COAL AGE

Established 1911—McGraw-Hill Publishing Company, Inc.

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

SYDNEY A. HALE, *Editor*

January, 1938

◆

Recession Gains

NOBODY is bursting with enthusiasm over the current recession in general industrial activity. But it is not without possible compensations on the political and economic fronts. One of these is the tentative abandonment of the TVA "seven sisters" bills to create regional power authorities in other parts of the country. Establishment of such authorities, of course, would further endanger the coal industry and mine employment, and have adverse repercussions on railroads and public utilities. It would be unwise, however, to take the promised abandonment too literally; the fight is not over until the proposals are dead beyond resurrection.

Sweep or Suck Dust?

POWDERED ROCK often becomes moist or wet and impregnated with binding material such as ferric hydrate so that it will not act effectually in the face of an explosion. Perhaps, therefore, in taking a dust sample, it should be sucked, not swept; then only the loose dust will be included in the sample. Should tests prove that suction will not serve or will be too cumbrous, it would seem safest to clean roadways and rock-dust them frequently—more often than sampling would indicate, especially where the dust is trodden underfoot or has been applied on the ribs and roof for the first time.

No matter how inert a dust may be, it is of value only if it will rise when an explosion occurs. Sprinkling for the floor, and dust for floor, ribs and roof in some mines might prove the best corrective for explosions. If the floor should dry, the inert dust, though not at its best, would be present and, if the floor were wet, the coal dust would not rise. Because of its deterioration from travel and caking, more dust should be used than suffices for immunization in a test gallery. Mild explosions which kill by carbon monoxide rather than by violence may lift the coal dust and leave most of the inert dust in place. The quality of rock dust and its condition have not been given the consideration they deserve.

Critical Test

FOR WEEKS—even months—there was insistent clamor that the National Bituminous Coal Commission take speedy action on minimum prices. Last month the Commission took the desired step. The result has been a flood of protests by inspired consumers, complaints from producers who object to certain specific relationships and prices established, and many requests for postponement of the effective date of the schedules promulgated.

These reactions should be neither surprising nor alarming. Had the schedules been a work of abstract perfection—which no one, the Commission probably least of all, claims—they still would have been subject to criticism and attack. What is really important is that price fixing has been removed from the conversational stage and the industry and the public at large now have something definite at which to shoot.

Obviously no such experiment as that written into the Guffey-Vinson act can be carried out without some upsets and casualties. Buyers and sellers who may have enjoyed unfair advantages under free competition must expect to see those advantages taken away or substantially curtailed. But this elimination should neither be matched nor effected by the creation of new injustices. Unfair penalization of either producer or consumer is as vicious as unfair advantages. The critical test of the law and its administration will lie in the readiness of the Commission to correct promptly inequalities which hearings on specific prices or relationships may disclose.

Accent on "Cleaning"

JUST BECAUSE many tipples have been grimy structures filled with clouds of free coal dust is no valid reason why the external and internal apeparance of cleaning plants should belie their name. Three things only are necessary to effect a change; modern design aimed at dust control, a willingness to spend the relatively small additional sum required for such a plant as compared with the cost of more conventional structures, and an unyielding determination to enforce good housekeeping principles in the operation of that plant. These requirements are neither fantastic nor unattainable. Concrete evidence of this is to be found in plants such as the Champion No. 6 of the Pittsburgh Coal Co., described in this issue.

In 1941?

ACCORDING to its own terms, the present bituminous coal-control act expires in less than four years. There may be a few optimists who take that to toll the end of government regulation of the soft-coal mining industry. Realists familiar with the national legislative psychology and the history of other control measures, however, must reject such a cheerful view. Assuming always that the statute now on the books is not outlawed, the chances that either the government or the industry itself would be willing to cry "quits" in 1941 are too dubious for practical consideration.

Since this is so, the National Coal Association is to be congratulated on bringing the subject to the forefront at its recent Pittsburgh meeting. Today is not an hour too soon to start weighing the possibilities of an imminent future and to evaluate the administration and the effects of the present law with an eye to the form and scope 1941 legislation should take. Without such continuing study, analysis and deliberation, the expiration of the Guffey-Vinson act would catch the coal industry as unprepared to make definite recommendations on policy and concrete details of legislation as it was when N.R.A. burst upon its astounded sight and later as suddenly vanished in the icy breath of the Supreme Court.

