the substation equipment is thoroughly cleaned, inspected, and minor repairs or adjustments are made.

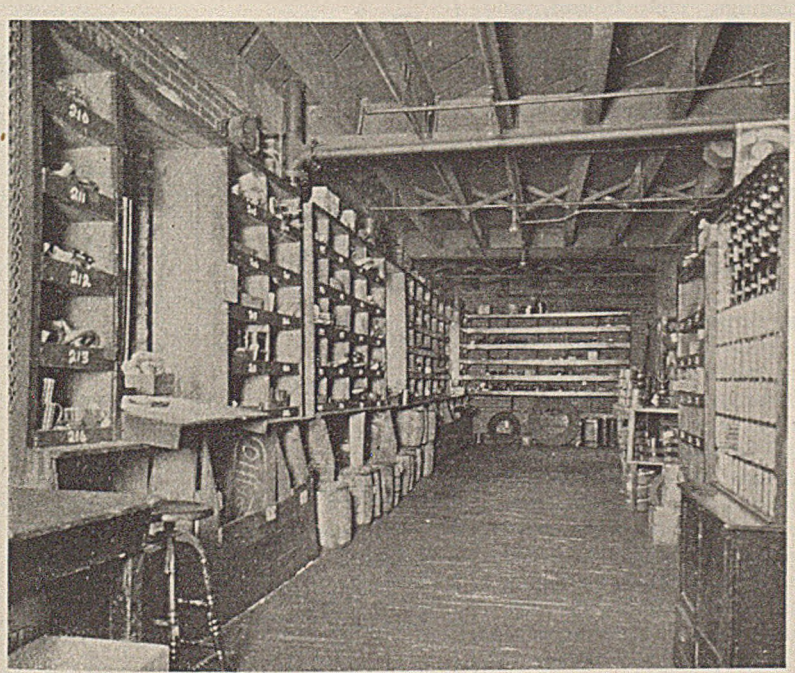
In some of the divisions night schools are conducted during the winter for the maintenance force. The classes meet once a week. One hour is allotted to instruction and one hour to discussion. Ordinarily certain local men are appointed to lead class periods assigned to electrical and mechanical subjects in which these men are especially proficient.

In every respect an effort has been made to raise maintenance to the high standing that it merits. Organization set-up rather than specific methods is to a large degree credited with the decided improvement that the company has experienced during the last few years.



This Central Shop at Jenkins, Ky., Is Twelve Miles by Hard Road From the Farthest Mine in the Division

By having a supervisor of supplies reporting directly to the general manager of operations, the Consolidation Coal Co. maintains a check on material, giving due consideration to all operating angles, conservation of material, satisfactory and suitable material, and minimum inventories. The principal duty of this supervisor, who has his headquarters at Fairmont, is to scan every requisition and make desired changes before it goes to the purchasing agent. He checks each requisition for standardization, quantity, and availability from overstock or from stock that has become obsolete at some other mine because of changed equipment or methods. He also visits the divisions to supervise through the division managers the methods followed by the division supply clerks.



View in the Jenkins Warehouse

Because the six divisions of the company are in four states, and therefore widely separated, a general system warehouse is not provided. Central warehouses are maintained at Frostburg, for the Maryland division; at Coalwood, W. Va., for the Pocahontas-New River division; at Van Lear, Ky., for the Millers Creek division; and at Jenkins, Ky., for the Elkhorn division. For the West Virginia division dependence is placed on the stock which may be purchased at Fairmont, but as in all other divisions each mine carries a limited stock. Because the three active mines in the Pennsylvania division are several miles apart, each mine in that division carries its own stock.

Where central warehouses are maintained, mines are permitted to carry only three days' requirements of repair parts. There are two regular deliveries daily to each mine. As central warehouses are adjacent to central repair shops, these shops need carry no stock. A further advantage results from the considerable traffic necessary between the two departments: The shop foreman is easily available to inspect scrap materials and decide which may be repaired at a saving and put back into stock.

Warehouses are operated on the perpetual inventory and order system. A 6x8-in. double-faced card is filed for each individual class of material or repair part. These cards are grouped in the files alphabetically by name—for instance, "Locomotives," then manufacturer, and finally the part name or catalog number. Materials are stocked in uniform bins designated by section and

(Turn to page 624)

INDUSTRIAL RELATIONS

+ At Consolidation Coal Co.

NO INDUSTRY is better than the men who make it. For a time, management may overshadow men or men rise superior to the stupidities of inefficient direction, but, in the long run, unless there is harmony and singleness of purpose, success is coy. This is particularly true in coal mining, where the human equation is still the dominant production factor. Mechanization, of course, is steadily reducing the man-power mass by making possible larger unit outputs, but not even the most extravagant enthusiast of the machine age in coal dreams of mechanization in terms of robots.

Industrial relations, therefore, must continue to be one of the major problems of the coal industry. And the natural conditions surrounding the mining of coal preclude a narrow definition of the scope of the phrase. Isolated communities where coal is the only industrial activity and the coal company landlord as well as employer widen any successful industrial relations program beyond simple wage and working conditions relationships. The natural comfort of the employee and his dependents outside working hours, the social, recreational, and cultural advantages open to them become an integral part of a well organized program.

In the case of the Consolidation Coal Co., with over 9,300 mine workers and several hundred other mine employees and their families, problems of organization and administration of an industrial relations program are complicated by the fact that operations of the company are spread over four states. Distances between the different operating divisions range from 60 to more than 300 miles. One division covers 30 miles and the communities within that division are widely separated. Management must depend upon staff representation to carry out policies formulated at headquarters and look to divisional staff representatives not alone for routine reports but for a current, clear-cut picture of the intangibles in human relations which cannot be set down in statistical summaries.

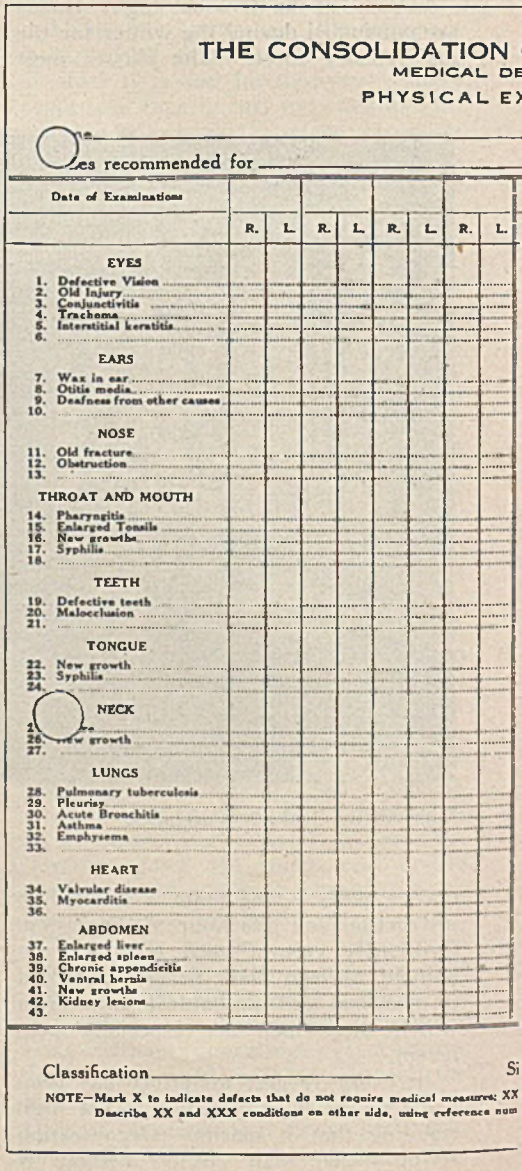
Major policies involving industrial relations, of course, are determined at the executive headquarters of the company, in New York. Actual conduct of the program is in the hands of three divisions of the operating department at Fairmont, with a fourth division—stores—under the purchasing department, also actively entering the picture. The operating divisions participating in the program are the production, industrial relations, and buildings and civic improvements departments. Supervision of employment and employees' services, including the operation of recreation buildings, club houses, and boarding houses, and the medical unit comes under the department of industrial relations. Erection and maintenance of company houses, recreation buildings, club houses, boarding houses, playgrounds, the leasing of farm lands, and all reforestation activities are under the jurisdiction of the manager of buildings and civic improvements. At present, the company is leasing approximately 21,500 acres under 174 leases for farming purposes.

Primary authority to hire, discipline, and discharge rests with the mine management. That authority is shared to a degree, however, with the department of industrial relations and, in the Pennsylvania and West Virginia operating divisions, where industrial relations in the more limited sense of the term are governed by formal written agreements between the company and the men, is subject to appeal through a mine committee to a joint board of review. The machinery in these two divisions will be considered in more detail in later paragraphs.

In the Elkhorn, Pocahontas - New River, Millers Creek, and Maryland divisions, where no provision has yet been made for formal employee representation in negotiations with management, industrial relations in the broader definition of the term are handled through the department of industrial relations. The director of the department is represented in each of these divisions by a personnel man, who, unlike the commissioners and boards of review set up under the Pennsylvania and West Virginia plans, can take official action without waiting for a formal complaint or grievance from the workers. Moreover, these personnel managers are definitely charged with many duties not officially recognized in the machinery of the Pennsylvania and West Virginia plans.

These duties include:

1. Acting as a buffer between management and men in relieving the



THE CONSOLIDATION
MEDICAL DE
PHYSICAL EX

es recommended for

Date of Examinations	R.	L.	R.	L.	R.	L.	R.	L.
EYES								
1. Defective Vision								
2. Old Injury								
3. Conjunctivitis								
4. Trachoma								
5. Interstitial keratitis								
6.								
EARS								
7. Wax in ear								
8. Otitis media								
9. Deafness from other causes								
10.								
NOSE								
11. Old fracture								
12. Obstruction								
13.								
THROAT AND MOUTH								
14. Pharyngitis								
15. Enlarged Tonsils								
16. New growths								
17. Syphilis								
18.								
TEETH								
19. Defective teeth								
20. Malocclusion								
21.								
TONGUE								
22. New growth								
23. Syphilis								
24.								
NECK								
25. [illegible]								
26. [illegible]ew growth								
27.								
LUNGS								
28. Pulmonary tuberculosis								
29. Pleurisy								
30. Acute Bronchitis								
31. Asthma								
32. Emphysema								
33.								
HEART								
34. Valvular disease								
35. Myocarditis								
36.								
ABDOMEN								
37. Enlarged liver								
38. Enlarged spleen								
39. Chronic appendicitis								
40. Ventral hernia								
41. New growths								
42. Kidney lesions								
43.								

Classification _____ Si

NOTE—Mark X to indicate defects that do not require medical measures; XX
Describe XX and XXX conditions on other side, using reference num

division manager and superintendents of many of the petty details arising out of complex labor relations which in the past have absorbed much of the time of these operating officials.

2. Investigation and adjustment of complaints affecting employer and employee relations and involving: (a) Working conditions, (b) wages, (c) living conditions, (d) stores complaints, (e) medical and nursing complaints, (f) complaints alleging payroll errors, (g) compensation cases, (h) miscellaneous grievances involving personnel relationships with supervisors.

3. (a) Supervision of boarding houses, (b) elimination of undesirable workers and citizens, (c) efficient recruiting and proper placement of labor, (d) follow-up of labor as to earnings, satisfactory living conditions, and related questions, (e) general supervision of community activities—social, athletic, educational, and religious, (f) reduction of labor turnover, (g) reduction in absenteeism, (h) reduction in debit balances, (i) development of the necessary records to co-ordinate and tabulate experiences involving (a) to (h).

Company Store at Van Lear

4. Development among the working forces of a morale and a confidence in the company as a result of closer contact between management and employees.

5. Projection and administration of group insurance and the adjustment and settlement, subject to supervision from the central office at Fairmont, of life, accident, and health claims.

In brief, the personnel manager is expected to interpret and transmit to the management the individual and collective viewpoints of the workers with respect to working and living conditions, and to interpret to the workers the ideals, policies, and working plans of the management.

All applicants for employment are required to fill out a formal application, which is checked against records of former employees in the division. Should that check reveal facts which would militate against employment or re-employment, those facts naturally would be communicated to the mine foreman. There is no uniformity in handling applicants. In some cases the man seeking work will go directly to the mine foreman, who may hire him and then send him to the employment office to be written up; in others, application will first be made to the local employment and personnel manager, who will write up the applicant's record, and, if there is an opening, send him to the proper mine. Mine foremen, of course, keep the employment offices advised of their labor needs.

In the West Virginia, Pennsylvania, Pocahontas-New River, and Millers Creek divisions, applicants for employment are required to pass a physical examination by a company doctor, who advises the employment manager whether the applicant may be accepted for general employment, for work only of a certain character, or should be rejected. Where physical defects are subject to correction, the applicant is advised what he must do to become acceptable for employment. The scope of the physical examination is shown in Fig. 1. It is the intention to extend the requirement of physical examination gradually to other divisions. Incidentally, a quiet campaign is on to exclude not only the physically defective but also applicants congenitally dirty in person and habits, as filthiness is not an asset to any mining community. The company wants its employees to be good neighbors as well as physically sound workers.

Discipline records are transmitted to the personnel and employment manager to become part of the permanent record of the employee. These are scrutinized to guard against possible injustice to an employee for whom a foreman may have a personal dislike. The accident record, too, becomes part of the same general file. Notices of termination of employment and the reasons therefor also reach the division employment office. The local personnel manager endeavors to interview all men whose employment has been terminated, to obtain the worker's version of the termination. In a great many cases, however, the information so obtained requires further investigation in order to verify its reliability. In only 4 per cent of the terminations has unsatisfactory earnings been given as a cause for leaving.

Turnover, it has been estimated, costs the company $16 to $35 per man. Careful records of turnover and absenteeisms, therefore, are kept by individual mines and divisions, and are summarized by the industrial relations department each month. Theoretically, three days' unexplained absenteeism is considered a termination of employment, but in practice an attempt is made to investigate all such cases and to treat as terminations only those cases in which investigation reveals a determination not to return to work or actual acceptance of a job elsewhere. For the company as a whole, the turnover in 1925 was 263.3 per cent; in 1926, it dropped to 224.7 per cent; in 1927, it fell to 195 per cent; in 1928, it was

Fig. 1—Physical Examination Chart

COAL COMPANY, INC.
PARTMENT
AMINATION

— Check No._____ Age_____

Date of Examinations								
	R.	L.	R.	L.	R.	L.	R.	L.
INGUINAL REGION								
44. Inguinal hernia								
45. Inguinal adenitis								
46.								
GENITO-URINARY								
47. Chancre								
48. Varicocele								
49. Hydrocele								
50. Undescended Testicle								
51. Epididymitis								
52.								
EXTREMITIES								
53. Old fracture								
54. Old mutilation								
55. Varicose veins								
56. Ankylosed digits								
57. Wrist deformities								
58. Flat foot								
59. Bunion								
60. Ingrowing toenails								
61.								
SKIN								
62. Acne								
63. Eczema								
64. Psoriasis								
65. New growth								
66. Syphilis								
67. Other infectious diseases								
68. Scars or identification marks								
69.								
ARTERIES								
70. Arterio sclerosis								
71. Aneurism								
72.								
BLOOD PRESSURE								
73. Systolic								
74. Diastolic								
75. Difference or pulse pressure								
76. Ratio of P. P. to diastolic								
GENERAL								
77. Weight in pounds								
78. Height								
79. General appearance								
80.								
URINALYSIS								
81. Sugar								
82. Albumin								
83. Specific gravity								
MISCELLANEOUS								
84. Stiff joints								
85.								
86.								
87.								

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that require medical measures, but do not disqualify; XXX that disqualify.
ers and diagrams where necessary.

101.24 per cent, and last year, 98.26 per cent.

Analysis of the turnover records shows that 17 per cent of the men left after working one to two months; 15 per cent, after two to four weeks; 15 per cent, after three to six months; 14 per cent, after less than two weeks; 13 per cent, after two to three months; 10 per cent, after six months; 7 per cent, after one year; and 6 per cent, after two years. The greatest turnover is in tonnage men; last year 6,999 workers so classified left, as compared with 3,991 other inside workers and 681 outside men. These turnover figures, it should be noted, make no allowance for the worker who works a certain length of time, disappears, and reappears at regular intervals; were he considered an intermittent - permanent employee, the percentages of turnover would be further reduced. Approximately 50 per cent of the men taken on in a year are former employees.

The absenteeism record of the company by operating divisions during the past two years is shown in Table I.

Table I—Per Cent of Absenteeism

Division	1928	1929
West Virginia	10.25	10.84
Pocahontas-New River	15.16	16.49
Elkhorn	11.74	15.02
Millers Creek	14.07	13.66
Pennsylvania	9.6	9.2

Maintenance of records of former employees who left in good standing has enabled each operating division to build up files of several thousand names, from which men can readily be recruited when the need arises. For the company as a whole the file now covers over 40,000 prospects. As a result, recruiting by labor agencies has ceased. In 1926, Consolidation Coal Co. shipped in 5,209 men—over 17 per cent of the number put on the payroll that year. In 1927, the number shipped in dropped to 600, and since that time no labor agency has been employed. On the other hand, the cost of hiring labor has declined from approximately $115,000 in 1926 to $15,000 in 1929.

Labor affiliations of candidates for employment are not questioned. In taking on new men, no bar is put up against applicants over 45 years old; in fact, several hundred men who have passed that milestone in life have been added to the Consolidation payroll. Effort also is made to find employment for men thrown out of work by the closing down of mines. Last year the shutting down of six mines in the West Virginia division left 1,600 men without employment. The majority of these workers were placed either at other mines of the company, at neighboring operations, or in other districts through labor agents. This year, 600 men thrown out of work by the closing down of two mines were placed at other operations within two to three weeks after the shutdown.

The agreement in effect in the Pennsylvania division, adopted Nov. 24, 1922 and amended in 1924, provides for a mine committee of three men at each mine, elected by secret ballot, to serve for a year. Men so elected must be at least 21 years old, citizens of the United States or applicants for citizenship, and must have been employed at least one year at mine from which elected. The chairmen of the various mine committees select an employees' commissioner to give his full time to his commissionship. Commissioners are chosen annually and paid by the men. The company also selects a full-time commissioner to represent its interests. The agreement also creates a joint board of review consisting of three mine committee chairmen and three company officials. This board is empowered to name an umpire to decide cases upon which the board cannot agree. In case the board is unable to agree on an umpire, selection of that official is left to a federal district judge.

Individual complaints and grievances must be taken up first by the complaining worker with the foreman or superintendent. If no satisfactory adjustment is reached, the case then goes to the mine committee. If the committee fails to effect a settlement with the foreman or superintendent, the question is referred to the commissioners, who, in case of disagreement, appeal to the manager. When this method of adjustment fails, the board of review steps in and disagreement at that stage leads to the appointment of an umpire, whose decision is final. Neither strike nor lockout is countenanced and no dispute will be considered while either is in effect. Discharges and suspension cases have precedence. While the right of management to hire, suspend, and fire is recognized, employees who feel they have been discriminated against can invoke the aid of the machinery of the agreement and, if their claim is upheld, may be compensated for time lost. The agreement also provides for the employment of a checkweighman at the expense of the men. Incidentally, while checkweighmen are employed only in the Pennsylvania and West Virginia divisions, loaders in all

Fig. 2—A Complete Record of Each Employee Is Kept on Card Form. On One Side, This Form Shows Personal Data Transcribed From Worker's Application for Employment and Actual Service Record With Company; The Other Side of the Form Summarizes the Discipline and Accident Records of the Worker While on the Job

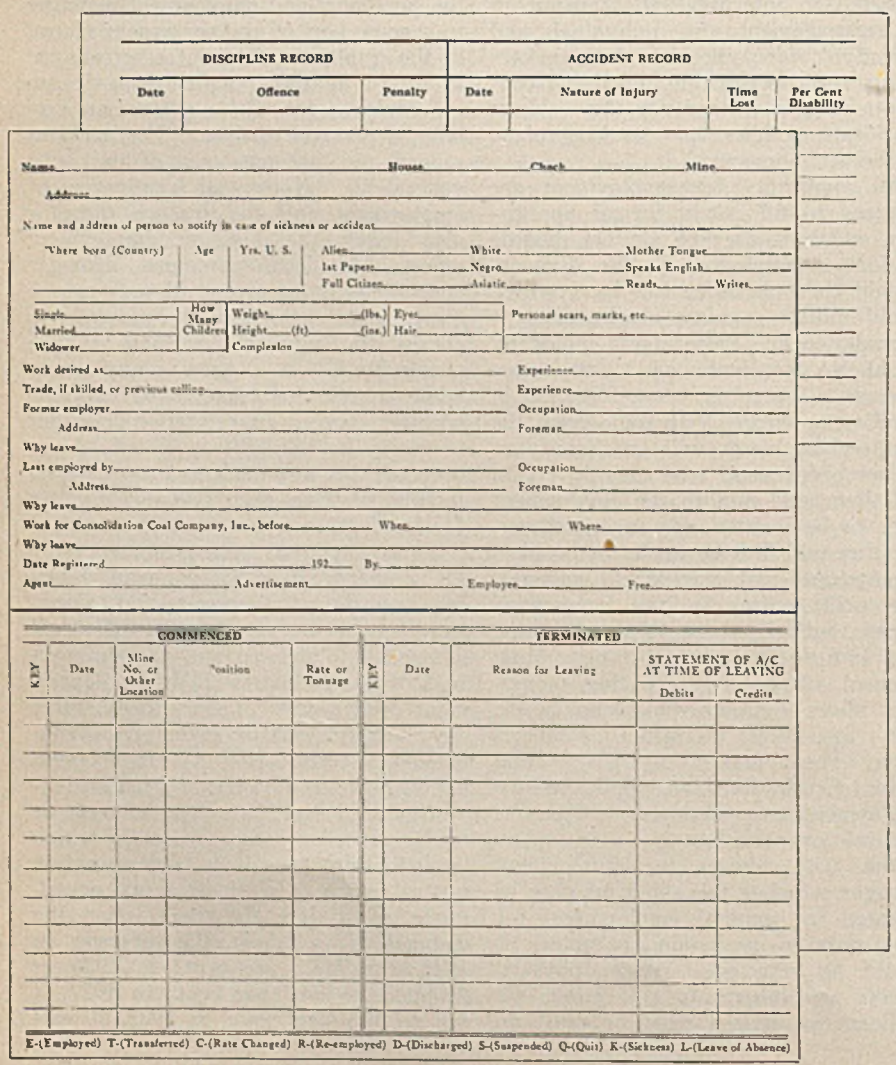


Table II—Housing Facilities, Consolidation Coal Co.

Division	Double Houses	Single Houses	Total Tenements*	Garage Stalls
West Virginia	448	1,686	2,582	337
Maryland	23	141	187	83
Pennsylvania	364	86	814	86
Millers Creek	81	359	521	150
Elkhorn	459	848	1,766	387
Pocahontas-New River	82†	1,048	1,218	354
Total	1,457	4,168	7,088	1,397

*In arriving at the total number of tenements multiple houses are counted twice if two-family.
†Includes three quadruplex dwellings.

divisions are paid on a tonnage basis and weights are posted daily at each mine. Consolidation rate sheets carry no "per car" schedules of payment for loaders.

Either party to the agreement can request a joint conference to consider a revision in wages and working conditions, and a conference so requested must be held within ten days. The only limitation on these requests is that they may not be made oftener than once in six months except by mutual consent. "In consideration of all requests brought before such joint conference, due weight shall be given their relation to production cost and existing economic and competitive conditions. Decision shall be reached by a majority vote of representation of each party to the agreement." In the event the joint conference fails to agree, the question is referred to the board of review, and if the board also cannot agree, the question goes to the umpire. "Appeals to the board of review and the umpire in these matters shall, so far as possible, be held and final decision rendered within twenty days." Local agreements on local conditions may be made at individual mines without prejudice to agreements elsewhere.

The West Virginia agreement, adopted Aug. 1, 1925, follows the Pennsylvania agreement, with the following exceptions: Miners at each mine elect a president, vice-president, secretary, and a committee of three: the employees' commissioner is selected to serve for two years; and the joint board of review consists of five members from each side. In addition, the West Virginia agreement also specifically covers questions of abnormal conditions, wet places, day labor, mining methods, smithing, house coal, pay days, and holidays. It was under this agreement that the 12 per cent reduction in wages in the Fairmont district was put into effect last May. Only once in the history of these agreements has a dispute been carried to an umpire. In that case, involving a wage reduction, the decision rendered was a compromise for employer and employees.

When it is necessary to recruit men, an effort is made to represent working conditions honestly and fairly to applicants for employment. For example, a circular used in recruiting labor in the Pocahontas-New River division frankly stated that Coalwood and Caretta are gaseous, described the method of shooting and cutting coal, the rates of pay, and what those rates covered. Similar information with respect to rates and the character of operations was given for the other two mines operated in that division, as well as house rentals and charges for room and board at company boarding houses.

The Consolidation Coal Co. has facilities for housing 7,088 families in 5,625 dwellings. In addition, in community and private garages the company has facilities for housing nearly 1,400 automobiles. The distribution of housing and garage facilities by divisions is shown in Table II.

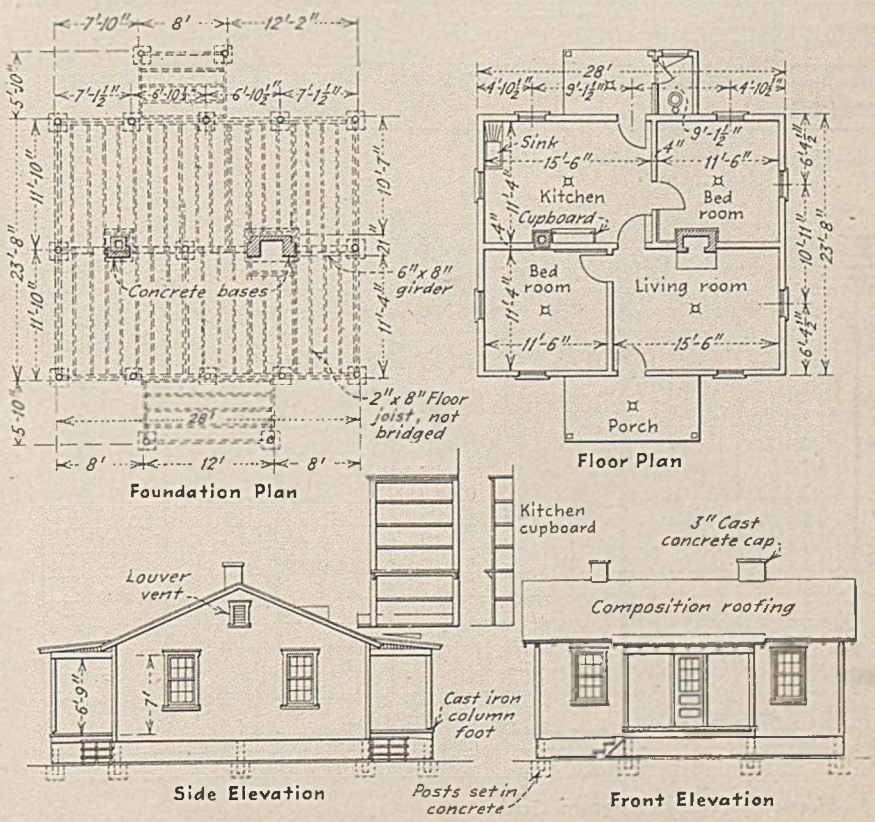
Approximately 25 per cent of these are three-room dwellings, 50 per cent are four-room dwellings, and 25 per cent are official and semi-official houses.

In the construction of new houses the basic plan is a four-room, one-story-type house. For the better type housing, standard plans have been developed, taking as a nucleus a four- and five-room two-story house, which may be increased to eight and ten rooms by different combinations of the basic plan and by changes in exterior treatment secure at least two different type houses of each size in appearance. Standardization has been the watchword in these designs and practically the same bill of material is required, even though the exterior presents a much different appearance.

Standard construction specifications call for yellow pine framing, Douglas fir for siding and exterior trim, 1x4-in. edge grain Douglas fir slats placed $\frac{1}{8}$ in. apart invariably used for porch flooring—these laid on 3-in. wide strips of composition roofing laid over porch joists. Generally, composition roofing is used, although hexagonal asphalt shingles have been used for some houses at Coalwood and Caretta. All walls and ceilings are plastered and houses are wired for electric lights and service outlets.

