COAL AGE

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

SYDNEY A. HALE, *Editor*

New York, November, 1932

Coal Stock Reports

ACCURATE and comprehensive data on the quantity of coal in the stockpiles of industrial consumers contribute materially to a more orderly production and distribution of tonnage. Mine and consumer alike benefit from the prompt publication of figures showing the extent of current coal storage reserves. For this reason, the recent agreement between the Bureau of Mines and the National Association of Purchasing Agents for cooperative gathering of such data comes as welcome evidence that the publication of this important information will be neither curtailed nor eliminated.

This pooling of effort, however, might well be carried further. At present, the purchasing agents' association issues monthly reports; the government, a quarterly summary. With the machinery now set up, it should not be difficult to further expand this joint effort to the cooperative publication of a monthly report which would draw upon the sources of information available to both agencies and give the industry a monthly report which would combine the speed of the publication of the data now collected by the purchasing agents' group and the greater detail embodied in the present quarterly summaries of the Bureau of Mines.

Fine Dirt in Coal

IN GENERAL it has been assumed that the extraneous matter in coal, the heavy-gravity material, spoils coke only when that dirt is large. The expansion of the slate, it has been recognized, is different from that of the coke on heating, and the contraction of slate differs from that of the coke on cooling. This tears the product apart and causes cracks, weak coke and breeze.

J. R. Campbell, at the Hazleton Coal Division meeting of the American Institute of Mining and Metallurgical Engineers, declared that metallurgists were now showing much interest in the percentage of high-gravity material found in coal of a size between ⅜ in. and 20-mesh. A 4-in. cube of over-heavy material in coal, when broken into ⅜-in. cubes, would consist of 1,214 pieces. Investigators say each piece of such impurity causes a star fracture of several points; one declares there are five such points, so there will be with the ⅜-in. cube 6,070 cross-fractures for each piece of 4-in. cube that is broken to the smaller size.

This fine-sized material is readily overlooked, but the product testifies distressfully to its presence. Smaller particles may form a small percentage indeed of the whole mass, but their effects are not less important if they are still large enough to cause crevices. All of which seems to make mechanical cleaning necessary where such impurity exists, for material of that size cannot be cleaned by visual inspection.

Modernization Moves

DESPITE THE FACT that the organization set-up has not been entirely completed in any of the twelve Federal Reserve Districts into which the work of the Committee on Industrial Rehabilitation has been divided, early reports show commitments to expenditures of nearly $71,000,000 for modernization since the committee started its campaign. Private advices indicate active consideration of hundreds of other projects not yet officially reported. These projects range from individual expenditures of a few thousand dollars to proposals running into the millions.

Two considerations, and only two, motivate these commitments. The first is the realization

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that idle dollars have a greatly enhanced purchasing power in the capital-goods industries today. Modernziation is "a good buy." Second is the foreknowledge that it will be extremely difficult, if not impossible, for the plant burdened with obsolete equipment or methods to make a profit in the era of intensified competition facing industry. Business is on a shortened diet, and crumbs for the hangers-on will be unpalatable and few.

Nowhere should these considerations of self-interest have greater weight than in the coal industry. Internal and external competition place a premium upon inefficient methods and equipment that the lean pocketbook of the industry cannot pay without robbing stockholders and employees of their just returns.. Whether we like it or not, price, in both internal and external competition, is a dominant factor. Competitive prices minus the high production costs chargeable to obsolescence can never be equated to profits.

No Place for Ostriches

Despite the devotion to progress which is part of the American business creed, ready acceptance of change is not always easy. When oil and gas first began to eat into the profitable domestic coal market, the pioneers who offered the industry the competitive weapon of mechanized heating met with more indifference and even open hostility than encouragement. Certain anthracite retailers, grumbling over their shrinking volume of stove and egg, failed to realize that the domestic stoker was holding customers who otherwise would have installed gas or oil burners; some producers privately denounced the stoker manufacturer as a menace to the coal industry.

While this hostile attitude still persists in some quarters, there is growing evidence that enlightened leadership in the industry is keenly conscious of the change which has taken place in the domestic market and the rôle mechanized heating plays in that change. The first thing that must be recognized, to quote A. T. Goodenough, president, Shanferoke Coal & Supply Corporation, is that "the public is going to have automatic heat, whether it be oil, gas, bituminous or anthracite." B. R. Gebhart, director of public relations, Illinois Coal Bureau, expresses the same truth when he says: "The job is to give the people what they want. And that isn't just coal, but clean, convenient, economical heat."

When an industry ceases to regard unfavorable developments as a fleeting mirage that time will automatically erase, the first step in overcoming adverse competitive conditions has been taken.

Winter's Muggy Days

Scientific reasons for favoring the use of the open anthracite fire are slowly gathering. To the length of the waves of the various kinds of light probably will be traced the evil effects of some rays and the benevolent effects of others. Some rays from the sun, like the ultra-violet, have a short wave length, and some, like the infra-red, have long waves, while in between are rays with waves of intermediate length. When the sun's radiance tries to force its way to the earth, it is resisted by reflection and refraction. The longest infra-red rays, being the least refracted, come more readily to earth than the violet rays or even than the shorter of the infra-red rays.

Some of the rays are absorbed, heating the little beads of moisture and dust in the clouds, which in turn give out the longest infra-red rays such as are naturally emitted from such secondary sources, the heat of which is of low intensity. For all these reasons, on muggy days the longest infra-red rays are in undue proportion, and these Sir Leonard Hill has recently declared are maleficent, whereas the shorter infra-red rays, though long as compared with the violet rays, are kindly to the human system.

Sir Leonard finds that the beneficent rays of the infra-red part of the spectrum have only a narrow range—between 20,000 and 30,000 Angstrom units—and that these rays are not produced by electric radiators or the ordinary gas flame. That, probably, is why both are so lacking in real solace. They give few short-wave infra-red rays and many rays of a kind that Sir Leonard stigmatizes as causing congestion of the nasal passages. Recently, he declared that the more refrangible and shorter of the infra-red rays, of the range indicated, reduce congestion and correct the action of the others. Thus will an open coal fire relieve the distress of a muggy long-ray day.

TIME STUDIES

+ Point Way to Improvements

In Underground Transportation

By D. L. McELROY

Assistant Director, Mining Extension
School of Mines, West Virginia University
Morgantown, W. Va.

MANY operating officials are inclined to regard the "time study" as a mysterious waste of time by a man with a watch, a pad, and a pencil, whereas it actually is a searching, scientific analysis of an operation to determine when and how the assigned task is being performed. Time-study data, therefore, give the percentage of the total time spent by a man or machine in productive work, and, by bringing out the causes of delay, points the way to remedial measures. This method of determining the details which affect the efficiency of a man, machine, or operation may be used by anybody (engineer, superintendent, foreman, or section boss) who desires information on the actual performance of any operation in mining coal as a basis for eliminating delays and increasing efficiency.

Application of time-study methods to the determination of haulage efficiency, showing the data collected, how they were obtained, and how used, is discussed in this article. Pertinent information on physical and operating conditions at the mine is given in Table I. The haulage system is reproduced in Fig. 1, which shows the location of the shaft, main-line tracks, and side tracks. Number of gathering units hauling to each side track, number of loaders, the tonnage produced by each section, the distance between various points, and the general dip of the seam also are shown in Fig. 1.

In obtaining data on the operation of the transportation system and the hoist, records on the operation of the hoist, the arrival and departure of trips, and the number of empty cars and loads in each trip were kept by a man stationed on the bottom. Data on main-line and gathering locomotive performance were entered on forms provided for the purpose by the respective motormen. One loader's time was studied by having him enter the time spent at various tasks, divided according to the classifications furnished him, on a suitable form.

A partial record of one day's operation of the shaft bottom is reproduced in Table II. This form was used to collect all the data on the operation of the bottom from the first hoist in the morning until the last in the evening. A record of the movements of the main-line locomotive No. 1 for a portion of the shift is shown in part in Table III. While the forms are not shown here, motormen on the gathering locomotives divided their time into placing empties, pulling loaded cars, and time lost; the loader's day was divided into time used for inspection, timbering, drilling holes, shooting, trackwork, loading coal, and time lost.

Operation of the main-line locomotives and the shaft bottom is shown graphically in Fig. 2. Information used in plotting the charts was obtained from the records kept as in Tables II and III. The lower chart shows the shaft-bottom performance, while the middle and upper charts show the operation of main-line locomotives Nos. 1 and 2, respectively. Horizontal divisions for all three charts represent hours of time from 6 a.m. to 8 p.m. Vertical divisions for the shaft-bottom chart represent the number of loaded cars on the bottom, while the vertical divisions for the locomotive charts represent the places visited.

These charts show the time when activity started and stopped, as well as the total time required for all movements. For example, locomotive No. 1 left the shaft bottom at 6:30 a.m. with no cars (indicated by the dot-and-dash line) and arrived at the Passway at 6:45. At 6:48, the locomotive left the Passway with 30 loads (shown by the figure 30 marked on a solid line) and arrived at the bottom at 7:05. It started on its return trip at 7:11 with 52 empty cars (shown by the figure 52 on a dotted line), and arrived at 3 South at 7:41. Movements of No. 2 locomotive are shown in the same way on the top chart.

Examination of the lower chart in Fig. 2 shows that there were 50 loaded cars on the bottom when hoisting began at 6:45 a.m. Forty cars were hoisted,

Table I—Physical and Operating Conditions

Thickness of seam, ft	6
Depth of cut, ft	6
Width of room, ft	18
Width of entries, ft	12
Number of loaders	116
Cars in use	200
Cars in use per loader	1.72
Car capacity, tons	3.00
Capacity of cars in use per loader, tons	5.17
Cars loaded on day shift	431
Cars loaded on night shift	90
Total cars loaded	521
Weight, main-line locomotives, tons	13
Track conditions	Good

Table II—Shaft Bottom Operation

Time	Locomotive No.	Loaded Cars IN	Empty Cars OUT	Remarks
12:33	1	25	..	....
12:46	1	..	26	....
1:11	2	30	..	....
1:31	2	..	31	Bottom lost 3 min. due to tipple (1:22-1.25)
2:00	1	30	..	....
2:13	1	..	25	....

Table III—Operation of Main-Line Locomotive No. 1

Departure		Arrival		Cars Hauled		
Time	Place	Time	Place	Loads	Empties	Remarks
6:30	Bottom	6:45	Passway	..	..	Light trip
6:48	Passway	7:05	Bottom	30		....
7:11	Bottom	7:41	3 South	..	52	Waited 3 min. at bottom for empty cars
7:42	3 South	8:05	Main East	..	..	Went to Main East light for loaded cars
8:07	Main East	8:35	Bottom	30		....
8:37	Bottom	9:05	Main East	..	25	....
9:07	Main East	9:38	Bottom	10	..	....

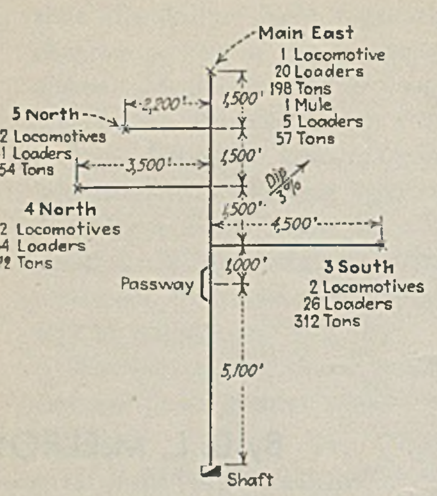


Fig. 1—Haulage Layout

leaving 10 loads on the bottom when locomotive No. 1 arrived at 7:05 with 30 loads, bringing the total number of loaded cars on the bottom up to 40. The hoisting and arrival of loaded cars on the shaft bottom are thus shown for the entire shift. Similar charts (not included in this article) may be plotted for gathering locomotive and loader performance.

Reference to the proper chart in Fig. 2 shows that the shaft bottom employees were on the job 12 hours and 17 minutes, or a total of 737 minutes. During this time, coal was hoisted for only 298 minutes, the remaining 439 minutes being lost as follows:

	Minutes
Waiting on coal	428
Putting in supplies and cars	8
Waiting on tipple	3
Total	439

The 439 minutes lost represented 59.56 per cent of the total working time.

Locomotive No. 1 was on the job 756 minutes, of which 619 minutes, or 81.88 per cent, was spent in hauling cars (this includes the time of changing trips, which must be counted as working time). The 137 minutes lost were divided as follows:

	Minutes
Waiting on empty cars at the bottom	61
Waiting on locomotive No. 2 at Passway	76
Total	137

Locomotive No. 1 traveled 41.47 miles in 588 minutes of actual running time, making the average speed 4.23 m.p.h.

Locomotive No. 2 was on the job 785 minutes, of which 644 minutes, or 82.04 per cent of the total time, was spent in hauling cars, including the time of changing trips. The time lost was divided as follows:

	Minutes
Waiting on empty cars at the bottom	80
Waiting on locomotive No. 2 at the Passway	29
Waiting for loads	30
Miscellaneous delays	2
Total	141

No. 2 locomotive traveled 42.55 miles in 603 minutes of actual running time, or at an average speed of 4.21 m.p.h. Trip data for each of the two locomotives are shown in Table IV.

An analysis of the working time of the Main East gathering locomotive, which serves 18 loaders in rooms and 2 loaders in entries, shows that it placed 66 empties and pulled the same number of loads. Average length of haul, not including room travel, was 1,800 ft. in one direction. The locomotive worked 587 minutes, of which time 492 minutes, or 83.82 per cent of the total, was spent in placing empties and pulling loads. Average time for placing a trip of cars was 48.5 minutes, and the average time for gathering a trip of loads was 73 minutes, each average being based on four trips.

The time record kept by the loader

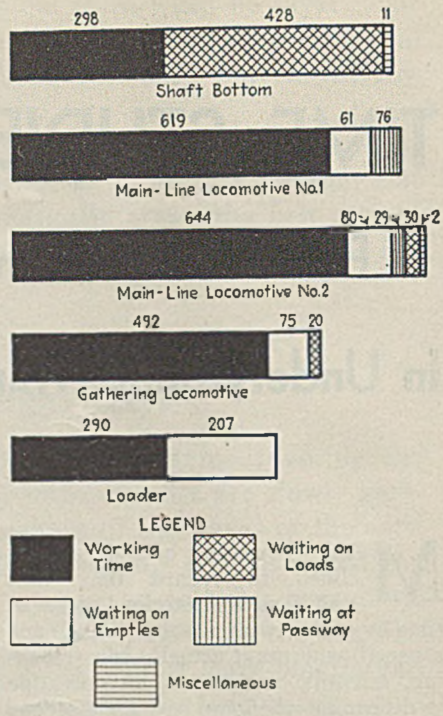
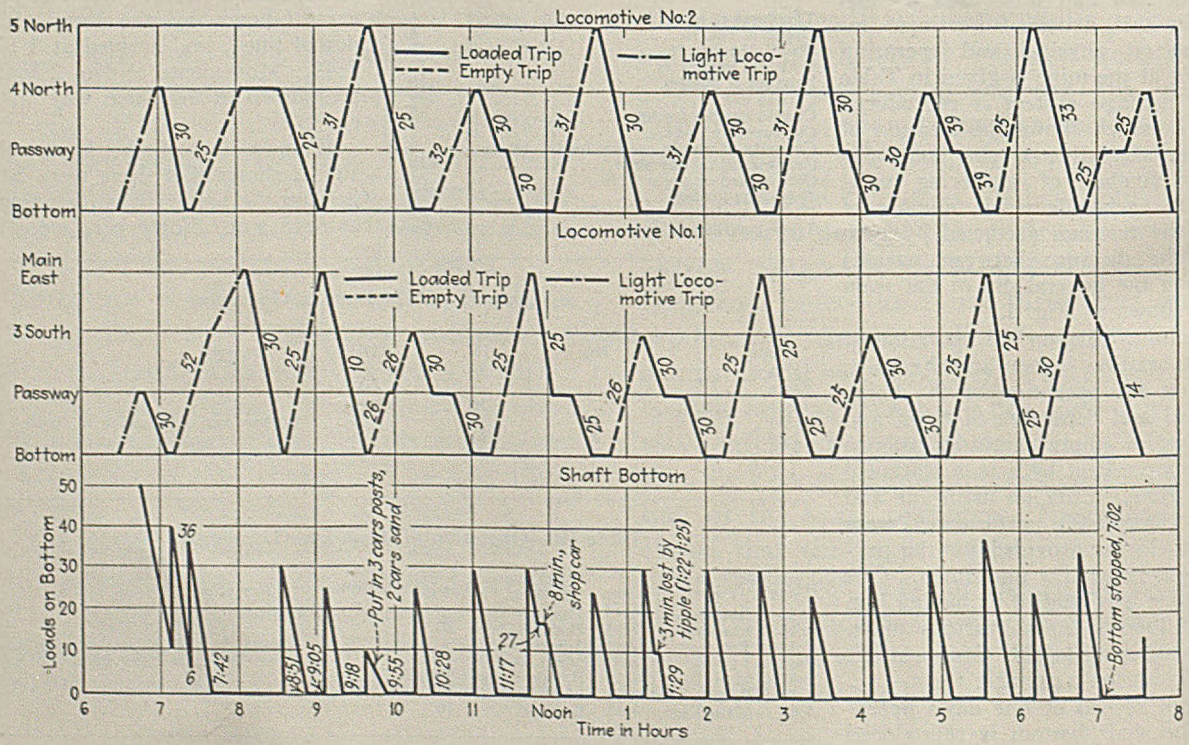


Fig. 3—Graphic Summary, Working Time of Shaft Bottom, Locomotives, and Loader

Fig. 2—Graphic Representation of Main-Line Locomotive and Shaft-Bottom Operation



showed that he was in his place 497 minutes, which was spent as follows:

	Minutes
Preparing and loading coal	108
Timbering	67
Drilling	45
Trackwork	40
Shooting	20
Miscellaneous work	10
Waiting on empty cars	207
Total	497

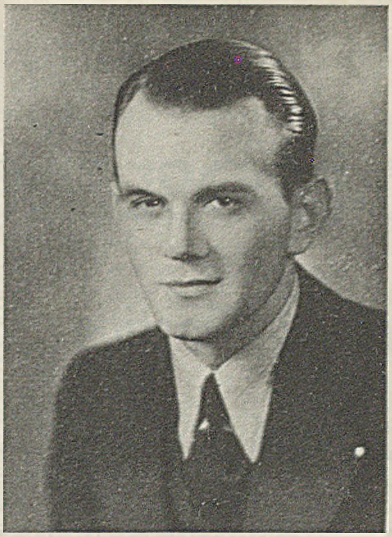
The 207 minutes lost represent 41.65 per cent of the total working time. This man loaded four cars, which was as many as were loaded by any other man during this shift. A graphic summary of the working time of the shaft bottom, main-line locomotives, gathering locomotive, and loader, is given in Fig. 3.

Efficient mine haulage requires that each loader be furnished with an empty car as soon as the previous car is filled. This applies to both hand and machine loading. At this mine, the loader whose time was tabulated loaded 12 tons of coal in 290 minutes, leading to the conclusion that if he had not spent 207 minutes waiting for cars he could have loaded 20 tons or more. In view of the fact that this loader produced a tonnage as great an any other in the mine, it may be concluded that the mine is short of cars.

Study of Fig. 2 shows that the main-line locomotives spent the major part of the shift in hauling cars (81.88 and and 82.04 per cent, respectively). The main-line locomotives are only a link in the haulage chain, however, and in spite of their high individual efficiency it seems evident that they still hold up the other units—a true bottle neck. There are two apparent reasons why the operation of these locomotives slows up the haulage system: insufficient mine cars to handle the tonnage; and long hauls (too many ton-miles) from widely scattered sections.

As was the case with the main-line locomotives, the gathering locomotive studied (Main East) has a good record, which in this case also, hides the fact that it is causing the loaders on that section to lose time. Although it gathered more coal than any other of the gathering units, Main East loaders, on the average, loaded less coal per man. This means that at least the same quantity of coal and probably more could have been gathered from fewer places if the section had been furnished with more cars.

Reference to the data on shaft-bottom operation shows that this is a simple case of a bottom designed to handle 60 per cent more tonnage than is being put through it at present. Car shortage also is indicated here by reason of the fact that there usually are no cars on the bottom when the locomotive arrives, with the result that it has to wait until a part of its trip is hoisted before it can return with empties.



D. L. McElroy

Mr. McElroy, who was graduated from the School of Mines, West Virginia University, Morgantown, W. Va., in 1927, received his practical coal-mining experience in the employ of the Richland-Marshall Coal Co., Elm Grove Mining Co. of Ohio, and the Dragon Coal Co., all northern West Virginia companies, from 1918 to 1927, and in the operating department of the Penn-Pitt Coal & Coke Co., Greensburg, Pa., from 1927 to 1928. He returned to the School of Mines in 1928 as a graduate student, and began a two-year study of mine haulage in West Virginia, which was completed in 1930. Shortly after receiving his master's degree in 1930, Mr. McElroy was appointed to his present position as assistant director of Mining Extension.

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Examination of the data collected in this study brings out the conclusion that enough additional cars should be purchased to increase the total from 200 to 322; the latter number would be distributed as follows:

	Cars
Shaft bottom	30
Locomotive No. 1	30
Locomotive No. 2	30
Gathering locomotives	116
Loaders	116
Total	322*

* Based on 30-car trips. No allowance is made for shop and supply cars.