The approach to 1941 should be critical. But no operator can afford to forget that Washington seldom confesses a mistake in the field of regulation. The usual Congressional prescription for the failure of specific legislation to achieve its advertised goal is to increase the dosage. If the present act bogs down, more, not less, regulation may be expected. "The declared policy of the National Coal Association to cooperate fully with the National Bituminous Coal Commission to the end that the best results may be obtained from the operations" of the law now in effect is one every producer who does not wish to see his freedom of action still further circumscribed should follow.

On Guard!

GAINS made in recent years in the reduction of fatal accidents are in jeopardy. A sharp increase in deaths from major explosions in bituminous mines during the first ten months of 1937 is primarily responsible for a reversal in 1933-36 trends and more than offsets anthracite's freedom from fatalities attributable to that cause. Haulage fatalities were greater in both fields than for the corresponding period in 1936 and deaths from electricity, halved in anthracite, increased more than 43 per cent in the bituminous mines.

While, as shown in the detailed figures published elsewhere in this issue, reductions were effected in the number of deaths from certain other causes, including falls of roof and coal, the over-all increase is a direct challenge to the industry to tighten up on its safety work this year. The achievements of the industry as a whole from 1933 to 1936 and of individual mines and companies in season and out are proof that continued improvement is not impossible. Eternal vigilance is still the price of safety.

NEW LAUNDER

+ Developed by Battelle Institute Makes Commercial Debut at Nellis

By BYRON M. BIRD
Chief Concentration Engineer Battelle Memorial Institute

and J. H. EDWARDS
Associate Editor, Coal Age

SHARP REDUCTION in ash content is being attained at the Nellis mine of the Nellis Coal Corporation, Boone County, West Virginia, in a new washer for the cleaning of fine-sized coal. This unit, a Battelle launder handling 30 tons per hour of $\frac{3}{16}$-in. x 0 coal, reduces the ash content of the feed from 31 to less than 7 per cent and holds the float in the refuse to less than 3 per cent of the total weight of the refuse. Low cost and small-space requirements are among other advantages which mine officials see for the new washer.

The installation was made April 1, 1937, after eighteen months' experience at the mine with a pilot plant. It is the first commercial application of a design developed by engineers of the Battelle Memorial Institute, Columbus, Ohio. The system is the outgrowth of an investigation which Battelle has been carrying on for a number of years in the separation effected in a mass of solids and water while flowing down a launder or trough. Both the pilot plant and the commercial-size washers used at Nellis were built in the mine shops there.

Floor space required by the washer is approximately 6x24 ft.; the height is approximately 5½ ft. The launder trough proper is 14 in. wide, 11 in. deep and 21 ft. long. It is equipped with a series of twelve draws each divided into four compartments, thus providing for close adjustment of the water flow up through the screen plates between pockets. Gates of the draws are tooth cylinders driven by pawls engaging ratchet wheels, and the arms which operate the pawls are adjustable individually as to length of stroke.

A series of twelve short screw conveyors angled 45 deg. from the horizontal convey the draw material to points higher in elevation than the water in the launder, and from these points it is dropped into a refuse trough or into a recirculating flume, as the case may be. At the present time the launder is being operated with only the last three draws adjusted for recirculation. Twelve transparent Pyralin windows in the launder side plate afford views of the respective beds above the draws and facilitate adjustment of water valves and draw cylinder speeds. To simplify the installation, which was made in a small available space in the existing cleaning plant, the launder was built in two sections; drives of the draws and screw conveyors also consist of two assemblies installed in line to form a continuous machine.