It is probable that no new housing will be undertaken without putting running water in all houses and making arrangements for proper sewage disposal. Kewanee or similar septic tanks are used for the latter. Fire protection is provided by hydrants or fire plugs connected on to 4-in. and 6 in. cast-iron water mains, as required. Most of the houses in the Pocahontas-New River division have inside toilet facilities, this being the most recent construction. In the other five divisions these conveniences are largely confined to official type houses. The majority of the houses occupied by

Fig. 3—Standard Floor Plans for Company Houses



foremen and higher officials have complete bathroom facilities. For cleaning outside vault toilets the company has developed a chemical compound which liquefies, sterilizes, and practically deodorizes the excrement. The waste so treated is pumped into "honey" wagons. Cleaning of the toilet vaults is done as needed and the material is wasted in a manner as directed by the medical department. All houses are provided with garbage cans and weekly collections of garbage are made.

Water supply in four divisions is filtered through American Water Softener or Scaife filters with an aggregate filtering capacity of approximately 1,000 gal. per minute. In the Elkhorn Division there are two American Water Softener and three Scaife plants; in the Millers Creek Division, one American Water Softener and two Scaife plants; and two Scaife plants each in the Pennsylvania and West Virginia divisions. One of the Pennsylvania plants also handles water for power. Well water is the principal source of supply in the Pennsylvania division; mine, well, and spring water in the Elkhorn division; mine, well, and river water in the Millers Creek; and river water in the West Virginia division.

Houses are allocated to workers by the production department, but rentals are fixed by the buildings and civic improvements department, which also is charged with maintenance. Repair work is done by special crews under the jurisdiction of this division and are not left to "handy" men and mine workers in their odd moments. New houses are generally constructed under contract with outside builders. An individual card record (Fig. 4) is kept in Kardex files for each house; this record covers size, character of construction, and equipment. A second card (Fig. 5) gives a ten-year record of monthly maintenance expenditures. Job card records are kept and reported covering maintenance expenditures at each house. Where maintenance expenditures in any one year exceed $100, the outlay is checked carefully and proper notes are entered as to reasons, etc.

Unlike mine operating expenses, maintenance expenditures are made on a budget, by accounts, and are not held down in any one month on account of tonnage produced but are influenced by occupancy. Included as a major maintenance item is exterior painting. The program calls for repainting each house once in five years. Formerly all houses were painted a gray-green combination; now six combinations developed from four shades are available and used for exterior painting. Interior walls are preferably treated with water-color paint. The use of wallpaper is discouraged where possible.

Centralized control and the placing of properly skilled workmen by the buildings and civic improvements department has resulted in a decrease in maintenance expenditures of approximately 30 per cent under the average expenditures over a period of fifteen years, and a decrease in civic improvement expenditures of approximately 40 per cent over the same period.

The units of the operating department act jointly in monthly sanitary inspections of company houses and surroundings. The local division superintendent of the building and civic improvements unit, a public health nurse representing the medical branch of the industrial relations division, and the mine superintendent and the personnel manager constitute the inspection committee. Notice to remedy conditions is left with the tenant when any of the following conditions are found: (1) uncovered garbage can; (2) garbage can in unsanitary condition; (3) untidy premises; (4) dirty toilet seats; (5) trash on premises; (6) unsanitary waste disposal; (7) grass and weeds in need of cutting. In addition, the general condition of the premises is rated good, fair, or bad. This inspection system was inaugurated last year in all operating divisions except Maryland. Persistent offenders risk an unpleasant interview with the mine superintendent and, in extreme cases, may be given the choice of cleaning up or terminating their connection with the company payroll. The thought motivating this campaign is that filth unchecked will breed more filth and infect families anxious to maintain sanitary standards with the feeling that their efforts in that direction are fruitless.

To provide medical attention and nursing service for the scattered camps of the company, the medical division has established fifteen medical areas or units in charge of twenty full-time physicians who give employees all necessary medical attention, including minor surgery. Except in the Elkhorn division, where a 50-bed modern hos-

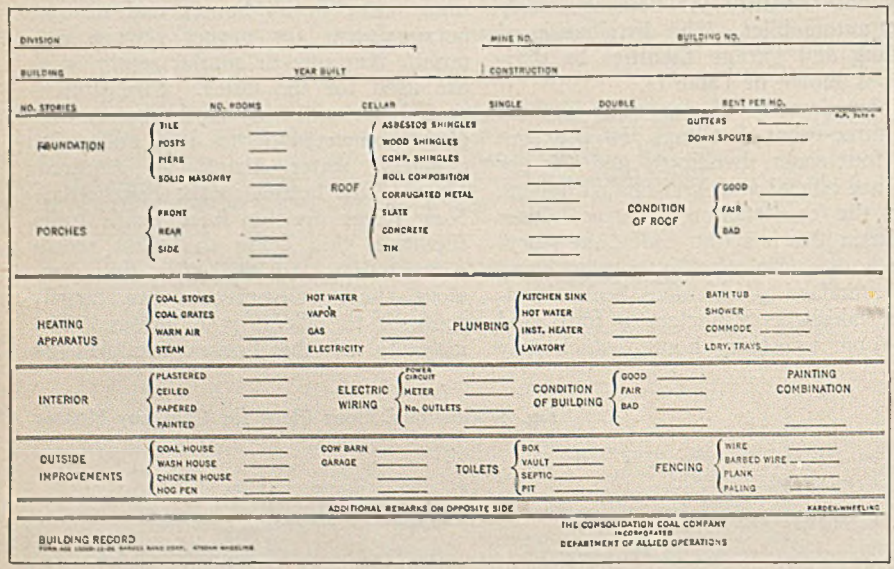


Fig. 4—House Construction Record Card

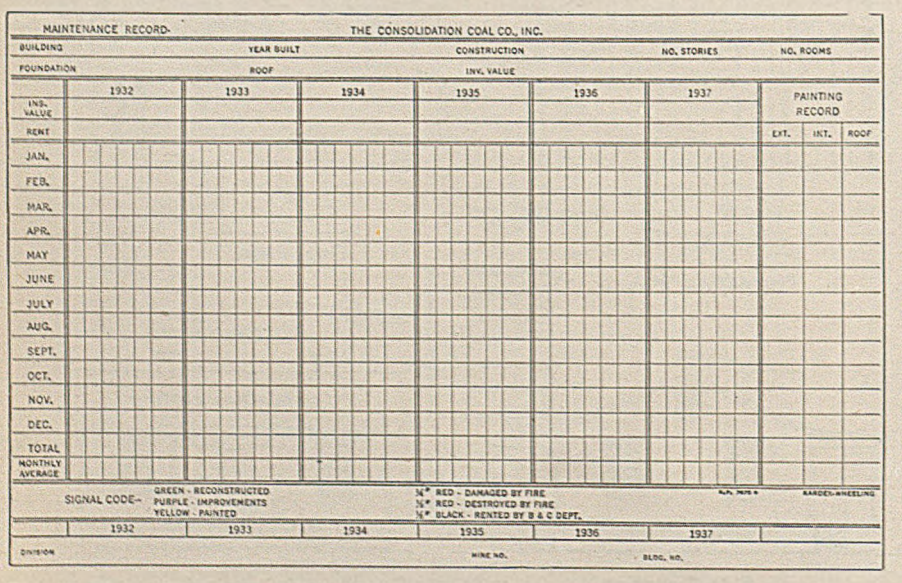


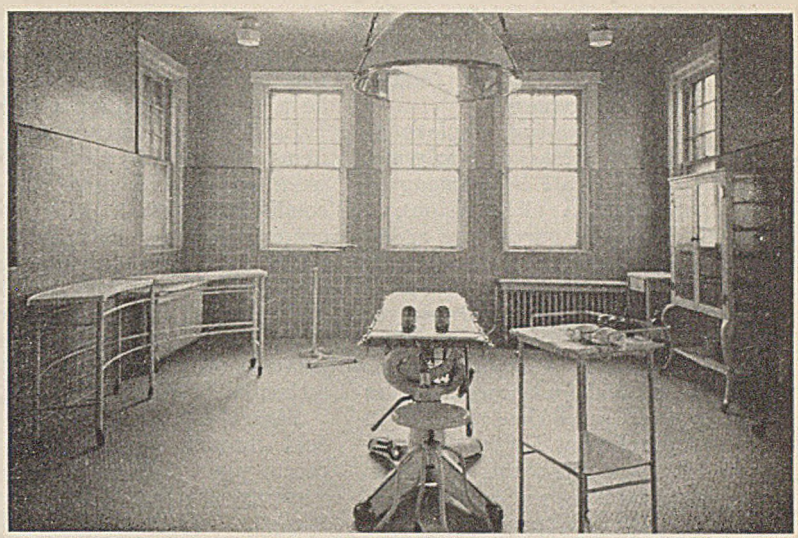
Fig. 5—House Maintenance Record Card

pital is operated at Jenkins, hospital service is given by private institutions under contracts. Monthly deductions are made from the workers' pay to cover these services. In addition to the medical director and the physicians in charge of the medical units, the personnel of the division includes a chief hospital surgeon, an assistant, a full-time laboratory technician, a supervisor of public health nurses, twelve full-time public-health nurses, and eight hospital nurses. Six dentists, whose work is closely correlated with that of the doctors, are resident in various communities.

Since the present program of the medical division was adopted about three years ago, equipment, instruments, drugs, and supplies have been largely standardized, so that each unit practically duplicates every other unit in that respect. A standardized drug list was established and each physician now requisitions his supply from this list bimonthly. Considerable economy has resulted from this standardization of drugs and biologicals.

The immediate task of the medical personnel, of course, is the care of injured and ill employees and their families. But great attention is given to a preventive campaign in which through health educational work certain long-established precedents in the coal fields are gradually being outlawed. In addition to the examination of new applicants for employment and monthly sanitary inspections, the general health program also includes work in the schools, health-study classes in home nursing, nutrition, first-aid, and maternity; periodical examination of all food handlers in company stores, club houses, and boarding houses, and immunization of all employees and their families against typhoid fever and smallpox. All new employees and their families are so immunized upon entering the community. All school children under five years of age are immunized against diphtheria. Water and milk supplies are watched and periodic laboratory examinations made.

Some idea of the scope of the work can be gained from a review of the records, which show the administration of over 75,000 individual doses of typhoid vaccine, over 1,500 physical examinations of applicants for employment annually, training of more than 350 girls and women in home nursing classes and first-aid each year, and approximately 2,000 corrections of major physical defects each year. In 1929, more than 154,000 patients passed through the medical division and the work of the division included 44,000 home visits. Monthly well-baby, preschool, maternity, and tuberculosis clinics are held. Other types of clinics are held semi-annually or annually. The public-health nursing program is divided into: (1) bedside nursing, (2) prenatal, (3) maternity, (4) infant welfare, (5) child pre-school welfare, (6) school, (7) tuberculosis, (8) communicable diseases, (9) social service, and (10) educational.



Operating Room at Jenkins Hospital

Naturally, the care and treatment of occupational injuries is an important part of the work of the medical division. In 1929, company physicians handled approximately 5,000 cases. An injured employee or one who has suffered a long illness must receive a return-to-work certificate before he can go back on the job. This is to decrease absenteeism, avoid risk, regulate compensation payments, and obtain data on time lost. Health records are further built up by daily reports from physicians, covering all cases seen, nature of illness or injury, age, color, and sex of patient.

Recreational buildings, facilities, and equipment are built, maintained, and leased by the building and civic improvements department and operated by the department of industrial relations, or by other lessees. Nine out of seventeen recreation buildings are operated by the company. These buildings are administered to serve company employees and their families as community centers, and are the scene of first-aid and safety-first instruction, home-talent shows, dancing and card parties, lectures, concerts, lyceum and Chautauqua features. Drug stores, ice cream parlors, pool rooms, barber shops, and rest rooms for ladies (which also serve as meeting rooms for civic clubs, bible classes, farm bureaus, ladies' aid societies, and other feminine activities) are housed in these buildings. Sound picture apparatus has been installed in three of the larger theater auditoriums of the recreation building group.

Commercial profit, of course, is not the primary aim in the operation of the recreational centers; on the contrary, many of the buildings are operated at a loss. The company feels, however, that the place these buildings have in promoting proper industrial and community relations is too important to permit financial considerations to be the controlling factor.

Under the group insurance plan, which went into effect June 1, 1929, employees in the service of the company less than one year may be insured for $1,000 at a cost of $2.44 per month; service of more than one year and less than two years entitles employees to carry $1,250 in group insurance at a monthly cost of $2.63; service of two years and less than five makes employees eligible to $1,750 group insurance on payment of $3.01 per month; employees in service five years or more may carry $2,000 group insurance at a monthly cost of $3.20. The difference between the total premium and the monthly payment of the insured is absorbed by the company.

All policies carry $12 weekly accident and health benefits, payable for a temporary total disability from accident or sickness for a period not exceeding 13 weeks after the first seven days of disability for which no payment is made. In the event of total permanent disability prior to reaching the age of 60 premiums cease and the face value of the policy is paid in monthly installments of not less than $50. The policy carries conversion privileges which may be exercised if the employee leaves the company; such termination of employment, of course, automatically terminates the insurance. During the first year the group plan was in effect, $131,250 was paid out in death claims on 88 policies and $283,844 in health and accident benefits on approximately 4,200 claims.

Due to the geographical location of its mines, the company operates approximately 80 stores, including manufacturing plants, filling station, warehouses, and markets. A number of these stores are of the department store type. Others carry only staple products and miners' supplies. "Service" stores

are established in communities where it might prove a hardship to compel the smaller groups there to make frequent trips to the larger centers.

The stores department employs approximately 250 clerks and salesmen. Frequent meetings are held among the stores personnel in all divisions, at which the company purchasing agents, merchandise managers, and other executives address the sales forces on company policies, ideals, and progressive methods of merchandising. These meetings constitute a training school for the young and inexperienced salesmen and at the same time serve to inform the purchasing and merchandise departments as to the wants of the employee customers.

Executives in charge of this department, as well as the division managers, stress as one of the most important factors in the merchandising program the factor that the employee and his family must be treated courteously and in a human manner so as to beget confidence between the employee and the company. The contact between the company and the employee in his relations with the stores is considered as important as a contact in the mines.

The larger stores carry 1,500 to 2,000 items and 4,500 to 4,800 brands. The gross annual volume of business runs into several million dollars. Retail prices for all stores are established after careful analysis of market costs and local conditions in each division by the merchandise department's headquarters at Fairmont. This centralizing of control has removed the possibility of irregular charges within divisions for similar commodities or products. All merchandise is neatly displayed and plainly price marked, so that the customer knows exactly what he is paying for his purchases.

Each store features ten to twelve items at special prices every other week and special sales are run when conditions warrant. All purchasing is centered at Fairmont. New items are added to the lines from time to time and limited quantities of such items are sent to individual stores. Local store managers then requisition for additional supplies in accordance with estimated sales volume.

Several hundred radio sets have been sold through Consolidation stores in recent years. Electric refrigerators and washing machines also are handled. Radios, refrigerators, washing machines, musical instruments, furniture, and clothing are sold on time payment. The only ready-made men's clothing now handled are work suits, overalls, and coveralls. Other clothing is tailored to measure and the representatives of the tailoring concerns serving Consolidation communities make their regular rounds of the different company stores. The merchandise department also operates ice, ice cream, bakery, and bottling plants at Jenkins.

Mining communities controlled by the Consolidation Coal Co. are in no sense closed camps to outside mercantile institutions. Chain stores are nearby competitors at many places and independent stores at the outskirts of Consolidation towns come and go. The merchandise department of the company rests its claim for patronage on price, quality, service, and courtesy to the employee customer.

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MAINTENANCE at Consolidation

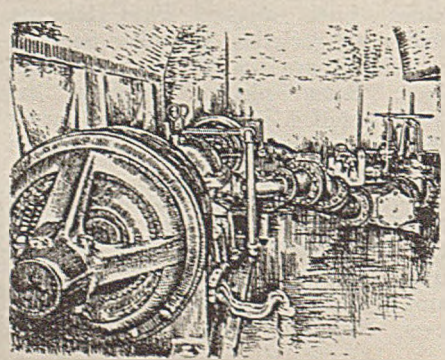
(Continued from page 617)

number, and these locations are indicated on the perpetual inventory cards. This makes it possible for a person unfamiliar with the locations to find any item described on a card. All parts for each type of machine are stocked in adjoining bins which form a section.

The supply clerk reports directly to the division manager but is expected to co-operate with the supervisor of supplies. This is in conformity with the policy of allowing a division manager full authority over his domain and at the same time obtaining the benefit of one-man supervision of the different departments.

Every six months a physical inventory is taken. While this is in progress, perpetual bin tags are attached to each bin and receipts and disbursements are entered thereon. At the completion of the inventory, the bin tags are collected, the physical inventory is checked against the perpetual inventory cards, and the latter are corrected where necessary. Bin cards on which all of the spaces have not been filled are filed away for use in the next inventory.

All purchase requisitions are made by the warehouse supply clerk and are scrutinized and signed by the supply clerk, division superintendent of mining, division manager, and, in case of those for maintenance repair parts, by the division maintenance superintendent. Material is taken from the warehouse only when covered by a "Mine Store-Room Requisition," which can be made only by the maintenance foreman, mine foreman, or superintendent, and the latter must countersign those made by the other two. All invoices are approved by the division supply clerk before going through the mine auditor's office and to the purchasing agent.



At the end of each month the division supply clerk sends a report to the supervisor of supplies showing what class of materials increased in purchases, and the reason; this to guide the supervisor of supplies in revising quantities.

Recently a new form was adopted covering the troublesome formalities connected with the transfer of supplies from one mine to another. Each transfer form carries a printed serial number and is made up on four sheets that are duplicates, except that the colors are different. The top sheet is pink, the second blue, the third yellow, and the fourth white. The mine shipping the material fills in the description, quantity, unit price, total amount, and other details, on the four sheets, retains the lower, or white, copy and sends the other three sheets to the supervisor of supplies. The latter adjusts his records of materials available for transfer, retains the yellow sheet and sends the pink and blue sheets to the mine receiving the material.

After receipt has been noted on the form, the second, or blue, copy is retained at the mine and the original, or pink, copy is sent to the local auditor, by way of the supervisor of supplies, for the charging and crediting of the material transferred. As the pink copy goes through the office of the supervisor of supplies on its way to the auditor, the third, or yellow, copy, which was retained by the supervisor, is sent to the mine which made the shipment signifying that credit has been allowed. This closes the transaction and automatically has advised all parties of the completion of their interest in the matter.

Heavy or bulky materials which cannot be stocked and handled economically at the central supply houses are shipped directly to the mines, but are considered warehouse stock until the mine actually uses them. The division supply clerk maintains a perpetual inventory of these materials stored at the mines.

From start to finish the system is projected with the idea foremost of supplying the mines promptly with all materials required for uninterrupted production. Preventing losses and overstock, utilizing materials that become obsolete for a certain mine, and proper accounting follow in importance.

MERCHANDISING

+ At Consolidation Coal Co.

MODERNIZATION of the sales methods of the Consolidation Coal Co. has gone hand in hand with modernization of the operating methods of the company. Both sales and operating departments bend their efforts toward a common goal—satisfaction of the ultimate consumer. Mining and preparation have been stepped up to improve the quality of the product and, in turn, modern merchandising methods have been developed for its efficient distribution.

At the time the modernization program was inaugurated, existing sales districts were largely the result of growth and additions made during the 70-year life of the company. These have been retained, with some few changes, in the present setup. Merchandising methods and personnel, however, are now organized on the basis of the sale and servicing of potential production of 15,000,000 tons annually.

Consolidation coals, because of their diversity, lend themselves to a wide range of industrial and domestic uses. Industrial coal, which absorbs the bulk of the production, goes largely to railroads, public utilities, byproduct coke plants, government bureaus, gas plants, manufacturing establishments, and the export trade. The sales department is called upon to cover practically every industrial center in the United States and Canada, as well as territories in South America and Continental Europe. To serve these fields with the various kinds of coal produced, the organization must familiarize itself with the details of rail, river, and lake transportation, in addition to tidewater and export shipping problems.

Sales in the eastern half of the United States and in foreign countries, other than Canada, are handled by the company's own organization. Activities in the Northwest are under the control of a subsidiary wholesaler, the North Western Fuel Co. Canadian sales are handled by the Empire Coal Co., a subsidiary of the North Western Fuel Co. In all, Consolidation maintains 22 sales offices in the United States, Canada, England, and Italy, either under its control or that of its subsidiaries.

Responsibility for all sales and service is vested in a vice-president in charge of sales, located in New York City. Under his direction, a general manager of sales has personal charge of the 22 district offices of the company and its subsidiaries. These offices, in charge of district managers, are located in Portsmouth, N. H.; Boston, Mass.; New York City; Philadelphia, Pa.; Washington, D. C.; Norfolk, Va.; Fairmont, W. Va.; Cincinnati and Cleveland, Ohio; Detroit, Mich.; Chicago; Milwaukee, Superior, and Washburn, Wis.; St. Paul, Minneapolis, and Duluth, Minn.; Winnipeg and Toronto, Canada; London, England; and Genoa, Italy.

Orders, contracts, inquiries, or changes originating with the salesmen in United States and Canadian districts are cleared through the district offices to the general office in New York City. Control sheets, covering all the activities of the sales department, also go to the vice-president and general manager of sales for their guidance. In this way, the customer is assured of an immediate decision by the district manager, supported by the chief executives, on all questions relating to his orders or inquiries. Customers located in foreign countries other than Canada receive the same service and attention through the export department in New York City, headed by the export manager, who reports to the vice-president in charge of sales. Foreign orders and inquiries are cleared through the district offices in England and Italy, and forwarded to the export department in New York.

With six producing divisions and a multiplicity of sales outlets, some means of controlling and directing the movement of grades and sizes produced becomes a necessity. This activity is centered in a distribution department, under a director of distribution, who reports directly to the vice-president. The distribution director is vested with complete responsibility for the movement of coal to line customers and lake, tidewater, or export points, and for the proper balancing of sizes and coal flow on all sales department orders going to and from all the mines in all the divisions. Control sheets, showing the condition of production, shipments, and orders, frequently are forwarded to all offices of the sales department for their guidance in rendering intelligent service to the customer.

The key to the sales plan is the district office, headed by the district sales manager, who is responsible for his particular district. Each district sales office is a self-contained sales and service unit. A service engineer, who must be a technical graduate with practical experience, is a part of the staff of each district sales office, and acts as technical assistant to the district manager in all matters pertaining to application and combustion of coal and boiler room practice. These men, while an integral part of the district sales staff and operating exclusively in the district to which they are assigned, are at the same time under the supervision of a general service engineer, located in the office of the vice-president in charge of sales in New York. Through the general service engineer, technical standards throughout the organization are upheld and a direct contact maintained between the engineering service in the field and the executives in the general office.

SALES research, merchandising counsel, and advertising for the department as a whole and for the district offices and subsidiary companies are combined in New York under an assistant to the vice-president.

Selling is done under a definite policy, which recognizes that coal is a service and not just a commodity; that the buyer, be he industrialist or householder, is entitled to the ultimate in benefit from the coal he purchases; and that the responsibility of the producer does not end until the product has successfully been burned by the consumer.

With the basis on which sales will

be made established, actual accomplishment becomes a matter of directed effort and suitable personnel. The company has in the past few years embarked on an extensive program of market research in each of its sales districts for the purpose of finding out just where its opportunities lie. The first step in any district is to ascertain the total consumption and the routes by which the coal reaches that consuming area. The second step is a detailed canvass covering the kinds or sizes of coal consumed, the classes of consumers, the number of consumers in each class, the tonnage taken by each of the individual consumers, and any consumer affiliations which might militate against sales. As a final step, county maps are made, with all communities listed for the guidance of the salesmen and, incidentally, to aid the sales executives in checking coverage.

With the final results of the complete survey at hand, the sales department knows, considering transportation facilities and rates, just which of the company's coals are suited for distribution in the district, as well as the potential sales opportunity as measured in the possible tonnage which might be placed. In addition, consumers using the types of coal which the company might place in the district are classified as to the tonnage consumed to show just where sales effort can be concentrated with the greatest possibilities of success.

With detailed information on market possibilities in the sales district, the next problem is a sales staff trained to take full advantage of it. The older type of salesman whose sole equipment was price list and little else finds no place in the organization. Consolidation salesmen must be versed in the principles of modern selling and thoroughly familiar with the company's product and its performance. The latter items are the first things Consolidation representatives are called upon to learn.

A COURSE of study at the mine is depended upon to give the salesman a background of actual knowledge of the coal and its preparation. In addition, he is supplied with a manual containing data on actual performance tests (if industrial coal) to back up his selling talks. Each salesman also is grounded in the fundamentals of combustion through the medium of a correspondence course under the supervision of the general manager of sales. Instruction takes the form answering question lists dealing with phases of combustion. These are so designed that the salesman in digging up the answers, usually in co-operation with the service engineer in his district, must perforce learn something about the mechanism of coal-burning.

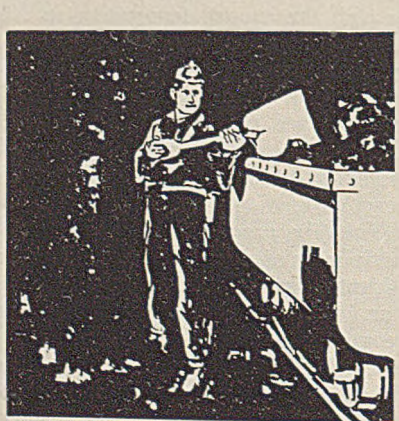
To keep salesmen from wasting their energies in the cultivation of barren fields, a system of checks has been devised by which the district manager has at his finger tips a detailed record of their accomplishments in the territories to which they are assigned. The elements of the system are a list of the customers in the territory and a schedule of the kinds and sizes of coal selected as most suitable for distribution there. The salesman's record for each month is checked against the preceding month and the same month the year before.

With the customers and kinds of coal definitely known, the monthly record shows just where the salesman has failed in selling the coal he should and whether he is wasting his energies and embarrassing the company by selling coal unsuited to the territory or which can be disposed of to better advantage elsewhere. A recapitulation of each salesman's monthly record, containing only the salient features, is sent to the general manager of sales for his guidance and information.

Sales supervisors are part of the general sales staff, and function in the dual capacity of instructors in selling and leaders in the recapture of slipping business or the development of new. Ordinarily, they are employed to develop the salesman's technique to better enable him to discharge his duties. But if the records show that a salesman is slipping in some phase of his job, the supervisor fills the rôle of the shock troops. In other words, he accompanies the salesman and points out the opportunities he is missing.

Industrial and specialty coals are sold on a service basis. Through the market studies, the types and kinds of industries and localities for which Consolidation coals are most suited are picked out. This information is supplemented by firing tests on the leading types of equipment used in the industries and localities. The resultant data are then compiled for the guidance of both company sales and service representatives and the customers.

Actual sales to an industrial consumer are made on the basis of a survey by the service staff. On the findings is based a recommendation as to the size and kind of coal best suited to the particular burning equipment and plant conditions. The initial recommendations ordinarily are followed up by a burning test on a trial order of coal selected by the department on coal application, under the direction of a manager of coal application, reporting direct to vice-president in charge of sales. This department is charged with the responsibility of selecting coals to suit conditions found in the users' plants.



UPON satisfactory completion of the firing test, the application department assigns the order to a definite mine producing the particular type and size of coal desired. Once the department on application assigns the order, the mine must fill all subsequent orders for the plant only with the particular size specified for use in that plant. The mine is prohibited from making any changes in the kind of coal shipped until advised to do so by the application department, which acts only when new service data warrant such a move.

Engineering service does not end with the initial survey of the plant. In accordance with its program of seeing that the customer obtains the full benefit from the coal he buys, the company service engineer maintains frequent contact with the boiler room force as a check on the performance of the coal or for the solution of any new problems which may come up. The service engineer also is charged with the responsibility of seeing that the plant attendants understand the proper firing methods for the most efficient utilization of the coal.