The 322 cars is about the minimum number that will give the desired efficiency of operation. These figures are based on 30-car trips, though trip size or operating speed, or both, might be increased to insure proper distribution. Purchase of the additional cars would increase the number in use per loader from 1.72 to 2.77.

The installation of 122 additional cars should increase the average tonnage per loader per shift sufficiently to allow for a reduction of 40 per cent in the number of working places, giving due weight to development work. This concentration of working places probably would allow the main-line and gathering locomotives, which now haul from places too widely scattered, to reach approximately the peak of efficiency, and, by providing a steadier and larger run of coal per hour, would cut down the long hours of operation for the main-line locomotives and hoisting shaft. In addition, loading, ventilation, drainage, supervision, and maintenance should be more efficient, and the purchase of more or heavier main-line locomotives might be deferred for some time by shortening the distance that the haulage units have to travel.

The major delays in main-line haulage (waiting for empty cars at the bottom and delays at the Passway while one locomotive waits for the other to arrive) could be practically eliminated by the purchase of 30 cars in addition to the total of 322. These 30 cars would be placed at the Passway, and one locomotive would haul to the Passway while the other would haul from there to the bottom. With this system, the inside locomotive, if it arrived before the other came in from the shaft bottom, would drop its trip of loads and pick up the empties without delay. The locomotive running to the shaft bottom would leave the empty trip and pick up the loads, also without delay. However, the use of the 122 additional delays probably would eliminate delays due to waiting for cars at the bottom, and make the purchase of the extra 30 cars unnecessary if the movements of the main-line locomotives were properly synchronized.

In conclusion, it is clear that a shortage of cars and a lack of concentration of working places was responsible for the low average tonnage per loader, long working hours, and generally inefficient performance at this mine. All of these facts were revealed by the study, which, with modifications in method, can be extended to practically all operations around the mine, whether large or small, revealing the causes of inefficiency and in most cases clearly indicating the remedies.

Table IV—Trip Data, Main-Line Locomotives

	Number of Trips		Cars Hauled		Coal Hauled	Avg. No. Cars Per Trip	
Locomotive No.	Loaded	Empty	Loads	Empties	Tons	Loaded	Empty
1	10.0	9.0	249.0	209.0	747.0	24.90	23.20
2	9.0	9.0	272.0	261.0	816.0	30.20	29.00
Total	19.0	18.0	521.0	470.0	1,563.0	.....	.....
Average	9.5	9.0	260.5	235.0	781.5	27.55	26.10

ANTHRACITE PROBLEMS

+ Dominate Discussion at Meeting

Of Coal Division of A.I.M.E.

SUBSIDENCE, dedusting of coal, use of high-volatile coal for gas making and metallurgical purposes, methods of reducing the waste of compressed air, and forecasting methods of accounting occupied the Coal Division and the Pennsylvania Anthracite Section of the American Institute of Mining and Metallurgical Engineers at the joint fall meeting, held in Hazleton, Pa., Oct. 14-15.

H. W. Montz, mining engineer, Lehigh Valley Coal Co., Wilkes-Barre, Pa., recording the experience of his company with subsidence, showed a curve (Fig. 1) relating the apparent final subsidence to depth of cover, the vertical abscissas of which represented inches of subsidence to feet of coal and the ordinates the depth of rock cover. As the subsidence of the surface responded so readily to all appearance with the subsidence of the rock below, the total thickness of cover was disregarded, even though, in some cases, the surface wash might be 100 ft. or more and the rock cover not much thicker.

The surface disturbance, said Mr. Montz, was extended well beyond the limits of the area from which the pillars had been withdrawn; the greater area was explained, he believed, by slides in the side rock after vertical collapse around the actual area excavated. The final slope, as determined by points of disturbance on the surface, might be, he remarked, at an angle of 60 deg. to the horizontal instead of 90 deg. Levels were taken on steel rods driven about 5 ft. into the ground so as to obviate the effect of frost.

H. H. Otto, chief mining engineer, Hudson Coal Co., Scranton, Pa., described the repair work, temporary and permanent, which was made by his company to houses injured by subsidence wherever the repair would not cost in excess of $5,000 per residence. Temporary repairs covered keeping the building level, though not necessarily at the original level, and repairing damage to gas lines, water lines and sewers. The best results were attained by using structural steel girders under the houses and jacking the buildings up under the steel.

One representative property, a slide of which he showed on the screen, had gone through the ordeal of having a 3-ft. seam of coal extracted from under it with only 70 ft. of protecting cover. Structural steel entirely prevented the windows and doors from jamming and the house from being wracked out of shape.

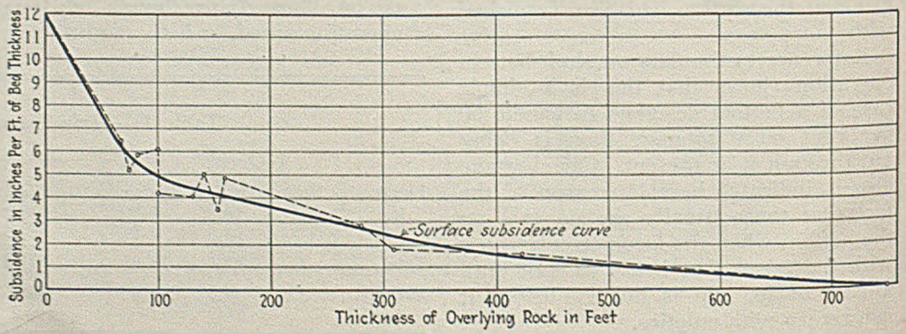
Where one seam of coal is recovered, the average cost has been 15c. a ton of coal, but as several seams are removed at varying depths, the cost has not averaged more than 6½c., and when all the coal has been taken out of all the seams, the cost probably will not exceed 3½ to 4c. per ton. Of course, this merely shows the cost for that particular company, which has various specific coal thicknesses, depths, pitches and varied densities and values of residential occupation.

Preliminary dedusting, said Henry F. Hebley, mining engineer, Allen & Garcia Co., Chicago, speeds up the drying of fine coals and the clarification of washery water. The fine coal may be extremely high in ash, as he showed in charts, especially in the case of Illinois No. 5 coal. On the other hand, it may be as clean as the large coal and be readily returned to the rest of the washery product after reasonable draining. The dust also may be a fusain that will prevent coal from coking, some fusain being extremely harmful. With slow drying the capacity of the dryers and thickeners is cut down, and more equipment of this kind accordingly must be provided.

In dedusting, the presence of moisture and tenacious clay makes difficulties. Especially troublesome is flaky laminated material of small mass which is readily raised and deposited with material of smaller dimensions. A dust of over 10 microns (0.01 mm.) diameter will fall in still air with increasing velocity; one between 0.1 and 10 microns will fall at uniform speed. Finer dusts than these will float like smoke and not settle at all.

Mr. Hebley showed the Dry-Flo tank car for transporting dust (*Coal Age*, Vol. 37, p. 216). He also showed several lantern slides of bag filters, the efficiency of such bags depending on the presence of small fibers to which the dust adheres. These fibers, he said, in the process of a periodical shaking of the bags, break off, greatly reducing the capacity of the filters and necessitating the renewal of the cloth. A speed of air of 4 ft. per minute, he said, favors

Fig. 1—Final Surface Subsidence Based on Rock Cover, Disregarding Surface Wash, in Northern Anthracite Fields, 1925-1932.



the deposition of the dust in the filter.

Briquetting the fine dust, in the opinion of K. C. Appleyard, Birtley Co., Ltd., Durham, England, was a doubtful expedient where the coal was dirty, because the public wanted briquets with a percentage of ash as low as could be expected in large coal. It is true, he added, that dedusting of coal shortened the settling period of the fine coal from washing, but, unfortunately, after an experience in installing 70 such dedusting equipments, he had been totally unable to forecast to what degree the size of settling equipment could be safely reduced. Perhaps a 30 per cent reduction might be anticipated, but even that statement was fraught with much danger. One might be grievously disappointed in actual practice.

High efficiencies were possible in dedusting equipment. The Lessing system, for example, was very efficient, but Mr. Appleyard greatly questioned whether such efficiency was worth paying for, because of the expense of installation and maintenance. The percentage of oversize in the dust and the percentage of dust left in the fine coal might both be small, but the expense was so great in attaining and maintaining those percentages that it might not be found worth while. The same was true in regard to screening. There was a limit after which further efforts to attain perfection did not bring any adequate return.

One could aspirate and screen, he continued, but in all cases one particle rubbed against another and some particles collided with the equipment, with the result that degradation increased. A primary dedusting to remove the bulk of the dust seemed all that should be attempted. A Blaw-Knox representative declared that with the newer equipment they were installing, a loss by degradation of only 1.25 per cent was incurred.

At the afternoon session, H. N. Eavenson, consulting engineer, Pittsburgh, Pa., described the availability of the Southern high-volatile coals for metallurgical and gas-making purposes, excluding in making his estimates of coal available and extracted all seams and parts of seams that had more than 6 per cent of ash in the bed and more than one per cent of sulphur, as well as those which were thinner than 42 in. With these restrictions and allowing only 75 per cent of recovery, or 1,350 net tons per foot-acre, he found that there are 483,600,000 short tons available in southern West Virginia out of an original content of 604,800,000 short tons. In Kentucky he estimated that 1,777,100,000 short tons remain out of an original tonnage of 1,990,100,000. In Virginia, 256,400,000 short tons remain of an original content of 349,400,000 short tons. In all, 2,517,100,000 short tons still remain out of a former wealth of 2,944,300,000 short tons.

Coal between ⅜ in. and 20-mesh sometimes contained such a high percentage of ash as to make beneficiation of such sizes highly necessary, asserted J. R. Campbell, engineer, Koppers-Rheolaveur Co., Pittsburgh, Pa., in discussing the papers presented. "It appears," he said, "that the removable impurities in the fines of coal—say, ⅜ in.x20-mesh—affect the coke structure very unfavorably; the minute hairlike cross fractures caused by the fine refuse produce poor-structure coke and result in degradation into smaller sizes which are dirtier and which show a lower realization. One large steel company, operating a cleaning plant, has imposed a specification that the ⅜-in. to 20-mesh cleaned metallurgical coal shall not contain over 0.5 per cent of heavy-gravity material when making a three-product separation; that is, metallurgical coal, middling and refuse."

How MUCH will the surface subside when coal is removed? How and at what cost can buildings be protected from subsidence?

H. W. Montz answers the first question in this story of the Hazleton meeting of the Coal Division of the A.I.M.E., and H. H. Otto furnishes some much-needed information on the second.

Dedusting is a phase of coal cleaning which seems destined to attract increasing attention.

H. F. Hebley and K. C. Appleyard discuss the matter illuminatively in these pages.

How rapidly are our Southern coking coals being depleted and what part must mechanical cleaning play in the preparation of the remaining reserves?

H. N. Eavenson, in a paper abstracted in this story, gives the quantitative measure and J. R. Campbell comments on the cleaning phase.

Waste in the use of compressed air has been notorious, but many operators have felt themselves powerless to correct the situation.

F. N. Becker, however, has invented a valve which cuts off most of this waste.

Red ink spreads over our books and annual reports: what can be done about it?

J. J. Crane, speaking from an experience of fifteen years, told the Coal Division, in an address summarized in these pages, how the Dodson company keeps a steady hand on the tiller—and the till.

High-gravity material in this size of coal with a two-product separation is kept slightly under 0.75 per cent. The 4x0-in. Pittsburgh seam raw coal shows 8.5 per cent ash and 1.15 per cent sulphur and is a fairly clean raw coal as far as removable impurities are concerned, only 2.5 per cent at 1.55 specific gravity. "The resultant 4x0-in. washed coal shows about 7 per cent ash, 0.98 per cent sulphur and 0.4 per cent heavy-gravity material; a really and truly clean coal, though not particularly low in ash and sulphur."

Mr. Campbell showed analyses of the Eagle seam in which the $\frac{3}{16}$-in. to 48-mesh carried 5.49 per cent ash, 1.07 per cent sulphur, but no less than 4.92 per cent of heavy-gravity material. Contrasted with this, the clean coal from the float test would have an ash content of 3.11 per cent and a sulphur content of 0.84 per cent. Powellton coal had 2.53 per cent of sink, more sink than the Pittsburgh coal already referred to and now being cleaned. No. 2 Gas showed 4.39 per cent of heavy-gravity material at 1.60 specific gravity, which denominates it "dirty coal." Elkhorn $\frac{3}{16}$-in. to 14-mesh has 12.1 per cent sink at that gravity and 10.47 per cent in the 4 to $\frac{3}{16}$ in. This, however, is based on the whole seam without careful differential mining. It includes the parting and the bottom rash, now so carefully removed. A Chilton seam ½- to ¼-in. coal analysis showed 4.4 per cent of sink material at the same gravity.

When a mixture of coal was crushed, the ½- to ¼-in. material showed 5.64 per cent of extraneous matter; the ¼-in. to 10-mesh, 3.85 per cent; and 10- to 20-mesh, 3.08 per cent, showing clearly that the crushing was differential, or discriminate, and unfortunately left the harder impurities in the larger and objectionable sizes, in which they were the more harmful.

In the light of modern thought, he concluded, the Southern high-volatile coals, though low in ash and sulphur, are really dirty coals and fine crushing is not the complete solution of the problem, for the ⅜-in. to 20-mesh had most of the heavy-gravity material, which was an undesirable condition. Thomas Fear, general manager, Consolidation Coal Co., Fairmont, W. Va., took exception to the Elkhorn figures, saying that with their system of mining the percentage of ash was 3.

A new valve (Fig. 2) developed for Carroll Garner, mining engineer, Jeddo-Highland Coal Co., Jeddo, Pa., was described in a paper written by F. N. Becker, director of research of that company, who designed it. This valve, known as the Yarway-Becker automatic air-control valve and manufactured by the Yarnall-Waring Co., has cut down the loss of air at the Jeddo mines materially. When first introduced the miners were disposed to look on it unfavorably, but now realize its value, for it enables the men when using jackhammers to get much better air service than had formerly been available. It also prevents miners from using compressed air to drive smoke out of their working places.

When a jackhammer is connected, the air entering the space under the valve through a $\frac{1}{16}$-in.-diameter passage builds up a pressure, allowing the valve to rise and admitting just the quantity of air needed for the efficient operation of the jackhammer. As soon as the machine is disconnected, the air pressure under the valve falls to atmospheric pressure, causing the valve to drop back into place and shut off all the air except what will pass through the $\frac{1}{16}$-in. passage.

Seventeen of these valves have been installed in the Ebervale mines of the Jeddo-Highland Coal Co. With them 550 cu.ft. of air per minute serves to operate 17 jackhammers and one Tugger hoist, which, when all working together, would use 1,400 cu.ft. of air per minute. Prior to the installation, charts indicated consistently low, variable pressure, which became consistently higher and less variable after the installation. The safety valves on the compressor now lift occasionally, showing the ability of that equipment to produce more air than is expended. This was an unheard-of condition before the valves were installed. As the valve is automatic, the miner can disconnect his drill without having to go to the gangway to close a valve at that point.

Water in the compressed air does not prevent the valve from acting. In fact, the valve has been successfully operated by water alone. The valve can be used for pneumatic tools in foundries and machine shops and with paving breakers. After it is adjusted it is sealed and no one can tamper with it.

At the mines of Weston Dodson & Co., Inc., sales tonnage has been forecast to 99.5 per cent, production to 97 per cent, mine car yield to 99.6 per cent, working time to 96.5 per cent, production in mine cars per breaker start within 5.1 per cent and production cost per ton to 92.5 per cent, said J. J. Crane, mines accountant of that company, Bethlehem, Pa. The mining work is forecast five years ahead. The number of mine cars developed by a gangway is estimated by multiplying together the following factors: the length of the gangway in feet, the pitch distance feeding to the gangway, the seam thickness and the constant $1\frac{1}{3}$ which represents the swell of the coal in being broken and loaded into cars. The figure thus obtained is divided by the number of cubic feet per mine car.

In the calculation of development are included shaft and slope extensions, rock work—such as main tunnels, panel tunnels and rockholes—gangways in virgin territory and reopening of gangways. Due weight is given to speed of development, coal already developed, sequence of mining, possible rate of extraction and forecast production in terms of mine cars.

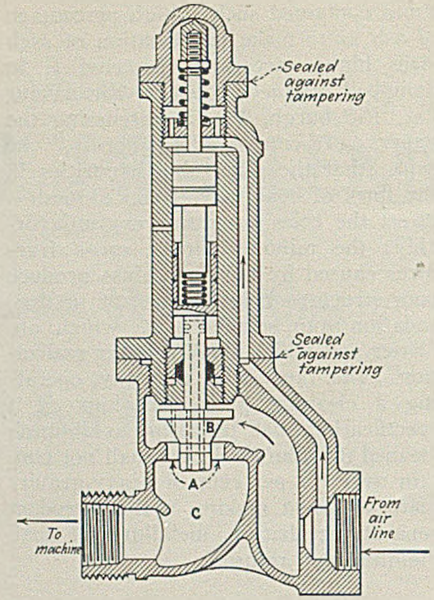


Fig. 2—Valve Which Automatically Supplies Needed Volume of Air to Machine. Chamber *C*, Which Contains Atmospheric Air Before Machine Is Connected, Receives Air at Line Pressure Through Passage *A*, Causing Valve *B* So to Open That It Will Deliver a Regulated Supply of Air. Cannot Be Used to Drive Out Fumes or Gas.

An inventory of mine cars developed and available is made monthly for each bed by gangways. The inventory shows: (1) cars developed, (2) unrecoverable cars developed; that is, cars that would have been obtainable if parts had not been rendered unminable by reason of quality of coal, mining cost, roof conditions, permanent reservations or other restrictions; (3) net cars recoverable (by difference), (4) cars unavailable because coal is tied up for temporary reservations or because of sequence in mining, (5) cars available (by difference), (6) cars extracted during month and (7) available cars for mining (also by difference).

Daily costs are available daily at 4 p.m. and include an estimated material cost, which is corrected the next morning. Material costs for idle days are forecast at 25 per cent of those for a working day, Sundays excluded.

Forecasting, said Mr. Crane, is an essential guide to executive as well as operating management and has been practiced by the Dodson management for over fifteen years, during which time a method has been devised that minimizes, and in many instances eliminates, the element of surprise. The compilation of history, data and trends, from which causes and effects rapidly can be calculated, are to the management what the barometer and the wireless are to the ship's navigating officer; they enable him to anticipate or avoid conditions about to occur, or to shape existing conditions so that they will produce a certain desired result. By a forecast the integrated parts of a mining operation are measured and controlled, so that a maximum, continuous output is produced at minimum cost and at the lowest possible investment.

Mr. Fear declared the Consolidation Coal Co. had given up forecasting the cost of tonnage, because that depended on the tonnage sold and from what mine. The forecast made was based on the cost per ton for the various tonnages that might be demanded at any time at any mine. The sales department cannot be induced to give any forecast of the market.

Eli T. Conner, consulting engineer, Hudson Coal Co., Scranton, Pa., presided at the morning session, Mr. Fear at the afternoon session, and Donald Markle, president, Jeddo-Highland Coal Co., Jeddo, Pa., at the banquet. The "Sentinels of Safety" trophy was presented to A. B. Jessup, of the same company, for the record established at Highland No. 2 mine. Visits were made to the breakers and gas plant of the Jeddo company and to the Coaldale mine and breaker of the Lehigh Navigation Coal Co.

The Story of Wheelwright

When the Inland Steel Co. purchased the Wheelwright mine in the Elkhorn (Kentucky) field in 1930, the management immediately started a comprehensive modernization program which included greater electrification with lower power costs, improvement in transportation, a new cleaning plant and an aerial tramway refuse disposal system, and a safety campaign which has been successful in substantially reducing accidents.

E. R. Price, superintendent of the Wheelwright operation, will tell the story of these changes and what has been accomplished in a series of six special articles in the December issue of *Coal Age*.

Correcting the Record

In the article on the modernization program of the West Virginia Coal & Coke Corporation, which appeared in the September *Coal Age*, the statement is made, in discussing the results of transportation improvements (p. 321), that "In March, 1931, each locomotive was serving an average of 15.8 loaders and was gathering an average of 70 cars." The figures on the loaders served and cars gathered are correct, but the month should have been March, 1932.

CONSISTENT DAILY OUTPUT

+ Per Loader Key to Building Up System of Economical Production

By A. R. LONG
Superintendent, New River Co., Scarbro, W. Va.

HOW MUCH coal should a loader load? How much coal should a gathering locomotive gather? How many loaders should a tracklayer serve in order to produce a consistent daily tonnage from each man? These are basic questions that must be answered if a system of economical production is to be built up.

The coal loader should earn in proportion to his efforts and skill, and, whether loading on the tonnage or car basis, his earnings should be based on volume. In mines where the coal is between 3½ and 4 ft. in thickness, this volume should be 12-15 tons per day, in addition to time spent in timbering and tracklaying. Around this objective for the coal loader, the system outlined in this article is built. The suggestions have been tried out sufficiently to demonstrate the practicability of their being interwoven in a complete operating system.

The mining system is based on the operation of two rooms as a unit. Two stages in the development of such a pair of rooms, including tracklaying and timbering methods, are shown in Fig. 1, which also gives the plan adopted for driving and timbering entries and aircourses. Two loaders, working as buddies, take care of each pair of rooms. They load in one room while the other room is being cut, thereby eliminating waits on cutting machines or interference with loading activities.