Excepting tonnage from a two-room chain conveyor unit recently purchased for working low coal sections, the mine output of 2,400 tons (two mine shifts and two tipple shifts) is handled by mobile loading machines (*Coal Age*, November, 1937, p. 47). Ten to twelve inches from the top of

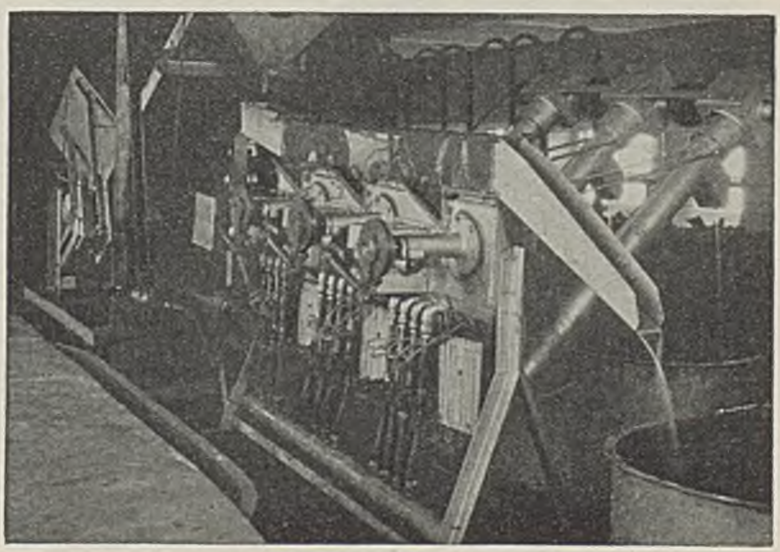


Fig. 1—Close-up of three-pocket launder unit used at Battelle laboratories. Note transparent side, wedge-shaped pockets, refuse-draw drive mechanisms and screw conveyors for removing refuse from chambers beneath refuse draws.

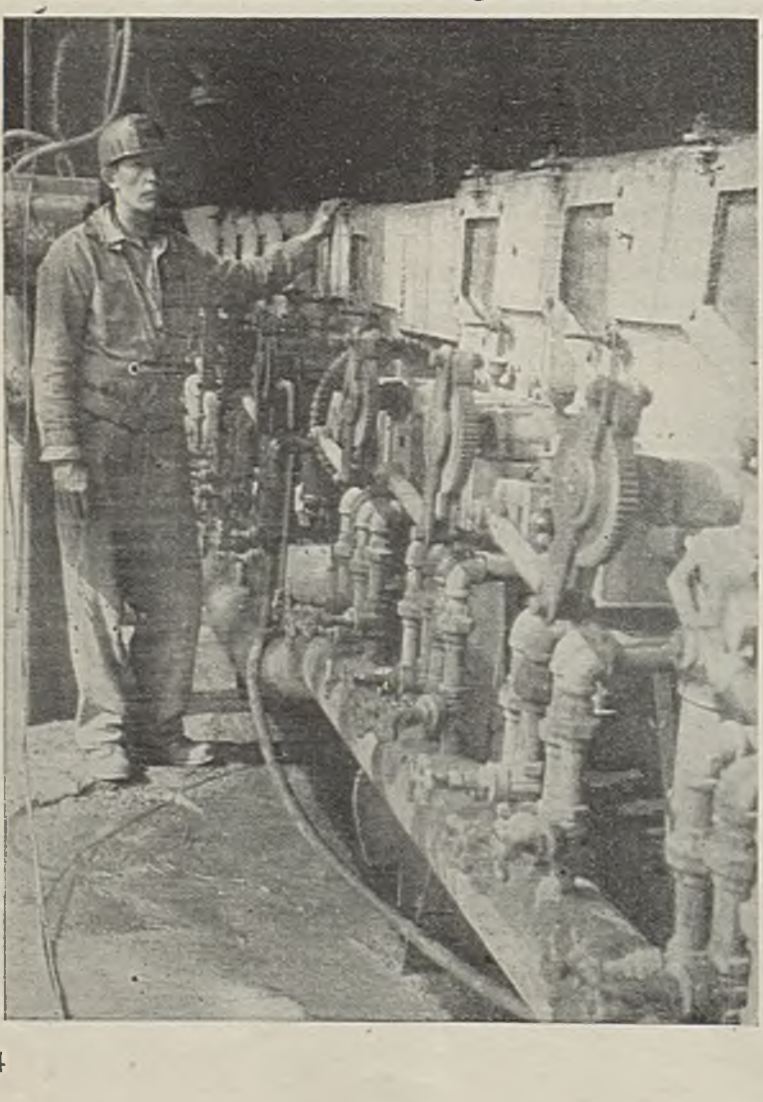
the seam (No. 2 gas) is a $2\frac{3}{4}$-in. parting of hard bone, most of which is loaded with the coal. In rooms, 7 to 8 in. of drawslate comes down with the cut; about 5 per cent of this material is not removed at the face by slate men on the loading crews. This drawslate and the hard-bone parting constitute the two materials which are washed from the coal by what is now a combination Rheolaveur and Battelle plant. Coal above $4\frac{1}{2}$ in. is cleaned by hand picking in the tipple.