Sales to retail coal merchants are made with an eye to resale by the retailers, rather than on the old basis that, as far as the operator was concerned, the retailer was the final link in the chain. In May of this year, Consolidation announced a new retail sales plan, based on the appointment of "authorized dealers." As part of the foundation work for this plan, all coals sold through retail channels were given distinctive trade names. This work was begun with the introduction of "Mountaineer" coal in 1927, and has since been completed with the addition of the trade names "Grenadier," "Pathfinder," "Cavalier," "Volunteer," and "Planter."

As a part of the general modernization of Consolidation merchandising, the retail coal merchant assumes an important rôle, not only for the distribution of the larger sizes to the householder but also because of his service to local industrial users. The new merchandising plan

offers selected dealers the opportunity to become "authorized dealers" and to operate under a franchise for the sale and service of Consolidation coal in their communities or localities. The franchise is the company's guarantee to the public that the dealer has been selected because of his fitness for merchandising in his community, and that the quality and preparation of the coal he is handling is warranted by the producing company.

Selection of authorized dealers is not based on their ability to buy coal—or pay for it after it is delivered—but on a survey of the capabilities of the dealers and the market conditions in the locality they serve. This survey goes into the sales opportunity for domestic coals by retail price classes. When completed, it shows just what price class coals are most in demand in that locality and what retailers are best fitted to handle each one. With this information, representatives of the sales department present the plan to selected dealers and apply it upon acceptance. A dealer is selected finally for each of the price classes in the territory, whether they be "Grenadier," "Cavalier," or any or all of the Consolidation brands. Acceptance of the franchise by the dealer means that he will be without competition from other Consolidation coals of the same price class and that the dealer gets the benefit of advertising designed and placed by the company itself in its campaign of backing and facilitating the dealer's resale.

In consideration of the dealer's acceptance of a franchise and fulfillment of the necessary requirements, the Consolidation Coal Co. undertakes to insure him a stable and uninterrupted supply of well-prepared coal, a stable price structure and freedom from price competition; efficient merchandising counsel, including summer sales campaigns; engineering service; and aggressive advertising.

Education of the dealer and his employees is a function which the company assumes under the dealer plan. Not only does the dealer receive instruction, but his employees as well. Special representatives of the Consolidation sales department and sales supervisors are charged with the responsibility for this activity, and ordinarily address dealer or dealer employee groups on merchandising and common household heating faults. Supplementing the educational facilities is the engineering service, of which all authorized dealers may avail themselves.

▼ ▼ ▼

Who's Who at Consolidation

THE WIDE RAMIFICATIONS of the production and sales activities of the Consolidation Coal Co. call for an elaborate organization set-up and personnel. Responsibility for the successful conduct of these activities along the lines of the divisions of authority analyzed in the study of organization and management problems published on pages 572-576 rests chiefly upon the following men:

Executive Department

Robert C. Hill, chairman, board of directors, New York.
George J. Anderson, president, New York.
Brooks Fleming, Jr., assistant to president, Fairmont, W. Va.
W. W. Stevenson, assistant to president, New York.

Operating Department

F. R. Lyon, vice-president, Fairmont, W. Va.
Thomas G. Fear, general manager of operations.
F. A. Krafft, director of industrial relations.
H. F. Giffin, manager, buildings and civic improvements.
Charles Enzian, chief engineer.
C. C. Hagenbuch, mining engineer.
W. L. Doolittle, construction engineer.
R. L. Kingsland, electrical engineer.
B. H. McCrackin, maintenance engineer.
F. E. Bedale, safety engineer.
M. H. Forester, supervisor of supplies.
G. S. Brackett, statistician.
W. J. Wolf, division manager, Frostburg, Md.
F. F. Jorgenson, division manager, Fairmont, W. Va.
L. H. Schneer, division manager, Somerset, Pa.
J. D. Snyder, division manager, Van Lear, Ky.
D. A. Reed, division manager, Jenkins, Ky.
T. W. English, division manager, Coalwood, W. Va.
D. J. Kindel, medical director, Fairmont.

Sales Department

J. Noble Snider, vice-president, New York.
H. A. Glover, general manager of sales.
J. M. Dougherty, assistant to vice-president.
W. T. Coe, director of distribution.
A. L. Brown, general service engineer.

Corporate Affairs

H. H. Snoderly, vice-president, New York.
A. K. Bowles, acting controller.
G. W. Kratz, general auditor.
C. I. Finnan, general accountant.
H. H. Warfield, treasurer.
C. E. Beachley, secretary.
Charles Plitt, assistant treasurer.
C. H. Bradfield, real estate agent.
F. C. Davis, general purchasing agent, Fairmont, W. Va.
J. M. Weekly, general manager of stores, Fairmont, W. Va.

Traffic Department

J. F. Graves, manager, New York.

The studies of Consolidation management, operating methods, and merchandising in the Tenth Annual Model Mining Number were made possible by the generous and wholehearted co-operation of these men and their associates throughout the various operating divisions of the company with the editorial staff of *Coal Age*.

COAL AGE

SYDNEY A. HALE, *Editor*

NEW YORK, OCTOBER, 1930

Detroit beckons

WHAT amounts to a critical examination of the present economic state of the bituminous industry is provided in the program of the thirteenth annual convention of the National Coal Association, to be held at Detroit, Mich., Oct. 15-17. At that time, expert diagnosticians drawn both from within the organization and from the outside world of industry and finance will analyze, forecast, advise, and recommend. That the clinic will be in no sense a post mortem, however, is clearly indicated by the fact that many of the clinical studies presented will revolve about a consideration of "what's ahead" for the coal business.

Economic maladjustment has been a chronic complaint with bituminous coal. The general industrial situation since the stock-market collapse of last fall may not have aggravated the complaint except in profitless intensification of the constant scramble for orders, but the depression has given a sharp touch of immediacy to the necessity for a painstaking re-examination of the entire industrial structure of the country. Such a general re-examination makes possible—even imperative—careful consideration of the interrelationships and the interdependence of one industry with another.

These relationships find direct recognition in the Detroit program. Since they are so vital to the future of the industry, few bituminous coal company executives will want to miss the opportunity which the forthcoming National Coal Association convention offers of sitting down and taking frank counsel with their fellows and with mentors from other industries.

Concurrent causes

EVIDENCE that no longer are accidents to be considered as having a single cause was repeatedly manifest at the meeting of the Mining Section of the National Safety Congress. "To determine the *cause*" has been the acknowledged purpose of all committees to inquire into fatalities and injuries. One cause was to be loaded with all the responsibility. All minor causes were overlooked, though without them the accident would not have happened. As a rule, the cause was chosen which furnished the best alibi for the person or persons who needed such a defense.

Yet the cause might be that the industry had not developed a safety method to prevent such an accident or the technical skill to anticipate it. It might be that light was not afforded to prevent the risk, or that the man himself was defective and not suited to perform the task. Perhaps there should have been less intelligence and observation required of the man. Safety should have been provided so that with these qualities lacking, or temporarily absent because of excitement, the accident could not happen. It might be that the mechanism was ill-designed. Maybe the victim had not been warned, or, if warned, in language or in a manner that left him still ignorant or in doubt, or again in so casual a manner that the advice was overlooked. Perhaps he had received no training in the manner in which his work shall be done, or was it the will to work safely that was lacking? Were home troubles or financial ills a distracting element, causing carelessness or forgetfulness?

In the records of an accident many such notations should be made. Classifications should be provided according to these notations, so that from these data when assembled could come a clear understanding of just what change in managerial method would eliminate the greatest number of accidents. Intelligence should save us from many accidents—especially intelligence in the keeping of accident records.

Architects of fortune

BUSINESS in the United States has enjoyed depression for a full twelvemonth. Although the impact of crude economic forces crashing through roseate dreams of "The New Era" has long since been spent, a morbid psychology magnifies the fading reverberations. Whether business is to move upward within the next few weeks or is to crawl along subnormal levels is largely a question of the ability of business leadership to rise above the defeatist philosophy which was reborn when the Wall Street boom died.

Courageous leadership will find in the present business and financial set-up shining opportunities to build soundly for the future. In the coal industry specifically, general business conditions are distinctly favorable for an acceleration of any modernization program. The dollar invested in modernization will buy more than it would for a number of years. Market demands for coal at present are not so voracious that time out for rebuilding and improving plant facilities will mean lost orders for the coal operator's product.

Money, no less than men, is actively seeking fruitful employment. It is true that, generally speaking, banking funds are not available for projects to bring in new coal production or expand present outputs—and the industry should be glad that this is so. But credit is open for modernization projects designed to reduce costs and improve quality. Short-term financing of expenditures for

equipment which will soon pay for itself out of reduced production costs is particularly attractive.

Undoubtedly, because of the unfavorable earnings record for the industry as a whole in recent years, financial institutions approach consideration of loans to coal operators with more than the usual degree of initial caution. But whether credit be extended will depend more upon the character and record of the applicant than upon his industry. Inquiry in banking circles reveals no disposition to treat coal operators either as pets or stepchildren of finance. The rules of the game are neither suspended nor changed for the mining industry.

Bituminous coal operators in a position to finance improvements should have a distinct selfish interest in the acceleration of their modernization programs. There is not only the immediate advantage of spending money in a market which favors the buyer but the advantage too which accrues to his own industry as a producer of fuel. With more than 80 per cent of the bituminous tonnage directly entering industrial consumption, the coal producer has a daily lesson in his dependence upon other industry. It should also be apparent that expenditures he makes for equipment and labor contribute to the demand for his own product. He is a double beneficiary of quick action—now and in the future.

Shall we or they?

WAS it not Mark Twain who said the New Englanders had for generations been complaining about the weather but had done nothing whatever to improve it? But why thus single out the New Englander? Year after year the insufferable summer weather goes untempered in our homes and places of public assembly. The only way we know to escape it is to go to the seashore or on some mountain top, whereas if we were wise we might cool our houses by conditioned air.

In the winter we let the weather block up the streets and sidewalks when a little artificial weather on the underside of the traveling surface would make warm, comfortable, and dry the otherwise cold, cheerless, and damp surface. Those cold upper rooms, that chilly garage, may be a source of less discomfort if a little more fuel be used. Pneumonia and the catarrhal affection that will not be shaken off will be prevented by heating a little earlier and later in the season. Baseball gives way now to football and our stadiums are not heated. Many farmhouses in the country still have their stoves with only one or two rooms habitable, and mittened folk, traveling from room to woodpile in the bitter cold of arctic winter days, bring in the meager fuel by which the stoves are fed.

Room there is, and will be for many years, for coal—more coal. It is useless to talk of the New Englander when the coal men have grumbled about the weather and yet have done nothing at any time of their own instance to better it.

The President suggests

THE ECONOMIC PLIGHT of the bituminous coal industry was again brought forcibly to public attention when President Hoover, addressing the American Federation of Labor at Boston, Mass., on Oct. 6, pointed to that industry as an outstanding example of the demoralization which inevitably shadows destructive competition. Succinct and penetrating analysis of the situation was coupled with apt suggestion as to one remedy, when the President concluded that part of his speech with this significant statement: "If our regulatory laws be at fault, they should be revised."

Mr. Hoover is not the first to intimate that the coal industry may be the victim of too much regulation. But his commanding position, both as Chief Executive and as a deep student of economic trends, gives a potency to his viewpoint which the opinions of others less highly placed lack. Coming from this source, no imputation of selfish interest can attach to the proposal, but only knowledge and a genuine concern over a situation which already has seriously affected industries closely allied to coal and as seriously threatens others less directly connected.

It is one of the ghastly jokes of our efforts to control economic forces by rigid laws that a statute originally formed to protect the public from oppression by large industrial groups should, under changing economic conditions, become an instrument to oppress a great essential industry and those employed by it. Yet that is the position in which the Sherman anti-trust act now holds the bituminous coal industry. To say that, however, is not to ascribe—as some do—all the existing ills of the industry to that and similar regulatory statutes. But that this law effectively bars a quick approach to stabilization cannot be denied. With so eminent an authority as the President of the United States questioning, by inference at least, the wisdom of a legislative straitjacket, those who have him advocating modification ought to take fresh courage.

Safe repairs

MAINTENANCE MEN display great ingeniousness and speed in making emergency repairs in and around the mines. Ready hands and orderly preparation ahead do much to accelerate such jobs toward their early completion. Usually the work is well done. But sometimes, to meet the schedule set for major repairs, short-cut methods are employed on emergency jobs which later prove disastrous. Speed always should be accompanied by caution and good workmanship in conditioning equipment vital to safe operation. Deliberate disregard of caution in matters of this kind will nullify the effectiveness of management's plea to workers to take no chances.

NOTES

. . . from Across the Sea

ADDRESSING the Midland Institute of Mining Engineers of Great Britain recently, Dr. W. Payman recommended the use of single cartridges in a shot so as to avoid the danger that the explosion of one cartridge might fail to explode the next. Some collieries, Dr. Payman says, are using a cartridge large enough to do the work required and are insisting that one only shall be used. All of which is contrary to our practice of making the cartridge smaller by far than the hole, thus getting the effect of cushioned shorting. Dr. Payman, be it remembered, is an expert on explosives in the Mines Research Board Experimental Station. He declared once again that the admixture of inhibitors in the form of cooling salts had gone so far in Great Britain as to make explosives somewhat too insensitive. That may be the reason why the use of a single cartridge is favored.

Dr. Payman also discussed the use of an inhibitor in the stemming or in a safety sheath. As he pointed out, one of the functions of stemming is to mix with and cool the gases emitted by a blow-out shot. The safety sheath of M. Lemaire, of Belgium, presumably cooled off the hot products without interfering with the reactions of the explosive.

He called attention to the fact that the French investigators do not like plastic clay for stemming, because it is so incompressible and is likely for that reason to be thrown out of the borehole. Rock dust and sand, on the other hand, are compressible, and when the layers near the explosive give way a little under the blow of the explosion, the outer portions are unaffected and the shothole remains sealed.

Dr. Payman calls attention to the fact that it is the crevices near the mouth of a hole that cause many of the explosions of gas. He says that even 1 in. of stemming will prevent effectually the ignition of firedamp when 28 in. of a permitted explosive is used under the conditions of the official test. The recently devised test will ignite a methane-air mixture with as little as 2 oz. of such an explosive if fired unstemmed.

In America we are clarifying our washery water without much trouble, though there has been persistent difficulty in a Colorado mine. Perhaps our good fortune arises from two causes: (1) that we rarely have clay mixed with our coal and (2) that frequently the water is acid enough to aid in settlement.

In Great Britain, where conditions are not everywhere so fortunate, L. W. Needham, of the mining department of the University of Birmingham, has been making experiments in the settling of fine coal in water, especially in relation to the clarification of washery water. The results of those experiments he has presented to the Institution of Mining Engineers at Birmingham.

He says that even if 15 per cent of clayey, or colloidal, matter is introduced into water the specific gravity would be raised only to 1.05, so the effect of the colloidal condition cannot be solely one of specific gravity. Mr. Needham took (1) fine clean coal with 9.6 per cent ash and (2) clean coal mixed with 8.5 per cent of "dirt" to give 19.6 per cent of ash, both consisting of ⅛ in. particles. He noted the time of settling. In 30 minutes only 3.2 per cent of the clean coal remained in suspension, but 40.7 per cent of the coal and dirt admixture was still afloat. That part of the clean coal (1) and the dirty coal (2) continuing in suspension had just about the same percentage of ash, 46 per cent in the one case and 45.7 per cent in the other. Evidently the colloidal dirt, or the dirt in the colloidal state, to put the statement in the approved form, was preventing the good clean coal from settling.

In another experiment, analyzing that part of the picking-belt refuse that floated with the part that sunk he found much more silica and alumina in the part that floated, showing that clay was at the bottom of the trouble. Taking a 30-gal. tank of galvanized-iron, he made experiments with reagents to ascertain what proportion of the solids would be settled in certain given times.

Chlorides are not desirable, according to the author. That may be questioned, seeing that calcium chloride is used so generally to prevent freezing and in Great Britain is being used for cleaning coal. Tests also were made with the 720-gal. tank of a washer, with the results shown in Table II.

The tests show results with both alkalies and acids. Apparently nothing was done to ascertain what effect an electric charge would have on the settlement of the solids and the clarification of the water.

A change from wood to steel in coal mines might well be of value to the coal men by reason of the impetus it would give to the steel industry. At least the Britons seem to see that as one of the advantages in the exchange. With them, the wood must come from abroad, whereas the steel might be of British origin, though not by any means necessarily so, for Belgian steels are coming on. These steels are cheaper though not so good as the British, according to the *Colliery Guardian*.

Imported timber costs $25,000,000 a year. Steel would cost, it is estimated, only $14,800,000. The difference would be 4c. per ton, but the $14,800,000 would go to the British ironmaster and his employees, and the $10,200,000 more or less to the mine owner and his employees, helping them all. Only the woodsmen of Russia and Scandinavia and the timber shipping interests would suffer.

Table I—Settlement of Slurry in Given Time With Various Reagents In 30-Gal. Galvanized Bin

Coal Used, Lb.	Quantity and Kind of Reagent Added to Water	Percentage Concentration of Reagent	Percentage Initial Concentration of Solids	Solid Content as Percentage of Original, Minutes from Start: 0	2.5	5	7.5	10	Water
40	None	.....	3.38	100	75.4	63.2	58.2	49.0	Not clear in 48 hr
40	30 g. sulphuric acid	0.022	3.28	100	48.5	38.4	29.0	26.3	Quite clear after 6 hr.
40	30 g. ferric chloride	0.022	3.54	100	49.2	9.4	1.0	0.4	Quite clear after 3 hr.
40	30 g. ammonium acetate	0.022	3.65	100	45.5	36.0	30.1	28.4	Quite clear after 5 hr.
60	15 g. aluminum sulphate	0.011	4.35	100	48.3	33.5	13.4	8.6	Quite clear after 4 hr.
60	15 g. ammonium sulphate	0.011	3.78	100	37.2	25.4	24.2	23.2	Quite clear after 6 hr.
60	15 g. glue in solution	0.011	4.12	100	0.6	0.4	0.2	0.1	Clear after 1 hr.

Table II—Settlement of Slurry in Given Time With Various Reagents In 726-Gal. Washer Settling Tank

Coal Used Lb.	Quantity and Kind of Reagent Added to Water	Percentage Concentration of Reagent	Percentage Initial Concentration of Solids	Solid Content as Percentage of Original, Minutes from Start: 0	5	10	15	20	40	60	Water
400	None	.....	2.73	100	64.8	59.0	49.8	46.4	41.1	31.5	Not clear in 48 hr.
400	300 g. acetic acid	0.009	3.19	100	54.8	52.0	31.3	28.3	23.8	8.0	Quite clear after 8 hr.
400	300 g. lime	0.009	3.00	100	45.5	38.7	36.5	35.5	32.1	0.8	Quite clear after 6 hr.
400	300 g. sodium silicate	0.009	4.86	100	64.0	60.4	52.0	35.7	29.5	18.5	Quite clear after 24 hr.
400	300 g. calcium acetate	0.009	3.04	100	28.2	24.6	23.7	23.3	13.8	9.3	Quite clear after 10 hr.
400	65 g. glue	0.002	2.30	100	36.4	0.04	....	....	....	....	Clear after 2 hr.

There seems a likelihood that we, in America, are overlooking a great opportunity in failing to make more use of steel. When we do use it we make it unyielding, so that it breaks. The advantage of steel is that it can be made to yield without breaking not less, but more, than wood.

R Dawson Hall

On the ENGINEER'S BOOK SHELF

"The Principles of Coal Property Valuation," by A. W. Hesse, Coal Mining Engineer, Youngstown Sheet & Tube Co. John Wiley & Sons, Inc., New York City. 183 pp., 5x7½ in. Price, $3.

"Good wine needs no bush," and a book by A. W. Hesse no recommendation. Mr. Hesse has done his work well, covering almost every salient point in the estimation of properties, either in operation or in prospect of operation.

The reader will find information to aid him in the estimation of the value of the coal on a property, in the determining of its value for any one of several uses, and in making such an examination of the deeds and leases as will enable him to guard the operator against their many pitfalls. He will find references to depreciation and to the importance of those less obvious, but none the less potent, hereditable drawbacks in mine operation which have wrecked many good properties; namely, discontent of labor, lack of suitable water, and irregular car distribution.

Mr. Hesse discusses the cleaning of coal and quotes Forbes as saying that the sole advantage of dry cleaning is that it enables the consumer to avoid the expense of transporting and evaporating the moisture which is added in wet washing. In this judgment Forbes overlooks freezing in the car. But where this is a condition, the finer sizes can be dried without much expense.

Mr. Hesse deals briefly with taxes and insurance, but at great and justifiable length with sinking funds, appraisals, and interest. The guide he furnishes for making an appraisal is excellent. In general, if the book were duly read and pondered, the quality of engineers' reports should much improve.

Only in trifling matters would one suggest modification; such, for instance, as in the record of the essential qualifications of an examining engineer; some attention should have been given to his ability to recognize market values. The purpose of the author apparently is not to list all the qualifications but perhaps it is not well that he omitted the one in which most engineers are deficient: an understanding of markets. The reviewer recalls seeing a report with this vital feature entirely overlooked. It is needless to say it was not written by the author of the book under review.

Mr. Hesse speaks of the wants in the Upper Freeport, especially of a 40-acre plot in which the seam was missing. It was fortunate that it was only 40 acres; it might easily have been 400 or even 4,000 acres. The reviewer remembers an area where the coal was replaced by rock over an area nearer the larger figure than the smaller.

And, speaking about drilling, that should be done today, not alone to determine whether the coal is present but to ascertain the probable analysis of the coal, its coking quality, if coke is desired, and the character of the roof. The analysis, of course, is not correctly determinable from a drilling, but the outcome of the test will have some bearing, especially if it is found that the coal in the best part of the seam is high in sulphur or ash. R. DAWSON HALL.

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"American Industry and Commerce," by E. Dana Durand, Statistical Assistant to the Secretary of Commerce and former Director, U. S. Bureau of the Census. Ginn & Co., New York City. 637 pp., leather. Price, $4.

One of the most difficult types of writing is that of presenting dry statistics in such a way as to hold the interest of the average reader. Few writers ever attain this ability to make figures "live." In his treatise "American Industry and Commerce," Dr. E. Dana Durand, statistical assistant to the Secretary of Commerce and former Director of the U. S. Bureau of the Census, has attained an enviable position as an interpreter of data in the interest of the average reader. Few who take up this book will lay it down until several chapters have been covered, and then it will be laid aside only for a more convenient moment.

The author, drawing upon his long statistical and economic experience in American industry and commerce through his contact as a government official, presents a vivid picture of the development of American industry and commerce since the founding of the nation and especially during the present century. Special stress has been laid upon international comparisons, upon the interrelation of the various economic activities, and upon the general course of recent economic development. The earlier history of industry and commerce is traced only in broad outline, since various other works have covered that field. The trends since the beginning of the present century are discussed with greater fullness; they are the more significant because the forecast elements are largely of a continuing character, so that economic movements for some time to come are likely to be in the same direction.

The author has relied almost entirely upon authoritative statistical publications for his basic facts. Using these facts, Dr. Durand paints a continuing picture of the present riches of the country, the character and magnitude of its industries and commerce, and the history of its material development. He seeks to discuss the basic causes of American prosperity and progress, and finally undertakes to discuss the relation of the general economic status and trends of the country to the well-being of the masses of the population.

R. M. DAVIS.

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"Corporation Contribution to Organized Community Welfare Service." National Bureau of Economic Research, Inc., New York City. 347 pp., cloth. Price, $3.

This report is an analysis of the extent to which business corporations contributed to 129 community chests in 1929. Of the nearly sixty million dollars raised by these communities, 22 per cent was contributed by corporations. It was found that of the nearly thirteen million dollars contributed by corporations last year, 47.2 per cent came from corporations engaged in manufacturing. Retail and wholesale trade, including chain stores, contributed 22.4 per cent, followed by banking institutions with 10.7 per cent. Between 1920 and 1929 the amount contributed by corporations to community chests rose from $2,535,819 to $12,954,769.

There is a marked divergence in the per cent of total contributions received from corporations by different community chests, ranging all the way from a maximum of 50 per cent to a minimum of 3.7 per cent. A selected group of nationally known manufacturing corporations accounted for 2,255 of the nearly 34,000 contributions, one corporation contributing to 99 different community chests in 1929 and 5 contributing to more than 50 or more each.

With the exception of steam railroads, contributing 0.3 per cent, the mining and quarrying group was at the bottom of the list. In the study of 129 chests last year, the investigators found that 356 mining and quarrying corporations—covering both metallic and nonmetallic fields and minerals, but excluding petroleum interests also refining their product—had contributed $123,928, or approximately 1 per cent of the total. The low place in numbers and in money taken by this group is doubtless explained, says the volume, by the fact that few such corporations carry on their principal operations in urban communities. In only seven of the communities studied did the contributions from this group exceed 5 per cent. In Wilkes-Barre, Pa., the group contributed 27.4 per cent; in Springfield, Ill., 11.1; Salt Lake City, Utah, 11.4; and Washington, Pa., 6.8 per cent.

THE BOSSES TALK IT OVER

Dangerous Practices—

Should a Man's Family Be Informed?

"WHAT in the world did you do to Buck Evans? The old fellow sure seems to be on the outs with you," remarked Mac, encountering the super on the store steps.

"O, it was little to get excited over, and involved nothing personal. He's been getting mighty careless of late, and I told his wife about it. That's all."

Mac whistled. "All!" he exclaimed. "No wonder he's peeved. You can't treat a worker like a school kid and report him home for his faults."

"I can't, eh?" answered the super. "Well, that's exactly what I'm going to do every time a man fails to observe safety rules. I have an idea that one word from the wife or daughter will do more to bolster a man's safety thinking and acting than an hour's talking by us. Maybe I'm wrong; but the scheme is worth a trial."

WHAT DO YOU THINK?

1. Will the men resent this action?

2. Is Jim overstepping management's prerogative?

3. If not, should the report be verbal or written?

4. Can you suggest alternative action to accomplish the same object?

All superintendents, foremen, electrical and mechanical men are urged to discuss the questions on page 630. Acceptable letters will be paid for ▶▶▶▶

Should wages be paid by the day, by the ton, or by bonus? The super and Mac went into this question in September. How the readers of *Coal Age* would solve the problem is told in the letters following.

Bonus System Given Preference

THE only wage system that is fair to the men and the company is the bonus system. It gives the men the incentive to do their best, needs least supervision, and at the same time allows the older men to make a living commensurate with the amount of work they do. It stimulates the good man, shows up the lazy man and eventually leads to the elimination of the drones.

It may be argued that the tonnage rate does this, but anyone familiar with mining knows that this is not the case. The tonnage basis has led to a lot of the ills to which the mining industry at the present time is heir. Tonnage men have developed an independence that does not contribute to team work. They have worked when they pleased, as little as they pleased, and have come to think that as long as they are paid by the ton the boss has no right to inquire the reason for any delinquence. There is much talk about the six-hour working day at the present time. Contract workers in mining have had it a number of years. Thus far is the company's side.

The men also have a well founded grievance. It is true beyond controversy that the tonnage men in most mines have had to stay underground six hours and more to get the cars which they could load in three hours and which they would have gotten if they had been working daywork. It is not fair to the tonnage men that they should wait one, two, and three hours between cars. Unfortunately, many mine managers think that a surplus of tonnage men means greater efficiency. They forget that a greater open territory means more props, ties, and iron tied up and rotting; more brattices to build; more falls to clean; and more ventilation to supply.

Idle time waiting for cars allowed the men to congregate in breakthroughs and their mole-hill troubles grew into mountains of trouble by each repetition, until very often a stampede strike was the result. It was not the result of any great wrong but simply that the men had idle time to get together, air their grievances, and magnify their dissatisfaction. This idleness boosted the rate to a higher price per ton than was necessary, for if the tonnage men had been supplied with cars they could have earned more wages at the lower rate. These are just a few of the ills for which the tonnage system is responsible and which the day-wage bonus system will cure.

A straight day wage is neither fair nor satisfactory. Why should I cut 300 tons of coal in a shift when Bill gets by with 200 tons? Why should I pull 150 cars when Jack gets by with 85? That is the way the day men reason, and not without a lot of justification. The only way the boss has to get results in this system is by driving, and I know that this is unsatisfactory. There is no reason why a bonus system could not be worked out for crews or groups, except in union mines, where labor will not stand for anything that is not already in the contract. Bosses should share in the bonus for the same reasons as for the men. However, it should be understood that the conveyor bosses should not be allowed to juggle the main haulage to their own advantage. But this also could be worked out.