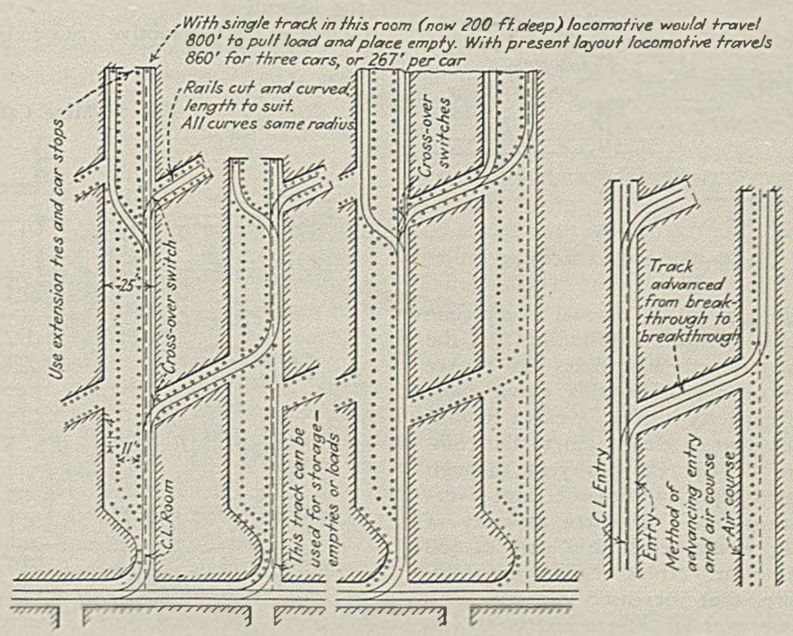
Duties of the loaders include track extension, as in Fig. 2, using extension ties (Fig. 3) and slide rails. These ties and rails comprise an adjustable track that can be moved as the coal is extracted, keeping the car in proper relation to the face at all times. Loaders are required to keep the extension track up, and also must lay all straight rails as the track advances. Steel ties are used exclusively. In consideration of the laying of the straight rails, the loader is paid a fixed price per foot of track, based upon the actual time which a road layer would require for such work. The footage of track is taken up at yardage time, provided it is laid in accordance with the company's requirements.

Each loader is provided with the safety car stop shown in Fig. 4, which is considered a part of his tools. The stop fits over the extension rail and is equipped with a sprag, holding the car in place on either an up- or a downgrade.

Switches in the rooms are advanced from breakthrough to breakthrough, as shown in Fig. 1. The tracklayer is charged with the duty of moving the switches, while the loader takes up the straight rails and moves them to the face. The loader also does the timbering, as in Fig. 1, and all gob is placed in the center of the room between the timbers.

The locomotive crew in mining is responsible for providing the loaders with cars and hauling them away after they are filled. In mines working 3½ to 4 ft. of coal, gathering locomotives usually weigh approximately 5 tons and have a traveling speed of 6 m.p.h. To determine the practicable daily performance of a locomotive under continuous operation, it may be assumed that it travels at an average rate of 2½ m.p.h., which is less than 50 per cent of its maximum speed. If the total distance covered is 20 miles per day, the number of cars which the locomotive can gather and the number of loaders it can serve is dependent upon

Fig. 1—Method of Driving Rooms and Entries



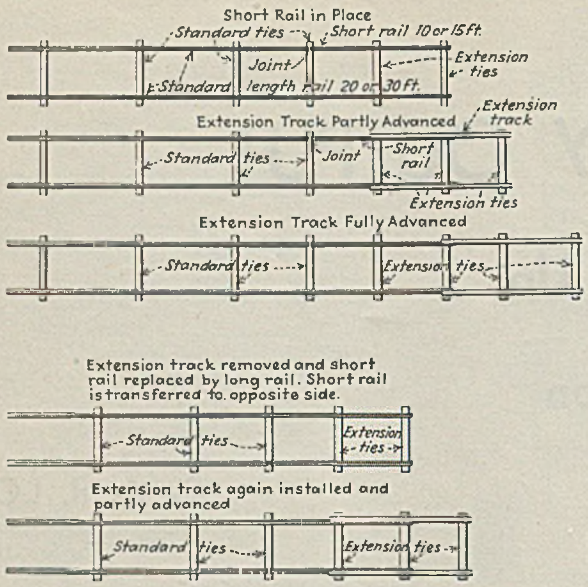


Fig. 2—Extending Temporary Track at the Face

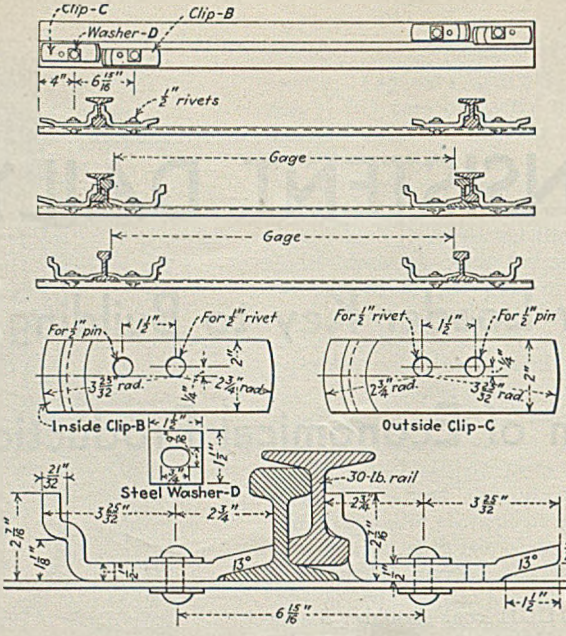


Fig. 3—Details of Extension Ties

the length of the room and the distance from the main-line sidetrack from the room entry. Assuming the sidetrack to be within 2,000 ft., and that the extreme depth of the room is 300 ft., the maximum locomotive travel per car gathered should be less than 1,000 ft. Then 105,600 ft., or 20 miles, divided by 1,000 will give the number of cars that a locomotive should gather and deliver to the main-line sidetrack per day.

The number of men to be served and the tonnage which the locomotive could haul is determined by the capacity of the mine car. Capacity, in turn, is a function of the over-all dimensions of the cars, which are determined by the conditions in the particular mine in which they operate. Each extra cubic foot gained by improved design is equivalent to 50 lb. of coal every time the car is dumped. Assuming that the car is dumped 300 times in twelve months of operation, this extra cubic foot of capacity means 7½ extra tons of coal per year, a clear gain to the company of $5 per car per year through the added capacity with the same over-all dimensions. An extra capacity of 10 cu.ft. would result in a gain of $50 per car year. It is readily apparent, therefore, that increased capacity with the same over-all dimensions is an important feature in economical operation.

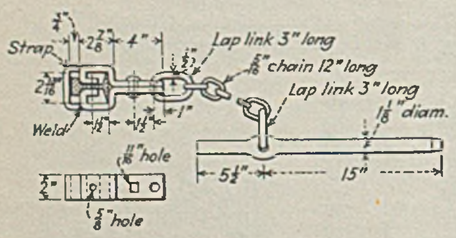


Fig. 4—Car Stop and Sprag

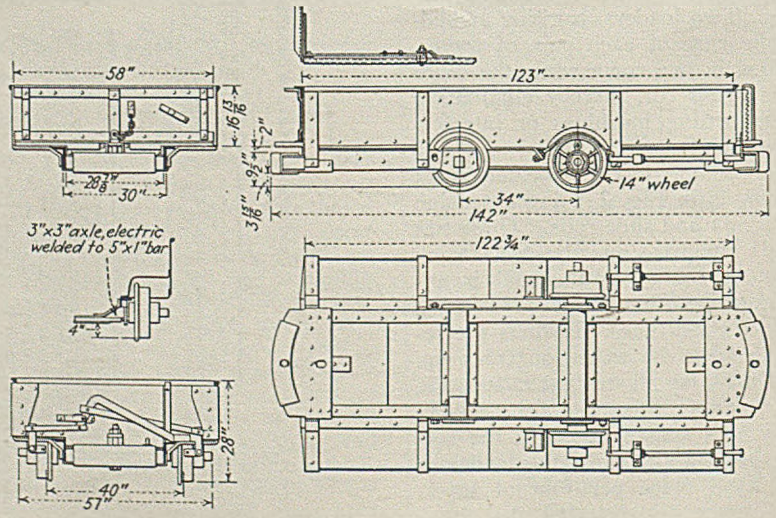
Assuming in this case that the car in use (Fig. 5) has the maximum possible capacity (3 tons) with equal over-all dimensions, and setting the day's work of the loader at 12 tons, each loader should receive four cars. Allowing time for handling slate cars and for unavoidable delays, the daily task of the gathering locomotive may be placed at 80 cars, which is well within the possible total with the system described in this article. This indicates that each locomotive crew can serve twenty loaders and that these loaders as a whole can average 12 tons per man per day. In case a few of the loaders are absent on any one day, the reserve capacity of the remainder is sufficient to enable them to load more than their individual allotments of four cars, this taking care of the allotments of the absentees.

To enable the locomotive crew to give each loader an empty car as soon as he is ready for it, the number of cars the locomotive is expected to haul during the day should be in the section where they may be obtained without delay. Gathering locomotives should have main-line sidetracks where they can deliver their loads and receive empties without interference from other gathering locomotives, and these sidetracks should be long enough to hold the full trips hauled by the main-line locomotives. All surplus cars, whether empty or loaded, should be carried within the live workings.

Again referring to Fig. 1 and the previous statement that room trackage is moved up from breakthrough to breakthrough, it can be seen that the haulage road in one of the rooms serves both after the first breakthrough is passed. The track in the second room should be

(Turn to page 408)

Fig. 5—Mine Car With Maximum Capacity



EFFICIENT HAULAGE

+ Theme of Wilkes-Barre Meeting

MOST coal companies fail to obtain from their equipments the tonnage which either the money invested in them or spent in operating them should rightly afford, said Frederick C. Hohn, mining engineer, J. Robert Bazley, Inc., Pottsville, Pa., at a joint meeting of the Anthracite-Lehigh Valley Section of the American Society of Mechanical Engineers with the Engineers' Society of Northeastern Pennsylvania, held at Wilkes-Barre, Oct. 21. This failure is due to the fact that the layout, designs and capacities of the various facilities have been based on antiquated practice, on plans in which first cost and not efficiency have been the ruling consideration, and in which actual or future transportation requirements have not been visualized.

Mine-transportation engineers, like mining engineers, should base their studies on mining forecasts which indicate the loads that will have to be transported, the points at which they will be received, the class and intensity of the traffic, the duration of the need for specified transportation facilities and the characteristics of the haulages. A factor of safety must then be imposed on these determinations.

When not scientifically constructed and maintained, a mine track will sometimes cost as much to maintain as a railroad track, ridiculous as that statement may seem, declared Mr. Hohn. Mine tracks are laid with unsuitable materials, improperly installed and inadequately maintained, so that their life is short. Labor is spent on continuous patching which is merely a waste of effort. High-priced materials alone will be an expense rather than an economy unless properly installed and maintained.

Track and terminals, well drained, lined, surfaced and ballasted, laid with 60- or 40-lb. A.R.E. type B or double-duty section rails, angle-bar joints, $\frac{3}{4}$-in. track bolts, $\frac{7}{16}$x5-in. track spikes, 6x8-in. or 5x7-in. ties of decay-resisting hardwoods and turnouts in accord with American Mining Congress standards with heavy-duty split switches, Graham-flanged, flange-bearing manganese-steel frogs and parallel switchthrows should take care of the major track problems, giving the following advantages: (1) Ball of rail kept dry and clean, insuring maximum tractive effort and free running of cars; (2) flange of rail kept clear of acid-laden materials, thus eliminating corrosion and mechanical wear on ties and spikes; (3) track held in uniform line and surface, reducing costs; (4) track open for inspection and repairs; (5) enough room provided for coal spillage that track will not block nor traffic be interrupted.

. . . Modernized transportation opens way to: (1) Larger output per man because loaders will be supplied promptly with cars; (2) fewer derailments; (3) speedier car movement, increasing daily mileage per car; (4) reduced overtime preparation costs through elimination of morning lag and afternoon peak deliveries to breakers; (5) decreased maintenance expense through elimination of unnecessary wear and tear on rolling stock.

—Frederick C. Hohn

Track facilities, especially at shaft landing and top or bottom of planes, are often determined by first cost rather than by the hoisting cycle or cars to be handled, thus throttling the transportation system.

A well-designed landing at shafts, with automatic cager, car hauls or pushers, should cage the cars in 4 to 6 seconds. Landing facilities on slopes and planes, Mr. Hohn pointed out, are as important in increasing hoist capacity as rope speed. By improving these facilities capacities have been almost doubled, even though at the same time rope speeds were reduced 33 per cent. Where slopes or planes are on pitches of 25 deg. or more, to eliminate sharp curves, the landing should be developed in top rock. To economize power, hoists are frequently designed for slow speed, but such hoists cannot handle overloads at critical times and may restrict operation unduly.

Storage-battery locomotives, which are to be preferred where gradients permit them to be used, should have quick-changing battery trays of high ampere-hour capacity and normal speeds of $2\frac{1}{2}$ to 3 miles per hour. Such speeds may seem unduly low, but the maximum speed developed in anthracite mines seldom exceeds 3 miles per hour and averages about 2.8 miles, except in long main haulages, where speeds from 6 to 10 miles per hour are developed.

Mine cars should have spring bumpers, absorbing both draft and buffer shocks; spring trucks, detachable bodies, automatic couplings, hand brakes operated from either side of car, brake shoes engaging the wheels on the upper inside quadrant, roller-bearing journal boxes not less than 6-in. roadway clearances, wheelbases from 56 to 60 in. lifting end gates and be built of steel throughout.

Nothing disrupts morning car movements more than loading of cars on night shifts, continued Mr. Hohn. With this practice, too few cars are available for morning loading and not until about 11 a.m. can capacity loading be realized, when 25 to 30 per cent of the day's car turnover will have been lost. Thus a peak load develops late in the day which breaker and hoisting facilities cannot handle fast enough to supply empty cars for night loading. As a result, breaker and shafts must work overtime. Excessive night loading often decreases rather than increases production and raises operating costs.

A locomotive with two trucks separately driven was described by W. C. Gatchel, of the Vulcan Iron Works. These locomotives, he said, were well adapted to temporary tracks and tracks that can be maintained with difficulty, such as are found in strippings and on rock dumps. They will climb gradients as high as 12 per cent, if need be, and if one truck leaves the track the power of the other truck is available for retracking, speeding that operation greatly.

HOW TO CHOOSE MOTORS

+ For Mine Fan Drives

By H. W. CHADBOURNE
Industrial Engineering Department
General Electric Co.
Schenectady, N. Y.

When selecting a motor for mine fan drive it is necessary to know the type of fan and the power required to accelerate and drive it under different conditions. Fan output is expressed in volume and pressure. The volume is determined as the cubic feet of air required to supply fresh air to the men working in different parts of the mine and to dilute and sweep away the poisonous and explosive gases which are given out by the mine faces. The pressure (usually expressed in inches of water) depends on the length and cross-section of the air passages through which this air must be forced. These two items fix the size of the fan.

For a fan forcing air through a given system of air passages the volume varies directly as the speed; the pressure varies as the square of the speed; and the horsepower required varies approximately as the cube of the speed. Fig. 1 shows the theoretical horsepower-speed curve. It must be borne in mind, however, that this curve will vary slightly, due to the type of fan used and also due to variation of fan efficiency at different speeds. This curve is for constant speed at any given point. During acceleration, the horsepower values will be increased to take care of fan and motor inertia.

Today a large percentage of mine fans operate at constant speed. There is, however, a limited field where, either because of intermittent operation of the mine or the probability of mine expansion, a variable-speed fan is desirable. This latter condition requires a two-speed or variable-speed motor drive. In non-gaseous mines and in times where only three or four days are worked per week, a variable-speed fan will save considerable money.

Considering the power requirements of fans, we find a wide divergence due to differences in fan construction. Most older fans were of large diameter and ran at slow speeds. The inertia of these fans is large and, therefore, they require a large quantity of power to accelerate them, as compared to the horsepower required for normal operation. Modern fans are smaller in diameter and operate at higher speeds; these have smaller inertia and, therefore, require a comparatively small quantity of power to accelerate. The amount of inertia may be a large factor in deciding the type of motor to be used. As the output of a fan is zero at starting, low motor torque at this point is desirable, the required value rarely exceeding 25 per cent of normal.

Motors for driving mine fans may be divided into two classes: constant speed and two-speed, or adjustable-speed. Under constant speed there will be considered four types of motors: squirrel-cage induction motor, slipring induction motor, standard type synchronous motor and super-synchronous motor. Under two-speed, or adjustable-speed, motors will be considered five types: two-speed squirrel-cage induction motor, two-speed slipring motor, single-speed slipring motor with resistance, brush-shifting a.c. motor, and direct-current motors with variable voltage control. Two-speed synchronous motors at 200 hp. and above can be used, but have not yet been applied.

The *squirrel-cage* induction motor is a very simple and inexpensive type. It has high efficiency and power factor. This motor is ideal for small direct-connected units, but in larger sizes and for belt or chain drive it has its limitations. This type of motor may be started on either full or reduced voltage. When started on full voltage the starting torque will be from 75 to 150 per cent of full-load torque. The maximum torque at 80 to 90 per cent speed is high, usually from 200 to 250 per cent. For these reasons, motors used with belt or chain drive should have reduced voltage starting. This type of motor is not suitable for driving fans having large inertia, as the thermal capacity of the squirrel cage is limited. In large sizes it usually is better to use synchronous motors.

The *slipring* or *wound rotor* type of induction motor is the ideal motor for fan drive from an operating standpoint. With control by secondary or rotor resistor, its torque can be accurately controlled from practically zero to a maximum of about 250 per cent at any point from zero to full-load speed. This allows a constant rate of acceleration regardless of the inertia of the fan. The efficiency and power factor are somewhat lower than for a squirrel-cage motor and the cost slightly higher. The control is more complicated and expensive.

An example of the use of a slipring motor is an installation in western Pennsylvania. The fan was 25 ft. in diameter with an 8-ft. face. The motor was of the slipring type, rated 350 hp. at 450 r.p.m. The control was of the time-limit type. It was found necessary to adjust the relays to give about 65 seconds acceleration time, and under this condition the motor developed more than 250 per cent torque at the peak of each step from the 25th to the 65th second. No other type of a.c. motor, unless possibly the super-synchronous type, would have operated successfully on this application.

A *synchronous motor* starts as a squirrel-cage induction motor and, therefore, has similar starting characteristics. As the field is applied at about 95 per cent of synchronous speed, the motor must have sufficient "pull-in" torque to accelerate from 95 per cent to synchronous speed while the fan is delivering full load. A minimum value of 110 per cent is required. This is the critical point in synchronous motor applications. If the pull-in torque is too low, it may not pull in or may hunt. In any case where a standard type synchronous motor is used the motor manufacturer must know the WR^2 of the fan to be sure of enough pull-in torque. The efficiency is slighly higher than that of the squirrel-cage motor and the power factor may be unity or even 0.80 leading. The value of the power factor is one of the important factors in the use of synchronous motors. The price is about the same as for a squirrel-cage motor unless the control becomes too complicated. (For a further discussion of synchronous motors for mine-fan drives, see *Coal Age,* Vol. 37, p. 182.)

The *super-synchronous* motor is electrically the same as the standard-type synchronous motor, but mechanically it is different. The stator is mounted in bearings so that it can revolve. When power is applied to the stator windings, the stator revolves and comes up to full speed, running light. After the stator is running at synchronous speed, with its field applied, a brake is applied to the stator frame, causing it to slow down. The rotor, being in synchronism, starts. When the stator is at rest the rotor is running at synchronous speed. The advantage of this type of motor is the ability to start, accelerate and synchronize it under no-load conditions and have maximum torque available to accelerate the load. The efficiency of this type of motor is high, and the power factor can be anything desired; but the cost is high. The particular application is to fans having high inertia and driven from a system needing power-factor correction.

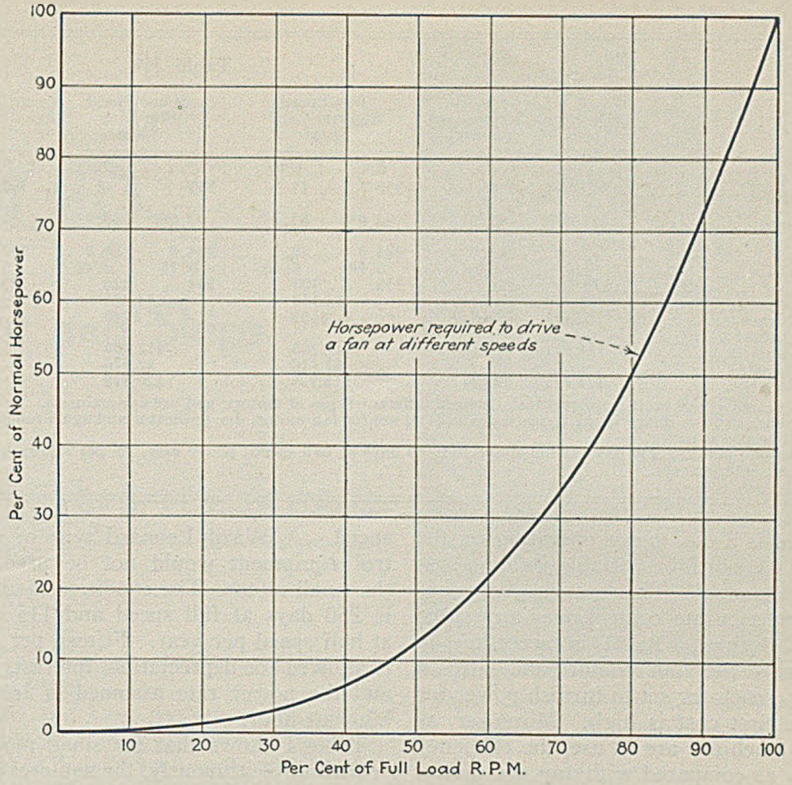


Fig. 1—Theoretical Horsepower Speed Curve

The *squirrel-cage two-speed* induction motor is one of the simpler and less expensive types for this service. A speed ratio of 2:1 is the usual one, but other ratios can be obtained at increased cost of the motor. This speed change is obtained by changing the stator windings to give a different number of poles. These motors have the same limitations as constant-speed squirrel-cage motors. The comparative costs, efficiencies, power factors, etc., are given in the following tables. These motors can operate at two definite speeds only.