Essentially the launder is a trough with a series of closely spaced, wedge-shaped pockets in the bottom, each of which is supplied with controlled upward currents of water. The launder as a whole usually is sloped at about one inch to the foot. Coal to be cleaned is fed in at the upper end along with about one part of water to one part of coal by weight. While the coal is being transported along the launder by the water, the materials of highest specific gravity, such as bone and shale, settle to the bottom of the moving mass and deposit in the wedge-shaped pockets. The refuse so collected is drawn off through rotary draws and dropped into sealed chambers, whence it is elevated with screw conveyors or bucket elevators.

Fig. 1 is a close-up of a three-pocket unit that has been used in the Battelle laboratories. This shows the launder with its transparent side to facilitate adjustment, the wedge-shaped pockets, the drive mechanisms for operating the refuse draws which project out laterally just beneath the wedge-shaped pockets, and the screw conveyors on the back side for removing the refuse from the chambers beneath the refuse draws. The installation at Nellis (Fig. 2) is similar to this except as to capacity; the Nellis launder is 14 in. wide and has twelve pockets.

The unique features of the launder lie mainly in the shape of the pockets and in the method of introducing upward-current water along the bottom.

Fig. 2—Chief Engineer H. D. Parnell stops in the preparation plant to study the launder's performance. This side view shows water-feed pipes and valves, ratchet wheel and window in launder trough of individual draws.



The object of the wedge-shaped pockets is to use the force of the horizontal currents to crowd the refuse particles as they deposit from the moving mass of coal. This crowding, by closing up the spaces between the particles of refuse, is highly important in keeping it free from coal. Deposition of clean refuse is further aided by the use of the controlled upward currents of water.

In the treatment of bituminous coal the upward currents usually are necessary only in the pockets, though they may be applied over the entire bottom surface of the launder. So that the application of the upward-current water may be controlled accurately the space beneath the pockets is subdivided into four chambers each of which can be regulated to deliver the proper supply of water through the perforated plates. The quantity is regulated by the small orifice meters shown in the supply lines to each chamber (see Fig. 1).

Accumulation of the upward-current water throughout the entire length of the launder amounts to about one part of water per part of coal by weight. Although the upward currents at any given point along the launder are of very low velocity, these upward currents in combination with the shape of the pockets have a profound effect upon the sharpness of the separation, so that a clean refuse product is obtained with a single treatment in the launder. Thus this combination of wedge-shaped pockets and properly distributed upward currents of water has been effective in overcoming one of the great weaknesses of launder apparatus; namely, their inability to produce a clean, high-gravity refuse product in a single washing.

Can Control All Variables

To secure the full benefit from the wedge-shaped pockets and the water it is essential that the launder be properly adjusted and properly operated. All of the important variables are completely under the control of the operator. These include control of the slope of the launder as a whole, horizontal and vertical velocities of the water, over-all depth of the mass of coal flowing down the launder, sharpness of the wedge in the wedge-shaped pockets, width of the openings leading from the pockets to the rotary draws, and number of r.p.m. of the rotary draws. With all of these adjustments under his control, the operator usually has no difficulty in finding the optimum operating conditions for any given coal.