Vincennes, Ind. THOMAS JAMES.

Flat Rates Dull Initiative

FROM any discussion of the subject of wage payment should emanate some good ideas. Successful wage plans are worthy of more than passing consideration, for wages are the basis of all industrial harmony. We should make a summary or digest of the pertinent points, clip and file away the information, and thus be that much further prepared to submit some good ideas to our respective managements at the first opportunity.

There is a lot of merit in nearly all wage incentive plans, whether they be straight rate plans of so much per ton or payment by group. It may be a bonus on total performance based on a standard day's task, paying each worker for his share in excess of the standard, figured as so many per cent of his day-rate wage. Of course, there must be careful supervision to see that the poor workers of any group are either weeded out or made to step up their labor to that of the others, or at least to do their level best. This will prevent the lazy or indolent worker from profiting by the hard work of other members of the group and avert the possible loss of a bonus to good workers by the lagging of a few. The stimulus of a bonus permits the group to work advantageously and co-operatively with one another, provided the group leader is of the proper type.

Either group bonus or individual rate plans are better than plain day rates. The latter are one-sided, offer no inspiration to better effort, and allow loafing and limiting of output. There is in the make-up of many men the feeling that to "do just enough to get by will make more jobs." Flat rates dull initiative in all except the better trained worker. A decent day rate plus an incentive will develop interest in the work and, when carefully administered, will pay.

As to the bosses being included in any bonus plan, a great deal depends on the types, whether they are selfish or might neglect company interest in order to push up the group tonnage for the sake of what they will get as a bonus, and let important duties be neglected. Men reflect the attitude of their leaders to a great degree. If the boss is grouchy, careless, or discontented it will show up in the work of his men. Consequently, I have always felt that a boss should be rewarded in a more substantial way than dependence on a bonus or incentive depending on output. Bosses should be largely free from any worry as to their earnings.

Any wage system must, of course, be based on a careful study of the past years of operation, the present, and what is desired in the future. This necessitates frequent revisions to meet changing conditions. Efficient management goes far to establish confidence in the men, which is the cornerstone of industrial success.

CHARLES H. WILLEY.
Concord, N. H.

A Modified Bonus Plan Will Stimulate Endeavor

WE ALL NEED that something, so hard to define, which, added to the daily routine, makes one better fitted for one's work and adds inspiration and zest to the daily task. Everything worth while in life has been accomplished through this precious medium, though its form may vary somewhat. The thrill of a published letter causes thousands of readers to "vox pop" the editors' sanctums throughout the world; the spirit of adventure has sent intrepid souls to the remote corners of the world in spite of danger and difficulty; yet, the merry clink of extra coin is the lever that moves the world today as nothing else can. The average toiler's lot is, at best, a drab affair, and when the same daily round is repeated without variation week in, week out, there is ample provocation for unrest and dissatisfaction.

Of the three wage payment systems under discussion, a modified bonus sys-

The BOSSES Talk It Over . . .

tem is much to be preferred. In fact, either a day wage or a tonnage rate plus an added bonus for exceptional merit would yield returns beyond the rosiest expectations. For this bonus represents extra money, and, like stolen fruit, there's nothing sweeter under the sun.

A few years ago, prior to the introduction of conveyor loaders, I had the opportunity to observe the results obtained from the introduction of a modified bonus system. In this instance, high tonnage and high percentage of lump coal were the objects sought.

Before its inauguration, snubbing the coal above the cut to allow it to roll over was difficult to achieve, even with threats and stern measures, and pulverized slack was the order of the day. This trifling bonus, however, altered the picture completely, and it was no uncommon sight to witness the loader crawl out from under the cut only after the coal had been snubbed as far as the cutter bar had reached. The quantity of powder used for the shooting was judged with remarkable precision, even a fraction of a stick being added to or subtracted from the quantity of explosive allowed to bring the desired result.

Much of the discontent so evident since the introduction of the conveyor loaders would be immediately eliminated with the establishment of payment on a tonnage basis, the operators accepting a fair differential for the use and maintenance of the machinery. The timbering of the rooms and the preparation of the coal face for shooting represents a change in the routine and is a relief from the steady grind of shoveling coal. The quality of the coal would be much better, inasmuch as more care would be taken by each individual to assure the best possible results to expedite loading without difficulty for his own sake.

Where marketable lump coal is desired, the establishment of a bonus for each section for both wide and narrow work, based on the highest tonnage and the best quality of coal each month, would work wonders. Touch a man's pride and you awaken a frenzied zeal in him. ALEXANDER BENNETT.

Panama, Ill.

Flat Wages Cause Indifference In Conduct of Mine Labor

MINE work would be more economically done if more of it was paid for by contract and bonuses were applied to accomplishment over and above a fixed task. No miner will give the same efficiency when he is working for a flat wage as for contract or bonus payment. He knows that whether he works hard or takes things easy, he adds nothing to his pay. Consequently, he works only toward quitting time and pay day.

On the other hand, if his wages come by contract, he is encouraged to load a larger tonnage; and with a bonus system, he will redouble his efforts to bring the tonnage still higher. The system can be applied to all labor in and around the mines. Certainly, it is applicable to motormen, trip riders, and drivers. These men will work harder to get the cars to the miner and will see to it that he does not leave his working place until after he has cleaned up his cut. Pay the track men, timber men, and rock men so much per ton for the coal produced on their various sections and they will use more care in doing their jobs.

Foremen might be paid a bonus of 1c. for every ton of coal produced over the normal output. HOWARD LONG.

Heber, Calif.

Family Influence

Since real thinking and acting along safety lines are in part psychological and definitely influenced by family relations, it is suggested that perhaps much can be accomplished by attempts to reach the man through his home. Though this is not an untried idea, the plan might advantageously be given a broader trial. The problem for discussion in the November issue is devoted to this question. Whether or not you agree with the tenor of the proposal, send in your opinion. Do it today.

A Bonus Is Only a Bribe

MY YEARS of experience in supervising coal mining have led me to believe that the contract system is the only logical plan of payment for the loading of coal, either by man power or by machine. There will be no shirking, because the system requires steady working. The men will use more judgment in preparation for the getting out of a large tonnage than they will when working on a straight day rate.

Bonuses merely cause strife and dissatisfaction. Some crews will take advantage of others; a few will not take pains to clean the coal thoroughly; in the main, market requirements will be altogether forgotten in the rush for the bonus. What is more, machines will be neglected. I think a bonus is only a bribe. In no case should the bosses share in a bonus, for if they are of the right sort they will keep the company's interest at heart without any added incentive.

If Jim and Mac have money to spend for an increase in the tonnage loaded, they should give it directly to the loaders in increased wages. The higher the wage, the greater is the opportunity for the employment of good workers.

Glo, Ky. WALTER HORNSBY.

Men Accomplish Only That For Which They Are Paid

MEN working on conveyors will not do their best when paid a flat day rate. They will say: "What is the use? We get our pay anyway, whether we load 10 or 15 tons." When this attitude is dominant in the minds of the workingmen there is either something wrong with the system or with the individual, and either the system should be changed or new men employed.

Why the coal industry leans toward the flat day rate is a mystery, inasmuch as men will produce only that volume of work for which they are paid. Good workers are never satisfied with a flat wage, because they know they can make more by piece work without any greater effort on their part. They will make good conveyor attendants if you can satisfy them. However, they will not produce any greater tonnage on piece work than on a flat day wage basis, but they will remain satisfied, feeling that they are being paid for what they do. Nevertheless, the tonnage rate has its obvious faults. I am in favor of a tonnage rate plus a bonus for tonnage in excess of a standard amount. This will cause the miner to strive for the easy money. At the same time, management would profit by a lower operating cost. I am not in favor of the foreman receiving any part of the bonus, as it is directly the men who earn it and not the bosses. SAMUEL A. JONES.

Johnstown, Pa.

Compensation for Labor Needs Immediate Adjustment

IN THE case of pick-up type of loading machines, I can see no alternative for the flat day rate, at least for some time to come. Machines of the conveyor type, which merely assist loading manually, require utilization of some other method of remuneration. Otherwise, the full advantage of these mechanical contrivances will not be derived. The wide introduction of machines in mines has been accompanied by difficulties in the equitable settlement of reward for labor, which should not be neglected but immediately attacked and solved. Of all our present-day industrial problems employment and wages are the most serious. W. H. LUXTON.

Linton, Ind.

Flat Wage Will Never Succeed

I AGREE with Mac that a straight tonnage rate never has proved satisfactory, and never will. With a bonus payment plan established for loading, in general the men will become more interested in their work and do their best to beat out the other fellow. Yes, the bonus should be applied to the bosses. It will cause them to put on their studying caps and put more effort into their jobs. F. J. HALL.

Stickney, W. Va.

OPERATING IDEAS

From PRODUCTION, ELECTRICAL And MECHANICAL MEN

Management of mining properties which are pace-setters for the industry must be as alert in carrying efficiency down through every detail of day-to-day operations as in planning major developments. This alertness is illustrated in the many Operating Ideas which came under the eyes of editors of *Coal Age* in gathering data for the Tenth Annual Model Mining Number. This month, therefore, this department is given over to ideas in use at mines of the Consolidation Coal Co.

Water Is Taken Out Through Bottom of Deep Well

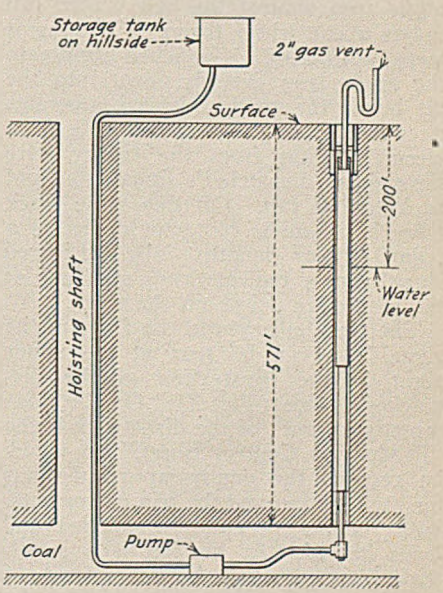
For low-cost, trouble-free operation the ordinary horizontal-shaft centrifugal pump is superior to a deep-well pump. By an unusual arrangement the town water supply well at Mine 261 of the Consolidation Coal Co., Caretta, W. Va., is pumped by a centrifugal unit and, moreover, is effectively sealed at the top against surface water.

The well was drilled on through the water-bearing strata and into a heading in the coal seam where the pump is located. Water is taken from the bottom of the well and is forced out through a pipe in the hoisting shaft leading to a high tank located on a hillside near the plant. Although the well is 571 ft. deep, the normal water level is but 200 ft. from the surface and, therefore, there is a pressure of 160 lb. per square inch on the pump suction when the pump is not running. The level drops somewhat when the pump is started, but the heads on each side of the pump are balanced to the extent that the unit works against a total head of only 120 lb. to force the water out through the shaft and into the high tank.

The pump is a 150-g.p.m. three-stage 1,800-r.p.m. 50-hp. unit and is located in the same room with a 900-g.p.m. unit which dewaters the mine.

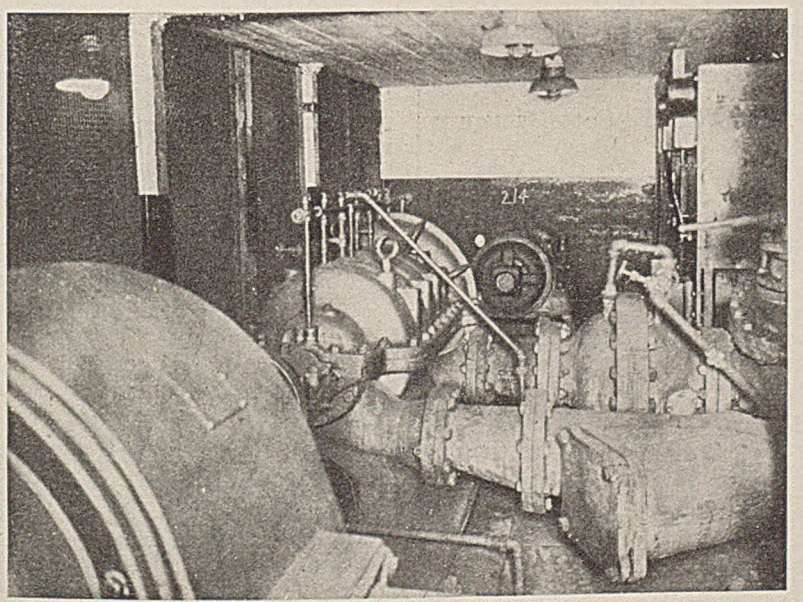
Referring to the accompanying drawings indicating details of the well, the following procedure was followed in the drilling and casing:

1. Drill 13-in. hole to rock and install 13-in. drive pipe to shut off surface water and prevent caving.
2. Complete drilling of 13-in. hole to depth of 75 ft. and place 10⅝-in. casing.
3. Cement outside of 10⅝-in. casing to the surface.
4. Drill 10-in. hole to depth of 310 ft. and install 310 ft. of 8¼-in. casing with loose joint just above bottom of 13-in. hole.
5. Bail, and test hole to determine how effectively water has been shut off. If flow is of any consequence, cement may be placed outside of the 8¼-in. casing to a depth not to exceed 10 ft.
6. After water has been closed off, drill 8-in. hole through No. 4 Pocahontas seam.
7. Install approximately 30 ft. of 6-in. water pipe in bottom of hole with proper fittings, same resting on base tee. Cement 6-in. pipe into hole.
8. Place 6⅝-in. casing in bottom 262 ft. of hole, stopping same just above bottom of 10-in. hole. This casing to protect hole from caving.
9. The 8¼-in. casing in water bearing strata is to be ripped by drill, allowing water to enter it.
10. Unscrew 8¼-in. casing at loose joint above bottom of 13-in. hole, and remove same.
11. Plug 10⅝-in. casing at top of 8¼-in. casing and cement to surface, a 2-in. pipe to extend from plug through cement for vent.



Schematic Diagram and Well Details

A Mine Pumping Station, but the Small Pump in the Background Handles Domestic Water From a Deep Well



On the bottom of the 6-in. tee at the base of the well is a blank flange which is removable to clean out sediment which may accumulate in the well.

Angle Iron Hinged to Rail Operates Car Position Contactor

In Mine 32 of the Consolidation Coal Co., Owings, W. Va., it is necessary for the dispatcher to know if a string of loads standing at either of two booster car-feeders on the main bottom is equal to or longer than the minimum length necessary to reach the main feeder. This information is communicated automatically to his office by four

Operating Ideas from PRODUCTION, ELECTRICAL *and* MECHANICAL MEN

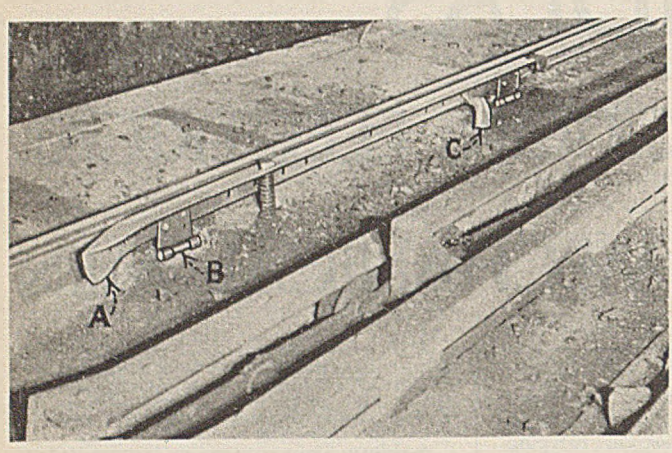


Fig. 1—Cars Standing on This Section of Track Light a Lamp in the Dispatcher's Office

Fig. 2—By Remote Indication the Dispatcher Is Apprised of the Presence and Critical Length of a Loaded Trip

lamps located on the wall above one corner of his desk.

Fig. 1 shows the lamp circuit contactor device at one of the boosters. *A* is a 2½x2½ angle iron 12 ft. long which is hinged to the base of the rail at *B* and at two other points. Springs hold the angle iron against the ball of the rail unless a car wheel flange is holding it away. An arm, *C*, attached rigidly to the angle iron extends down into the pit below the track, where it operates a contactor in the negative side of a circuit leading from the trolley wire through the dispatcher's signal lamp and back to the rail. On this same track there is a similar contactor device at a point 60 car lengths inby. Lighted signal lamps indicate cars standing at the respective points on the track.

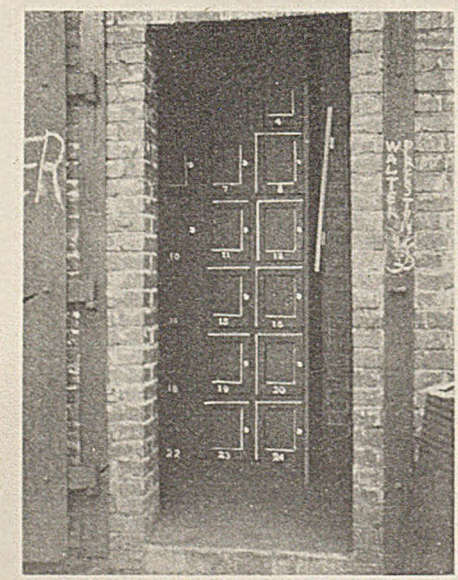
The four bullseyes in the front of the signal box can be seen at the upper right in the illustration of the dispatcher's office (Fig. 2). On the table directly in front of the dispatcher is the "Production Control Sheet," on which he records the empty-car requisitions for each section and the trip movements, with number of empties supplied and loads hauled. At his left is a small-scale map on which he keeps track of the three main-haulage locomotives by moving three pegs to holes indicating the main bottom and side tracks.

Magazine Removes Hazard in Handling Detonators

Blasting operations at Consolidation Coal Co. mines are carefully controlled in the interests of safety. To eliminate, as far as possible, hazards in the use and distribution of detonators, a special magazine for the storage of blasting caps and their issuance to shotfirers has been built. Its construction provides both for ease in apportioning the day's supply of detonators to each shotfirer and for the latter's convenience in obtaining them.

Interior arrangement of the magazine is similar to that of a postoffice. One side is given over to a tier of locked boxes for the reception of the shotfirers' pouches, in which the detonators are carried. The lockboxes are open at the back, where space is provided to allow access by the magazine attendant. A locked door prevents anyone but the attendant from going back of the lockboxes. The steel door to the magazine is locked at all times except when the attendant is in charge.

As each shotfirer comes out at the end of the shift, he goes to the magazine, unlocks his box and places his pouch inside. With the pouch he leaves a record of the number of detonators used and the places where they were used. Also he includes the brass checks which the miner is obliged to give him, one for each detonator used in shooting a place. The magazine attendant then goes over each pouch, counts the number of checks returned, compares them with the shotfirer's report, and counts the number of detonators returned unused. Discrepancies are the subject of an immediate investigation. After checking the pouches, the magazine attendant replenishes the supply of detonators, making a record of the number supplied and the total in each pouch, and returns the pouches to the lock boxes, ready for the next shift.



Construction of Magazine for Detonators

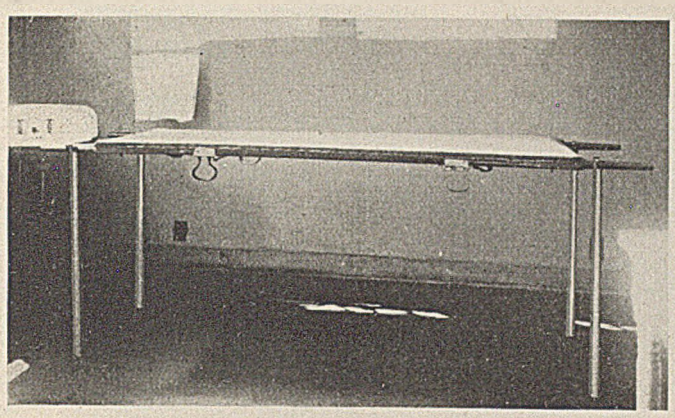
An Opportunity

When operating talent details its attention too closely to the routine of production, it becomes oblivious to large savings obtainable in maintenance, repair, and extension work. That the Consolidation Coal Co. has not overlooked an opportunity is attested by this display of operating ideas which have been released for your use. You, too, no doubt have ideas worthy of publication. Send them in. If accepted, they will be paid for at a minimum rate of $5 each.

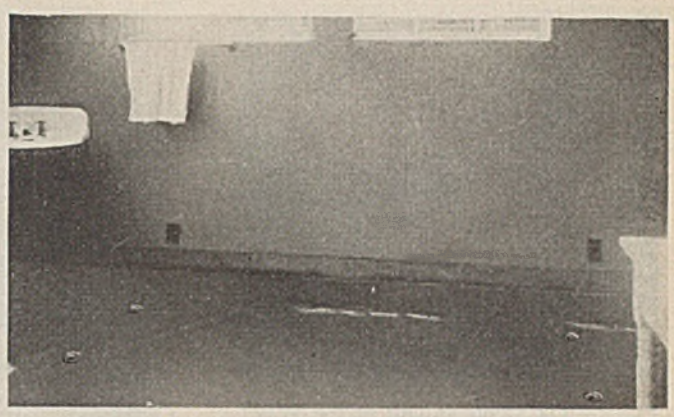
Stretcher Posts Removed While Not in Use

Equipment in the receiving room of a first-aid station should include a table or other arrangement on which to place a patient when it is inadvisable to remove him from the stretcher. This table should be out from the wall so that the doctor or attendant can work from either side or from either end of the stretcher. Because a table takes up considerable space, especially if left out

Operating Ideas from PRODUCTION, ELECTRICAL *and* MECHANICAL MEN



Stretcher on Firm Supports and Away From the Wall



Leaves the Center of the Room Clear When the Posts Are Put Away

from the wall, an arrangement of four removable posts is used in the new first-aid station of the Consolidation Coal Co. at Mine 120, Acosta, Pa.

The first-aid station is at the mine portal, which is about three-eighths of a mile from the doctor's office. If a man is injured in the mine, the doctor is called to meet the injured at the portal as he is brought out. Only first aid or emergency treatment is administered at this station.

Accompanying photographs show the receiving room with and without the stretcher support posts in use. These posts are of 1¼-in. hexagonal steel shaped with a forked socket at the top to receive the stretcher handle. The posts slip into steel sockets set flush with the surface of the concrete floor. These sockets also are hexagonal, in order to hold the posts without turning and thus prevent confusion or delay in placing the stretcher handles in the forks.

Ordinarily the posts are removed from the sockets and stored in a cupboard. This leaves the room free of the obstruction practically all of the time.

Wall Lockers Are Efficient As Oil Dispensers

Dispensing of oil to motormen, machine men, pumpers, and other workers has always been a vexing problem. Allowing the men to draw the oil themselves from barrels or storage containers generally is a decidedly poor practice, because of wastage and the tendency for the men to draw more oil than needed and to take the wrong grade of lubricant if that is available. There appears to be but one satisfactory method, and that is to have one person designated to fill the cans. But next comes the problem of dispensing the cans. Only in some instances would it be practicable to leave all of the cans accessible and trust each man to take his own.

At several mines of the Consolidation Coal Co. a lock-and-key self-dispenser has been built in the side of the oil house. The accompanying illustrations, showing inside and outside views, were made at Mine 120, Acosta, Pa., where the method was originated. Each motorman, machine man, and pumper is assigned a locker and given a key to its door, which is on the outside of the building. At the end of a shift the workman deposits his empty can in his locker and at the beginning of the next shift takes out the can, which in the meantime has been filled by the supply man or other person designated to do that work.

On the inside of the oil-house wall, the lockers do not have individual doors, but instead there are two long doors each consisting of four narrow wood strips. One, hinged at the top, covers the upper tier of lockers and another hinged at the bottom covers the lower tier. In Fig. 2, the upper door is closed and the bottom one is swung down to the open position. After the cans are filled these doors are closed and locked to prevent anyone from shifting cans from one locker to another.

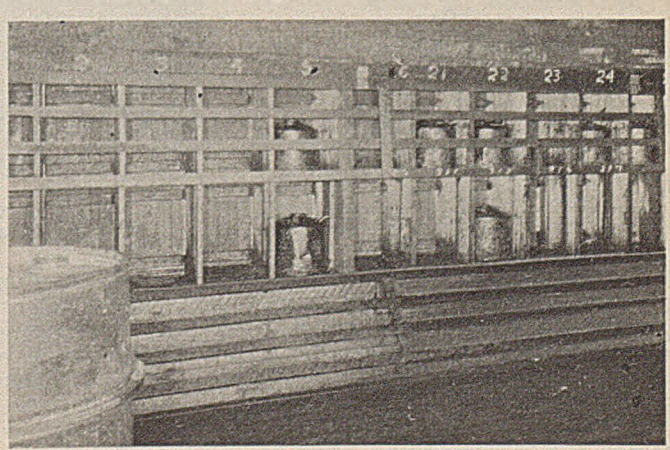
Automatic Water Quenching by Bit Sharpener Attachment

If machine bits are plunged into water at the heat at which they are usually removed from a roller sharpener, the cutting edges will be hardened satisfactorily, but the body will be made too hard if the bit is left in the water long enough to cool it completely. Dipping the bit into water for the proper length of time, then removing and placing it in a bit box, is done automatically by a home-made device attached to a roller sharpener.

This device consists of a metal chute or pan hinged near the center and floored with a grating of small rods. The rods of the longer section extend several inches beyond the hinge and work through the spaces between the rods of the other section. The shorter pan is pivoted near the end opposite the hinge and the extreme end is linked to the machine foot treadle. Fig. 1 shows how the hinged chute is held up out of the

No One to Argue With When Drawing Oil for the Shift

Lockers Open Through the Wall Into the Oil House



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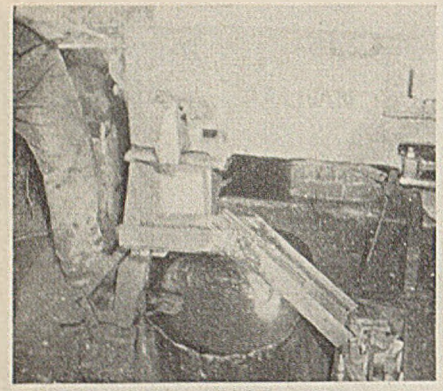


Fig. 1—The Chute Is Out of the Water While a Bit Is Being Rolled

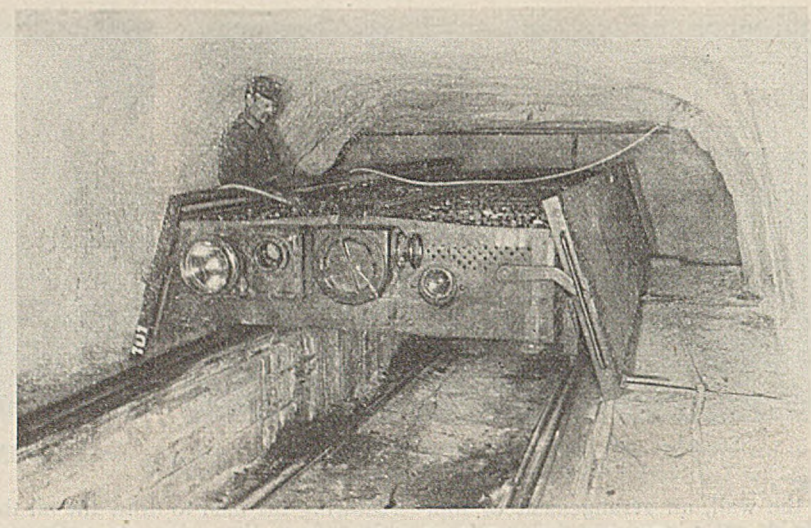
water while the machine operator has his foot on the treadle, which throws the machine in gear during rolling of the bit. As he takes the bit out and removes his foot from the treadle, the chute bows down at the center and into the water. He drops the hot bit into the chute, and it stays in the water while he takes the next bit from the furnace and places it in the machine. When he pushes the treadle to start the rolling of this bit, the preceding bit is automatically raised out of the water and dropped into the bit box.