The second type of motor to be considered is the *adjustable-speed slipring motor.* This motor can be built as a two- or three-speed motor by pole changing, the same as the squirrel-cage motor, or the speed can be adjusted by the use of a resistor in the secondary, or rotor, circuit. When used as a two-speed motor, its efficiency and power factor are comparable with those of the squirrel-cage two-speed motor, but when the speed is adjusted by use of the secondary resistor, the efficiency falls off rapidly. This is compensated for by its ability to operate at a number of speeds instead of at two speeds only. It is possible to take a two-speed slipring motor and operate from either basic speed with the secondary resistance, thus obtaining a larger speed range with fairly good efficiency. This motor—either two-speed or adjustable speed—has advantages, as stated under constant speed.

The third type of motor for adjustable-speed drive is the *shunt characteristic brush-shifting* motor. This is an a.c. motor but with some of the characteristics of a d.c. motor. Its construction may be compared to an induction motor with the secondary winding on the stator and the primary and an adjusting winding on the rotor. The commutator segments are connected to the adjusting winding. There are two sets of brushes on the commutator; one end of each phase of the stator winding is connected to one set of brushes, and the other end to the other set. When the brushes, to which each end of a given phase are connected, are on the same commutator segment, the adjusting winding is idle, the secondary is short-circuited and the motor operates as an induction motor at slightly below synchronous speed. As the brushes are moved apart, a section of the adjusting winding is included in series with the secondary winding. This forces the motor to change its speed so as to generate the correct secondary voltage. Shifting the brushes in one direction decreases the speed; shifting the brushes in the opposite direction increases the speed.

The usual speed range is from about 50 per cent of synchronous speed to about 40 per cent above synchronous speed. This gives a ratio of 3:1. The efficiency is less than that of either of the foregoing motors, but under some conditions it is better than the slipring motor with secondary resistor. The power factor is high. The motor is started with the brushes in the slow-speed position, and under this condition the starting torque will be at least 100 per cent. With a given brush setting the torque drops rapidly as the motor speed increases, but the torque can be held up by changing the brush position to give higher speed. The control is very simple.

The last motor or system to be con-

Table I

	Synchronous Motor	Single-Speed Squirrel-Cage	Two-Speed Squirrel-Cage Speed		Single-Speed Slip-Ring Speed		Two-Speed Slip-Ring Speed		Brush-Shifting Speed	
			Full	*Half*	*Full*	*Half*	*Full*	*Half*	*Full*	*Half*
Hp. required....	75	75	75	9.4	75	9.4	75	9.4	75	9.4
Efficiency......	90%	90%	90%	82%	89%	40%	88%	73%	85%	59%
Kw. input......	62.0	62.0	62.0	8.5	62.7	17.5	63.5	9.6	65.5	12.0
Power factor....	1.0	0.89	0.84	0.47	0.87	0.50	0.84	0.41	0.96	0.495
Kva. input.....	62.0	70.0	74.0	18.1	72.5	35.0	76.0	23.3	69.0	24.0
Purchase price..	$1,100	$650	$950		$990		$1,340		$3,310	
Fixed charges...	$165	$98	$142		$150		$200		$500	
Power charge:										
Full speed....	$5,450	$5,450	$3,730		$3,760		$3,820		$3,940	
Half speed....	......	......	$236		$485		$265		$335	
Total charge*...	$5,615	$5,548	$4,108		$4,395		$4,285		$4,775	

*Based on operating 250 days per year at full speed and 115 days at half speed; power rate, 1c. per kw.-hr.; fixed charges, 15% of purchase price, cover depreciation, interest, etc.

Table II*

	Synchronous Motor	Single-Speed Squirrel-Cage	Two-Speed Squirrel-Cage *Speed*		Single-Speed Slip-Ring *Speed*		Two-Speed Slip-Ring *Speed*		Brush-Shifting *Speed*		Ward Leonard D.C. Control *Speed*	
			Full	*Half*	*Full*	*Half*	*Full*	*Half*	*Full*	*Half*	*Full*	*Half*
Hp. required	350	350	350	45	350	45	350	45	350	45	350	45
Efficiency	93.5%	92.0%	92.0%	83.0%	92.0%	38.0%	90.0%	65.0%	86.5%	63.0%	90.0% 91.0% 93.0%	67.5%† 74.5%† 70.0%†
Kw. input	279.0	284.0	284.0	40.5	284.0	89.0	290.0	52.0	303.0	53.0	345.0	96.0
Power factor	1.0	0.84	0.80	0.40	0.78	0.40	0.77	0.30	0.97	0.60	1.0	0.50‡
Kva. input	279	336	355	101	364	220	375	170	312	89	345	192
Purchase price	$3,300	$3,440	$4,550		$4,286		$5,750		$9,500		$13,000	
Fixed charges	$495	$517	$685		$640		$865		$1,410		$1,950	
Power charge:												
Full speed	$24,300	$24,800	$17,200		$17,200		$17,500		$18,400		$20,800	
Half speed	......	......	$1,110		$2,470		$1,440		$1,460		$2,650	
Total charge§	$24,795	$25,317	$18,995		$20,310		$19,805		$21,270		$25,400	

*The figures in this table show realtions between different types of motors, and are approximate.
†Efficiencies shown under Ward Leonard d.c. control are for fan motor, d.c. generator and synchronous motor, respectively.
‡Leading power factor.
§Based on operating 250 days at full-speed and 115 days at half-speed; power rate, 1c. per kilowatt-hour; fixed charges, 15 per cent of purchase price, cover depreciation, interest, etc.

sidered is a *d.c. motor* operating on the Ward Leonard, or variable voltage, system of control. This system gives simple and accurate control over any speed range desired. As it is necessary to purchase the fan motor and also a motor-generator set to furnish power for it, the first cost is high. Moreover, as three machines are in use, the efficiency is low as compared with any one motor, except at low speeds, where the losses in other machines are high. This is partially offset by using a synchronous motor, operating at unity or leading power factor, to drive the set.

Table I gives data on a fan motor rated 75 hp. at 900 r.p.m. and Table II on a motor rated 350 hp. at 400 r.p.m. Both tables give data on synchronous and squirrel-cage single-speed motors and also on other types at full and half speeds. The power required by the fan varies nearly as the cube of the speed. Therefore, for the small motor, requiring 75 hp. at full speed, only 9.4 hp. is required at half speed; and for the 350 hp. motor only 45 hp. is required at half speed. A Ward Leonard type of control equipment would not be used for the small motor. The condition assumed is 250 days at full speed and 115 days at half speed per year. Fifteen per cent is allowed for depreciation, interest, etc., and the power rate assumed is 1c. per kilowatt-hour.

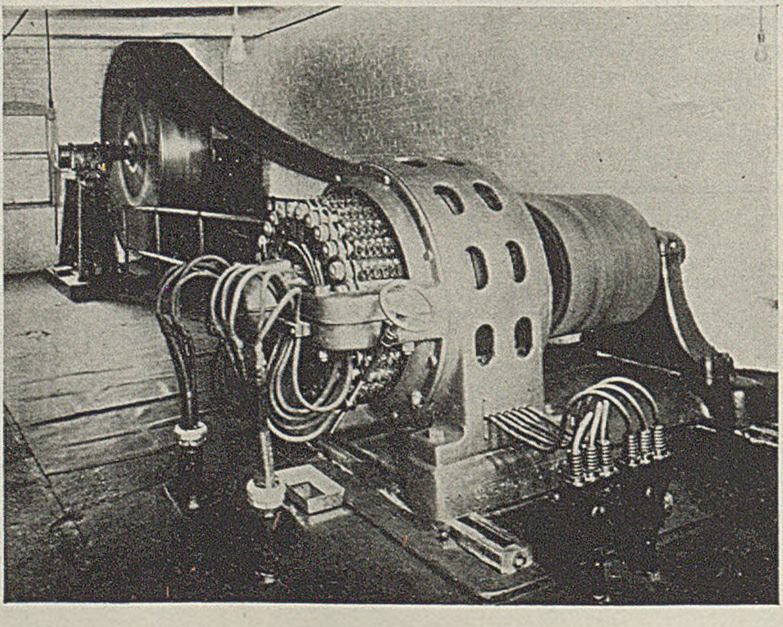
Table I shows that for small motors, operating continuously, the squirrel-cage motor is the most economical. For some half-speed operations, the two-speed squirrel-cage motor is most economical. Table II shows that for large motors the synchronous motor is slightly more economical for continuous service at full speed, and the two-speed squirrel-cage motor is better suited for half-speed work.

These data are on the basis of paying for kilowatt hours. The newer power contracts usually penalize a purchaser for low power factor or give a bonus for high power factor. For continuous operation at full speed on this basis, synchronous motors usually are the most desirable. As the brush-shifting motor has a high power factor, it is a very economical motor to use where slow speed is used a large part of the time. The d.c. Ward Leonard type equipment is rarely used, but for a large amount of slow-speed operation it is economical and the synchronous motor of the set gives leading power factor.

The problem as chosen assumes that the fan must run at full speed 24 hours per day when men are at work. If it could be operated at part speed for 12 to 15 hours per day during this time, the two-speed motor would show a greater saving.

In applying the foregoing data to any specific problem, it must be remembered that as the horsepower and speeds are different, so the efficiencies and power factor will also be different. It is probable that the values given can be interpolated and used to arrive at a rough estimate as to which type of equipment to use. In any case, the details of the power contract must be known before any solution of a given problem is possible.

Driving a Mine Fan at Western Pennsylvania Mine With a 250-Hp., 600-R.P.M., 4,400-Volt Brush-Shifting Variable-Speed Motor.



REFUSE HANDLED

+ By Subway Conveyor and Skips

By J. H. EDWARDS
Consulting Editor, Coal Age

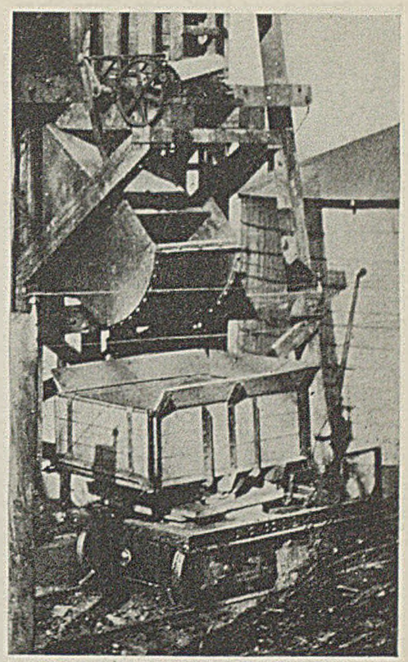


Fig. 2—Construction View Showing Motor-Driven Undercut Gate

FROM a dozen mines a few years ago to one active mine in 1932 is the history of the Boone County Coal Corporation's centralization of activities. The one mine, No. 2, located at Monclo, Logan County, but in the Kanawha district, has been improved to modern standards and is producing between 3,500 and 4,000 tons daily. The latest improvement is a refuse disposal system which has reduced the labor of wasting mine rock and plant reject to one-fourth the former figure. The installation added approximately $30,000 to the plant investment.

Before the new equipment was installed, cars loaded with mine rock were pulled up a hillside on a single rope incline to an elevated dumping point. Two men were required, one to operate the hoist and the other to effect the dumping at the top. Two other men using a 1½-ton truck and a team and wagon were engaged in hauling picking-table and washer reject from the preparation plant.

With the new system, mine rock tipped from cars in a rotary dump rearranged to handle rock and coal instead of coal only, together with reject from the plant, is deposited by automatic skips into an elevated hillside bin. One man operating an electric larry between the bin and dumping ground is the only labor involved. The new equipment was furnished by the Link-Belt Co. and was installed under its supervision. Rated capacity of the skip-hoist equipment is 100 tons per hour, and mine rock containing pieces 30 in. or greater can be handled.

An unusual feature is a subway conveyor installed under the loading tracks to carry the plant reject over to a concrete hopper under the dumphouse where the skips load. From picking-table pockets and Simplex jigs the rejects flow by gravity through steel chutes to the subway conveyor. These chutes are located beside the steel columns between loading tracks. The subway conveyor comes above ground where it crosses the creek and then inclines up the bank to the dumphouse.

This conveyor gallery is the lower of the two that appear at the left in Fig. 1. The other contains the conveyor that transports coal from dump hopper to tipple. At the right hand in the same figure appears the double-tracked skip incline and 100-ton refuse bin. Fig. 3 shows one of three steel chutes leading down to the subway conveyor. The latter is a Link-Belt single-strand malleable-iron drag chain with wings projecting from the sides of the links. The chain is 5-in. pitch; the link width is 9¾ in.; and the total width over wings is 14½ in.

Chutes leading down to the subway conveyor are fitted with accumulation pockets to take the blow of falling material. The conveyor pan clears the bottom of the trench sufficiently to allow

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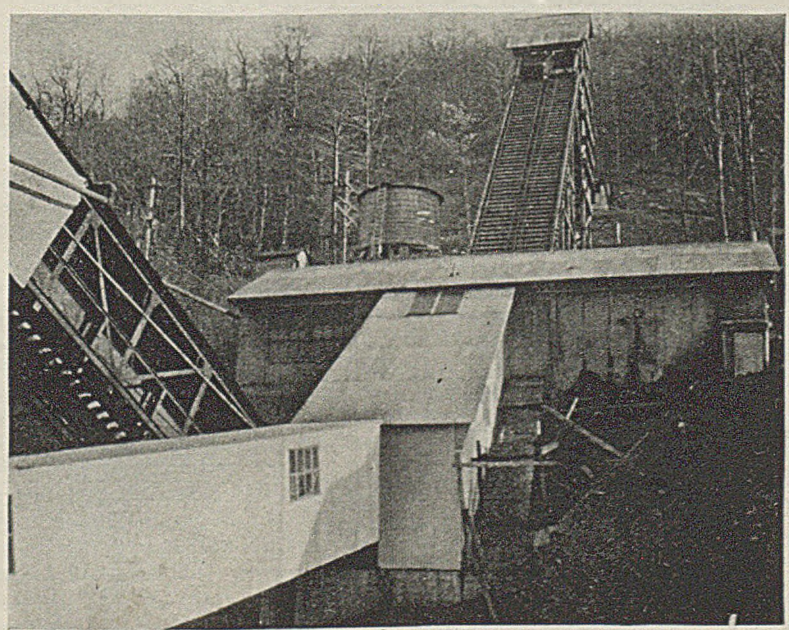


Fig. 1—Plant Reject Is Conveyed Back to the Dumphouse and, With the Mine Rock, Is Hoisted to the Larry Bin

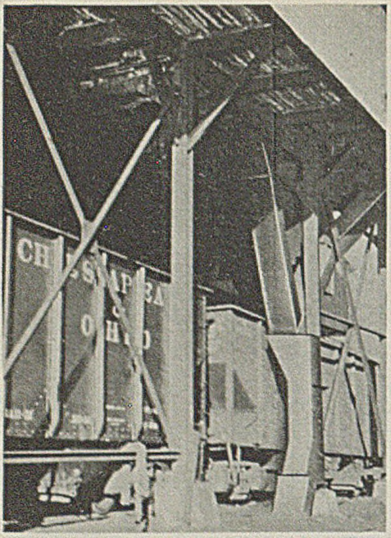


Fig. 3—Chutes Lead to an Underground Refuse Conveyor Which Runs at Right Angles to the Tracks

flushing the latter out through an opening draining to the creek. When the preparation plant is shut down this subway conveyor can be utilized as occasion demands for carrying loading-track clean-up coal to the raw-coal conveyor for re-treatment. Removable trench cover plates provide openings through which this clean-up coal can be shoveled onto the subway conveyor. A fly-gate is provided at the discharge for diverting the material from its normal course.

Under and to one side of the rotary dump a large space was excavated adjacent to the coal hopper and in this space was built a 20-ton concrete hopper fitted with an apron feeder for loading the skips. A flygate was installed under the rotary dump to divert material to either bin. Because the dump, which is one installed nine years ago, is air-operated, the same power is used to move the flygate.

Pans of the skip feeder are armored with wood planks topped with steel plates. Operation of this feeder is entirely automatic in that it starts when a skip has landed and runs a predetermined length of time sufficient to fill one skip bucket. The skips operate in balance, and near the foot of the incline they switch to a single loading track. Skip dumping at the top of the 100-ton bin is effected by the well-known method in which special wide-tread track wheels at the rear engage elevating rails. Skips hold 3 tons and the wheels are fitted with Timken bearings.

Once the dumper pushes the start button the skip and feeder equipment continues in automatic operation until stopped by the dumper. Signal lamps operated automatically enable the dumper to stop the equipment with a skip in loading position under the feeder. A curtain of heavy chains hung in front of the feeder with lower ends free prevents dribbling after the feeder has stopped and when neither skip is in position to catch the material.

An undercut gate controling the discharge from 100-ton bin to larry is driven by an electric motor. A hand-operated auxiliary gate is provided for emergency in case the power should fail while the regular gate is open for loading a larry.

▼ ▼ ▼

Building Up Economical Production System

(Concluded from page 402)

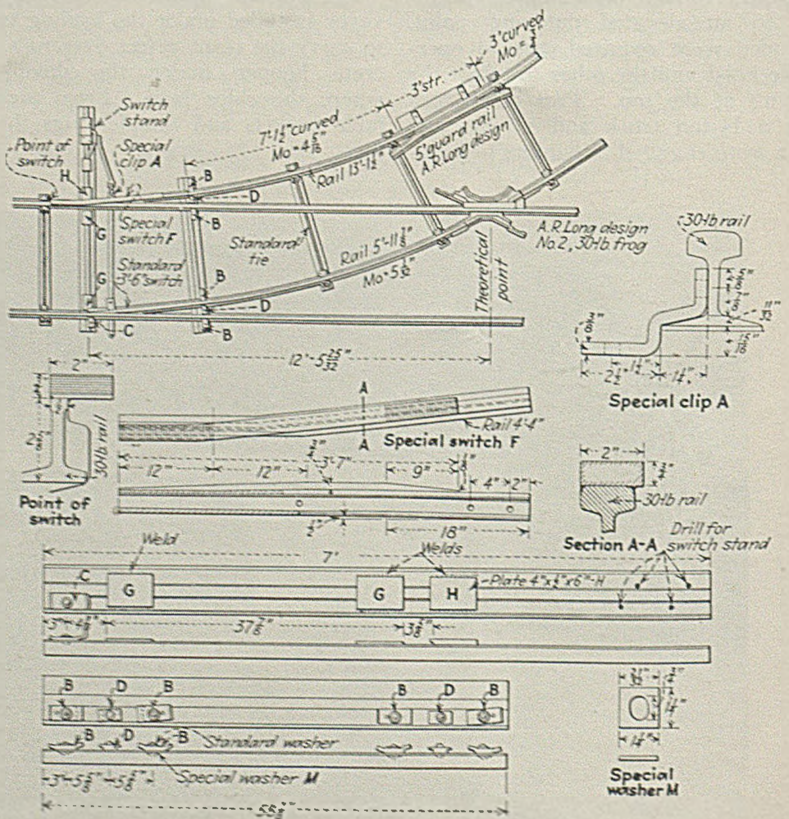
left intact up to the first breakthrough to supply sufficient storage room for all cars, empty or loaded, in excess of those on the main-line sidetrack.

Tracklayers under this system lay all switches. This work is simplified by the use of steel ties and specially curved rails. The standard portable switch is shown in Fig. 6. One tracklayer easily serves 30 loaders. All track material is kept on the section where the locomotive crew which is charged with the responsibility of distributing it can conveniently reach it. With this system, the tracklayer is assured that the proper materials will be on the ground when he goes to lay a switch.

In isolated sections where it is not possible to station sufficient loaders to keep a locomotive crew busy, the gang system, whereby loading, tracklaying and haulage is combined under the proper tonnage rate, can be successfully applied. Use of this system allows the locomotive to absorb the loss in efficiency.

The primary object of the experiment outlined in this article is the fixing of a consistent tonnage with due regard to manpower which will allow a man to earn in proportion to his effort, and at the same time reduce fluctuations in production and mine cost. With this system, haulage, loading and tracklaying is put on a contract basis, making it possible in the mine, as in well-regulated factories, for all contract men to make a fair mine-run wage, and putting the burden of absorbing delays for various reasons on mine cars, main-line haulage and tipple equipment, all of which usually have sufficient reserve capacity to take care of most of the hitches in daily mine operation.

Fig. 6—Portable Switch for Room Use



SAFETY COUNCIL

+ Studies Major Factors

In Accident Prevention

N. S. C. Highlights

Safety Progressing
Reflectors and Glare
Lamp Candlepower
Steel Arches and Props
Making Men Read Posters
Checking Men In and Out
Protective Clothing
Padding for Knees
All Wood Will Burn
Cigarette Sandwiches
Safety in Signals
Get Accidents Reported
How to Shoot Safely
Selecting Bosses
Amending Wire Methods
Safety Dividends

FURTHER PROGRESS in accident prevention, despite curtailment in safety departments, was recorded at the Twenty-First Annual Congress of the National Safety Council, held at Washington, D. C., Oct. 3-7. This improvement, declared Daniel Harrington, chief safety engineer, U. S. Bureau of Mines, at the Mining Section meeting presided over by Chairman W. H. Comins, general manager, National Lead Co., could be ascribed to the increased desire of mining companies to profit from the economies inherent in lower accident rates.

Without exception, said W. W. Adams, statistician, Demological Division, Bureau of Mines, the accident severity per man-hour of employment of companies reporting to the Council was lower in 1931 than in 1930. For coal mines as a whole the decline was 8 per cent, with anthracite rates falling 2 per cent and bituminous, 12 per cent; metal mines, 25 per cent; non-metallic mines, 10 per cent. Prior to 1931, accidents in coal mines had been increasing faster than man-hours of employment, but last year this trend was reversed.

"Three of five coal mines which have operated a year or more without a lost-time accident," Mr. Harrington stated, "had the entire personnel trained in first-aid almost immediately before the record was made, and officials of all three credit this training with having had a vital influence in securing the subsequent no-lost-time accident record. The other two mines with the year or more of operation without a lost-time accident took 100-per cent training either during the period when the record was still in the making or immediately afterward."

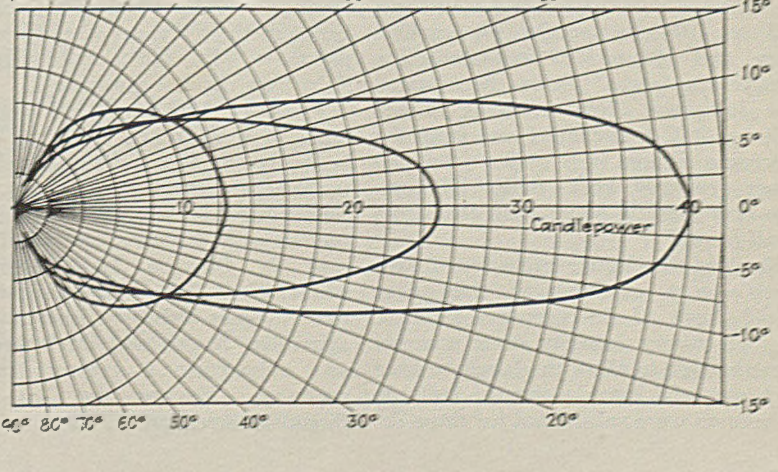
During the past decade, asserted C. W. Owings, associate mining engineer, Bureau of Mines, improved illumination has decreased industrial accidents caused by improper lighting from 25 to about 15 per cent. But little concerted effort has been made to take the miners "out of the twilight zone in which they work," he added as preface to presenting some of the tentative findings of a study of mine illumination made by the safety division of the Bureau in recent months.

Two general types of reflectors are in use in the mines, he continued: (1) The polished, or bright-surface, reflector, which projects an intense beam near the axis of the light, but with which, at 10 or 15 deg. from that axis, a light intensity less than one-tenth of the maximum is attained, and (2) the diffusing reflector, which distributes the illumination evenly without any light or dark areas within the illumination zone.

In accident prevention, "the type of reflector finish is important because glare may result in reduced or confused vision and thus cause an accident. The bright reflector produces a glare that may be harmful. Glare in mines is the result of contrast rather than brightness. With the dark or black background found in mines, even a relatively dim light may cause glare. The diffusing reflector spreads the light and reflects it from a number of different points, thereby providing a light-colored background behind the flame of an open light or the filament of an electric lamp; by reducing the contrast, glare also is reduced.

"Reflectors may be designed to give widely different distribution of light, although the total quantity of light given off remains constant. Fig. 1 illustrates a light beam on an electric cap lamp that has an average intensity of 8 mean cp. The smallest curve has a maximum of 11.2 cp., the middle curve of 22.5 cp., and the largest curve of 40 cp. The average intensity is the same in each curve, due to the fact that the intensities at the wider angles have greater weight than intensities near the axis of the light beam. The area of the candlepower distribution curve is no criterion of the total quantity of light given off or the mean candlepower of the light. The mean candlepower is not the

Fig. 1—A Single Electric Bulb With Three Reflectors Gives the Three Candlepower Curves in This Illustration. Though the Areas Inclosed by Them Are So Different, the Mean Intensity of Each Is the Same, 8 Cp.



arithmetical average of the candlepower at each angle. It is necessary to weight the candlepower readings."

Comparing carbide and electric cap lamps actually tested in the mines, Mr. Owings found that "the average intensity of the carbide lamps, 5.19 mean cp., is nearly 50 per cent greater than the average, 3.36 mean cp., of the electric lamps," but some of the electric lamps tested were run down and obsolete. The mean candlepower of the carbide lights ran from 4.00 to 6.80 in seven different mines, and the mean candlepower of the electric lamps from 2.55 to 14.2, but the difference in the axial candlepower favored the electric lamp, being from 4.52 to 7.25 with the carbide lamp and 4.16 to 59.6 with the electric lamp, the last figure being that for a lamp with a polished reflector. Electric lamps with a diffusing deflector in the same mine showed an axial illumination of 8.90.

Mr. Owings favored taking for comparison a total angle of diffusion of 60 deg. (30 deg. on each side of the axis); this gives an illumination of an area 4 ft. in diameter at a distance of 4 ft. He suggested that the distance between the workman's light and his work might be assumed to be 4 ft. Taking this angle, the carbide light showed 0.25 to 0.43 foot-candle; the electric light, 0.20 to 0.90 foot-candle. "When polished reflectors are used, intensities of 270 to 700 cp. may be obtained in the center of the beam; the maximum actually measured in service was 400 cp. The bulb in most electric lamps cannot be focused and maximum intensities will vary considerably if the bulb is removed from the lamp and is replaced again."

In machine mining, cutters, motormen, brakemen, loading-machine operatives and helpers, drillers and foremen usually require a light that will "spot" a point at a distance and penetrate a cloud of dust; the polished reflector provides a beam of this character. Shotfirers, trackmen, clean-up men, timbermen and bratticemen are provided with diffusing reflectors, as their work is of a close nature.

"When it is considered that 90 to 95 per cent of the light is absorbed by the coal," said Mr. Owings, "it is seen that the effective illumination at 4 ft. is from 0.03 to 0.04 foot-candle for carbide lamps and 0.01 to 0.09 foot-candle for electric cap lamps. It has been stated that full-moon illumination is of the order of 0.02 foot-candle, and from the preceding figures it is evident that the miner generally works under illumination only slightly better than that from a full moon."

Many of the electric lamps tested gave much lower candlepower than they would have if in proper condition. Storage-battery capacity often was not great enough to allow the lamps to burn 10 hours, and lower-amperage bulbs in some cases were substituted for those de-

J. I. Banash, President,
National Safety Council

signed for the lamps, causing a loss of nearly 17 per cent of the candlepower. With intermittent working time, precautions in charging batteries must be taken. Many of the lamps in one mine had been burned 12 to 16 hours and then failed to receive proper charge. A lamp thus used and losing 12 ampere-hours, or 60 per cent of its charge, should be charged at a rate of 2 amp. per hour instead of $1\frac{1}{4}$ amp. or be charged for 14 hours at $1\frac{1}{4}$ amp. Bulbs also rub the reflectors, removing the finish. Use of the minor filament after rupture of the major filament, cracking of glass lenses and dirt on lenses are other ways in which lighting power is reduced.

Certain lamps of newer construction were found to give two or three or even more times the illumination obtained with the carbide lamp and an average of ten times the illumination 4 ft. from the lamps at the same angle, but voltage drops rapidly on putting a lamp in operation, and the candlepower likewise. A candlepower of 12.5 on switching on the light may be 9 after an hour; and after eight hours, 7. The drop in potential will be from 4.3 volts to about 4 and 3.7 at the same intervals. "Carbide lamps at all times and under essentially all conditions provide a flame that is unsteady and uncertain," said Mr. Owings. "With equal care electric cap lamps in their present development supply more light and a more dependable light than carbide cap lamps."

Probably between 1,500 and 2,000 miles of steel-arched roadways were to be found in Great Britain today and perhaps as many in Germany; Nova Scotia already has two miles of such roadways and expects to install more, said R. Dawson Hall, engineering editor, *Coal Age*. The United States has in places both arch linings of short aggregate length and steel three-piece sets supporting a greater length of roadway. Europe also has several thousand steel props, some of which yield in varying degree under pressure and others which are absolutely rigid. Long corrugated-steel cap pieces, or "straps," are used extensively abroad.

"Change your posters once a week; put up three at a time," suggested C. F. Keck, safety director, Jamison Coal & Coke Co., during the question-box discussion. "Have your foremen and superintendent question the men regarding the bulletin board and its message. One man told me he hadn't looked at the bulletin board for nine years. It was moved to the mine mouth and thence to the sectional quarters under ground."

"When the men enter our mines, they throw up a tag on the board and pull it down when they come out," said M. McCoy, American Zinc Co., answering the question as to checking men into and out of the mines. J. D. Cooner safety inspector, Hudson Coal Co., explained that timekeepers checked the men as they entered and left the mines on the three shifts, and if the men entered or left at other times a record was made at the lamp house.

"Don't compel your men to wear protective clothing. Wear it yourself. Let the officials wear it first. The practice will work without difficulty down the line after 100 per cent of the officials wear it. And don't sell it at the company store. Let the operating department handle it," contended J. T. Ryan, vice-president, Mine Safety Appliances Co. "It may be a little troublesome, but it brings the desired results, and does it without friction."

"That is what we did," said Cadwallader Evans, Jr., general manager, Hudson Coal Co., "but we campaigned for the introduction of hats. As a result, 1,800 hats were purchased in three days." "The American Zinc Co. sells the hats for $1.50 below cost," added Mr. McCoy.

O. V. Simpson, safety director, Alabama By-Products Corporation, wanted information about the protection of miners' knees and was informed that scrubwomen's kneepads could be purchased in gross lots at 70c. a piece. Some advocated rubber ties for strapping over the knees. Sheep hides with the wool against the knee were good, but sweated the knees, and that resulted in injury.

Discussion as to the use of hooks for uncoupling revealed through John Lindley, safety inspector, Koppers Coal Co., that his company supplied the men with any hooks they desired, but when they had them it was obligatory that they be used.

Even a wet mine will catch fire, said Mr. Harrington, speaking on metal-mine fires and ventilation at the Thursday morning session. Fires often start in backfilled timbered stopes where they cannot be handled. Where gunite is used in shafts one might believe one had absolute protection, but fire will get behind the gunite and wreck the shaft unless the shaft is concreted solidly at the landings. F. B. Dunbar, general manager, Mather Collieries Co., said that, for fear of electrical fires, he had put walls around temporary pumps where no attendant was provided. A 12-in. space was left between the walls and the coal, so that no fire could spread from the hot brickwork.

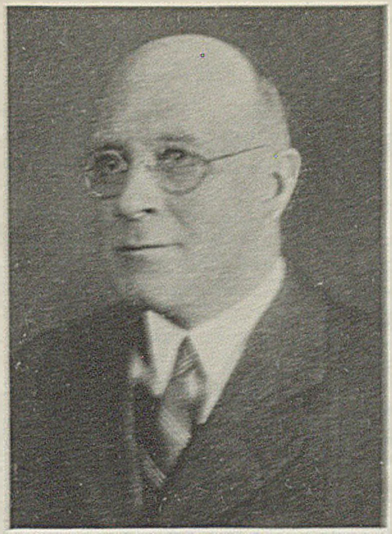
At the Mather mines, every precaution was taken against smoking. One man in ten is examined on coming to the surface and men are examined as they go down. Having learned that men put cigarettes into sandwiches, the searchers make the men open up such comestibles for examination. Knowing that smokers' articles are secreted in shoes, they make the men remove their footgear. Such stringent inspection cannot be enforced on everybody always; but every day a few are taken and vigorously searched.

Tripriders have been taken off the trips at Valier, said D. W. Jones, superintendent, Valier Coal Co., in an article describing the automatic signal system at his company's mine (see *Coal Age*, Vol. 37, p. 327). Where there is no light there is no signal, and the locomotive runner must stop. Signal lights are placed so far back that, even where the gradient is heavy in favor of the trip, the motormen can stop in plenty of time. Two lights are always placed in series. If one burns out, the other burns all the more brightly.

Reports of minor injuries, said Rush N. Hosler, Pennsylvania Compensation Rating and Inspection Bureau, come in to the insurance authorities by reason of the fact that reports must be made under Schedule Z to obtain medical service costs. Mr. Evans observed that foremen sought to make a good record by neglecting to report accidents in their sections. "We don't charge any man's record with any but a lost-time accident," said Mr. Dunbar. "As a result we get complete records. When a foreman uses a dressing from his kit he has to explain on whom it was used, and why, before he can get another."

Men try to hide injuries so that they can work, especially when there is broken time, declared Theodore R. Morgans, sectional foreman, Hudson Coal Co. If a man is found with an unreported cut he is sent out of the mine. Injured men also are spotted and sent back home on their way into the mine. In this way, men lose more time than if they disclose the injury. In his belief, at the mine in which he is employed, 98 per cent of even the less important injuries are reported.

Discussing the handling of permissible explosives, Mr. Dunbar said that at Mather enough explosive for a single shift, plus a margin to guard against shortage, was delivered in electrically



Thomas E. Lightfoot, Chairman, Mining Section

insulated cars to a point near the working faces. Thence the men take it to their places in leather receptacles or bags. Some men are allowed to take in their powder from the surface, and perhaps this is the preferable method, if each man brought out at the end of his shift whatever explosive he didn't use. The shotfirer carries his own fuse.

In choosing section foremen, care must be taken to avoid individuals who are either too easy-going or grouchy, said Mr. Evans. A foreman should be at once pleasant and firm. The Hudson Coal Co. has a training school and, in admitting men to this school, character is the qualification on which stress is laid rather than elementary education. Some of the men chosen for training are not able even to read and write well and have to be grounded in those studies. Too many men who are made section foremen are of only limited experience. For instance, some may come from a transportation job, and the Hudson company will give such men experience as laborers and miners before allowing them to act as section foremen. The section foreman's beat is scaled off on the map and the distance he has to walk or crawl is determined, and if the beat is too long, it is shortened. A considerable reduction is made in the beat if the percentage of crawling is large.

College graduates are given a special two-year course. Men who are looking for a clean and easy job are rejected, as also those who believe the ladder of success can be climbed in a few short years or months.

Addressing the Congress on "Inspection and Maintenance of Electric Wiring," C. F. Haselton, safety engineer, Pickands, Mather & Co., deplored substandard wiring in mines with lines overloaded and overfused; cables too often sagged till they made contact with other lines or the mine strata. Care should be taken lest insulation near light bulbs deteriorate from their heat and lest taping soften under the influence of moisture. Switch boxes should be mounted on rigid supports or they will become distorted, bad contacts will result, which will cause the blades to arc and burn out, and switch handles may become energized. Stringolite Sullivan lamps are being used for longwall face illumination by the Hudson company, said Mr. Evans. Ten-foot connections are provided. Each man has an extension lamp.

Elimination of bonuses for accident prevention found favor with many participating in the question-box discussion of that subject. One speaker remarked that the workmen need the bonuses more than the bosses. Discharge for bad records and the advance of safe men was advocated by another, who said that the safety record of a foremen usually is an evidence of his efficiency.

Thomas E. Lightfoot, engineer, accident prevention and compensation, Koppers Coal Co., termed his bonuses "safety dividends." Foremen are not paid, however, solely for safety from accidents. They are rated on thirty factors, and if they make 80 per cent, the dividend is paid them. Under the ordinary bonus system, when a foreman has an accident early in the month he realizes his chance of getting an award is gone, so he slacks up. With the multi-conditioned award, the man continues to do his best, and the safety record has been improved accordingly.

National Safety Council Officials for 1932-1933

President, J. I. Banash, consulting engineer, Chicago.

Managing Director and Secretary, W. H. Cameron, Chicago.

Mining Section:

General Chairman, Thomas E. Lightfoot, engineer, accident prevention and compensation, Koppers Coal Co., Pittsburgh, Pa.

Vice-Chairman in Charge of Engineering, P. M. Arthur, director of personnel, American Zinc Co. of Tennessee, Mascot, Tenn.

Vice-Chairman, Frank Dunbar, general manager, Mather Collieries Co., Mather, Pa.; J. W. Ait, safety engineer, Calumet & Hecla Consolidated Copper Co., Calumet, Mich.; W. G. Metzgar, safety engineer, Hudson Coal Co., Scranton, Pa.

Secretary, Daniel Harrington, chief engineer, safety division, U. S. Bureau of Mines, Washington, D. C.

NOTES

. . . from Across the Sea

FIRING of two or more shots at precisely the same time is known as "simultaneous shooting." In Europe, the advantages and dangers of this practice have recently been given careful evaluation. Whether to permit the practice, discourage or forbid it is a live issue. The Explosives in Coal Mines Order of Great Britain prohibits it in the actual mining of coal. In Belgium, it is permitted in shaft sinking, in the driving of tunnels from shafts to the coal bed and in the driving of the development roads of mines which are either free from firedamp or contain so little of it as to qualify them for inclusion in the list of mines of the "first class."

Mines of this class evolve only a small quantity of methane and have 15 to 22 per cent of volatile matter in the coal they produce. In mines of the second class, which emit a larger quantity of gas and have more than 22 per cent of volatile matter in their coal, approved explosives must be used and external rock-dust protection or a safety sheath. In these simultaneous shooting is not permitted. In fact, shooting of any kind is forbidden in such mines except where special permission is given. However, in mines of this class the permission is not much sought, because the coal is soft and readily can be brought down with pickaxes without preliminary undercutting. The coal with this range of volatile matter seems much like that in the United States of similar analysis, rather badly cemented and softer alike than anthracite or true bituminous coals or lignites.

Strange to say, third-class mines—those, namely, that are subject to violent emissions of firedamp—are allowed to fire simultaneous shots, and to fire so many and in such close proximity that the expression "volley firing" has been introduced to express it. In 1923 as many as 48 shots were fired at one time in the Marcinelle-Nord colliery, and an average of 27 shots per volley, but in 1931, according to A. Breyre, at a meeting of research station officials, the maximum number had been cut to 27 and the average to 10 shots. A similar reduction in the number of shots to a volley occurred at the Produits colliery, which from 1923 to 1926 fired an average of 25 to 30 shots per volley, and in 1930 and 1931 only 6 to 10.

The purpose of this volley firing is to shake the face and release the gas, thus obviating the likelihood of face movements and gas outbursts when men might later be working at the face. The men who fire the shots must be either at the surface or in a shelter where they are adequately protected from an explosion or an outburst of methane, these chambers being well lighted and also supplied with compressed air. Except for these well-protected shotfirers, the mine must be entirely cleared of men.

It may be added that the coal in certain seams, on the edge of the Northern field at Liége and Charleroi, which is hard and requires shooting, is practically free of methane and low in volatile matter. This coal may be shot down with explosives, and presumably can be shot with more than one shot at a time. These mines are not listed in the first class, strangely enough, because only mines containing methane and a volatile content of more than 15 per cent are placed in a definite class.

In France, Germany and the United States simultaneous shooting is not forbidden, according to I. C. F. Statham, in a paper read before the Yorkshire branch of the National Association of Colliery Managers of Great Britain. Mr. Statham lists the dangers of consecutive firing as follows:

(1) First shot may break across hole made for second shot, and firedamp may accumulate in the break during the interval between successive shots. Instances of accidents caused in this manner are on record; (2) examinations between firing of shots may be perfunctory because of hurry, presence of smoke, dust and fumes; and (3) first shot may raise cloud of flammable dust into which the second shot may be fired later.

But simultaneous firing, according to the same authority, is said to have its dangers also, for the danger of ignition is increased. For France, Mr. Audibert, at the research stations' conference, declared that simultaneous shooting was not only permitted but demanded in French mines. He did not believe there was any danger in that practice. Mr. Taffanel had shown that in firing several shots simultaneously, presumably by electric means, no long interval could occur between shots. Apparent lags on detonation probably were caused by the burning of one of the cartridges, and perhaps resulted from presence of a gap between them.

But with all its simultaneous shooting, France had the notable record of only nine recorded instances of the ignition of firedamp by explosives in 27 years, which would seem to prove it a safe practice, according to Mr. Audibert, at least with French explosives.