Fig. 2—A Bit Is Cooling in the Water During the Few Seconds That Another Is Being Inserted Into the Machine

The time of submersion is made just right. The bit comes out of the water with the forward end of the body still showing signs of red heat but not so hot as to reheat the point enough to soften it.

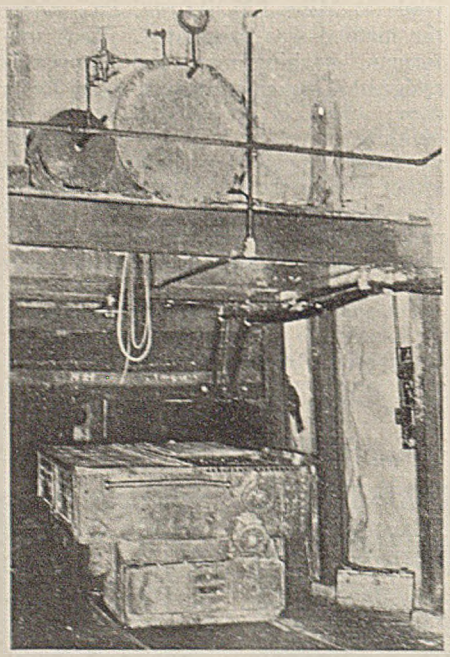
Air Pressure Forces Water To Charging Stalls

Proper maintenance of mining-equipment batteries is largely a matter of keeping the cells filled with pure distilled water. In order that this filling at the proper time will not be neglected, it is necessary to provide for a never-failing supply of the water and that the water be delivered to the barn or charging stalls. At the three battery-operated mines of the Consolidation Coal Co. the distilled water is piped down the shafts from steam stills on the surface, to storage tanks on the bottom, and thence it is piped to watering hose connections at the charging stalls.



Watering a Cutting Machine Power Tank Battery at the Charging Stall

At Mine 86, Carolina, W. Va., the 425-gal. storage tank is located near the roof in the motor barn. The elevation, however, is not sufficient to force the water to all of the charging stalls, so a check valve is placed in the pipe line leading down the shaft and compressed air is admitted through a reducing valve to keep the tank pressure at 12 to 15 lb. When the storage tank is nearly empty, the steam still on the surface is put into operation, and when the water in the shaft pipe line accumulates to a head of approximately 30 ft. on the check valve, the latter opens and admits water to the tank against the air pressure.



Air Receiver (Left) and Water Storage Tank in the Motor Barn in Mine 86

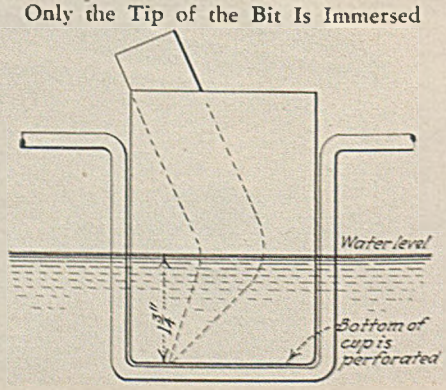
Equipment at No. 86 mine, consisting of six 117-cell 39-plate batteries, twenty-four 48-cell 39-plate batteries, and twelve 117-cell 27-plate batteries, requires a total of 40 gal. of water per day. The ½-in. pipe line down the shaft, the storage tank, and distributing pipes on the bottom are lead lined to prevent contaminating the distilled water with iron. Very small percentages of iron in the electrolyte of a lead battery will cause a continuous internal discharge of the cells.

Bits Hardened by Conveyor Passage Through Tank

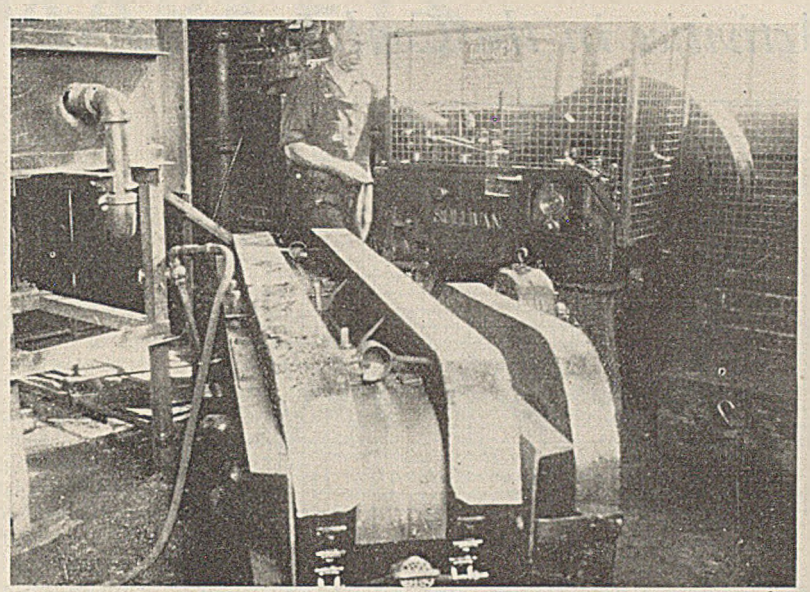
Quenching of bits as they are removed from the roller sharpener is done by a motor-driven machine at Mine 86 of the Consolidation Coal Co., Carolina, W. Va. This machine consists of a chain conveyor with perforated bit cups pivoted on cross flights. The top of the machine contains a water tank through which the bit cups travel. The speed at which the chain is operated and the length of the tank controls the time that the bit point is immersed in water.

The cups are spaced on the chain so that they appear around the sprocket in synchronism with the normal speed of removing the bits from the sharpening machine. As the operative removes each bit, he drops it point downward in a cup. The cup swings to horizontal position as it rounds the vertical curve before reaching the tank. Here it swings by gravity to vertical position, which puts the bottom about 1¾ in. below the surface of the water and hence immerses the bit point to that

Only the Tip of the Bit Is Immersed



Operating Ideas from PRODUCTION, ELECTRICAL *and* MECHANICAL MEN



Conveys the Bits Through Water and Drops Them in a Box

depth. As the bit cups encounter the end of the tank they must turn again to horizontal position. When passing around the other sprocket they turn upside down and discharge the bits into a box. The drive is by a fractional horsepower motor through a worm gear reducer.

In the accompanying illustration the quencher is the low-height machine in the foreground. The water tank is in the middle between the two long chain guards. A sketch shows the relative positions of the bit, cup, and water level as the cup passes along the length of the tank.

New Saw Guard Combines Safety and Facility

Safety standards of the Consolidation Coal Co. include regulations providing that all shop machinery must be properly guarded. Considerable thought was given to the design of a guard for a cut-off saw in the woodworking shop at Jenkins, Ky., to satisfy the demands of the safety inspector and yet which would not interfere with convenient operation of the tool.

The guard moves with the saw by reason of an arm, *A* in the photograph, which is connected to the saw-bearing mounting. The front of the guard is tapered so it will climb upon the piece being cut off, and the guard is counterweighted. *B* is a guide which supports the weight of the guard and counterweight. When the work rest happens to be set so close to the saw that a certain piece is too wide to lie between the rest and saw, the guard can be raised by pulling the lever at the front of the machine.

Construction of the guard and its operating mechanism is so neat that it appears as a factory job instead of one designed and made up in a mine repair shop.

Marking Car Clearance Line Forestalls Argument

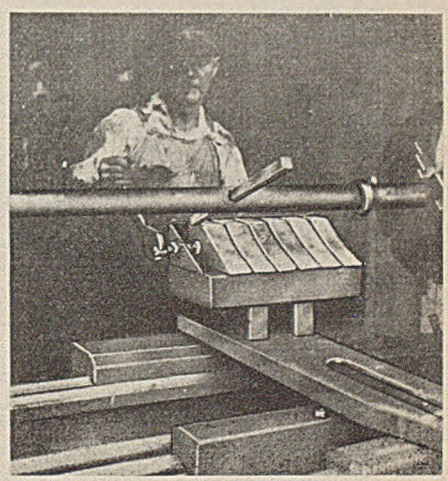
It is not efficient operation to leave a thing to the individual judgment of a foreman when standard can be set. An example is the leaving of proper clearance for the main road when letting cars stand temporarily on a turn-off track.

The picture shows the standard method of specifying clearances for all turn offs from empty and loaded tracks in the Van Lear mines of the Consolidation Coal Co. The end of a car must not extend beyond the sign "Clearance" hung on the roof above the turnout track. "I thought I left enough clearance," is no longer an excuse for a delay or an accident.

Car Stop Blocks Made Better And Cheaper in Lathe

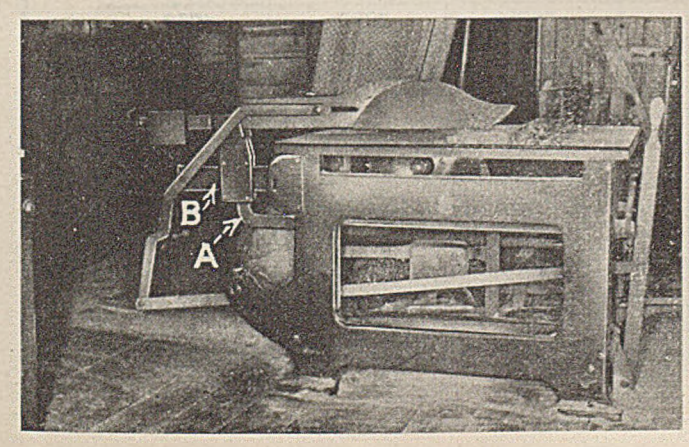
Wooden blocks for braking mine cars by placing on the track in front of the wheels do not hold well unless the face is cut to nearly the same radius as the wheel tread. Cutting a curved face by hand is expensive if care is taken to make it the true circle that it should be. In the Van Lear (Ky.) shop of the Consolidation Coal Co. the curved faces are cut in a lathe by means of a boring bar to hold the cutting and a screw clamp for holding the blocks attached to the carriage.

Six blocks are bored at a time after having been sawed to approximate shape. Each block is then equipped with a wooden pin projecting from the side to serve as a handle so that the user need not endanger his hand.

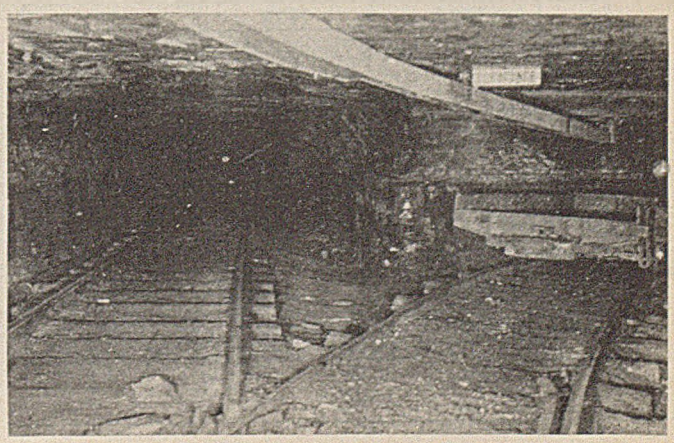


Clamping Six Blocks for Boring to True Circular Faces

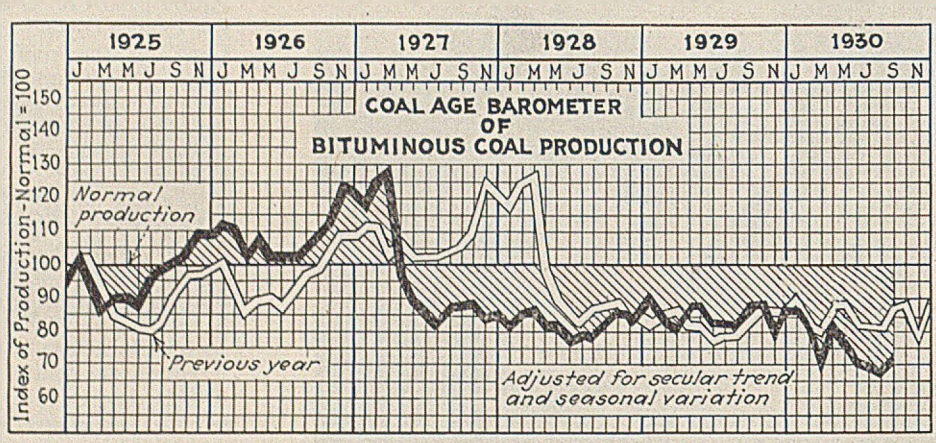
Guarding That Satisfies Every Requirement

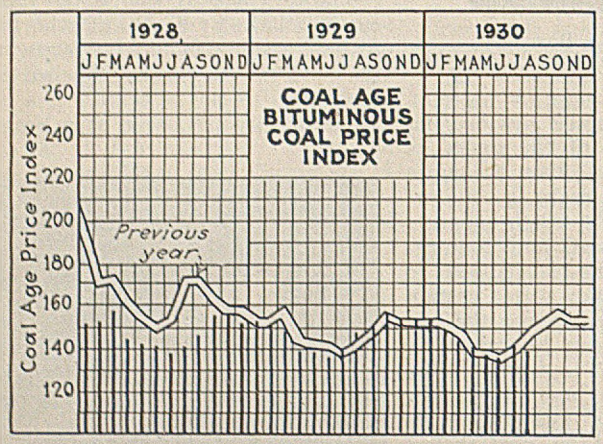


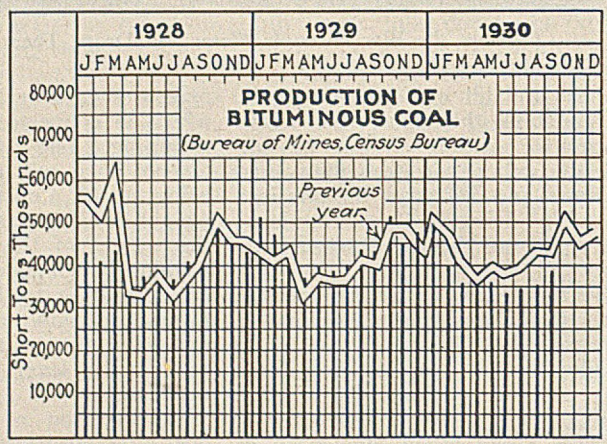
Car Is Properly "Parked" Beyond the Clearance Sign

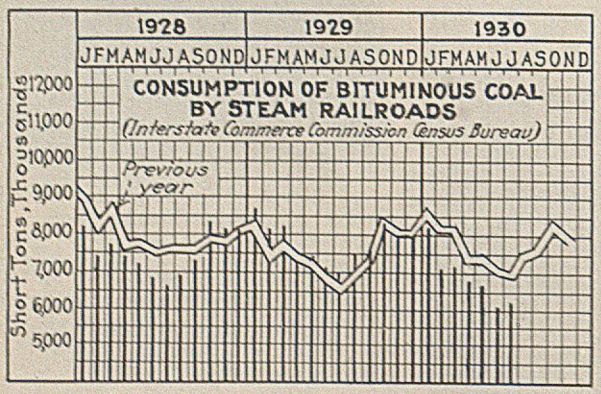


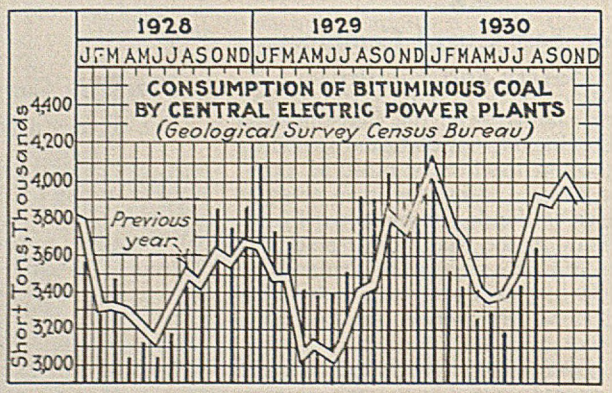
Indicators of Activities in the Coal Industry

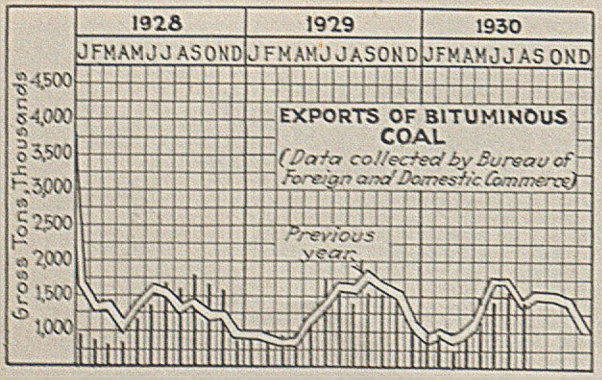


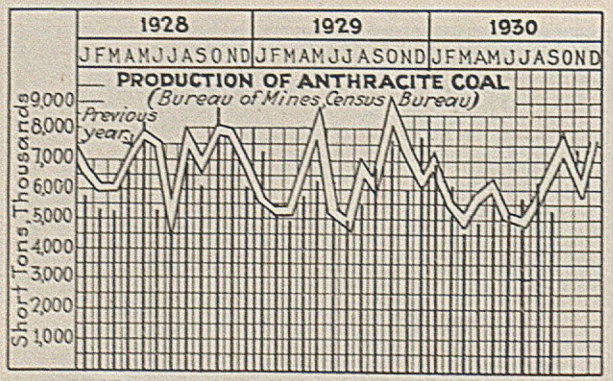












MARKETS in Review

SEPTEMBER proved to be a good month for domestic sizes in the coal markets of the country, though lump and egg figured principally in the increased demand. With the consequent increase in production of the larger sizes, coupled with the continued business depression, slack and screenings accumulation glutted the markets in many instances, with consequent demoralization of the prices on those sizes. In some cases, operators bent their efforts toward the disposal of their output as mine-run to avoid the slack problem incident to screening. "In-between" sizes, including mine-run, in most instances, changed little from the position they held in the preceding summer months.

September production of bituminous coal is estimated by the U. S. Bureau of Mines at 38,580,000 net tons, an increase of 2,919,000 tons over the production in August and a decrease of 6,430,000 tons from the output in September, 1929. Anthracite production is estimated at 5,327,000 net tons for September. This compares with 6,190,000 tons in August and 6,543,000 tons in September of last year.

Coal Age Index of spot bituminous prices (preliminary) was: 142, Sept. 6 and 13, and 147, Sept. 20 and 27. The corresponding weighted average prices were: $1.72, Sept. 6 and 13, and $1.78, Sept. 20 and 27. Revised Index figures for August were: 139, Aug. 2; 136, Aug. 9; and 140, Aug. 16, 23, and 30. Corresponding weighted average prices were: $1.68, Aug. 2; $1.65, Aug. 9; $1.69, Aug. 16; $1.70, Aug. 23; and $1.69, Aug. 30. The monthly Index for August was 139, as compared to the unrevised figure of 144½ for September.

Dumpings at the lower lake ports continued in slightly lower volume than for the corresponding period last year. Total dumpings to Sept. 30 were: cargo, 28,446,826 tons; fuel, 1,018,356 tons; and total, 29,465,182 tons. In the same period in 1929, dumpings were: cargo, 28,508,708 tons; fuel, 1,108,599 tons; total, 29,617,307 tons.

Unseasonable temperatures in the anthracite markets of the country in September in conjunction with heavy purchases by retail dealers in August resulted in a sharp curtailment in the demand for domestic sizes and was reflected in decrased running time at the mines. In the steam division, conditions were a bit better, but the continued business depression militated against any real activity. The chronic shortage in buckwheat became more pronounced in September as a result of the slacking-off in production.

MORE seasonable weather at the end of September contributed to an improvement in demand for domestic sizes from practically all the fields in the Chicago market. For the first time since February, buying was fairly general on lump and egg. Secondary grades shared for a few days in the advance in standard varieties. At the first of the month, there was a slight spurt in demand for the better grades under the stimulus of price advances. Southern Illinois and western Kentucky operators, as a result, were sold ahead on lump and egg. There was practically no demand for secondary grades, however.

Business on Eastern prepared sizes was brisk during the first half of the month, but the spot demand eased off in the last half. Smokeless operators, as a rule, had no spot coal, and lump, egg, and nut were in active demand on contracts as a result of the small quantity available because of curtailment in production forced by the stagnant demand for slack. Smokeless mine-run was only moderately active, with spot cars offered freely at $2, as compared to the contract price of $2.25. Mine-run contract takings improved at the last of the month, but the quantity of coal in the open market increased because of the tendency of operators to ship this grade rather than screen their product. Low-ash smokeless slack was held firm in spite of the light demand. Prices ranged $1@$1.50. Quotations on prepared sizes were: lump, $2.85@$3.15; egg, $3@$3.25; stove and nut, $2.75. For October shipment, standard smokeless operators announced advances as follows: lump, 40c.@60c.; and egg, 65c.

EASTERN high-volatile block was firm and tight as the month progressed, and producers advanced prices 25c. Ordinary block sold at $2.50, and even $2.75. Egg and slack were dull, as an accompaniment to reduced buying of Illinois, Indiana, and western Kentucky varieties. Eastern high-volatile slack sold from a low of 40c. to a high of $1.25. Western Kentucky screenings dropped to 5c. at the first of the month, and some was dumped for just the freight alone. Prices at the Indiana No. 5, central Illinois, and Belleville mines were demoralized by the screenings situation, and secondary grades sold on the basis of $2@$2.10, delivered in Chicago. Southern Illinois screenings were held fairly firmly at $1.20@$1.60. Some operators stored screenings, though most of the others managed to dispose of their product without jeopardizing the market.

Warm weather in the St. Louis market in September reacted on the demand

Current Quotations—Spot Prices, Anthracite—Gross Tons, F.O.B. Mines

		Week Ended							
		Sept. 6, 1930		Sept. 13, 1930		Sept. 20, 1930		Sept. 27, 1930	
	Market Quoted	Independent	Company	Independent	Company	Independent	Company	Independent	Company
Broken	New York	.....	$8.50	.....	$8.50	.....	$8.50	.....	$8.50
Broken	Philadelphia	.....	.....	.....	.....	.....	.....	.....	.....
Egg	New York	$8.65	8.65	$8.50@ 8.65	8.65	$8.50@ 8.65	8.65	$8.50@ 8.65	8.65
Egg	Philadelphia	8.65@ 8.90	8.65	8.65@ 8.90	8.65	8.65@ 8.90	8.65	8.65@ 8.90	8.65
Egg	Chicago*	7.59	7.59	7.59	7.59	7.59	7.59	7.59	7.59
Stove	New York	9.15	9.15	9.00@ 9.15	9.15	9.00@ 9.15	9.15	9.00@ 9.15	9.15
Stove	Philadelphia	9.15@ 9.40	9.15	9.15@ 9.40	9.15	9.15@ 9.40	9.15	9.15@ 9.40	9.15
Stove	Chicago*	8.04	8.04	8.04	8.04	8.04	8.04	8.04	8.04
Chestnut	New York	8.50@ 8.65	8.65	8.40@ 8.65	8.65	8.40@ 8.65	8.65	8.40@ 8.65	8.65
Chestnut	Philadelphia	8.65@ 8.90	8.65	8.65@ 8.90	8.65	8.65@ 8.90	8.65	8.65@ 8.90	8.65
Chestnut	Chicago*	7.59	7.59	7.59	7.59	7.59	7.59	7.59	7.59
Pea	New York	5.00	5.00	4.75@ 5.00	5.00	4.75@ 5.00	5.00	4.75@ 5.00	5.00
Pea	Philadelphia	5.00@ 5.25	5.00	5.00@ 5.25	5.00	5.00@ 5.25	5.00	5.00@ 5.25	5.00
Pea	Chicago*	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29
Buckwheat	New York	3.00@ 3.50	3.00†	3.00@ 3.50	3.00†	3.00@ 3.35	3.00†	3.00@ 3.35	3.00†
Buckwheat	Philadelphia	3.00@ 3.25	3.00	3.00@ 3.25	3.00	3.00@ 3.25	3.00	3.00@ 3.25	3.00
Rice	New York	1.70@ 2.00	2.00	1.70@ 2.00	2.00	1.70@ 2.00	2.00	1.70@ 2.00	2.00
Rice	Philadelphia	2.00@ 2.10	2.00	2.00@ 2.10	2.00	2.00@ 2.10	2.00	2.00@ 2.10	2.00
Barley	New York	1.25@ 1.50	1.50	1.25@ 1.50	1.50	1.15@ 1.40	1.50	1.15@ 1.40	1.50
Barley	Philadelphia	1.50@ 1.60	1.50	1.50@ 1.60	1.50	1.50@ 1.60	1.50	1.50@ 1.60	1.50

*Net tons f.o.b. mines. †Domestic buckwheat, $3.50 (D., L. & W.)

for domestic sizes, with the result that the trade found the month rather dull along that particular line. Large quantities of slack glutted the market, even though production of larger sizes was slow.

Dullness continued to pervade the market at the Head of the Lakes in September, though prices strengthened somewhat. Advances of 15c.@20c. were made on steam coals. Shipments from the docks continued at a decreased rate, with slight prospects of improvement in the near future. Dock operators made strenuous efforts to reduce stocks over the month, in response to advices from Eastern mining interests. Dock prices effective Sept. 16 were: Pocahontas egg, $8.25; lump and egg, $8; stove, $7.75; mine-run, $5; slack, $4.35; Kentucky block, $6.90; egg, $6.65; stove, $6.40; mine-run, $5; slack, $4.35; Youghiogheny block, $5.60; lump and egg, $5.35; stove, $5.10; mine-run, $5; slack, $4; splint block, $5.85; lump, $5.60; egg, $5.80; dock-run, $5; slack, $4.10; anthracite egg, $12.85; stove, $13.30; nut, $12.85; pea, $9.25; buckwheat, $7.45.

Production in the Southwest in September showed a gradual increase over the month with the opening of the Kansas deep-shaft mines. Prices on screenings, however, dropped 25c. to $1.50. Deep-shaft lump, on the other hand, advanced the same amount to $3.75, the maximum under the summer schedule. Shovel lump was unchanged at $3.

Little or no improvement was discernible in the Colorado market in September. The long drought, working a financial hardship on the trade, militated against any movement toward storage, and buying continued on the hand-to-mouth basis. Mines worked about two days a week. Ruling prices were: bituminous lump, $5.50; nut, $4.50; washed chestnut, $3.25; steam sizes, $1.25@$1.50; Crested Butte anthracite furnace, egg, and large base-burner, $9; small base-burner, $7; lignite lump, $4.25; Rock Springs-Kemmerer lump, $4@$4.25; nut, $3.75; grate, $4; steam sizes, $1.50.

Despite a fair demand for block coal, the Louisville trade went through a dreary September, with high temperatures the rule. Eastern Kentucky reported a fair demand for block, and prices were fairly firm at the following: Harlan and Elkhorn, $2.25@$2.50; Hazard, $2@$2.50, with little available under $2.25. Western Kentucky shared in the satisfactory business on the larger size, with prices at $2@$2.25. Lump, egg, and nut, however, were draggy in all fields. Screenings were abnormally weak in western Kentucky. Mines were overloaded with the size and some was shipped at 5@10c. However, the market stiffened up as the month wore on, and prices were 20@30c. at the last. Eastern Kentucky slack was fairly steady throughout the month at 50@75c.

Extremes in prices and demands made September a disconcerting month in Cincinnati. Domestic sizes were the leaders throughout the month, though each increase in production tended to depress the residuary grades. Smokeless coals were in the largest demand. The spot price at the end of the month was $4 for lump and egg, as compared to the late August circulars of $2.90@$3 for lump, and $3.25 for egg. Inability to move the "in-between" sizes, which resulted in a curtailment in production, was responsible for the upward move in lump and egg. Stove quotations advanced concurrently with the increases in the prices on the larger sizes, and good mine-run sold readily at the contract price of $2.25. Most of the latter went to retailers for rescreening. Quality slack on contract did not buge from the $1.25@$1.35 price, though off-grade varieties dropped back at one time to 75c., but later rallied to $1.

Current Quotations—Spot Prices, Bituminous Coal—Net Tons, F.O.B. Mines

LOW-VOLATILE, EASTERN	Market Quoted	Week Ended Sept. 6, 1930	Sept. 13, 1930	Sept. 21, 1930	Sept. 27, 1930
Smokeless lump	Chicago	$3.00@$3.50	$3.75@$4.00	$3.75@$4.00	$3.50@$3.75
Smokeless egg	Chicago	3.25@ 4.00	3.75@ 4.00	3.75@ 4.00	3.75@ 3.90
Smokeless stove	Chicago	2.50@ 3.00	2.75@ 3.00	2.75@ 3.00	3.50
Smokeless nut	Chicago	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50	3.25
Smokeless mine-run	Chicago	1.75@ 2.00	1.75@ 2.25	1.75@ 2.25	1.75@ 2.25
Smokeless slack	Chicago	.70@ 1.25	.50@ 1.50	.50@ 1.50	.50@ 1.50
Smokeless lump	Cincinnati	3.00@ 3.50	3.00@ 3.75	3.00@ 3.75	3.00@ 4.00
Smokeless egg	Cincinnati	3.25@ 3.50	3.00@ 3.75	3.25@ 4.00	3.25@ 4.00
Smokeless stove	Cincinnati	2.50@ 2.75	2.50@ 3.00	2.50@ 3.25	2.50@ 3.25
Smokeless nut	Cincinnati	2.00@ 2.10	2.00@ 2.10	2.00@ 2.25	2.00@ 2.10
Smokeless mine-run	Cincinnati	1.75@ 2.25	1.85@ 2.25	1.75@ 2.25	1.75@ 2.25
Smokeless slack	Cincinnati	.75@ 1.35	1.00@ 1.35	1.00@ 1.35	1.00@ 1.35
*Smokeless nut-and-slack	Boston	3.85@ 4.00	3.95@ 4.10	4.10@ 4.20	4.10@ 4.25
*Smokeless mine-run	Boston	3.25@ 3.30	3.35@ 3.40	3.50@ 3.65	3.50@ 3.65
Clearfield, mine-run	Boston	1.45@ 1.65	1.45@ 1.65	1.50@ 1.75	1.50@ 1.75
Clearfield mine-run	New York	1.75@ 2.00	1.75@ 2.00	1.75@ 2.00	1.75@ 2.00
Cambria mine-run	Boston	1.65@ 1.90	1.65@ 1.90	1.70@ 1.95	1.70@ 1.95
Somerset mine-run	Boston	1.55@ 1.75	1.55@ 1.75	1.60@ 1.80	1.60@ 1.80
Pool 1 (Navy Standard)	New York	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50
Pool 1 (Navy Standard)	Philadelphia	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50
Pool 9 (Super low-vol.)	New York	1.85@ 2.10	1.85@ 2.10	1.85@ 2.10	1.75@ 2.00
Pool 9 (Super low-vol.)	Philadelphia	1.80@ 2.10	1.80@ 2.10	1.80@ 2.10	1.80@ 2.10
Pool 10 (h. gr. low-vol.)	New York	1.65@ 1.90	1.65@ 1.90	1.65@ 1.90	1.60@ 1.75
Pool 10 (h. gr. low-vol.)	Philadelphia	1.70@ 2.00	1.70@ 2.00	1.70@ 2.00	1.70@ 2.00
Pool 11 (low-vol.)	New York	1.50@ 1.75	1.50@ 1.75	1.50@ 1.75	1.50@ 1.75
Pool 11 (low-vol.)	Philadelphia	1.45@ 1.65	1.45@ 1.65	1.45@ 1.65	1.45@ 1.65
HIGH-VOLATILE, EASTERN					
Pool 54-64 (gas and st.)	New York	$1.00@$1.20	$1.00@$1.20	$1.00@$1.20	$1.00@$1.20
Pool 54-64 (gas and st.)	Philadelphia	1.10@ 1.30	1.10@ 1.30	1.10@ 1.30	1.10@ 1.30
Pittsburgh sc'd gas	Pittsburgh	1.70@ 1.80	1.70@ 1.80	1.70@ 1.80	1.70@ 1.80
Pittsburgh gas mine-run	Pittsburgh	1.50@ 1.60	1.50@ 1.60	1.50@ 1.60	1.50@ 1.60
Pittsburgh mine-run	Pittsburgh	1.30@ 1.60	1.30@ 1.60	1.30@ 1.60	1.30@ 1.60
Pittsburgh slack	Pittsburgh	.90@ 1.10	.90@ 1.10	.90@ 1.00	.90@ 1.00
Connellsville coking coal	Pittsburgh	1.40@ 1.75	1.40@ 1.75	1.40@ 1.75	1.40@ 1.75
Westmoreland lump	Philadelphia	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50
Westmoreland egg	Philadelphia	1.75@ 1.85	1.75@ 1.85	1.75@ 1.85	1.75@ 1.85
Westmoreland ¾-in. lump	Philadelphia	1.80@ 1.90	1.80@ 1.90	1.80@ 1.90	1.80@ 1.90
Westmoreland mine-run	Philadelphia	1.65@ 1.75	1.65@ 1.75	1.65@ 1.75	1.65@ 1.75
Westmoreland slack	Philadelphia	1.05@ 1.25	1.05@ 1.25	1.05@ 1.25	1.05@ 1.25
Fairmont lump	Fairmont	1.40@ 1.90	1.50@ 2.00	1.55@ 2.00	1.65@ 2.00
Fairmont ¾-in. lump	Fairmont	1.25@ 1.50	1.25@ 1.50	1.25@ 1.50	1.30@ 1.60
Fairmont mine-run	Fairmont	1.15@ 1.35	1.05@ 1.30	1.00@ 1.25	1.00@ 1.25
Fairmont slack	Fairmont	.75@ .90	.65@ .90	.60@ .80	65
Kanawha lump	Cincinnati	1.75@ 2.75	1.75@ 2.75	1.75@ 2.75	1.75@ 2.75
Kanawha egg	Cincinnati	1.25@ 1.60	1.30@ 1.60	1.35@ 1.60	1.30@ 1.65
Kanawha nut-and-slack	Cincinnati	.75@ 1.00	.75@ 1.00	.65@ 1.00	.65@ 1.00
Kanawha mine-run (gas)	Cincinnati	1.35@ 1.50	1.35@ 1.60	1.35@ 1.60	1.35@ 1.60
Kanawha mine-run (st.)	Cincinnati	1.10@ 1.35	1.10@ 1.35	1.10@ 1.35	1.10@ 1.35
Williamson (W. Va.) lump	Cincinnati	1.75@ 2.25	1.75@ 2.25	1.75@ 2.25	1.75@ 2.25
Williamson (W. Va.) egg	Cincinnati	1.25@ 1.60	1.25@ 1.60	1.30@ 1.60	1.30@ 1.60
Williamson (W. Va.) nut-and-slack	Cincinnati	.75@ 1.00	.75@ 1.00	.65@ 1.00	.60@ .75
Williamson (W. Va.) mine-run (gas)	Cincinnati	1.40@ 1.60	1.40@ 1.60	1.35@ 1.60	1.35@ 1.60
Williamson (W. Va.) mine-run (st.)	Cincinnati	1.10@ 1.35	1.10@ 1.35	1.10@ 1.35	1.10@ 1.35
Logan (W. Va.) lump	Cincinnati	1.65@ 2.25	1.70@ 2.25	1.75@ 2.25	1.75@ 2.25
Logan (W. Va.) egg	Cincinnati	1.25@ 1.60	1.25@ 1.60	1.30@ 1.60	1.25@ 1.60
Logan (W. Va.) nut-and-slack	Cincinnati	.75@ 1.00	.75@ 1.00	.50@ 1.00	.50@ .75
Logan (W. Va.) mine-run	Cincinnati	1.10@ 1.35	1.10@ 1.35	1.10@ 1.40	1.10@ 1.40
Logan (W. Va.) slack	Cincinnati	.50@ .75	.50@ .75	.50@ .75	.40@ .75
Hocking (Ohio) lump	Columbus	1.90@ 2.00	1.90@ 2.00	1.90@ 2.00	1.90@ 2.00
Hocking (Ohio) nut-and-slack	Columbus	.80@ .95	.75@ .90	.80@ .95	.75@ .85
Hocking (Ohio) mine-run	Columbus	1.40@ 1.65	1.40@ 1.65	1.40@ 1.65	1.40@ 1.65

*Gross tons, f.o.b. vessels, Hampton Roads.

HIGH-VOLATILE coals behaved the same as the smokeless grades during the month, though the same control of production as of smokeless was not displayed. Quality blocks and lumps sold up to $3@$3.25 from a low of $1.65, but egg was notably neglected and some of this size in distress went at ridiculous figures. With every increase in production of the larger sizes, more of the smaller was thrown on the market, with consequent demoralization of the prices. In the scramble, slack as well as nut felt the force of the slide. Some effort was made to interest dealers in mine-run, with the hope of stirring up enough interest in the size to save the smaller stuff from sacrifice, but the response to the movement was slight.

Domestic sizes showed strength in the Columbus market in June, with better grades of splints and smokeless coals leading in favor. Some of the ordinary grades of splints, as well as Kentucky block and Ohio varieties, were in slightly better demand than in the preceding month. Slight advances were made in quotations on high-grade high-volatiles and prices on smokeless lump and egg were increased to $3.75@$4. Increased production of domestic sizes, however, depressed the screenings market, and prices slumped at the end of the month.

Aside from the domestic market, there was little change in the Pittsburgh situation in September. Industrial consumption increased slightly, but was not reflected in any increase in buying. Railroad demand continued at the same rate as in earlier months. Though the sea-

sonal fall pick-up in domestic sales occurred in September, it did not gain the same momentum as in other years, largely because of warm weather. Domestic quotations were low at $2@$2.25. With the increase in production at the first of the month, slack slumped to 60c., though it later rallied to 80c. Quotations on industrial lump were unchanged.

September brought little cheer to the northern West Virginia market. With the exception of a slight increase in the number of contracts signed, little business was done in the first half. The close of the month, however, saw some improvement in domestic shipments and a stiffening in quotations as a result of cooler weather. Slack, on the other hand, continued to suffer.

A distinct improvement in the demand for domestic lump featured the central Pennsylvania market in September. Concurrently, there was an increase in the call for railroad fuel. Both movements culminated in a marked strengthening in the price level. Ruling quotations at the end of the month were: Pool 1, $2.25@$2.50; Pool 71, $2.10@$2.75; Pool 9, $1.85@$2.10; Pool 10, $1.60@$1.75; Pools 11 and 18, $1.50@$1.80.

IN New England, the steam coal market improved appreciably in September. Accumulations at the Virginia terminals were more nearly in line with requirements and there was less inclination to force coal on unwilling buyers. Prices were on a more favorable basis, quotations ranging $4@$4.10 on No. 1, Navy Standard smokeless mine-run and $3.50@$3.65 for stoker coal, f.o.b. vessels, Hampton Roads. On cars at Boston for inland delivery, mine-run was quoted at $5.35@$5.45, though a considerable tonnage of less favorably known varieties was offered at $5. Nut-and-slack commanded $4.75@$4.90. Demand for all-rail coals from Pennsylvania was light. Though there was some improvement in contract takings, the volume remained small.

Quite a noticeable improvement was discernible in the Birmingham market in September, though demand never went beyond the semi-active stage. The lagging call for screenings delayed the movement of domestic coal in some cases and forced operators to stock the surplus. Quotations on Cahaba coals advanced Oct. 1. Ruling prices for October are: Cahaba lump, $4.25@$4.75; nut, $3@$3.50; Black Creek lump, $4.50@$4.75; nut, $3.50; Corona lump and egg, $3.25; nut, $2.75; Aldrich lump and egg, $5.75; nut, $3.50; Dogwood lump, $5.50; Straven lump, $4.75; nut, $3.25; Carbon Hill lump and egg, $2.50; nut, $2@$2.50; Big Seam lump and egg, $2.25; nut, $2. Steam sizes continued to struggle with poor market conditions. Mine prices changed but little, though in some cases screenings were sacrificed.

The New York market was only slightly more active in September than in August, as the seasonal upturn was less pronounced than usual, due to business depression and high temperatures. Industrial consumption continued on a hand-to-mouth basis, with only a little tonnage going to storage. Occasional orders to increase contract shipments were received and some business originated with manufacturers who use coal for heating. Although retail dealers bought a little more tonnage of screened coal and mine-run, this business was restricted by high temperatures. Mine-run prices were unchanged. Domestic lump was firm, and slack tended to sag.

Though there was a slow increase in demand over the month of September in the Philadelphia market, it had little effect on the market. Some buying for storage was evident, and retailers came into the market for small tonnages. There was little change in the tidewater situation, with bunkering the chief activity.

In the New York anthracite market, retail dealers sharply curtailed their buying of domestic sizes in the first half of September, as the result of heavy takings in August. But by the middle of the month, stocks had been reduced to the point where orders again began to flow in, though the demand did not become really active. Mild weather curtailed household buying, and made it possible for dealers to maintain stocks without calling on the mines for heavy shipments. All sizes were plentiful except buckwheat, in which a chronic shortage exists. Stove coal was in best demand, with egg and pea following.

September, with its high temperatures, was a disappointing month to the Philadelphia anthracite trade. Domestic business was almost non-existent, though steam coals moved fairly well. There was at times a slight shortage of stove coal, despite curtailed production. Pea was in good supply, while a continual surplus existed in chestnut. Some operators notified the trade that they would not be able to produce a full supply of buckwheat in the coming season, as orders were already in excess of the projected supply.

Current Quotations—Spot Prices, Bituminous Coal—Net Tons, F.O.B. Mines

	Market	Week Ended			
MIDDLE WEST	Quoted	Sept. 6, 1930	Sept. 13, 1930	Sept. 20, 1930	Sept. 27, 1930
Franklin (Ill.) lump	Chicago	$3.25	$3.25	$3.25	$3.25
Franklin (Ill.) egg	Chicago	2.75@ 3.00	2.75@ 3.00	2.75@ 3.00	2.75@ 3.00
Franklin (Ill.) mine-run	Chicago	2.15	2.15	2.15	2.15
Franklin (Ill.) screenings	Chicago	1.20@ 1.60	1.20@ 1.60	1.20@ 1.60	1.20@ 1.60
Central Ill. lump	Chicago	2.40@ 2.65	2.40@ 2.65	2.40@ 2.65	2.40@ 2.65
Central Ill. egg	Chicago	1.85@ 2.40	1.85@ 2.40	1.85@ 2.40	1.85@ 2.40
Central Ill. mine-run	Chicago	1.70	1.70	1.70	1.70
Central Ill. screenings	Chicago	.75@ 1.10	.75@ 1.00	.75@ 1.00	.75@ 1.00
Ind. 4th Vein lump	Chicago	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50	2.50@ 2.75
Ind. 4th Vein egg	Chicago	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50
Ind. 4th Vein mine-run	Chicago	1.65@ 1.90	1.65@ 1.90	1.65@ 1.90	1.65@ 1.90
Ind. 4th Vein screenings	Chicago	.90@ 1.40	.90@ 1.40	.90@ 1.40	.90@ 1.40
Ind. 5th Vein lump	Chicago	1.75@ 2.25	1.75@ 2.25	1.75@ 2.25	2.00@ 2.50
Ind. 5th Vein egg	Chicago	1.75@ 2.00	1.75@ 2.00	1.75@ 2.00	1.75@ 2.00
Ind. 5th Vein mine-run	Chicago	1.50@ 1.60	1.50@ 1.60	1.50@ 1.60	1.50@ 1.60
Ind. 5th Vein screenings	Chicago	.70@ 1.10	.70@ 1.10	.70@ 1.10	.70@ 1.10
Mt. Olive (Ill.) lump	St. Louis	2.00@ 2.50	2.00@ 2.50	2.00@ 2.50	2.00@ 2.50
Mt. Olive (Ill.) egg	St. Louis	1.85@ 2.25	1.85@ 2.25	1.85@ 2.25	1.85@ 2.25
Mt. Olive (Ill.) mine-run	St. Louis	1.65	1.65	1.65	1.65
Mt. Olive (Ill.) screenings	St. Louis	.75@ 1.00	.75@ 1.00	.75@ 1.00	.50@ .75
Standard (Ill.) lump	St. Louis	1.90@ 2.25	1.90@ 2.25	1.90@ 2.25	1.90@ 2.25
Standard (Ill.) egg	St. Louis	1.75@ 2.10	1.75@ 2.10	1.75@ 2.10	1.75@ 2.10
Standard (Ill.) mine-run	St. Louis	1.50	1.50	1.50	1.50
Standard (Ill.) screenings	St. Louis	.50@ .75	.50@ .75	.50@ .75	.35@ .50
West Ky. lump	Louisville	1.35@ 2.00	1.50@ 2.00	1.85@ 2.25	1.75@ 2.25
West Ky. egg	Louisville	1.35@ 1.50	1.50@ 1.75	1.75@ 2.00	1.75@ 2.00
West Ky. mine-run	Louisville	.85@ 1.25	.85@ 1.25	.85@ 1.25	.85@ 1.25
West Ky. slack	Louisville	.35@ .60	.05@ .60	.20@ .40	.25@ .50
West Ky. lump	Chicago	1.50@ 2.00	2.00@ 2.25	2.00@ 2.25	2.25
West Ky. egg	Chicago	1.50@ 1.75	1.85@ 2.00	1.85@ 2.00	2.00
West Ky. slack	Chicago	.25@ .50	.20@ .40	.30@ .40	.30@ .40
SOUTH AND SOUTHWEST					
Big Seam lump	Birmingham	$2.25	$2.25	$2.25	$2.25
Big Seam mine-run	Birmingham	1.60@ 1.75	1.60@ 1.75	1.60@ 1.75	1.60@ 1.75
Harlan (Ky.) block	Chicago	2.00@ 2.50	2.00@ 2.50	2.25@ 2.75	2.50@ 2.75
Harlan (Ky.) egg	Chicago	1.50@ 1.75	1.50@ 1.75	1.50@ 1.85	1.50@ 1.85
Harlan (Ky.) slack	Chicago	.90@ 1.00	.50@ .90	.50@ .90	.50@ .90
Harlan (Ky.) block	Louisville	2.25@ 2.50	2.00@ 2.30	2.00@ 2.50	2.25@ 2.50
Harlan (Ky.) egg	Louisville	1.50@ 1.75	1.35@ 1.80	1.50@ 1.75	1.60@ 1.75
Harlan (Ky.) nut-and-slack	Louisville	.75@ 1.00	.50@ .75	.75@ .90	.60@ .75
Harlan (Ky.) mine-run	Louisville	1.40@ 1.60	1.40@ 1.60	1.40@ 1.75	1.40@ 1.65
Harlan (Ky.) block	Cincinnati	1.85@ 2.75	1.65@ 2.75	1.90@ 2.75	2.00@ 3.00
Harlan (Ky.) egg	Cincinnati	1.35@ 1.65	1.35@ 1.60	1.35@ 1.60	1.35@ 1.75
Harlan (Ky.) nut-and-slack	Cincinnati	.75@ 1.10	.75@ 1.00	.60@ 1.00	.60@ .75
Harlan (Ky.) mine-run	Cincinnati	1.25@ 1.60	1.25@ 1.60	1.25@ 1.65	1.25@ 1.65
Hazard (Ky.) block	Chicago	1.75@ 2.25	2.00@ 2.50	2.25@ 2.75	2.50@ 2.75
Hazard (Ky.) egg	Chicago	1.30@ 1.75	1.30@ 1.75	1.50@ 1.85	1.50@ 1.85
Hazard (Ky.) slack	Chicago	.75@ .90	.50@ .90	.50@ .90	.50@ .90
Hazard (Ky.) block	Louisville	2.00@ 2.25	2.00@ 2.25	2.00@ 2.25	2.00@ 2.50
Hazard (Ky.) egg	Louisville	1.35@ 1.60	1.40@ 1.65	1.30@ 1.75	1.45@ 1.60
Hazard (Ky.) nut-and-slack	Louisville	.50@ .75	.40@ .75	.50@ .90	.50@ .75
Hazard (Ky.) mine-run	Louisville	1.25@ 1.50	1.25@ 1.50	1.25@ 1.50	1.25@ 1.50
Hazard (Ky.) block	Cincinnati	1.75@ 2.00	1.75@ 2.25	1.75@ 2.25	1.75@ 2.25
Hazard (Ky.) egg	Cincinnati	1.25@ 1.65	1.25@ 1.65	1.25@ 1.65	1.25@ 1.65
Hazard (Ky.) nut-and-slack	Cincinnati	.75@ 1.00	.75@ 1.00	.60@ .75	.60@ .75
Hazard (Ky.) mine-run	Cincinnati	1.10@ 1.35	1.10@ 1.35	1.10@ 1.40	1.10@ 1.40
Elkhorn (Ky.) block	Chicago	2.00@ 2.50	2.25@ 2.50	2.25@ 2.50	2.25@ 2.50
Elkhorn (Ky.) egg	Chicago	1.60@ 2.00	1.75@ 2.00	1.75@ 2.00	1.75@ 2.00
Elkhorn (Ky.) slack	Chicago	1.00@ 1.25	.75@ 1.00	.75@ 1.00	.85@ 1.25
Elkhorn (Ky.) block	Louisville	1.75@ 2.25	2.00@ 2.50	2.25@ 2.50	2.25@ 2.50
Elkhorn (Ky.) egg	Louisville	1.50@ 1.75	1.50@ 1.75	1.75@ 2.00	1.75@ 2.00
Elkhorn (Ky.) nut-and-slack	Louisville	.75@ 1.00	.50@ .75	.50@ .75	.50@ .75
Elkhorn (Ky.) mine-run	Louisville	1.50	1.40@ 1.65	1.40@ 1.75	1.40@ 1.75
Elkhorn (Ky.) block	Cincinnati	1.75@ 3.25	1.75@ 3.25	1.75@ 3.25	1.75@ 3.25
Elkhorn (Ky.) egg	Cincinnati	1.40@ 2.00	1.40@ 2.00	1.35@ 2.00	1.35@ 2.00
Elkhorn (Ky.) nut-and-slack	Cincinnati	.75@ 1.00	.75@ 1.00	.60@ 1.00	.60@ .75
Elkhorn (Ky.) mine-run	Cincinnati	1.15@ 1.65	1.15@ 1.65	1.15@ 1.65	1.15@ 1.65
Kansas shaft lump	Kansas City	3.75	3.75	3.75	3.75
Kansas strip lump	Kansas City	3.00	3.00	3.00	3.00
Kansas mine-run	Kansas City	2.50	2.50	2.50	2.50
Kansas screenings	Kansas City	1.50	1.50	1.50	1.50

WORD from the FIELD

Distribution Studies Planned

An appropriation for analyzing coal distribution has been granted the U. S. Bureau of Mines for the first time this year and the work is already under way under the direction of F. G. Tryon. The analysis will not deal with the merchandising activities of the wholesaler or retailer, but with the physical movement of the coal from the mines to the consumer, and the final tabulation will show shipments from each producing field to each consuming state and the uses to which the coal is put.

Reports scheduled for early publication include the following: distribution of railroad fuel in 1929 from each originating district, including comparisons with 1928 and 1917-1918; distribution of coking coals consumed by byproduct coke ovens from each originating field; distribution of coke in 1929, showing separately the tonnage of metallurgical and domestic coke consumed in each state; sources of coal and types of stokers and burners used by electric utility power plants; and distribution of fuel and power west of the Mississippi. The last report will show the movement not only of bituminous coal, but of anthracite, coke, natural gas, fuel oil, and hydro-electricity in each state of the trans-Mississippi area, including receipts from the east. Upon completion of these reports, the Bureau plans to take up the larger task of distribution east of the Mississippi.

Another study which the Bureau plans to inaugurate in the near future is an analysis of the domestic fuel market. Consummation of the plan, however, depends upon securing from Congress an appropriation for the purpose in the 1931-1932 Appropriation Act. A periodical analysis of the domestic market would supply accurate figures on the relative change in the consumption of bituminous coal and other fuels.

Anthracite Shipments Rise

Anthracite shipments in August, 1930, as reported to the Anthracite Bureau of Information, Philadelphia, Pa., were 4,821,790 gross tons, an increase of 475,949 tons over the preceding month and 257,364 tons over August, 1929. Shipments by originating carriers for the month of August, 1930, as compared with the preceding month of July and with August, 1929, are as follows:

	Aug., 1930	July, 1930	Aug., 1929
Reading	932,584	901,502	847,625
Lehigh Valley	745,772	820,564	835,825
Central R.R. of N. J.	452,289	359,188	377,590
Del., Lack. & Western	722,329	643,755	745,570
Delaware & Hudson	669,419	564,190	587,592
Pennsylvania	506,320	396,435	443,313
Erie	489,939	422,165	408,737
N. Y., Ont. & West	86,128	80,815	113,093
Lehigh & New England	217,010	157,227	205,081
	4,821,790	4,345,841	4,564,426

Business Improves

Despite reactionary influences, the gradual improvement in business, which began in September, is continuing, according to *The Business Week* of Oct. 8, which says: "After a last frantic attempt this week to sell the world back to the cave-men on the basis of the sheriff's auction, the bears in the commodity and security markets were routed in a revulsion to common-sense on the part of the business community. There has been a somewhat sheepish realization that though the high and justifiable hopes of vigorous business recovery this fall seems to have gone glimmering, it does not follow that the world is going back to bows and arrows, buggies, cave-bungalows, and bear-skins. Though still disappointing in its speed, gradual improvement in the general level of business activity continues, at slightly more than the seasonal rate.

"Our preliminary index for the week ended Sept. 27 shows a further slow rise from 85.8 per cent of normal to 86 per cent. The seasonal rise in industrial activity is still irregular and uncertain, but in general trade and in building it is more definite. Further improvement during October is fairly certain, but, without a sudden and decisive change in business psychology and banking policy, it is difficult to see from what source to expect trade to gather sufficient momentum in the next six weeks to carry us through the winter onto higher and firmer ground next year. The economic aborigines and Puritan fathers who like long winters will enjoy this one."

New Plant Construction

New contracts for topworks and construction under way or completed at various coal operations reported for the month of September are as follows:

Alpha-Pocahontas Coal Co., Alpoca, W. Va.; contract closed with the Kanawha Mfg. Co. for erection of a wood tipple; capacity, 150 tons per hour. Equipment consists of shaker screens, three loading booms, slack conveyor, slack storage bin, rescreen conveyor, and refuse conveyor.

Barnes & Tucker, Barnesboro, Pa.; contract closed with Roberts & Schaefer Co. for complete coal washery of steel construction equipped with Menzies hydro-separators for cleaning all sizes from 4 in. to ½ in.; capacity, 120 tons per hour.

Blackwood Coal & Coke Corporation, Blackwood, Va.; contract closed with the Fairmont Mining Machinery Co. for complete coal-handling equipment and steel structures to handle 250 tons per hour from two seams of coal. Equipment consists of two rope-and-button conveyors, 965 ft. and 1,010 ft. long, one 290-ft. belt conveyor, bins, hoppers, feeders, and rock conveyor; to be completed in February, 1931.

C. C. B. Smokeless Coal Co., Helen, W. Va.; contract closed with Roberts & Schaefer Co. for Menzies hydro-separator, coal-washing equipment for cleaning egg and stove coal; capacity, 100 tons per hour.

Island Creek Coal Co., Holden, W. Va.; contract closed with Roberts & Schaefer Co. for complete, Menzies hydro-separator, coal-washing plant of steel construction; capacity, 100 tons per hour.

Jamison Coal & Coke Co., Greensburg, Pa.; contract closed with the Fairmont Mining Machinery Co. for Peale-Davis, air-cleaning plant to clean nut and slack coal; capacity, 150 tons per hour; to be completed by 1931.

E. H. Johnson Coal Co., Spadra, Ark.; contract closed with United Iron Works, Inc., for erection of a five-track, steel tipple at an anthracite shaft mine, equipped with crusher, shaker screens, rescreens, picking chutes, loading booms, degradation conveyors, and refuse conveyors; capacity, 250 tons per hour.

McDowell Coal & Coke Co., McDowell, W. Va.; contract closed with Roberts & Schaefer Co. for Menzies hydro-separator, coal-washing equipment for cleaning nut and pea coal; capacity, 50 tons per hour.

West Virginia Coal & Coke Corporation, Omar, W. Va.; contract closed with the American Coal Cleaning Corporation for complete plant equipped with one Type R, American pneumatic separator and tube-type, dust-collecting system to treat 1½x0-in. coal; capacity, 100 tons per hour; to be completed Dec. 15.