Bergassessor Doctor Beyling, defending the German practice, said that all mines in Germany were considered gassy, and all used explosives that had been approved for safety. No explosion which could be attributed solely to an explosive had occurred in Germany for many years. Those that had occurred were due to the use of aluminum-sheathed detonators. In only one instance was the shooting simultaneous, and he believed that the accident would not have been avoided had only one shot been fired. He was of the opinion that the firing of a number of shots was safer than firing the same number one at a time, and that ignition was likely to result from firing one shot after another, for then there was a possibility that not only methane might be present but other gases resulting from the detonation of the explosive.

Dr. Payman said that in Great Britain the authorities feared simultaneous shooting for entirely different reasons from those which caused Belgian authorities to fear them. They believed that such shots might cause blow-outs, seeing that they might not all fire at precisely the same time. One shot might do so much work that it might be dangerous for another shot to explode in close proximity to it. Moreover, there was no way of knowing whether all the shots had fired. One of them might be left unexploded and its presence be overlooked. The effect on the roof of simultaneous firing also was dreaded. Dr. Beyling and Mr. Rother both declared that the firing of, say, 20 shots separately was a somewhat prohibitively expensive and slow operation and was, therefore, to be condemned, if it were not proved that the shooting of each hole separately was essential to safety.

Mr. Statham lists the dangers of simultaneous firing as follows: (1) increased danger of ignition; (2) shock to mine roof when a large length of coal which has been giving support to the roof is suddenly withdrawn; (3) increase in the number of misfires and hang-fires, because of the difficulty of insuring ignition when a large number of shots are connected in a single firing circuit; if a whole volley of shots misses, a relief hole has to be drilled for each missed shot, each accompanied with not a little danger; (3) greater quantity of smoke and fumes resulting from the shots, but that is a matter, Mr. Statham said, of adequate ventilation; (5) larger area to be examined before firing and the accumulation of gas during the examination of an extensive longwall face; Mr. Statham suggested a limitation to the length of face fired simultaneously; say, 30 to 36 ft.; (6) increased danger from flying débris, but with fewer shots more care would be taken to seek safety; (7) more connections at one time are necessary, but with single shots more connections would be needed per shot.

Low-tension detonators, said Mr. Statham, are to be preferred to high tension, (1) because the resistance of high-tension detonators varies from 1,150 ohms to 14,000 ohms, a variation of 1 to 12, whereas the resistance of low-tension detonators varies from 0.98 to 1.64, a range of less than 1 to 2; (2) because low-tension detonators may be graded so that only detonators of approximately equal resistance and, therefore, suitable for firing together may be used; (3) because low-tension detonators may be tested before use to insure their effectiveness; (4) because a high electromotive force is needed where high-tension detonators are connected in series.

Series methods of connecting simultaneous shots are preferable because in that case all shots fail to fire if one is defective, whereas with firing in parallel only one may fail and that is a dangerous condition. With series shooting, single wires are jointed instead of bunches of wire, as in parallel shooting. The Explosives in Coal Mines Order limits parallel firing to not more than three shots wherever simultaneous firing is permitted, as in the driving of rock headings.

Mr. Breyre, at the stations' conference, called attention to the fact that experiments at Frameries and Buxton showed that with a narrow heading the permissible charge limit was reduced. The Belgian authorities forbid simultaneous firing because, in the opinion of the authors of the regulation, the firing of n shots simultaneously in a cross-section S is the same as firing each shot in a gallery of cross-section $S \div n$.

It had been proposed that simultaneous firing of shots the explosive in which did not in aggregate exceed the charge limit might be permitted, but Mr. Watteyne, in default of experimental evidence, questioned whether charge limits can be added together with safety. Belgian regulations require that the heading shall not be less than 2 m., or 6½ ft., square, and only one shot can be fired at a time. Simultaneous shooting is particularly advantageous where backfilling is done, for it is then possible to complete the shooting between the mining and backfilling shifts. When work is done with shotholes 7.9 to 8.2 ft. long, simultaneous shotfiring requires 7 to 8 per cent more explosive.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Removal of Soot From Furnaces and Flues by the Use of Salts or Compounds. U. S. Bureau of Mines, Bulletin 360, by P. Nicholls and C. W. Staples. 76 pp.

Best of the compounds for burning out soot from furnaces and flues, says this bulletin, is chloride of copper. Chlorides of the elements lead, tin, zinc, lime and sodium follow in the order named, sodium chloride, or common salt, being the least effective, though zinc dust with salt, and red lead with salt are respectively almost as effective as zinc chloride and lead chloride.

Fire vaporizes the salts and deposits them on the soot, where, with an increase of heat, they act as catalysts, causing inflammation at a lower temperature than normal. Paper and wood would burn out the flues if enough were used, say the monographers, but, at least as far as the reviewer has observed, they do not stress the danger that paper may lodge in and block the flues.

It was found that cupric chloride lowers the temperature at which soot will ignite in air by 512 to 516 deg. F. and that common salt reduces the ignition temperature only 166 deg. F. Effectiveness of treatment with salts depends on the heat of the furnace and of the gases. Good, but rather uncertain, success was obtained when salts were used in the furnaces of household heaters; the burning of the soot was more certain and complete than in a cook stove because the deposit of soot was thicker. The action, however, extends further in warm-air furnaces because the gases leaving the furnace can reach a high temperature, so that the soot in the flue, and sometimes in the chimney, will burn.

It was not found that the treatment of the coal itself decreased the smoke or soot given off by the fuel bed or prevented the formation of soot. Regular treatment may, however, say the authors, give the soot a better chance to burn in normal operation, and thus may keep a furnace which "soots up" regularly in sufficiently good condition. Though it is not a necessary part of this inquiry, it seems a pity that the authors did not enter into the interesting question as to the effect of chlorine on the temperature of ignition of the volatile constituents of coal.

R. Dawson Hall.

* * *

Coal Distribution in the Twin Cities, by R. S. Vaile and V. G. Pickett. University of Minnesota Press. 100 pp., 6x9¼ in.; paper. Price, 75c.

This bulletin is one of several studies of distribution of consumer goods undertaken by the University of Minnesota. The authors estimate that families living on a $2,000 a year income pay in the Twin Cities about $100 a year for fuel, as against $75, which is the average family expenditure in the country, according to the U. S. Bureau of Labor.

Results are recorded of a careful study which the authors have made of the fuel situation, including quality of furnace oil used, types of domestic heating equipment, kind of coal consumed as to nature, origin and size, preferences of users, lake-dock versus all-rail wholesaling, methods of retailing, distribution of retailing costs, wholesaling in general, better retailing methods and uniform cost accounting.

As is usual when universities investigate matters, the book ends with a plea for public control. An ordinance is to be framed to assure proper service and delivery, retailers are to be licensed, a service department is to tell buyers what fuel to buy, a commissioner is to be appointed, liberal financial support is to be provided, and "perhaps" municipally owned markets and docks are to be acquired to avoid cross-hauling in wagons.

R. Dawson Hall.

* * *

Re-Treatment of Fine Washed Coal, by A. C. Richardson and others. U. S. Bureau of Mines Report of Investigations 3165.

This report gives the results of an investigation into the possibility of economically re-treating minus 1/16-in. washed coal from the Black Creek seam, Bradford, Ala., and the Mary Lee seam, Gamma, Ala., on concentrating tables. Bradford coal possesses fairly good coking qualities, and is blended with Mary Lee coal to compensate for the high ash content of the latter. The report gives float-and-sink data for both coals and the results of washing tests on both laboratory and commercial-size concentrating tables. Ash in Bradford washed coal was reduced from 5.2 to 2.5 per cent, and ash in Gamma coal was lowered from 10.2 to 8.0 per cent. Cost of re-treatment on commercial tables would not be excessive, the report states.

Publications Received

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted.

Rubber-Sheathed Trailing Cables, by L. C. Ilsley, A. B. Hooker and E. J. Coggeshall. Bureau of Mines, Washington, D. C. Bull. 358; 53 pp., illustrated. Price, 25c.

Tests of Rock-Dust Barriers in the Experimental Mine, by George S. Rice, H. P. Greenwald and H. C. Howarth. Bureau of Mines, Washington, D. C. Bulletin 353; 81 pp., illustrated. Price, 10c.

The Ignition of Firedamp by Explosives, by W. C. F. Shepherd. Bureau of Mines, Washington, D. C. Bulletin 354, 89 pp., illustrated. This covers a study of the process of ignition by the Schlieren method.

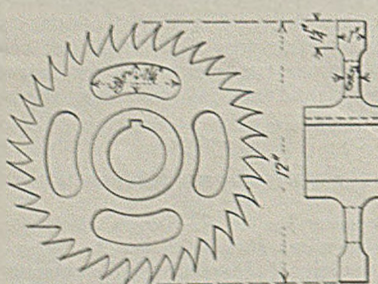
Carbonizing Properties and Constitution of Black Creek Bed Coal from Empire Mine, Walker County, Ala. Bureau of Mines, Washington, D. C. Technical Paper 531; 44 pp., illustrated. Price, 10c.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Dirt Removed From Shaft Sump With Saw-Tooth Impeller

Cleaning chips and pieces of coal out of a sump at a shaft mine by installing a saw-tooth impeller in a centrifugal pump is outlined by E. C. Tillson, Cassity, W. Va. At the mine in question, which had been in operation a number of years, water was pumped 185 ft. up the shaft by a standard-make, 6-in. volute pump (inclosed double-suction impeller). Capacity was 1,000 g.p.m.



Construction Details, Saw-Tooth Impeller

The presence of slack coal and chips in the mine water made it necessary to dismantle the pump several times a day to clean out the impellers. Strainers were employed, but these also clogged, usually when the water had reached the roof of the sump, so that it was impossible to get at them.

To clean out the sump, a saw-tooth impeller was made up as shown in the accompanying illustration. This was installed in the pump, and after most of the water had been removed, a man went in to agitate the fluid mass sufficiently to keep it runing to the suction inlet. Chips and small coal were ground up in the pump and discharged. After the sump was cleaned out, the original impeller was replaced.

The saw-tooth impeller was sturdily constructed of brass with four holes in the web to allow the passage of water and thus eliminate end thrust by balancing the pump. Similar impellers can be cast at any brass foundry at a very low cost, Mr. Tillson remarks. Care should be taken to keep down the width of the vanes. Otherwise, it is likely that the motor will be overloaded.

Conveyor and Scraper Store Slack At Low Cost

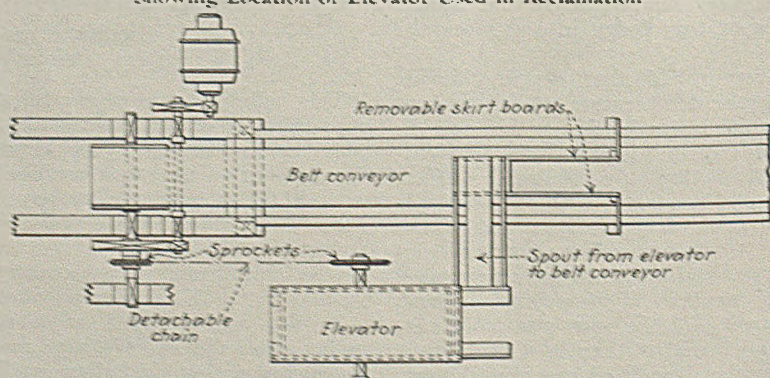
Slack storage, when it becomes necessary, usually catches the mine manager unprepared, and consequently is an expensive proposition. If storing slack were an every-day occurrence, large investments in money-saving machinery would be justified. But storage is seasonal, and the quantity of coal stocked and reclaimed usually is small. Yet hand work must be eliminated if it is to show a profit.

When the Liberty Fuel Co., Latuda, Utah, decided several years ago that slack storage was a necessity, L. R. Weber, now president, and George A. Schultz, now vice-president, considered many available systems, including the use of crawler and locomotive cranes with clamshell buckets, portable conveyors, and aerial tramways, in addition to the conveyor plan here described. Low first cost and low operating cost were deemed to be the prime essentials of any system selected.

Space was available for storage 400 ft. from the rescreen plant from which the slack was to be transported to the stockpile and to which it was to be returned for loading. An aerial tramway offered the maximum storage capacity, but it lacked ability to reclaim the coal and load it into railroad cars. In addition, the cost of the tramway, hoisting machinery and towers was high. Cranes or portable conveyors were open to the objection that the coal would have to be loaded into railroad cars, switched to the storage yard, and there unloaded. Switching charges and high cost of the equipment were other major disadvantages. In the light of this survey, a reversible belt conveyor was installed between the rescreen plant and the storage yard. A scraper which previously had been purchased for use underground was put in service in the yard for piling and reclaiming the coal.

Conveyor specifications were as follows: width, 18 in.; length, 400 ft. 8 in. from center to center of pulleys; speed, 350 ft. per minute; capacity, 90 tons per hour storing and 50 tons per

Arrangement of Equipment at Discharge End of Slack Storage Conveyor, Showing Location of Elevator Used in Reclamation



hour reclaiming; belt construction, 4-ply, 28-oz. duck with 1/16-in. rubber cover. Rise from the bin at the rescreen plant to the discharge point is 16 ft. The belt is driven through two sets of spur gears by a 15-hp., Type FT, normal-torque, low-starting-current, 860-r.p.m. General Electric motor, and is carried on Link-Belt Type 55, ball-bearing idlers on unit stands.

Coal discharged from the end of the conveyor falls to a pile from which the scraper, pulled by a Sullivan hoist, distributes it to the storage pile. In reclaiming the coal, the scraper is reversed to bring the coal to the boot of a 14x7-in. Link-Belt centrifugal-discharge elevator, which feeds onto the belt conveyor. The elevator is driven from the belt conveyor headshaft through a detachable chain, which is removed when storing coal. The reclaimed coal travels on the reversed belt to a point under the rescreen plant, where it discharges over the foot pulley into the railroad car.

The 15-hp. motor has proved to be ample for the duty of bringing the coal upgrade to the storage pile and for operating the elevator and belt in reclaiming. In estimating the installation, plain grease-cup lubricated idlers were considered to keep down the initial cost. It was found, however, that these idlers would be much more expensive in the long run, inasmuch as the increased friction would necessitate a 20- instead of a 15-hp. motor, and would require heavier driving equipment and 5-ply, 32-oz. belt.

When stocking coal, only one man, who operates the scraper hoist, is required. Three men are used in reclamation, as follows: hoistman, shoveler at the elevator boot and a car dropper at the loading point. In the autumn of 1930, 2,200 tons was stored, and reclaimed the following spring; in the autumn of 1931, the total ran up to 6,375 tons, likewise reclaimed the following spring. Estimated cost of storing slack is 5c. per ton; reclamation cost is 12c. per ton. These figures include labor, material, power and maintenance, but not interest and depreciation. Total investment in storage equipment, including conveyor and structures, and the scraper and hoist, did not exceed $8,000.

Going Up

Coal production is on the way up, bringing in its train increased working time at the mines. Practical operating men find their duties and responsibilities increased if the low-cost records of past months are to be preserved. Now they find still greater application for the tried and proved ideas embodying practical answers to the every-day problems encountered in mining and preparing coal and promoting safety. In this department, *Coal Age* presents each month selected cost-saving and safety-promoting ideas from coal-mining men throughout the country. Your idea has its place in these pages. Send it in. A sketch or photograph may help. Acceptable ideas are paid for the rate of $5 or more each.

Deep-Well Pump at Indiana Mine Solves Dewatering Problem

Mine pumping problems vary widely in character and consequently exert a considerable influence on the type of equipment installed. Under certain conditions, in the opinion of F. M. Schull, superintendent, and Dewey Loudermilk, engineer, No. 8 mine, Binkley Mining Co., Clinton, Ind., the deep-well turbine pump may prove superior to other types. Experience at No. 8 is cited as an example.

Workable seams at this mine, in descending order, are: No. 5, No. 4 and No. 3. The No. 5 seam has been worked out under the bottom lands, causing some surface breaks through which a large quantity of water enters the mine. This water drains to a swag 1,000 ft. from the shaft landing, and if not pumped out regularly would overflow into the present No. 3 workings. Mine conditions made it impossible to seal off the water in the No. 5 workings.

Up until October, 1931, the No. 5 water was handled by three centrifugal pumps totaling 315 hp. and operating ten hours per day. Sudden inrushes of water sometimes occurred, and in these cases, the pumps were operated continuously for as long as a month at a time. If the pumps should have been idle for 36 hours at any time, it would have been impossible to reach them. This condition was a constant worry to the management, inasmuch as getting repair parts, particularly armatures, to the pumps was a time-consuming job. An air lift was first considered to replace the centrifugal pumps, but the requirement of 75 per cent submersion for successful operation would have made it necessary to carry the lift down to the No. 3 seam. After thorough consideration of the problem, it was decided to install a Fairbanks, Morse & Co. Price deep-well turbine pump.

A hole large enough to take a 10-in. casing was drilled from the surface to the lowest part of the No. 5 swag, and the deep-well pump (with 60-hp., 2,300-volt, 1,800-r.p.m. motor) was installed in October of last year. Discharge rate with this pump is 700 g.p.m. against a head of 220 ft., and it operates 7½ hours per day. The night watchman looks after the operation. Savings in power and labor can readily be seen. The pump can be pulled out and put back in service in 24 hours if necessary.

The deep-well pump, according to Messrs. Schull and Loudermilk, lends itself to pumping from old workings that give off large quantities of water and cannot be sealed off, or from mine sumps that drain to the shaft. Both manual and automatic operation from either the top or bottom of the shaft are possible. The deep-well pump can be installed in the quartering shaft of the main shaft, and in case it is necessary to shut down the mine, or seal it off, the water can be pumped out by the watchman.

Automatic Rope Uncoupler On Incline Plane

When the mine-car gravity plane, which is 5,850 ft. long and operates on a 1,600-ft. elevation differential, was being completed at the Coal Creek (Tenn.) mine of the Southern Collieries, Inc., no one there could recall the details for making an automatic equipment of proved design to pull the rope clevis coupling pin at the top of the hill. From the crest of this hill the

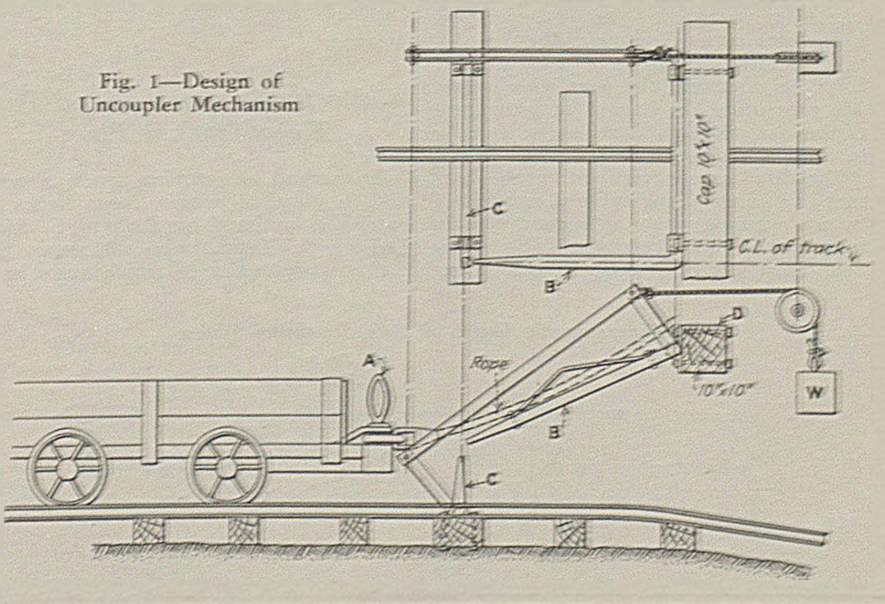


Fig. 1—Design of Uncoupler Mechanism

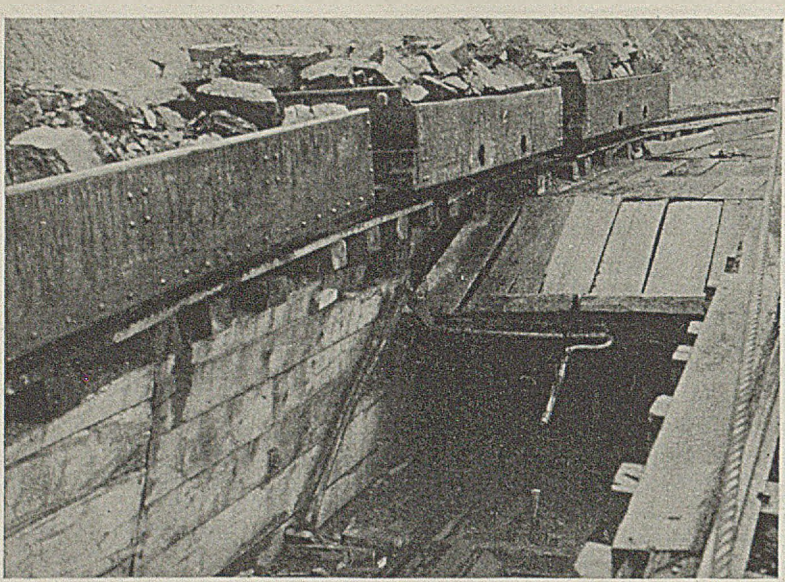


Fig. 2—Loaded Trip Beside Empty Hole

empty trip coasts down a gravity track or "empty hole" for distribution in the mine. The accompanying drawing and description following, furnished by A. W. Evans, chief inspector, Tennessee Department of Mines, indicate the design devised locally for the purpose.

The rope coupling pin *A* is forged with an eye of 12-in. diameter at the top. As the empty trip approaches, the eye hooks over the projecting arm *B* when the car bumper hits lever *C*, which in turn lifts *B* in a rapid motion and tosses the pin onto the platform above D in Fig. 1. This platform is shown in Fig. 2. After the trip of four to six cars has passed, the device resets itself by gravity.

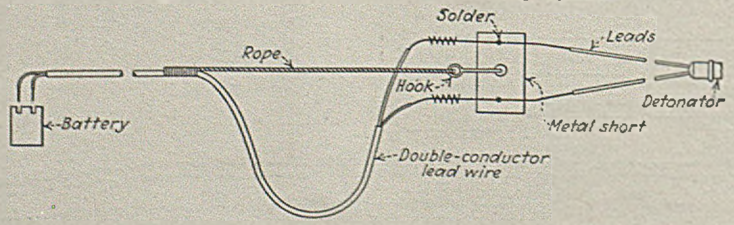
Safe Shotfiring

Shotfiring is the most hazardous job connected with the use of explosives, declares J. T. Gatehouse, general inspector, Pennsylvania Coal & Coke Corporation, Cresson, Pa., in detailing a safe method of firing with electric detonators. Many companies, he says, make the mistake of using cheap cables with a short life. As a result, the insulation wears off, presenting the hazard of premature explosions through bare spots coming in contact with steel ties or rails.

Twisting or short-circuiting the battery end of the firing cable is considered by many mining men as a good way to take care of stray currents. This, however, is an error. With a No. 6 detonator at one end of 125 ft. of good cable, the other end can be shorted, and contact 100 ft. from the detonator with a 3-volt battery will explode the cap.

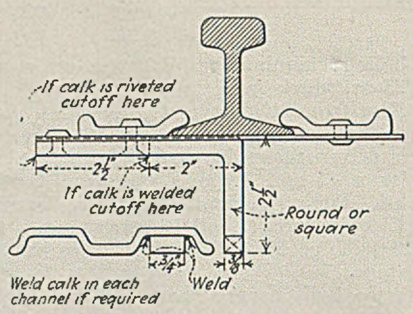
A simple but effective method of firing with electric detonators is shown in the accompanying illustration. Duplex cable is used, and the detonator wires are short-circuited by laying them across a good grade of light shorting metal and attaching them by soldering with a very small quantity of material. The metal short is made with a small hole in the middle. In attaching the firing cable, it is looped as shown in the illustration. At the back of the loop, a rope with a hook on one end is fastened to the cable. The hook is inserted in the hole in the metal short. After the attachments are made, the shotfirer goes back to the battery and, by pulling lightly on the cable, breaks the soldered connections between the detonator wires and the metal short. The shot can then be fired. With this system, the leads to the detonators are always shorted until the shotfirer is out of the way.

Diagrammatic Sketch of Safe Shotfiring System



Calks for Steel and Wood Ties Keep Track in Place

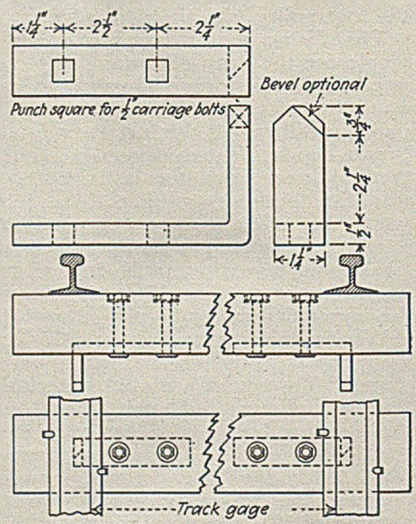
A method of keeping track aligned and in place in rooms, room necks or entries is outlined by Richard C. Rice, LaFollette, Tenn., who advocates the use of special ties to which calks have



Calks Riveted or Welded to Steel Ties

been welded, riveted or bolted. The method of applying the calks to different types of ties is shown in the accompanying illustrations. The prongs, which protrude downward into the pavement, may be of any length suitable to the character of the bottom.

By using four or five of the special

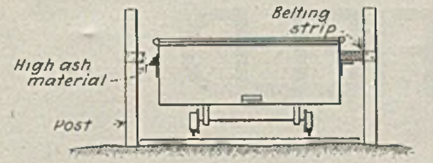


Method of Applying Calks to Wood Ties

ties to suit conditions, Mr. Rice declares that the rails can easily be held in place on straight stretches or on curves. Experience has shown that they work successfully where entries pitch 10 to 15 deg., and also on curves continuously traversed by heavy cars and locomotives. While the special ties involve an additional cost for construction and installation, it is held that they prevent spread track, eliminate additional work on the part of the trackmen, and enable cars and locomotives to operate without interruptions due to derailments.

Scrapers Remove Ash Material From Car Angles

At a southern West Virginia mine using a rotary dump, it was found that a small quantity of high-ash material was carried into the dump on the contact angles on the side of the car, writes C. H. Farmer, Montgomery, W. Va. The presence of this high-ash material assumed considerable importance, inas-

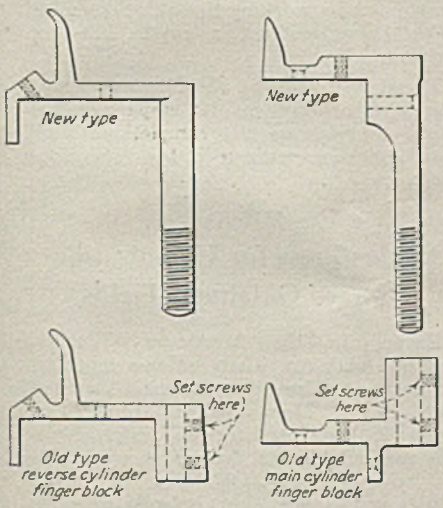


Scraper Installation for Removing High-Ash Material From Contact Angles on Car

much as the coal is used for coking. To prevent the material from falling into the dump, scrapers made of stiff rubber belting were mounted on posts, as shown in the accompanying illustration. These scrapers, riding on the contact angles, remove the high-ash material before the car enters the dump.

Controller Finger Base Blocks Stop Arcing and Burning

Burning of the terminal blocks which insulate the controller fingers is a feature of many locomotive controllers of certain types, writes F. Fraser MacWilliams, Flood City Brass & Electric Co., Johnstown, Pa., in describing an improved type of finger base block developed by the Pennsylvania Coal & Coke Corporation. The burning is due to poor connections between



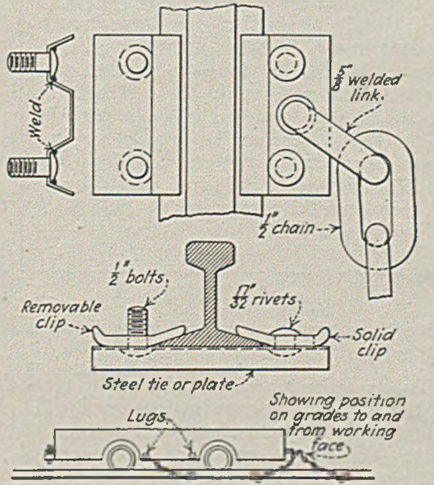
New and Old Types of Finger Base Blocks

the cable and the finger base block. These connections, as shown in the illustration, are made by two setscrews. With stranded wire, especially if the strands are not soldered together, use of the setscrews results in a bad connection, with attendant arcing and burning of the screws, insulators and other parts. Moreover, the setscrews frequently are inside the case where they cannot easily be reached with either a wrench or screwdriver.

The improved finger base blocks devised by the Pennsylvania Coal & Coke Corporation are shown in the accompanying illustration, together with types formerly in use. New types consist of a base block with a ½-in. threaded stud cast integrally with the block. This stud projects through the back of the controller. Here the leads, after being brazed or soldered into an ordinary terminal, are fastened on solidly by means of two nuts. An insulating bushing covers the stud where it goes through the controller case and is held in by one of the clamping nuts. Use of these finger base blocks has successfully eliminated one source of arcing and burning inside the controller. A further advantage is the fact that connections are made from the outside of the controller, where there is plenty of room for using a wrench to make a tight job.

Safety Car Holder

Safety considerations dictate the use of some method of holding mine cars in working places to prevent injuries from runaways. Track is seldom level in rooms, pitching either toward the face or the entry, which means that some safety device should be employed. In general, cars are held by means of a block of wood placed in front of the wheels, by a sprag in the wheel, or, where grades



Construction Details of the Car Holder Are Shown at the Top; Bottom View Shows Two Methods of Using the Holder

are heavy, by placing timbers in front of the car. At a Southern Appalachian mine, according to Richard C. Rice, La-Follette, Tenn, severe grades prevailed, and a number of methods were employed in holding cars. No particular attention was paid to the problem until a miner was crushed through timbers slipping from place in front of a car. Several methods were then tried to prevent runaways, and the one developed by Mr. Rice was finally adopted.

The Rice car holder, shown in the accompanying illustration, consists of two clips, one of which is riveted to a bottom plate made of flat steel or a sawed-off section of a steel tie. The other clip is fastened to the bottom plate by two bolts, and is removable. In making up the holder, the clips are so placed that they will fit closely to the base of the rail. A chain is fastened into the car holder, as shown in the illustration.

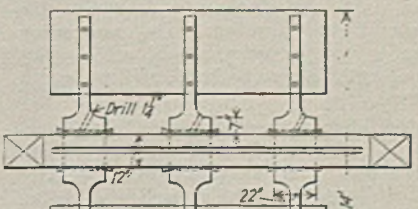
In using the holder, it is fastened to the rail by slipping the plate under the base of the rail and bolting on the removable clip. The link or hook on the end of the chain either is slipped over the rotary dump lugs on the side of the car or is inserted in the coupling link, as shown in the figure. Size of the holder and the length and size of the chain and hooks or links depend upon the size of the rail and how many cars are to be held. For one car on all grades, Mr. Rice recommends a ½-in. chain with ⅝-in. welded links on either end. If a hook is used instead of one of the links, ⅞-in. round steel or larger should be selected. The chief advantage of this holder is that the chain must be slackened before it can be removed. By using nuts corresponding in size to those used on room fishplates, the loader can easily move the holder from place to place. No accidents have occurred in the year these holders have been in use.

Fan Shafts and Hubs Repaired With Babbitt Metal

"Several years ago," writes E. C. Tillson, Cassity, W. Va., "I had under my supervision a number of 14-ft. fans, three of which had been allowed to run loose on the shafts for some time." As a result, keyseats were badly worn, shafts were irregular in cross-section, and the hubs were out of round and about ¼ in. larger than the shafts. These conditions made it impossible to install a tight bushing, so it was decided to repair them by putting in babbitt metal. As the working space was limited and the hubs were 22 in. long, it was apparent that the babbitt metal would not run the full length of the hubs, so 1¼-in. holes were drilled in the hubs, as shown in the accompanying illustration. This was done to shorten the distance the babbitt metal would have to run. Four iron wedges were driven under each end of the hubs to bring the rotors into line.

In applying the babbitt metal, sheet steel plates were installed around the hubs to hold a wood fire. Concrete fan houses and steel fans made the fires possible. After the hubs were hot, babbitt was poured into the holes, completely filling the space between the hubs and the shaft. Contraction of the hubs after cooling resulted in a good tight fit, which has lasted for eight years.

Showing Method of Repairing Worn Fan Shaft and Hubs With Babbitt Metal



WORD from the FIELD

To Collect Data on Relation Of Coal and Railroads

Collection of data showing the mutual interest of the bituminous coal and railroad industries for presentation to the National Transportation Committee headed by Calvin Coolidge was decided upon at a meeting of a special committee of the National Coal Association last month. The committee will gather information on losses to competitive fuels in 1932 and estimates of future losses; steps to combat these losses; efforts made by the railroads to combat competitive fuels; tonnage recovered by the coal industry and the means employed; control over natural-gas pipe lines exercised by public service commissions; general level of coal freight rates in different sections, as compared with 1914; and the relation between freight rates and delivered prices.

The committee is composed of: J. D. Francis, Island Creek Coal Co.; H. R. Hawthorne, Pocahontas Fuel Co.; W. J. Jenkins, Consolidated Coal Co. of St. Louis; R. Templeton Smith, Pittsburgh Coal Co.; and Charles O'Neill, Peale, Peacock & Kerr, Inc.

Stove for Cooking and Heating

An anthracite-burning kitchen range which, in addition to furnishing heat for cooking, also will heat a six-room house, humidify the air, and supply hot water, has been developed by the Jeddo-Highland Coal Co., Jeddo, Pa. The stove eliminates the basement furnace and, by supplying warm humidified air through an outlet in each room, does away with radiators. Including fuel for cooking and hot water, the new stove, it is asserted, will heat a six-room house all year on five to six tons of coal. Price will be only slightly higher than that of an ordinary range, company officials state.

Competition Under Fire

A nation-wide survey of bituminous coal trucking has been undertaken by the National Coal Association to determine the extent of the practice. The association hopes to uncover information on the quantity of coal handled by truck and the length of haul.

Modifying a previous order, the Interstate Commerce Commission last month authorized lower intrastate mileage rates on coal from Peoria, Tazewell and Fulton counties, Illinois, and certain mines in the Springfield district to the Peoria and Pekin districts to enable the carriers to meet truck competition. For hauls up to 30 miles, the reduction is 20c. per ton, grading down to 2c. per ton for hauls up to 110 miles.

To stem the movement of coal by truck to the Denver area, reductions in freight rates of 40 to 59c. on lump and nut and of 25 to 40c. on pea and slack from various Colorado fields, effective Nov. 5, were authorized by the Public Utilities Commission. The reductions grew out of a series of conferences between operators, railroads and retailers.

Coal Production Up

Bituminous coal production rose to 32,633,000 net tons in October, according to preliminary estimates by the U. S. Bureau of Mines. Output in September was 26,314,000 tons, while in October, 1931, production was 35,700,000 tons. Anthracite production rose to 5,225,000 net tons in October, against 4,108,000 tons in September and 6,561,000 tons in October, 1931.

Total production of bituminous coal in the first ten months of 1932 was 243,881,000 tons, a decrease of 23.3 per cent from the output of 317,740,000 tons in the same period in 1931. Anthracite production in the first ten months of 1932 was 39,981,000 tons, a decline of 21.3 per cent from the corresponding 1931 figure of 50,818,000 tons.

Canada Boosts Anthracite Tariff

In carrying out the provisions of the Empire agreements made at Ottawa last summer, the Canadian government raised the tariff on anthracite coal from the United States from 40c. to 50c. per ton in October. Anthracite from Great Britain enters the dominion free.

Receiver for Red Jacket

E. E. Ritter, general manager, Red Jacket Consolidated Coal & Coke Co., operating in the Williamson field of West Virginia, has been appointed receiver for the company by Judge McClintic, of the U. S. District Court. Judge McClintic also authorized the issuance of receiver's certificates up to $40,000 for continuation of operations. Total liabilities scheduled were $1,153,904; assets, $1,622,304.46.

Scotia Installing Power Plant

Scotia Coal & Coke Co., Slab Fork, W. Va., is installing a new power plant at its Brooklyn mine, near Thurmond, W. Va. The plant will include two 300-kw. d.c. turbo-generators, one 300-kw. a.c. turbo-generator, and will supply power for three operations producing 2,000 tons per day.

Safety Records Made

Harwick Coal & Coke Co., Harwick, Pa., has been awarded the trophy of the Western Pennsylvania Safety Council for the best record in the coal-mining group in an inter-plant safety contest conducted by the council.

Hammond Colliery, Philadelphia & Reading Coal & Iron Co., Girardville, Pa., established a new safety record for company mines by working through September and October without a single lost-time accident.

Premier Coal Co., Middlesboro, Ky., staged a barbecue for its employees last month to celebrate the completion of 90 days' operation without a lost-time accident.

Miners Press for Unionization Of Two Oklahoma Fields

Except in the McAlester-Wilburton field of Oklahoma, where union sympathizers carried on an active campaign against the Milby & Dow Coal & Mining Co., Craig Valley, Pittsburg-McAlester, Samples and Delokla coal companies, operations in Arkansas and Oklahoma proceeded quietly in October. Large forces of union men picketed the mines of these companies in defiance of injunctions, and intervention of state authorities to establish order and protect property was necessary. The companies under attack, however, declined to follow the McAlpine, Hartshorne, Globe, Osage, Mullen and Pittsburg County companies into the union fold.

The union turned its attention to the Henryetta district on Oct. 30, calling a mass meeting on that date as a preliminary step in the organization campaign. Reports indicated that the Henryetta operators would unanimously resist organization efforts. The non-union Tulsa and Lehigh fields were quiet.

In Arkansas, the Bryant Coal Co., Arkansas Anthracite Coal Co., Bernice Anthracite Coal Co. and Arkansas Mining Co. continued to operate non-union in the Bernice and Spadra fields. Aside from these four companies, Arkansas operating mines are entirely union. Most of the latter companies agreed that union operation was satisfactory, but a few, particularly those who had signed provisional contracts carrying higher rates which have not yet been modified, found union operations irksome.

The general wage scale for Arkansas and Oklahoma (Provisional District 21) is given in the accompanying table, together with details from certain special scales established at some mines. Nonunion operators have established a uniform scale based on a day rate of $3.60, against $3.75 provided for in the contracts.

New Arkansas-Oklahoma Wage Scale

GENERAL SCALE

Inside Day Labor	Per Day
Fireboss	$4.30
Tracklayers	3.75
Helpers	3.50
Timbermen, bottom cagers, drivers, tripriders, pushers, water and machine haulers, fire runners, electric or steam slope engineers, motormen, pumpmen.	3.75
Trappers	2.05
Spragging, coupling and greasing, boys under 20	2.75
Shotfirers and shot tampers, mines loading coal on tonnage basis	4.26
Tail-rope engineers	3.75
Electric hoist operatives, boys	3.08
Drillers and shooters, mines loading coal by the day	4.04
Head machinist	4.36*
Machinist	3.95
Digging and loading coal by the day	4.04
Machine runners	4.26
Helpers	3.95
All other inside day labor	3.50
Men driving slopes, developed mines	4.04
Shaft sinkers	4.80
Outside Day Labor	
First blacksmith	4.26*
Blacksmith	3.95
Helpers	3.50
Carpenters	3.57
Motormen	3.75
Dirt picking, boys	1.75
Men	2.00
Other outside day labor	3.11
Engineers, first class, hoisting more than 500 tons per day, per month	111.66
Per day, 9 hours	4.30
Engineers, second class, 300-500 tons, per month	104.65
Per day	4.02
Engineers, third class, under 300 tons, per month	95.32
Per day	3.66
Tail-rope engineers, men, 8 hours.	3.52
Boys	3.08

CHAIN MACHINE SCALE—TAHONA†

Mining rate, loader furnishing explosives:	
Entries, including yardage, room turning and dead work:	
Machine crew, per ton	0.15
Loaders, per ton	0.74
Room and crosscut coal:	
Machine crew, per ton	0.12
Loaders, per ton	0.58‡
Deductions from machine loading rates:	
When Cardox is furnished, per ton	0.07
When company does drilling and blasting, per ton	0.10
Additions for long rooms:	
Over 300 ft., per ton	0.03
Drawslate in rooms, more than 3 in. thick, per extra inch per yard 5 ft. wide	0.02
Room crosscuts, per yard	1.65§

HUNTINGTON (ARK.) MINES—SOLID SHOOTING BASIS

Loading, clean mine-run, per ton.	0.72
Entry, aircourse and dip switch yardage:	
Entries 8 ft. wide	2.25
Entries 12 ft. wide	1.68
Entries 16 ft. wide	1.12
Room turning	3.39
Entry and room crosscuts, per yard	1.68
Drawslate in rooms, more than 3 in. thick, per extra inch per yard 5 ft. wide	0.02

*Does not apply unless two or more are employed. †Differential in favor of machine mines, 7c. per ton. ‡Basic rate for machine mines. §Divided one-third to each of following: loader, machine crew and company.

Insurgent Union Gains Ground in Illinois; Anthracite Wage Board Chosen

With control of the state's miners divided between the United Mine Workers and the Progressive Miners of America, Illinois entered November with all but one major company in position to operate in all districts. This exception was Peabody Coal Co., which, with its mines in other districts manned by United Mine Workers, refused to deal with the Springfield insurgents.

The latest additions to the list of operators signing up with the Progressive Miners were the Mt. Olive & Staunton and Superior coal companies in central Illinois. They were preceded by a few days by the Consolidated Coal Co. of St. Louis, Mt. Olive, which also operates a mine in the same district under contract with the United Mine Workers; Indiana & Illinois Coal Corporation, and the Penwell Coal Co.

Operators in the Belleville field led the rush to the insurgent colors, the majority signing up at a conference on Oct. 7. As an inducement, the new union abandoned its stand for the old $6.10 wage scale and agreed to the new $5 base carried in contracts with the United Mine Workers. At the end of October, Belleville and Springfield mines were practically 100 per cent insurgent. The Progressive Miners' union was in control of the majority of the central Illinois mines. Three Peabody mines were manned with members of the United Mine Workers under the protection of the National Guard, and plans were drawn up for reopening the fourth. In the Fulton-Peoria and Wilmington districts, the United Mine Workers were in the ascendancy. Southern Illinois, the largest producer in the state, is solidly behind the United Mine Workers. Of the total working miners in the state, 23,000 are affiliated with the regular union and 9,000 with the insurgents.