Windsor Coal Co., Windsor, Mo.; contract closed with United Iron Works, Inc., for designing and erecting a four-track, steel tipple for a strip mine, equipped with crushers, shaker screens, rescreens, picking

tables, loading booms, degradation conveyors, and refuse conveyors; capacity, 350 tons per hour.

WYATT COAL CO., Eskdale, W. Va.; contract closed with the Kanawha Mfg. Co. for wood tipple and head-house, together with a steel conveyor gallery. Equipment consists of rope-and-button conveyor, shaker screens, three picking tables, loading booms, refuse conveyor, rescreen conveyor, egg-coal conveyor, slack hopper, and loading chutes; capacity, 300 tons per hour.

Slack Plant Near Completion

With work on the new central cleaning plant of Ashless Coal Sales, Inc., Ravenna, Ky., practically completed, operators in the Hazard and Harlan fields are reported to be considering the opportunity it offers for storage of slack as means of stabilizing prices for this grade. The Louisville & Nashville R.R. has granted milling in transit rates modeled along the lines of the agreement between the Pittsburgh Coal Co. and the Montour R.R. In operation, the Ashless Coal Sales company will handle slack, it is reported, either by buying it for storage or by cleaning and storing it for the operators' accounts. Air tables have been installed for cleaning, and the plant is located so that tonnage from either field may easily be handled.

Industrial Coal Reserves Rise To 35 Days' Supply

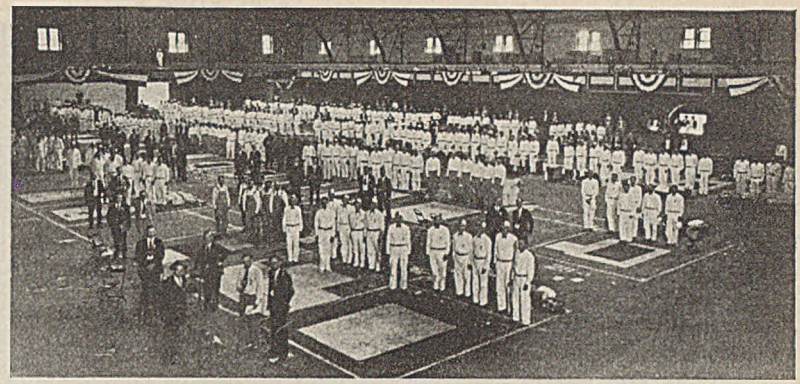
Stocks of anthracite and bituminous coal in the hands of industrial consumers in the United States and Canada on Sept. 1 were 33,720,000 net tons, according to the monthly report of the National Association of Purchasing Agents. This figure is equivalent to 35 days' supply, based on the August consumption of 29,817,000 tons. Stocks in industries were 1,000,000 tons larger on Sept. 1 than on the same date in August, due largely to an increase in reserves in Canada. Coal consumption decreased about 700,000 tons in August, as compared with July, indicating a drop of 2.25 per cent in business in general.

Days' Supply of Bituminous Coal in Various U. S. Industries

Byproduct coke	32
Electric utilities	61
Railroads	20
Steel Mills	45
Other industries	32
Average total bituminous stocks throughout the United States	32

Estimates of Output, Consumption and Stocks, in Net Tons

	United States Production	Industrial Consumption	On Hand in Industries
August, 1929	49,843,000	34,886,000	32,712,000
September	51,307,000	35,969,000	34,289,000
October	59,567,000	39,482,000	36,107,000
November	51,719,000	38,747,000	37,313,000
December	53,858,000	38,581,000	37,512,000
January, 1930	56,816,000	38,512,000	39,007,000
February	45,712,000	35,195,000	37,078,000
March	40,324,000	37,083,000	36,554,000
April	40,776,000	36,230,000	31,535,000
May	41,901,000	34,685,000	30,700,000
June	38,897,000	31,613,000	30,824,000
July	40,373,000	30,496,000	31,500,000
August	41,851,000	29,817,000	32,735,000
Sept. 1			33,720,000



Teams at Work in the International First-Aid and Mine-Rescue Meet

Fifty-Seven Teams in International Meet; Continental Wins in West Virginia

FIFTY-SEVEN first-aid teams and seven mine-rescue teams from various states in the United States and from Canada participated in the Ninth Annual International First-Aid and Mine-Rescue Contest, held at Louisville, Ky., Sept. 16-18, under the auspices of the U. S. Bureau of Mines, Joseph A. Holmes Safety Association, Kentucky Department of Mines, Louisville Convention and Publicity League, and coal operators' associations of Kentucky, Tennessee, Virginia, and West Virginia. Highest honors in the contest were won by the combination first-aid and mine-rescue team of the Madison Coal Corporation, Glen Carbon, Ill., with a rating of 90.44.

First place in the first-aid contest went to the team of the Mahan-Ellison Coal Corporation, Liggett, Ky., with a score of 99.5. Second honors in the first-aid contest were awarded the team of the Inland Steel Co., Wheelwright, Ky., and third place went to the New England Fuel & Transportation Co. team, Grant Town, W. Va. In the mine-rescue events, first prize was won by the Mine 86 team of the Consolidation Coal Co., Carolina, W. Va., with a rating of 82. Second and third honors, respectively, went to the Madison Coal Corporation team, Glen Carbon, Ill., and the Black Mountain Corporation team, Kenvir, Ky.

In addition to the international awards, separate state first-aid honors were awarded to the following teams: Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.; Phelps Dodge Corporation, Morenci, Ariz.; Madison Coal Corporation, Glen Carbon, Ill.; Mahan-Ellison Coal Corporation, Liggett, Ky.; Standard Oil Co., Baton Rouge, La.; Consolidation Coal Co., Frostburg, Md.; Pickands, Mather & Co., Mather, Pa.; Pruden Coal & Coke Co., Pruden, Tenn.; Utah Copper Co., Bingham Canyon, Utah; Stonega Coke & Coal Co., Derby, Va.; and the New England Fuel & Transportation Co., Grant Town, W. Va. State mine-rescue honors were given the following teams: Madison Coal Corporation, Glen Carbon, Ill.; Black Mountain Corporation, Kenvir, Ky.; Consolidation Coal Co., Carolina, W. Va.; and the Dominion Steel & Coal Corporation, Stellarton, Nova Scotia.

Ratings of the Kentucky teams were used to grade their standings in the Kentucky State Meet, held concurrently with the international meet. By winning first and second places in the international meet, the Mahan-Ellison and Inland Steel company teams took first and second places, respectively, in the Kentucky meet. The Black Mountain Corporation team, by taking third place in the international mine-rescue competition, became first for Kentucky in that class.

Eighty-five teams participated in the Fifth Annual West Virginia Safety Day, held at Wheeling, W. Va., Sept. 13, under the auspices of the West Virginia Department of Mines. In the mining division, first prize was won by a team of the Continental Coal Co., Rivesville, W. Va., with a score of 797 out of a possible 800 points. Second and third honors went, respectively, to the Consolidation Coal Co. team, Carolina, W. Va., and the Fordson Coal Co. team, Twin Branch, W. Va. In the industrial division, first prize was awarded to the machine shop team of the New River Co., Macdonald, W. Va., with a score of 796.

Twelve teams participated in the mine-rescue events in connection with the meet, held on Sept. 12. First honors in this division were captured by the Glendale Gas Coal Co., Moundsville, W. Va. The Bethlehem Mines Corporation team, Barrackville, W. Va., was second.

Kanawha & Hocking Earnings

The Kanawha & Hocking Coal & Coke Co., operating mines at Mammoth, W. Va., reports for the year ended June 30 a net loss of $83,637 after interest charges, taxes (except federal), depreciation, depletion, and other charges, as compared to a net loss of $221,379 in the preceding year.

Safety Council Holds Annual Meeting; Mining Attendance Large

ATTENDANCE at the Mining Section meeting of the National Safety Congress, held in Pittsburgh, Pa., Sept. 30-Oct. 2, reached record figures with 303 persons present, of whom 165 represented coal mining, 49 metal mining, and 89 affiliated interests connected with the operation and safety of mines. Of the total number present, 102 were operating men and 112 safety men.

Bituminous mines, said W. W. Adams, chairman, statistics committee, accident statistician, U. S. Bureau of Mines, showed a marked improvement in their frequency rates during 1929, the average rate falling from 84.96 to 69.25 per million man-hours of exposure as against 1928. The anthracite mines showed a big increase in frequency, 88.12 in 1928 and 99.68 in 1929. Metal mines slipped an amount expressible in the second place of decimals, and non-metallic mines other than coal made even a greater improvement than bituminous coal. This result is derived from 162 mines with 28,000 employees and 82,000,000 man-hours of exposure, which report through the National Safety Council.

The word "accident" said T. G. Fear, general manager, Consolidation Coal Co., Fairmont, W. Va., in his paper on the responsibility of management, is wrongly applied. An accident is an injury that is nobody's fault. Of all the so-called accidents only 2 or 3 per cent perhaps may be rightly so designated. The rest may be more correctly termed "personal injuries."

That rehabilitation of the injured was an important duty of management was the declaration of W. H. Comins, local manager, St. Louis Smelting & Refining Works, National Lead Co., St. Francois, Mo. Men who were injured refused frequently to undergo the labor necessary to refit them for industrial life, preferring to accept total disablement to rehabilitation.

In industries in general a man is subject to only one or two hazards, and even to these he is not continuously exposed, said H. S. Gilbertson, director of personnel, Lehigh Navigation Coal Co., Lansford, Pa., speaking for J. B. Warriner, president of the company. In mines, he added, there were multitudinous hazards and some of these were continuously in operation. The miner accordingly becomes fatalistic. It was necessary in investigating accidents to get the whole explanation and to fix the entire responsibility. A combination of causes, and not one alone, entered into each accident.

One or two days' work a week, said F. C. Dunbar, general manager, Mather Collieries Co., Mather, Pa., is the cause of many accidents. The empty dinner pail and worry prevent a man from facing his work with the spirit that makes for safety. Better shut off a section and lay off the men than keep a lot of men on a job that works so irregularly as to provide an insufficient subsistence.

"Management is solely responsible for safety in your organization," wrote W. V. Decamp, general manager of the United Verde Copper Co., Jerome, Ariz., at the opening of an address read for him by Daniel Harrington, chief safety research engineer, U. S. Bureau of Mines, Washington, D. C. It referred to the safety responsibility of management, a subject which Mr. Decamp shared with A. R. Pollock, general manager of mines, Ford Collieries Co., Curtisville, Pa. True, he admitted, the employee should, and does, share in this responsibility, but only when management first shows the way.

Rush N. Hosler

New General Chairman, Mining Section, National Safety Council

From the employee, he declared, the company demands labor and loyalty. The company gives wages, but does it always exhibit such a loyal interest in the employee as will give the company a right to demand something more than labor from its employees?

Ascertaining right ways of performing work, standardizing these right ways and then teaching them industriously to employees engaged in that work, was urged as a solution of the accident problem by P. G. Beckett, vice-president and general manager, Phelps Dodge Corporation, Douglas, Ariz. "Usually we learned after an accident," said Mr. Beckett, "that something was being done the wrong way and that nobody had told the workman the right way to do it. We reached the conclusion," he added, "that if the company did not take the trouble to ascertain the correct method of doing the work and did not then instruct its employees, it could not, in all fairness, place the blame for the accident at the door of the man himself."

Job analysis with instruction in performing the job was the contribution to safety demanded of mine-operating officials by W. D. Brennan president, Utah Fuel Co., Salt Lake City, Utah, in a paper presented by E. H. Denny, district engineer, U. S. Bureau of Mines, Denver, Colo. Before men can be taught the proper way to do their work the bosses must first take each job and analyze it, studying and questioning all the common practices relating to it, for many of these practices are not the result of thought, but of mere custom.

K. L. Marshall, assistant mining engineer, U. S. Bureau of Mines, Pittsburgh, Pa., declared that job analysis prevented officials giving conflicting instructions, which inevitably destroyed morale. The Bureau expected to prepare talking movies giving a complete analysis of every job. To investigate accidents is well; to prevent accidents by a careful job analysis is better.

Mr. Dunbar's question box covered the analysis and classification of accidents and the value of physical examination. On the first, Mr. Adams and Clyde A. McDowell, director of personnel, Pittsburgh Coal Co., Pittsburgh, Pa., presented written discussion, the first insisting that reports should be comparable and the second that they should be such as to show the success in avoiding casualties of each mine and boss.

On Wednesday morning the members of the Mining Section visited the U. S. Experimental Mine at Bruceton Pa., and were shown the action of an ignition of coal dust in the mine, the ignition being caused by the contact of a trolley wire carrying 250-volt current with the top of a mine car. A fire of coal and gas, the latter flowing at a rate of 20 cu.ft. per minute, was successfully extinguished by covering it with rock dust. The gas alone as it flowed from a pipe was extinguished by the deft delivery of rock dust from a shovel.

Safety conditions and organization in a mine producing 15,000 tons monthly were described by D. L. Boyle, superintendent of mines, Penelec Coal Corporation, Johnstown, Pa. This mine is Penelec No. 5. The mining engineer has an employees' school and the safety engineer has mine rescue classes, first-aid classes, a foreman's safety council, and a Joseph A. Holmes Safety Association. Mr. Boyle said that a safety man meant more supervision, and more supervision resulted in greater care of property.

That safety is not merely a mine problem but a broader consideration, of which mining casualties were but a province, was the contention of Carl T. Hayden, general manager, O'Gara Coal Co., Chicago, who stated in his paper on the safety organization for a large company that ten people had been killed in Saline County on the hard surfaced roads and only seven men in the mines in the same period.

B. M. Shove, Oliver Iron Mining Co., Ironwood, Mich., agreed with Mr. Hayden, who thought that safety should be taught more industriously than first-

aid. Mr. Shove said 100 per cent first-aid was not a panacea for all ills. Mr. Comins asked Daniel Harrington and J. J. Forbes if they still believed in the efficacy of such training. After assurances from Mr. Harrington, J. J. Forbes said: "Try it." One petroleum company, he said, declared that a man untrained in first-aid was four times as liable to accident as a man who had been trained. Another company had statistics to show that eight trained men had no more accidents than one untrained man. As many as 305 large coal, metal, and petroleum companies have all employees instructed in first-aid. Testimonials and records in U. S. Bureau of Mines files showed that the first-aid instruction had reduced accident rates at all 305 mines.

Five rules were given by R. H. Seip, chief of safety division, New Jersey Zinc Co., Franklin Furnace, N. J., for running a safety campaign: (1) Always prove that safety pays when appealing to manager, foreman and miner. Avoid the humanitarian or sociological approach. (2) Make safety standards and not a list of don'ts. (3) Rest responsibility for enforcement on foremen and bosses. (4) Discipline men for any disobedience to the terms of the code. (5) Let safety bosses specialize in safety and do nothing else.

H. C. Henrie, manager, labor department, Phelps Dodge Corporation, Bisbee, Ariz., said that more accidents happen on highways than in the mine. Mining can be made just as safe as other industries. It is easy to get to the point where mining is safer than being on the highway. His corporation had a benefit association and got a report on all accidents and illnesses. During 1929, there were 232 accidents off-work, and at work only 72 accidents. The relation of intelligence and education to safety was discussed as part of the question box.

That the anthracite mining law of Pennsylvania requires that the mine operator shall use every precaution for safety, whether embodied in the law or not, and that the inspector in the bituminous law is ordered to "exercise sound discretion in the performance of his duties" presented the state mine inspector with onerous obligations, asserted Walter H. Glasgow, Secretary of Mines, Commonwealth of Pennsylvania, Harrisburg, Pa., at Thursday morning's session, to which four chief mine inspectors contributed.

Friendliness and helpfulness, rather than antagonism and criticism, should be the attitude of inspectors in their rounds of the mines, for the operator is benefited by the inspectors' visits, was the opening thought of the paper by W. B. Hillhouse, chief, Department of Mines, Birmingham, Ala. This relationship has been fostered in Alabama, where full co-operation and mutual understanding have been established. Safety shoes are carried at mine stores and every effort is being made to get the men to wear them. Manufacturers have submitted insulated miners' caps, but so far no selection has been made.

John F. Daniel, chief, Department of Mines, Lexington, Ky., discussed his safety propaganda based on mimeographed drawings of the section of the workings where accidents occurred. R. M. Lambie, chief, Department of Mines, Charleston, W. Va., declared that safety undoubtedly would decline if the price of coal were allowed to slip below cost of production.

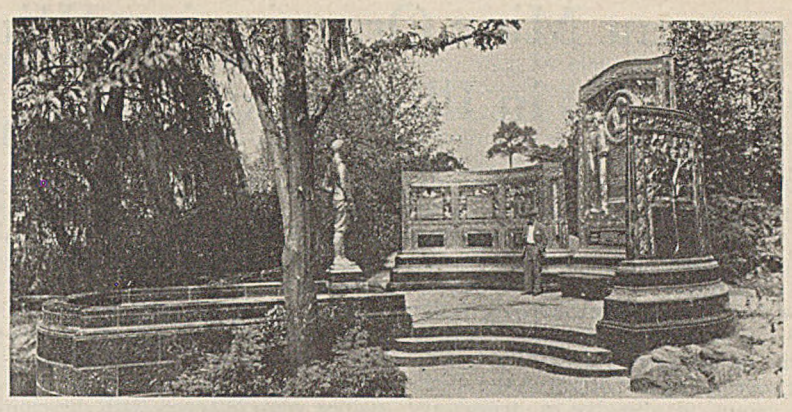
A western Pennsylvania mining company reduced disabling eye accident rates from 2.60 to 0.71 per cent per annum by the use of goggles, declared C. L. Lutton, safety director, H. C. Frick Coke Co., Pittsburgh, Pa., in his article on protective clothing in accident prevention work at mines. Not a single injury has been attributed to the wearing of goggles except in two or three instances, when the ends of broken wires in wire-screen goggles punctured the flesh or eye of the wearer. These wires are broken by careless handling of the goggles when they are not in use. Safety shoes have prevented many toe injuries from falls of coal, rock, rails, and timber and have mitigated many others.

A western Pennsylvania company with 600 full-time workers, all with safety toe shoes, had only one disabling toe accident in the last nineteen months. Rubber shoes should not be worn unless necessary, for the corrugations wear down, the heel wears level with the instep, and the foot has no hold. These shoes also cause fallen arches, tender feet, and other ills.

In discussion, Mr. Lutton said that the weakness of the safety shoe was that there was no protection for the instep. Unshatterable glass was not used in goggles, but there had been no accidents except that in one case the frame of the goggle had been broken and the miner who was wearing it was cut above the eye. With rubber shoes a molded metal cap was used.

W. F. Sullivan, safety engineer, Phelps Dodge Corporation, Nacozari, Mexico, complained that when men walked in water the toe after a few days became soft and the cap broke down. The shoes then hurt the men's toes. To correct this condition, they put the shoe in the oven. That made the shoes easier on the feet but destroyed their safety quality. Apart from slipping, the rubber shoe is the safest made. Mr. Seip said that the caps of the shoes worn at the Franklin Furnace plants did not soften.

Rush N. Hosler, Coal Mine Section, Pennsylvania Corporation Rating and Inspection Bureau, Harrisburg, Pa., was elected general chairman. Mr. Comins was made first vice-chairman; Thomas E. Lightfoot, Koppers Coal Co., Pittsburgh, Pa., second vice-chairman; A. W. Mendelsohn, Copper Range Co., Painesdale, Mich., third vice-chairman; Mr. Dunbar, fourth vice-chairman; Mr. Harrington, secretary and news editor. Carl W. Bergquist, superintendent of public relations, Western Electric Co., Chicago, was elected president of the National Safety Council for the ensuing year. About 10,000 persons were present, 7,000 of whom were from a distance.



Westinghouse Memorial Unveiled

Commemorating the achievements of George Westinghouse, inventor, industrial leader, and founder of the Westinghouse industries, national leaders in industry, business, and scientific research paid homage to his memory at the unveiling of the Westinghouse memorial in Schenley Park, Pittsburgh, Pa., Oct. 6. Composed of black Norwegian granite, bronze, and gold, the monument was erected by the Westinghouse Memorial Association, composed of 54,251 members, mostly Westinghouse employees, with the assistance of the Westinghouse Electric & Mfg. Co. and the Westinghouse Airbrake Co.

The central panel of the memorial shows the figure of George Westinghouse bent over his drawing board and flanked by the figures of a skilled mechanic and an engineer. On the right- and left-hand panels are shown the six major accomplishments of Mr. Westinghouse: illumination of the Chicago World's Fair, the air brake, the modern railway signaling system, alternating-current railway electrification, the steam turbine, and the hydro-electric plant at Niagara Falls. The dedicatory ceremony was presided over by E. M. Herr, vice-chairman of the board of directors, Westinghouse Electric & Mfg. Co., and included addresses by A. L. Humphrey, president, Westinghouse Airbrake Co., and John F. Miller, vice-chairman. The latter concluded the program with an address, "George Westinghouse—An Appreciation."

Insurgent Mine Organization Wins Tilts in Illinois Courts

IN THE quarrel between the regular and insurgent factions of the United Mine Workers in Illinois, developments during the month of September took the form of appeals to the courts on the part of both sides. On Sept. 10, Judge Frederick A. Hill, Joliet, Ill., sitting as a judge of the Iroquois County Circuit Court, overruled a motion of the Fishwick group to dissolve a temporary injunction obtained on Aug. 13 by fifteen Franklin County miners friendly to Lewis, restraining the insurgent organization from using the name of the United Mine Workers of America and enjoining all activities of the Howat-Fishwick group in Illinois. Judge Hill held that the action of the revolters at the Springfield (Ill.) convention early in the year "did not operate as a reorganization of the United Mine Workers of America, did not create a new constitution for that body, and did not invest the members there elected as its officers with any power as such."

Representatives of District 12 (Illinois) officers and the national insurgent organization then appealed to Judge Charles C. Briggle, of the Sangamon County Circuit Court, Springfield, Ill., Sept. 12, for an order preventing the Franklin County miners from prosecuting the injunction granted on Aug. 13 and sustained by Judge Hill on Sept. 10. Judge Briggle granted the plea of the insurgents on Sept. 13, issuing an injunction against the Franklin County order and requiring the Fishwick group to post a $50,000 bond to guarantee accounting of union funds. He based his action on the fact that the injunction upheld by Judge Hill would interfere with the settlement of the fight precipitated in the Sangamon County court by the granting of the original injunction of the series last October, restraining Lewis and his aids from setting up a provisional government in Illinois or interfering in the affairs of District 12.

Following Judge Briggle's action, Judge Hill, on Oct. 6, dissolved the Franklin County injunction against the insurgent group, leaving both sides free "to settle the entire controversy in the Sangamon County Circuit Court." Because of the pending litigation in Sangamon County, Judge Hill explained that he was not ruling on the merits of the original matter at issue, but was seeking to eliminate confusion and conflicts of jurisdiction. Clearing up the legal tangle in Illinois will now await the motion of John L. Lewis to dissolve the original injunction issued by the Sangamon County court last October.

As a result of granting the Franklin County injunction, Lewis was on Sept. 9 named in a new citation for contempt of court by Fishwick attorneys. The petition, entered at Springfield, Ill., charges that Lewis conspired with the Franklin County miners, who also are named as co-defendants, to violate the October, 1929, injunction. Lewis was cited for contempt of court originally on April 17, and was found guilty on July 9 and fined $500.

In a statement issued early in September by Adolph Germer, vice-president of the insurgent United Mine Workers group, non-union coal companies were charged with disseminating false reports of a state-wide strike in Illinois. "The statements made by coal salesmen for non-union coal companies from other states that such a strike is being arranged is strong evidence," Mr. Germer said, "that someone is trying to damage the coal interests of the state." He called attention to the agreement between the operators and miners and alleged that the Lewis faction has attempted to call strikes.

Several miners were injured in a clash between sympathizers of the Howat-Fishwick and Lewis factions at Fidelity No. 11 mine of the United Electric Coal Cos., Duquoin, Ill., Sept. 26. County police stated that nearly 50 men took part in the fight. No arrests were made.

Government regulation of the bituminous coal industry was advocated by Ellis Searles, Indianapolis, Ind., editor, *United Mine Workers' Journal*, in testimony in New York City, Sept. 26, before the Fish Congressional committee on the investigation of Communist activities, when he repeated his charge of several years ago that the Herrin (Ill.) massacre, June 21, 1922, "was purely a Communist affair." The U. S. Coal Commission, it will be recalled, in reviewing these charges said that there had been some Communist activity in Williamson County, but that "there was no evidence that this had any relation" to the massacre.

Conditions continued unsettled in the western Kentucky strike area in September. It was reported that of the 350 workers of the Green River Fuel Co., Mogg, Ky., 178 had voted in favor of a strike and 62 against. Officials of the company stated that the plant would close down indefinitely in case of a walkout. Sporadic shootings and dynamitings occurred throughout the month. On Sept. 26, it was reported, a railroad bridge of the Providence Coal Mining Co., Providence, Ky., was burned, and power poles dynamited. On Oct. 2, the sheriff of Hopkins County received reports that the barn of James Smith, employed at Mine No. 1 of the Ross Coal Co., Madisonville, Ky., was burned by a fire bomb dropped from an airplane.

Charles Gorman, president, Kentucky State Federation of Labor, at the annual convention held in Paducah, Ky., Sept. 16, stated that the American labor movement would not tolerate within its ranks any element indulging in violence. He declared that the outbreaks in western Kentucky were the work of malcontents. "I hold," he declared, "that the acts committed in Webster County are the acts of anarchists and the acts committed in Illinois in the attempt to wrest control of the United Mine Workers of America from the legally constituted authorities of that organization and the American Federation of Labor are the acts of Communists."

In southern West Virginia, officials of the United Mine Workers and miners at Ward, W. Va., were enjoined from interfering with the operation of the mine of the Kellys Creek Colliery Co. by a temporary injunction issued by Judge A. P. Hudson, Kanawha County Circuit Court, Charleston, W. Va., Sept. 24. Twenty-three men were named in the order, including Percy Tetlow, Charleston, president, District 17. The mine was closed several weeks ago after a "clean-up" system was established, but was reopened a week before issuance of the injunction with imported labor. Eviction actions were entered against 101 former employees at the mine.

On Oct. 6, however, the miners voted to accept the wage scale offered by the company and return to work. Loaders will receive 38c. a ton; inside labor, $4 a day; outside labor, $3 a day; and cutters, 7c. a ton. J. M. Mason, Charleston, attorney for the miners, stated that the compromise included the rehiring of four men dismissed for activities in the strike. The "clean-up" plan was not mentioned in the new agreement.

Early in September, Tetlow and Van A. Bittner, chief representatives of the United Mine Workers, Fairmont, W. Va., conferred with Secretaries Lamont and Davis of the Departments of Commerce and Labor in Washington, D. C., on conditions in the coal industry in northern West Virginia. They presented a petition addressed to President Hoover and signed by business men, coal operators, bankers, and publishers of approximately twenty towns in the region, asking that a conference of representatives of coal operators and miners be called "for the purpose of considering ways and means of stabilizing the industry." The petition, containing several thousand signatures, was filed with the growing accumulation of similar documents in the office of the Secretary of Labor.

Anthracite Blasts Kill Seven

Four men were killed and two others were injured in an explosion of gas in the West Skidmore Dip of the Sherman Colliery of the Sherman Coal Corporation, Pottsville, Pa., Sept. 17. The blast occurred just as the shifts were being changed and the dead and injured were part of the night crew. Property damage was comparatively light.

Three men were killed and four others perhaps fatally injured in an explosion of gas in the Laws shaft of the Central mine of the Pittston Co., Avoca, Pa., Sept. 29. The dead and injured were engaged in cleaning up a fall of roof when a collection of gas was ignited.

A. I. M. E. Studies De-Ashing of Coal And Other Preparation Problems

A TENTATIVE standard for cleaning coal was offered by J. R. Campbell, Koppers-Rheolaveur Co., Pittsburgh, Pa., at the Pittsburgh meeting of the Coal Division of the American Institute of Mining and Metallurgical Engineers, Sept. 11-13. Limited directly to Pocahontas coal, it suggested a basis for a definition of clean coal applicable with modifications, to coal everywhere.