Miners' antipathy to machine loading brought about an unusual situation in Saline County, where the O'Gara and Wasson coal companies removed all loaders and conveyors from four mines in return for a voluntary wage reduction of 10 per cent, carrying the basic day rate down to $4.50. The mines affected were Nos. 1, 3 and 12 of the O'Gara Coal Co. and No. 1 of the Wasson Coal Co. The miners took action without the sanction of the United Mine Workers, and so far state and national officers have kept hands off. Other companies in southern Illinois expressed little interest in this development, holding that the benefits of machine loading outweighed those of lower wages.

George Rublee, Washington, D. C., a former member of the Federal Trade Commission, and Frank Morrison, secretary, American Federation of Labor, were chosen members of a board to continue consideration of the anthracite operators' request for a wage reduction at a joint meeting of representatives of the miners and operators in New York City, Nov. 3. The board, which may enlarge itself to three members, provided both of the original appointees agree, has 90 days in which to arrive at a decision on the wage question.

Disregarding the warnings of union officials, employees of the Butler colliery of the Pittston Co., Pittston, Pa., ratified a modified wage agreement on Oct. 19, providing for readjustment of certain mining rates which formerly made operating cost too high for the colliery to run. Resumption of operation, which ceased in March, will take place when the details of the rates are worked out.

Four hundred men struck at the Brenizer mine of the Westmoreland Mining Co., Blairsville, Pa., early in October after a wage reduction of 15 per cent for loaders and 20 per cent for day men. The company at the same time announced reductions in rent, fuel and electricity.

Permissible Plates Issued

Five approvals of permissible equipment were granted by the U. S. Bureau of Mines in August and October, as follows:

(1) Goodman Mfg. Co.; Type L-10CL3 longwall mining machine; 50-hp. motor, 220-440 volts, a.c.; Approvals 246 and 246A; Aug. 19.

(2) Vulcan Iron Works; shaker conveyor; 15-hp. motor, 230 volts, d.c.; Approval 247; Oct. 21.

(3) LaBour mine pump; 5-hp. motor, 230 volts, d.c.; Approval 248 issued to Harris Pump & Supply Co.; Oct. 31.

(4) Mine Safety Appliances Co.; M-S-A Model 3 Type AP methane detector; Approval 803; Oct. 29.

(5) Mine Safety Appliances Co.; M-S-A Model 4 Type AP methane detector; Approval 804; Oct. 29.

To Reopen Gaylord Shaft

The Gaylord shaft at the Gaylord colliery of the Kingston Coal Co., Plymouth, Pa., will be reopened after a shutdown of 40 years due to a squeeze. The project will result in the operation of a 10-ft. seam of coal. Reclamation will require, it is estimated, several months' work.

Coming Meetings

Harlan County Coal Operators' Association; annual meeting, Nov. 16, Harlan, Ky.

Southern Appalachian Coal Operators' Association; annual meeting, Nov. 18, Knoxville, Tenn.

Operators' Association of Williamson Field; annual meeting, Nov. 29, Williamson, W. Va.

Tenth National Exposition of Power and Mechanical Engineering, Dec. 5-10, Grand Central Palace, New York City.

West Virginia Coal Mining Institute; twenty-fifth annual meeting, Dec. 6 and 7, Daniel Boone Hotel, Charleston, W. Va.

Coal Mining Institute of America; annual meeting, Dec. 15 and 16, Auditorium, Chamber of Commerce Building, Pittsburgh, Pa.

Anthracite Club of New York; third annual banquet, Jan. 19, 1933, Hotel Astor, New York City.

American Society Heating and Ventilating Engineers; annual meeting, Jan. 23-25, 1933, Cincinnati, Ohio.

Glen Alden Breaker Burns

Fire destroyed the Stanton breaker of the Glen Alden Coal Co., Wilkes-Barre, Pa., Oct. 21, while workmen were reconditioning the structure in preparation for a resumption of operations.

Industrial Notes

F. J. Rudd has been appointed managing engineer of the Lynn (Mass.) works of the General Electric Co., succeeding L. E. Underwood, who has been made manager of the Pittsfield (Mass.) works.

Ingersoll-Rand Co., New York City, has acquired exclusive rights for the marketing of SKF drill steel throughout the world.

Roller-Smith Co., New York City, has appointed Mark G. Mueller, 1700 16th St., Denver, Colo., as its district sales agent for Colorado, New Mexico and western Kansas.

Cleveland Tractor Co. and the Austin-Western Road Machinery Co. have completed a sales and service arrangement for the distribution of Cletrac crawling tractors in Mid-West and Southern territory (Michigan, Wisconsin, Minnesota, the Dakotas, Nebraska, Iowa, Illinois, Indiana, Kansas, eastern Missouri, Oklahoma, Texas, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, the Carolinas, part of Tennessee and the Virginias). The Cletrac line will be on display in all principal cities and trading centers in this territory and will be sold and serviced through the combined efforts of the present Austin-Western organization and the industrial sales division of the Cleveland Tractor Co. Similar working arrangements hitherto made by the Cleveland Tractor Co. in other territories with other companies will not be disturbed.

Marlin-Rockwell Corporation, Jamestown, N. Y., has consolidated the sales activities formerly carried on by the following subsidiaries: Gurney Ball Bearing Division; Standard Steel & Bearings, Inc.; and Strom Bearings Co. This action was taken to make more effective the combined sales, engineering, and manufacturing facilities of these subsidiaries.

Obituary

Harry A. Berwind, vice-president, Berwind-White Coal Mining Co., died at the Bryn Mawr Hospital, Philadelphia, Pa., Oct. 7. Mr. Berwind participated actively in the development of the Berwind-White interests for the greater part of his life.

John D. Jones, 62, prominent anthracite mining engineer, died at his home in Wilkes-Barre, Pa., Oct. 23. For the past twelve years, Mr. Jones had been engaged in fighting the fire in the Jersey mine, near Avondale, Pa.

Arthur Widdowfield, 55, general manager of the Connell Anthracite Mining Co., died at his home in Scranton, Pa., Oct. 10, after a brief illness.

Thomas Sawyer Crockett, chairman of the board, Leckie Coal Co., Inc., died at his home near Winchester, Va., Oct. 28, at the age of 60. Mr. Crockett was one of the pioneer operators in the Pocahontas coal field of West Virginia, beginning active participation in its development in 1902, and helping to organize the Leckie Coal Co. a few years afterward.

Samuel W. Patterson, 67, president of the Sycamore Coal Co., Cinderella, W. Va., died at his home in Huntington, W. Va., Oct. 24. Mr. Patterson began his mining career at Mahanoy City, Pa., early in life, and later was connected with the Bottom Creek Coal & Coke Co. and the Majestic Collieries Co.

Personal Notes

Col. W. D. Ord, president, Empire Coal & Coke Co., Landgraff, W. Va., has been appointed a director of the National Association of Manufacturers for the Virginia-West Virginia district.

John C. Cosgrove, president, Cosgrove-Meehan Coal Corporation, Johnstown, Pa., has been appointed head of the Technical Research Section of the National Coal Association.

Daniel C. Jackling, San Francisco, Calif., president of the Gallup-American Coal Co. and head of a number of copper, iron, and railway companies, was awarded the John Fritz Gold Medal of the civil, mining and metallurgical, mechanical and electrical engineering societies last month for "notable achievement in initiating mass production of copper from low-grade ores through application of engineering principles."

W. H. A. Penseler, director of the School of Mines, Huntly, North Island of New Zealand, has been awarded a doctorate for his work and papers on New Zealand coals.

Robert Smiles, superintendent of Ewen colliery, Pittston Co., Pittston, Pa., has been made superintendent of the Central colliery, Avoca. He is succeeded at Ewen by Robert Shepherd, assistant superintendent.

W. H. Lesser, general manager, Randolph colliery, Southern Pennsylvania Anthracite Co., Port Carbon, Pa., was awarded the prize for the best technical paper presented during the 1931-32 season at a joint meeting of the Lehigh Valley Section, American Institute of Electrical Engineers, and the Lehigh Valley Engineers' Club, held in Allentown, Pa., last month. Mr. Lesser's paper, presented in November, 1931, dealt with "Electrical Power in the Anthracite Field and Its Application to Coal Mining."

S. Austin Caperton, general manager, Slab Fork Coal Co., Slab Fork, W. Va., was elected president of the R. M. Lambie Coal Mining Institute at the annual meeting held at Mullens in October. W. H. Ruby, vice-president, Nuriva Smokeless Coal Co., Mullens, was chosen vice-president, and W. D. Nace, Gulf Smokeless Coal Co., Covel, was elected secretary-treasurer.

W. R. Kernohan, Cincinnati, Ohio, general sales manager, Pocahontas Coal Sales Co. and the Glen Alum Fuel Co., has been elected president and general manager of the two companies, succeeding the late W. P. Slaughter.

C. A. Cabell, Charleston, W. Va., president, Carbon Fuel Co., was reelected president of the Kanawha Coal Operators' Association at the annual meeting held in October. Other officers also were reelected, as follows: vice-president, W. C. Mitchell; treasurer, John L. Dickinson, Dickinson Fuel Co.; and executive secretary, D. C. Kennedy.

Mine Fatality Rate Declines

Coal-mine accidents caused the deaths of 64 bituminous and 13 anthracite miners in September, 1932, according to information furnished the U. S. Bureau of Mines by state mine inspectors. This compares with 59 bituminous and 18 anthracite fatalities in August, and 80 bituminous and 35 anthracite deaths in September, 1931. The death rate at bituminous mines dropped from 2.62 in August to 2.43 in September, while the anthracite rate declined from 5.19 to 3.16. Comparative figures are as follows:

BITUMINOUS MINES

	Sept., 1932	Aug., 1932	Sept., 1931
Production, 1,000 tons	26,314	22,489	31,917
Fatalities	64	59	80
Death rate per 1,000,000 tons	2.43	2.62	2.51

ANTHRACITE MINES

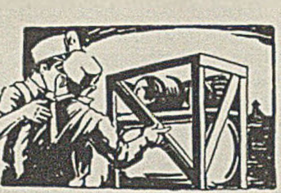
	Sept., 1932	Aug., 1932	Sept., 1931
Production, 1,000 tons	4,108	3,465	4,358
Fatalities	13	18	35
Death rate per 1,000,000 tons	3.16	5.19	8.03

Comparative fatality rates for 1932 and 1931 are given in the following table:

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

Cause	Bituminous: Number Killed	Bituminous: Killed per 1,000,000 Tons	Anthracite: Number Killed	Anthracite: Killed per 1,000,000 Tons	Total: Number Killed	Total: Killed per 1,000,000 Tons
January – September, 1931						
All causes	796	2.822	300	6.792	1,096	3.360
Falls of roof and coal	467	1.656	161	3.645	628	1.925
Haulage	157	.557	37	.838	194	.595
Gas or dust explosions:						
Local explosions	7	.025	12	.272	19	.058
Major explosions	41	.145	5	.113	46	.141
Explosives	9	.032	19	.430	28	.086
Electricity	41	.145	2	.045	43	.132
Surface and miscellaneous	74	.262	64	1.449	138	.423
January – September, 1932						
All causes	590	2.793	161	4.632	751	3.053
Falls of roof and coal	325	1.538	93	2.676	418	1.699
Haulage	92	.436	23	.662	115	.468
Gas or dust explosions:						
Local explosions	9	.043	6	.172	15	.061
Major explosions	54	.256	...	....	54	.220
Explosives	11	.052	9	.259	20	.081
Electricity	33	.156	4	.115	37	.150
Surface and miscellaneous	66	.312	26	.748	92	.374

*All figures are preliminary and subject to revision.



WHAT'S NEW
IN COAL-MINING EQUIPMENT

Coal Explosive

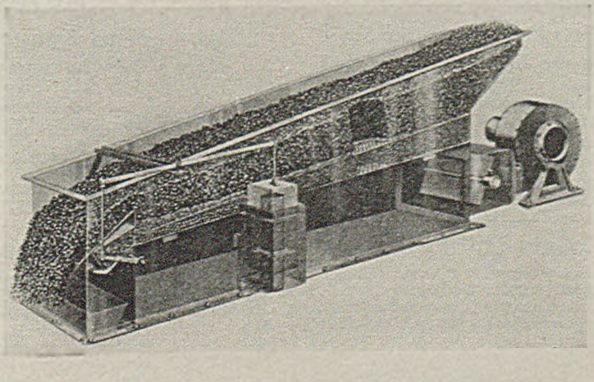
A new permissible coal explosive, Hercoal No. 1, has been developed by the Hercules Powder Co., Wilmington, Del., to take the place of Hercoal C. Improved lump production and greater economy are claimed for the new explosive, and, in common with the rest of the Hercoal series, the company emphasizes high cartridge count, low cost, and cushioned blasting without the use of air spacing or compressible stemming.

New Air Equipment Developed For Coal Cleaning

Roberts & Schaefer Co., Chicago, has developed the Stump "Air-Flow" cleaner for use in coal preparation plants. The equipment, according to the company, consists of a stationary metal box, 18 in. wide, 7 ft. long and 40 in. high. In operation, air is forced up through two perforated plates on which the material is carried. Between these plates is a resistance element designed to insure an even distribution of the air, which is supplied by a fan and regulated by a pulsator, or revolving shutter. The clean coal is carried down to the discharge end on a cushion of air, while the refuse settles to the bottom and travels forward to the automatic disposal gate.

Material passing through the cleaner, the company points out, is subject to the stratifying influence of the pulsating air current throughout the entire length of 7 ft., thus facilitating complete separation and raising the capacity of the unit. Other advantages set forth by the company are: Positive leakproof air control reduces air requirements one-third to one-half, and thus cuts power input; reduced air volume minimizes cost of dust collection; simple construction and absence of high-speed moving or vibrating parts reduces maintenance cost; all adjustable parts are easily accessible; smallness and compactness of the cleaner reduce first cost and installation charges.

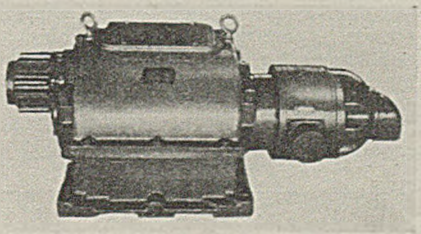
Stump "Air-Flow" cleaners, the companys says, can be installed in existing tipples as a part of complete air-cleaning plants or can be used in combination with wet preparation processes, using water to wash sizes down to egg, and the Stump "Air-Flow" process for sizes smaller than egg.



Showing Operation of Stump "Air-Flow" Coal Cleaner

Motorized Reducer

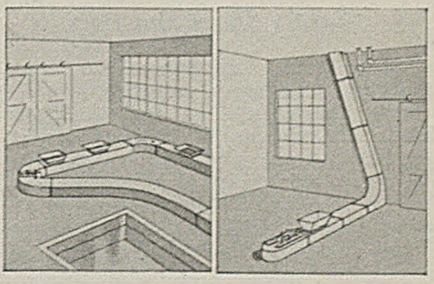
A new motorized speed reducer has been added to the line of inclosed speed-reducing units built by the Link-Belt Co., Philadelphia, Pa. Motor shafts extend into the reducer housings. This mounting is said to increase efficiency and compactness and eliminate the high-speed-motor shaft couplings. Roller bearings and continuous-tooth herringbone gears are employed. Gears run in oil to provide continuous automatic lubrication.



Triple-Reduction Link-Belt Motorized Speed Reducer

Conveyor and Elevator

Redler Conveyor Co., New York City, now offers Redler "En Masse" conveying for handling materials from cement to anthracite and bituminous coal. With this system, the company declares, the material is induced to flow through a covered trough in a compact, quiescent mass along a predetermined path—horizontal, vertical or inclined—with a material reduction in power requirements. Conveyors employing this principle, it is asserted, will carry material on the level, up an incline or vertically, and with certain types the material can be both conveyed and elevated. Direction of the conveyor can be changed to go around corners or to avoid obstacles on the plant floor. The equipment consists essentially of a covered trough and the transporting unit, made up of links of various shapes attached to a wire rope. Material containing individual pieces up to 3 in. in size can be conveyed and elevated, it is declared.



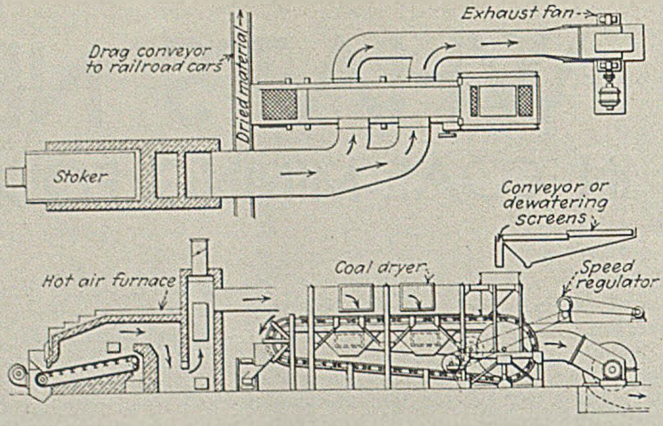
Showing Diagrammatically the Adaptability of Redler Equipment to Varying Conditions

Advantages of Redler equipment listed by the company are: elimination of dust, gentle handling, low upkeep, freedom from overloading, as the conveyor refuses more than a normal full load; reduction in space requirements, lower power consumption, freedom from contamination, self-cleaning, feed or discharge from any point, either wholly or in part, and great flexibility. Stephens-Adamson Mfg. Co., Aurora, Ill., manufactures Redler equipment in the United States, and also is licensed to sell.

Continuous Heat Dryer

Oliver United Filters, Inc., New York City, offers the "D.L.O." continuous dryer for the heat-drying of natural mineral products, including coal. In operation, the material is carried through the dryer on a conveyor, and is dried by a current of heated air or gases. The air is supplied by a suitable stoker-fired hot-air furnace, and is drawn down through the material on the conveyor by an exhaust fan. Both the quantity of the air and the speed of the conveyor are adjustable to meet varying conditions and, in addition, the temperature of the air may be regulated to suit drying requirements.

Production of dust and breakage of material are eliminated with the D.L.O. dryer, the company says, and low fuel rates result from the economical method of applying heat to the charge of wet materials. Power is less than that required for rotary



Construction and Operating Details, D.L.O. Dryer

dryers of similar capacity, it is asserted, and reduction in moisture content is said to be accomplished with an unusually low operating cost. The equipment is manufactured by the Sintering Machinery Corporation.

Safety Shoes and Pacs

Mine Safety Appliances Co., Pittsburgh, Pa., offers a new line of safety shoes and pacs. Two types of safety shoes are offered. No. 1 has a specially molded strong composition safety toe to withstand blows, heat and moisture, and a "Gro-Cord" sole and heel to prevent slipping, while No. 2 is of slightly heavier construction with rubber heels and extra-heavy oak-tanned soles.

M-S-A Safety Shoe and All-Rubber Pac

The all-rubber pac is designed, the company says, for use in wet places and, in addition to the vulcanized safety toe box, is made with a rubber lining that will not come loose in service. The safety toe, it is declared, is designed and inserted so that it permits free movement of the foot in addition to preventing injury from falling or rolling objects. Reasonable prices for both shoes and pacs are stressed by the manufacturer.

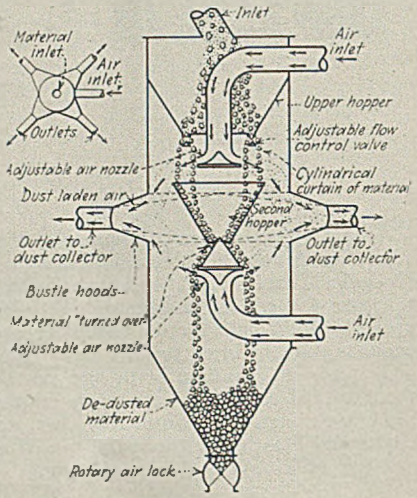
New Rock Explosive

Atlas Powder Co., Wilmington, Del., offers Apex No. 1, a new rock explosive which it recommends for use instead of more expensive high-strength explosives formerly used for this work. Apex No. 1 is a low-density explosive developed to give a detonating force with a greater purchase on the burden without excessive violence. Ideal fragmentation, controlled throw of débris, limited break back, and more tons of rock per pound of explosive are advantages claimed for the new explosive. A special use pointed out by the company is the blasting of rock lying over or under coal seams.

De-dusting Equipment

Blaw-Knox Co., Pittsburgh, Pa., has developed a new piece of equipment known as the Blaw-Knox "De-duster." Coal 1x0 in. is dropped through an inlet at top into the upper hopper. It then runs through circular feed slots over the adjustable-flow control valve, where it is split up into two cylindrical curtains. As the curtains fall, an air stream from the circular air nozzle blows the dust and fines out. The larger or cleaned particles fall down into the second hopper, where they are turned over and then fall onto a cone, which forms them into another cylindrical curtain. This curtain passes through a second air stream for further air scouring, completing the cleaning. Dust and fines are carried off through bustle hoods completely surrounding the De-duster. The air containing dust and fines is carried to a Blaw-Knox framed bag dust collector, where it is graded and collected.

By regulating the two air valves and the adjustable flow control, the De-duster, it is asserted, can be arranged to



Operation, Blaw-Knox De-duster

take out everything from ten-mesh down to the most impalpably fine dust. After the coal (which is divided into two separate curtains) is "blown through," it is turned over and "blown through" again, giving, the company says, very thorough cleaning and air scouring. Shell and hoppers are built of ¼-in. plate to resist abrasion and give long life. Piping is all standard construction.

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