When a buyer has purchased coal from any area, suggested Mr. Campbell, he should not be permitted to condemn it as improperly cleaned if the sink in the coal be found to be within the tolerances prescribed when tested by float-and-sink test at the specific gravity set. Egg is set at under 1 per cent, stove and nut, 1 to 2 per cent, pea at 2 to 3 per cent, and slack at 3 to 4 per cent. But as heavy-gravity material is regarded as specially undesirable the coal may be tested at, say, 1.80 specific gravity and the tolerance for this high-gravity material may be set at 25 per cent of the other tolerances. Thus a 50-ton car of Pocahontas egg might be permitted to carry 1,000 lb. of sink at 1.50 to 1.60, of which 250 lb. might be rock at 1.80.

Discussing the paper on "Control of Chance Cone Operation," by John F. McLaughlin, assistant superintendent of preparation, Hudson Coal Co., Scranton, Pa.; abstracted on pp. 538 and 539 of the September issue of *Coal Age*, W. H. Lesser, electrical engineer, Madeira-Hill anthracite interests, Frackville, Pa., said that he believed it a mistake to interfere with the water circulation or to use the agitation valves for anything except to start the cone in operation. "Get the cone working, adjust the main valve, and don't monkey with it thereafter," suggested Mr. Lesser. "You can do that if run at 1.70 specific gravity, but not at 1.65," replied Mr. McLaughlin.

In discussion of a paper by Edgar Schweitzer, assistant mechanical engineer, Lehigh Valley Coal Co., Scranton, Pa., abstracted in *Coal Age*, September, 1930, pp. 535-537, Cadwallader Evans, general manager, Hudson Coal Co., Scranton, Pa., questioned the value of the 200-ton bin provided for the feed of the Dorrance washer, but the author declared that it served to maintain a good mix of the coals from various mine workings. Mr. Schweitzer said that the float in the refuse was mostly of so low a grade as to be classed as No. 3 quality, or unsalable material, and G. V. Woody, Koppers-Rheolaveur Co., declared that if it were saved, the company sales force would reject it.

C. A. Connell, Anthracite Coal Service, Philadelphia, Pa., described modern methods of burning anthracite and the servicing and heating of homes, and F. G. Tryon, U. S. Bureau of Mines, Washington, D. C., presented a paper on statistical analysis of trends in bituminous coal preparation, the substance of which appeared in the September issue of *Coal Age*, pp. 519-520.

In the afternoon B. M. Bird, Battelle Memorial Institute, Columbus, Ohio, discussed the performance of coal-washing jigs, emphasizing the effect of the suction stroke in promoting separation. K. C. Appleyard, managing director, Birtley Iron Co., Birtley, England, in reviewing dry cleaning in England, criticised American structures on the score of excessive vibration. A 250-ton per hour plant in England, he said, involved the use of 237 tons of steel, to say nothing of the brick-filled walls and reinforced-concrete floors. There should be a ton of steel per ton of hourly capacity.

The "Y" table had a restricted output with such English coals as had heavy inherent moisture and large quantities of sluggish slate. So decks with straight-line spillage and finally the present type of V deck were evolved, which latter had a curved banking bar with straight deck edges. A "Super-Machine" had a capacity of two tons per square foot. He did not believe in big units with a large capacity in aggregate, if they require, as some do, an area of 2.4 sq.ft. per ton. Even the British figure of two tons per square foot could be increased.

Fred A. Jordan, Youngstown Sheet & Tube Co., Youngstown, Ohio, stated that a dry table he had used had proved so long and heavy that 30 per cent of it had been removed to reduce the weight. To his surprise the capacity of the table increased from 190 to 215 tons per hour as a result of the curtailment, and the coal was made a little cleaner. Edward O'Toole, American Coal Cleaning Corporation, Welch, W. Va., said that by feeding all along the deck, an increase of 35 per cent in capacity could be obtained. The coal can be cleaned in one-third the table length. By this means distribution is equalized and coal is not blown from the table.

Major Appleyard stated that heated air was not used in England either on the tables or for aspiration. Mr. Jordan wanted to know why one could not aspirate on the tables. Major Appleyard answered that it was impossible to remove the dust in that manner. Aspiration was necessary, for, after the process, the coal was more fluid and subject to treatment.

Thomas Fraser, mining department, Carnegie Institute of Technology, Pittsburgh, Pa., on behalf of himself and Robert MacLachlan, plant superintendent, Montour No. 10, Pittsburgh Coal Co., Library, Pa., in a paper on the conditioning of coal for treatment by pneumatic cleaners, (*Coal Age*, September, 1930, pp. 527-530), asserted that the sizing of the raw coal, when dry, has become a fairly mechanical operation now that concentrating machines have been designed capable of handling size ranges corresponding, in general, to those that have been adopted by the market. When unsized feed is treated on stratifying tables the need for the presizing of the feed is eliminated, but a new condition is introduced, because for the most efficient cleaning a certain degree of uniformity in size composition is required.

Ray W. Arms, vice-president, Roberts & Schaefer Co., Chicago, advocated the combined use of wet and dry processes. If dry-cleaning apparatus could be perfected to a point where its technical results, its costs, and other aspects were equal to wet washing equipment, water would no longer be used. As it is however, good technical results are more difficult to obtain by dry cleaning than by water. Obviously, the use of air tables for coarse coal is not ideal, for it involves the attempt to stratify material in a thin bed on a table surface when the load is only one particle deep.

When all conditions are propitious—that is, the coal is dry, the refuse is not too flaky, and the bony and mid-gravity material are at a minimum, etc.—the results of dry cleaning, asserted Mr. Arms, are as good as those of the most complicated washing process, and the advantages of dry cleaning outweigh those of wet cleaning. The ideal dividing line between wet and dry cleaning is approximately at the ¼-in. size, but this boundary line is affected by the available water supply. In discussing Mr. Arms' paper Mr. Campbell said that with mechanical dryers wet-washed coal could be dried to 5½ or 6 per cent moisture on the size dried; that is, ⅜ x 0 in.

D. R. Mitchell, associate in mining engineering, University of Illinois, Urbana, Ill., presented the paper on coal-preparation problems in Illinois, abstracted in the preceding issue of *Coal Age*, (pp. 531-532). Mr. Campbell declared that the ash in Illinois coal could rarely be reduced below 8 or 9 per cent, and that the sulphur that so greatly needs reduction cannot be removed in quantity, because so much of it is either organic or microscopic. Illinois coal does not in general, he declared, present an attractive guise to the preparation engineer.

In the absence of the authors, the papers of R. G. Baughman, chief engineer, Central Indiana Coal Co., Linton, Ind., on control of the quality of shipped coal, and of C. H. J. Patterson, engineer, Pittsburg Boiler & Machine Co., Pittsburg, Kan., on dust collection and air conditioning were read by title only. The Central Indiana plant was described in *Coal Age* several months ago (Vol. 34, p. 220); Mr. Patterson's paper was abstracted in the September, 1930, issue, pp. 533-534.

At the Friday morning session S. M. Parmley, preparation engineer, Pittsburgh Coal Co., Pittsburgh, Pa., described the heat drying of the coal from

Carpenter driers and Oliver, Dorr, and Laughlin type filters, which results in the delivery of washer coal with less moisture than is contained in the coal as it comes from the mine. It could, of course, be more completely dried by the same equipment, but that would create a dust nuisance. The average moisture in the coal as received at the plant is 5 per cent; that of the coal placed in the car is 3 per cent.

H. V. Coes, manager, industrial department, Ford, Bacon & Davis, New York City, discussed the possibility of solving distribution problems by mergers. He remarked that the purpose of present-day mergers is to increase production with decreased cost, to obtain a sufficiently large output to justify the management in expending large sums in research laboratories and in discovering ways and means of bettering the product and widening the market, thus placing the industry on a firmer and more permanent basis.

In an address on the evaluation of coal for blast-furnace coke, Mr. Campbell quoted estimates of the saving in the cost per ton of pig iron produced, which varied from 6c. to 30c. per unit of ash reduction in the coal or coke. The higher figures were based on high-cost coal and on coal hauled long distances. Figures under last year's conditions, however, varied from 6.9c. to 28c., with an average of 17.7c.

At the afternoon session Eugene McAuliffe, president, Union Pacific Coal Co., Omaha, Neb., read an article on mechanical mining, in which he described the bonus system in use at his mines. For the three months ended July 31, 1930, with this arrangement in force, a premium of 76.9c. per man-shift was earned by the men serving 34 per cent of the total man-shifts and producing 44 per cent of the tonnage. The men who received the premium produced 50 per cent more coal than the non-premium earners.

A general review of the investigation by the U. S. Bureau of Mines on stream pollution, presented by R. R. Sayers, chief surgeon of the Bureau, as the joint work of himself, W. P. Yant, and R. D. Leitch, revealed that a few mines had alkaline waters and some had waters both alkaline and acid.

H. P. Greenwald, physicist, U. S. Bureau of Mines, Pittsburgh, Pa., detailed tests of the strength of concrete stoppings, designed to resist the pressure of explosions in coal mines, presenting a paper prepared by G. S. Rice and H. C. Howarth in collaboration with himself. He stated that it was found that the strength of a massive concrete stopping is enormously increased when it is sunk into and fitted closely to the coal ribs and floor. Thus backed, and having a ratio of thickness to span of 1 to 10, it will resist an explosion pressure of 50 lb. per square inch—that is, a 10-ft. stopping should be 1 ft. thick to afford that resistance.

John T. Ryan, general manager, Mine Safety Appliances Co., Pittsburgh, Pa., showed that the output per fatality in the Pennsylvania bituminous mines in 1929 was 378,594 tons. In a selected group of mines of that state having well-organized safety departments the output per fatality was 594,381 tons. Companies without an organized safety department produced only 297,875 tons per fatality, and those with some sort of organized safety department 508,642 tons.

The paper of Kenneth A. Lambert, colliery superintendent, Loree Colliery, Hudson Coal Co., Scranton, Pa., was circulated but not read at the meeting. It stated that in the crushed area at Loree Colliery, the cost, including labor and material, with hand methods was $7.80 per ton, and with shaker chutes, including also maintenance and depreciation charges, $2.27.

Resources Survey Planned

Three representatives of the coal, oil, and timber interests were appointed to form a sub-committee to make a preliminary survey of federal laws affecting natural resources at a meeting of the Natural Resources Department Committee of the Chamber of Commerce of the United States in Washington, D. C., Sept. 18. Coal men attending were: George J. Anderson, New York City, president, Consolidation Coal Co.; Col. Wm. M. Wiley, Sharples, W. Va., vice-president, Boone County Coal Corporation; and C. B. Huntress, Washington, D. C., executive secretary, National Coal Association. Problems facing the three industries were outlined at the meeting. The sub-committee members are: coal—Mr. Anderson; timber—P. Ryland Camp, Franklin, Pa., vice-president, Camp Mfg. Co.; and oil—R. C. Holmes, New York City, president, Texas Co.

Alabama Directors Elected

At the annual meeting of the Alabama Mining Institute, held at the Tutwiler Hotel, Birmingham, Ala., Sept. 30, the following new members of the board of governors were elected: R. T. Daniel, president, Franklin Coal Mining Co., Cane Creek Coal Co., and Alta Coal Co.; Milton H. Fies, vice-president, DeBardeleben Coal Co.; and Leslie E. Geohegan, vice-president and general manager, Gulf States Steel Co. All are from Birmingham.

Kanawha Operators Elect

J. S. McKeever, Longacre, W. Va., general superintendent, Kanawha & Hocking Coal & Coke Co., was elected president of the Kanawha Coal Operators' Association for the coming year at the annual meeting held in Charleston, W. Va., Oct. 2. Other officers elected were: vice-president, W. H. Pettus, Montcoal, W. Va., president, Colcord Coal Co.; treasurer, John L. Dickinson, Charleston, vice-president, Dickinson Fuel Co., and executive secretary, D. C. Kennedy, Charleston (re-elected).

Consolidation Honors Lyon

In recognition of almost 29 years of service with the Consolidation Coal Co., Frank R. Lyon, Fairmont, W. Va., vice-president in charge of operations, was signally honored at a picnic of company officials, office employees, and invited guests, held at Lake Lynn, W. Va., Sept. 20. The executives of the company presented Mr. Lyon with a platinum watch and chain as material evidence of their regard, and the employees of the organization gave him a testimonial affirming their appreciation of his leadership and pledging their co-operation in the future. Officials from the headquarters of the company in New York City who were present to join in the tribute to Mr. Lyon included Robert C. Hill, chairman of the board, and George J. Anderson, president.

Screenings Pool Proposed

A movement for the formation of a pool to store screenings was launched in western Kentucky in the middle of September. J. A. Wallace, treasurer of the Western Kentucky Association, Madisonville, Ky., and chairman of the storage committee, has addressed a letter to the operators explaining the situation and asking if they favor sending their screenings to central storage points. Under the terms of the plan, a pool is to be formed of all screenings over and above contract requirements, this pool to be under the control of a board of governors or committee of the association.

Several storage plants would be established. No operator, however, would be barred from storing at his own plant. Rather, this would be encouraged, as it would relieve the central plants. However, any screenings stored by individual operators in the pool would be subject to the action of the governors, whether in central or private storage, and every operator would share in the proceeds in proportion to the total tonnage in the pool.

Maryland Operators Organize

Maryland coal operators representing 90 per cent of the production in the Georges Creek and Upper Potomac fields have organized under the name of the Maryland Coal Aid Association to bring about closer contact and better co-operation between producers and consumers in the state and to back legislation making it compulsory that only Maryland coal be used in state institutions. Officers were elected as follows: president, John S. Brophy, Frostburg, Md., president, Piedmont & Georges Creek Coal Co.; vice-president, Brooks Fleming, Jr., Fairmont, W. Va., assistant to the president, Consolidation Coal Co.; and treasurer, Roberdeau Annan, Frostburg, president, Union Mining Co. An executive secretary will be selected later. The association adopted the slogan "Maryland Coal for Maryland People."

Personal Notes

C. A. GIBBONS, Morgantown, W. Va., has been appointed safety engineer of the New England Fuel & Transportation Co., with headquarters at Grant Town, W. Va. Mr. Gibbons, who formerly was employed by the Koppers Coal Co., takes the place of W. H. Forbes, resigned.

C. R. BOURLAND has accepted a position as chief engineer for the C. C. B. Smokeless Coal Co., and will make his headquarters at Mt. Hope, W. Va. Mr. Bourland, who succeeds C. E. Bergendahl, deceased, formerly held a similar position with the Fordson Coal Co., Stone, Ky.

M. L. GARVEY, Macdonald, W. Va., has resigned as general manager of the New River Co., which position he has held since late in 1927. Before going with the New River Co., Mr. Garvey was for eight years general manager of the Keeney's Creek mines of the Maryland New River Co. Mr. Garvey has been succeeded by EDWARD GRAFF, mining engineer for the company for a number of years.

DAVID B. REGER, Morgantown, W. Va., has resigned as associate geologist of the West Virginia Geological Survey and has opened an office as a consulting geologist.

ROWLAND R. JONES, Kingston, Pa., an employee of the Glen Alden Coal Co. for 45 years, resigned his position as mine foreman of the Woodward Colliery on Oct. 1 at the age of 75.

EVERETT DRENNEN, Denver, Colo., has resigned as vice-president in charge of the fuel department of the Colorado Fuel & Iron Co. to devote his time to affairs in the eastern part of the United States. Mr. Drennen was president of the West Virginia Southern Coal Co. before going with the Colorado Fuel & Iron Co.

ERSKINE RAMSAY, Birmingham, Ala., chairman of the board of the Alabama By-Products Corporation, was appointed a member of the special committee on education of the United States Chamber of Commerce last month.

BYRON M. BIRD, formerly in charge of the coal-washing investigations of the U. S. Bureau of Mines at the Washington (D. C.) and Tuscaloosa (Ala.) experiment stations, has resigned to accept a position with the Battelle Memorial Institute, Columbus, Ohio, an organization carrying on fuel and metallurgical research.

Obituary

THEODORE C. KELLER, president, Indiana & Illinois Coal Corporation, Chicago, died Sept. 6 in the Evanston (Ill.) hospital of a hemorrhage of the brain after an illness of three months. Mr. Keller, who was born in Boston, Mass., Jan. 7, 1864, began his career as a mine operator at Clinton, Ind., in 1893. In 1906, he moved into southern Illinois, opening a mine in Franklin County, which was later sold to the Old Ben Coal Corporation. Several years ago, he went into the Utah coal industry, becoming president of the Utah Fuel Co., Salt Lake City, from which position he retired on Jan. 1, 1930.

DAVID V. RANDALL, general manager, Susquehanna Collieries Co. and the Lytle Coal Co., Wilkes-Barre, Pa., dropped dead Sept. 16, in Portland, Ore., when he was stricken by a heart attack while walking along the street. Mr. Randall had been associated with the Susquehanna and Lytle companies since 1898. Before that time he was an engineer at the collieries of the Delaware & Hudson Company.

BENJAMIN BISSELL, general manager of the Century Coal Co. for the past 25 years, died at his home in Baltimore, Md., Sept. 29. Mr. Bissell was 77.

Coming Meetings

National Coal Association; annual meeting, Oct. 15-17, at Book-Cadillac Hotel, Detroit, Mich.

Mining and Metallurgical Advisory Boards, Carnegie Institute of Technology and U. S. Bureau of Mines; fourth annual meeting, Oct. 17, Carnegie Institute of Technology, Pittsburgh, Pa.

Illinois Mining Institute; annual meeting, Oct. 31 at Centralia, Ill.

Indiana Coal Operators' Association; annual meeting, Nov. 18, Terre Haute House, Terre Haute, Ind.

Southern Appalachian Coal Operators' Association; annual meeting, Nov. 20, Knoxville, Tenn.

West Virginia Coal Mining Institute; annual meeting, Dec. 2 and 3 at Huntington, W. Va.

King Coal's Calendar for September

Sept. 6—Selection of a committee of coal operators, railroad officials, and consumers in Illinois to study intrastate freight rates with the object of negotiating new tariffs on Illinois coal decided on as a means of settling the coal rate controversy in that state at a conference in Chicago. The conference was called in an effort to settle without trial the railroads' complaints against intrastate rates on Illinois coal and the Illinois Coal Traffic Bureau complaint on rates from southern Illinois to Chicago.

Sept. 9—Members of committee to study intrastate coal rates in Illinois, with the object of negotiating new tariffs on coal, named by railroad, coal-operating and consuming interests. Coal men on the committee, formation of which was decided on at meeting of the interested parties in Chicago, Sept. 6, are: D. W. Buchanan, Chicago, president, Old Ben Coal Corporation; A. E. Lee, Springfield, Ill., president, Panther Creek Coal Co. G. W. Read, Chicago, vice-president, Peabody Coal Co.; E. C. Searls, Chicago, Crerar-Clinch Coal Co.; and a representative of the Belleville (Ill.) district to be selected later.

Sept. 9—John L. Lewis, president, United Mine Workers, named in a new citation for contempt of court brought by attorneys for Harry Fishwick, head of the insurgent District 12 (Illinois). The petition charges Lewis with conspiring with fifteen Franklin County miners, who are named as co-defendants, to violate an injunction issued last October preventing him from interfering in the affairs of District 12. Hearing on the petition was set for Sept. 17.

Sept. 10—Judge Frederick A. Hill, Watseka, Ill., denies a motion of the Illinois miners' faction led by Harry Fishwick to dissolve a temporary injunction granted fifteen Franklin County miners on Aug. 13, restraining the insurgent group from carrying on activities in Illinois. Judge Hill declared that the action taken at the insurgent convention at Springfield, Ill., early in the year did not create a new organization.

Sept. 11—French mine workers in the Lille coal field announce a strike as a result of a dispute over pay during vacations. Mine owners did not object to paying for the vacations but said that the miners should work extra hours to repay them. The final disagreement occurred when owners and miners failed to get together on just what days the extra work should be done on. Though strike plans were announced, a definite date was not set.

Sept. 13—Judge Charles G. Briggle, Sangamon County circuit court, Springfield, Ill., grants representatives of the insurgent District 12 (Illinois) miners an injunction restraining fifteen Franklin County miners from enforcing an injunction obtained Aug. 13 in the court of Circuit Judge J. C. Kern, Benton, Ill., and sustained by Judge Frederick A. Hill, Watseka, Ill., Sept. 10, preventing the insurgent organization or its officers from carrying on union affairs in Illinois.

Sept. 17—Explosion of gas in the 1,200-ft. level of the Old Victoria mine of the Victoria Coal Co., River Herbert, Nova Scotia, kills seven men.

Sept. 17—Four men killed and two injured in an explosion of gas in the West Skidmore Dip of the Sherman Colliery of the Sherman Coal Corporation, Pottsville, Pa.

Sept. 24—Percy Tetlow, Charleston, W. Va., president, other officials of District 17, United Mine Workers, and miners at Ward, W. Va., restrained from interfering with the operation of the mines of the Kellys Creek Colliery Co. under the terms of a temporary injunction issued by Judge A. P. Hudson, Kanawha County circuit court.

Sept. 26—Several miners injured in a clash between insurgent and regular factions of the United Mine Workers at Mine No. 11 of the United Electric Coal Cos., DuQuoin, Ill. Fifty men engaged in the fight, county police stated.

Sept. 26—Ellis Searles, Indianapolis, Ind., editor, *United Mine Workers' Journal*, at a meeting in New York City, Sept. 26, tells the Fish congressional committee investigating Communist activities in the United States that government control of the bituminous coal industry will be necessary to stop the spread of Communism among the miners.

Sept. 29—Three men killed and four others perhaps fatally injured in an explosion of gas in the Laws shaft of the Central mine of the Pittston Co., Avoca, Pa.

Coal-Mine Fatality Rate Higher in August, 1930, Than in July or Same Month Last Year

REPORTS received by the Bureau of Mines from state mine inspectors showed that 161 men were killed in the coal mines of the United States in August, 1930, which number was 24 less than in August, 1929, and 14 more than in July of the present year. The production of coal during August was 41,851,000 tons, a reduction of 8,359,000 tons as compared with August, 1929, and an increase of 1,478,000 tons over July, 1930. The death rate per million tons of coal mined during August was 3.85 as compared with 3.68 for August a year ago, and 3.64 for July, 1930.

Considering bituminous coal mines alone, the fatality rate for August was slightly higher than for either July of the present year or August a year ago, the rate being 3.25 per million tons, as compared with 3.19 for last August and 3.17 for July, 1930. There were 116 men killed in bituminous mines in August, 1930, which was 26 less than in August, 1929, and 6 more than in July of the present year. The production of bituminous coal for August was 35,661,000 tons; for the same month a year ago, 44,475,000 tons; and 34,715,000 tons for July, 1930.

In the anthracite mines of Pennsylvania 45 men lost their lives during the month; as 6,190,000 tons of coal were produced, the fatality rate per million tons was 7.27. While in August, 1929, only 43 men were killed, the production of coal was 455,000 tons less than in August of the present year and resulted in a death rate of 7.50. In July, 1930, the fatality rate was 6.54, based on 37 deaths and 5,658,000 tons.

Reports for the first eight months of the present year showed a total of 1,297 deaths from accidents in coal mines as compared with 1,353 for the same period in 1929. While the 1930 period showed a decrease of 56 deaths, there was also a decrease in the production, the tonnage for 1930 being 346,650,000 tons and that for 1929 being 388,288,000 tons. This resulted in an increase in the fatality rate, from 3.48 in 1929 to 3.74 in 1930. The death rate for bituminous mines alone increased from 3.08 in 1929, based on 1.053 deaths and 342,226,000 tons, to 3.33, based on 1,003 fatalities and 301,010,000 tons, during the eight-month period of 1930. The anthracite fatality rate decreased from 6.51 last year to 6.44 this year; the number killed for the 1930 period was 294 as compared with 300 last year, and the production decreased from 46,062,000 tons to 45,640,000 tons.

One major disaster—that is a disaster in which five or more lives were lost—occurred during August; this was on Aug. 8, when 8 men were killed by a fall of roof, at Gilberton, Pa. There were no major disasters in August, 1929. During the first eight months of 1930, 8 major disasters, with a total of 96 deaths, were reported, as compared with 4 such disasters and 75 deaths during the corresponding period of 1929. Based exclusively on these disasters the death rates per million tons of coal produced were 0.277 for 1930 and 0.193 for 1929.

Comparative rates for the eight-month periods 1930 and 1929 are as follows:

Cause	Year 1929	Jan.-Aug., 1929	Jan., Aug. 1930
All causes	3.581	3.485	3.742
Falls of roof and coal	1.934	1.852	2.031
Haulage	0.675	0.659	0.632
Gas or dust explosions:			
Local explosions	0.082	0.085	0.127
Major explosions	0.238	0.178	0.245
Explosives	0.145	0.152	0.159
Electricity	0.133	0.149	0.147
Miscellaneous	0.374	0.410	0.401

U. S. Bureau of Mines Issues Permissible Plates

Three approvals of permissible equipment were issued by the U. S. Bureau of Mines in August, as follows:

(1) Goodman Mfg. Co.; Types 12-EK3 and 12CK3, shortwall, mining machines; 35-hp. motors, 220-440 volts, a.c.; Approvals 198 and 198A; Aug. 1.

(2) Brown-Fayro Co.; Austin-Brownie, 5x6-in., "Perfect-Oiler," mine pump; 5-hp. motor, 250-500 volts, d.c.; Approvals 199 and 199A; Aug. 18.

(3) Jeffrey Mfg. Co.; Type 38D, pjt-car loader; 3-hp. motor, 220-440 volts, a.c.; Approvals 200 and 200A; Aug. 20.

Coal Mine Fatalities During August, 1930, by Causes and States

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

State	Underground												Shaft					Surface							Total by States	
	Falls of roof (coal, rock, etc.)	Falls of face or pillar coal	Mine cars and locomotives	Explosions of gas or coal dust	Explosives	Suffocation from mine gases	Electricity	Animals	Mining Machines	Mine fires (burned, suffocated, etc.)	Other causes	Total	Falling down shafts or slopes	Objects falling down shafts or slopes	Cage, skip or bucket	Other causes	Total	Mine cars and mine locomotives	Electricity	Machinery	Boiler explosions or bursting steam pipes	Railway cars and locomotives	Other causes	Total	1930	1929
Alabama	6	....	2	....	....	....	....	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	8	4
Alaska	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Arkansas	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	2
Colorado	1	....	....	....	....	....	1	....	....	....	....	2	....	....	....	....	....	1	....	....	....	....	....	1	3	5
Georgia and North Carolina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Illinois	5	....	2	....	1	2	....	....	....	....	1	11	....	....	....	....	....	....	....	....	....	1	1	2	13	8
Indiana	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	1
Iowa	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	0
Kansas	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	2
Kentucky	7	....	4	....	....	....	....	....	....	....	....	11	....	....	....	....	....	....	....	....	....	....	....	....	11	15
Maryland	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Michigan	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0
Missouri	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	1	0
Montana	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	0
New Mexico	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0
North Dakota	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0
Ohio	2	....	1	....	1	....	....	....	....	....	....	4	....	....	....	1	1	....	....	....	....	....	....	....	5	6
Oklahoma	....	....	....	....	....	1	2	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	3	2
Pennsylvania (bituminous)	10	1	4	1	1	....	2	....	1	....	....	20	....	....	....	....	....	1	....	....	....	....	2	3	23	34
South Dakota	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Tennessee	1	....	1	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	2	3
Texas	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	2
Utah	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	4
Virginia	1	....	....	....	....	....	1	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	2	4
Washington	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	0
West Virginia	17	4	7	....	1	....	4	....	....	....	....	33	....	....	....	1	1	2	....	....	....	1	....	3	37	47
Wyoming	1	....	....	....	....	....	....	....	1	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	2	1
Total (bituminous)	55	6	22	1	4	3	10	....	2	....	1	104	1	....	....	2	3	4	....	....	....	2	3	9	116	142
Pennsylvania (anthracite)	23	4	5	....	5	2	1	....	....	....	1	41	1	....	....	....	1	....	2	....	....	....	1	3	45	43
Total, August, 1930	78	10	27	1	9	5	11	....	2	....	2	145	2	....	....	2	4	4	2	....	....	2	4	12	161	....
Total, August, 1929	79	12	27	9	10	4	16	....	3	....	9	169	3	....	2	....	5	2	1	3	....	2	3	11	....	185