As far as control of the operation

is concerned, once it is properly adjusted, the launder may be considered entirely automatic for any condition ordinarily encountered. If the percentage of refuse changes in quantity or character due to a change in the rate or character of the feed, the weight of refuse materials in the individual pockets makes a corresponding increase or decrease. Since the weight of materials in the pockets is a prime factor in the movement of the refuse toward the draws, it naturally follows that, with a lighter or a heavier load in the pockets, the rate of movement toward the draws will be changed correspondingly. This is inherent in the nature of the separation and in the design of the pockets. However, at Nellis, where the fluctuations in the character of the feed are exceptionally great, it has been found advantageous to return the refuse products of the last three pockets to the feed in the form of a circulating load so as to smooth out the surges of refuse material to be taken care of by the launder.

Clear Water Is Essential

The only important requirement for good operation of the launder is reasonably clear water for the small requirement under the screen plates. This water should be well clarified to remove coarse particles of coal or refuse and pieces of vegetation. But even in this particular the launder has considerable latitude in that a drain has been provided in the bottom of each water chamber that can be allowed to run to remove any silt tending to collect under the plates. However, if the water is very dirty, the maintenance on the plates will be increased. If the water is clear, it is sufficient to clean them each week. If the water is exceptionally dirty, a daily cleaning would be advisable. Usually the screens can be cleaned in a few minutes, after the launder and the hutch compartments are empty, by tapping the screens lightly with a wood block while washing them with a hose.

The capacity of the launder is proportional to its width, being from 2 to 4 tons per hour per inch of width. The tonnage that can be washed of any given coal depends upon the difficulty of the separation and upon the steadiness of the feed to the launder.

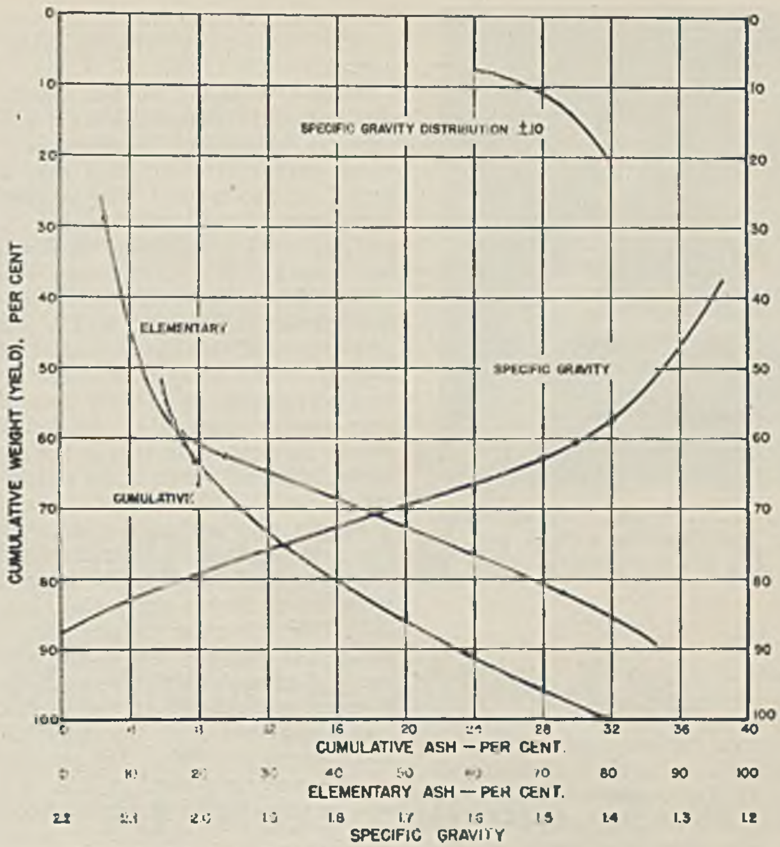


Fig. 3—Washability curves for raw coal through 5/16-in. round-hole feed to launder at Nellis.

At Nellis the 4½-in. x 0 raw coal is washed in a Rheolaveur sealed-discharge unit and the washed coal is screened on a $\frac{5}{16}$-in. round-hole screen. This $\frac{5}{16}$-in. x 0 washed coal constitutes the feed to the Battelle launder. This size, during the period the data in this paper were collected, amounted to about 35 tons per hour on the average, or about 2¼ tons per inch of width. From this average figure the hourly variations were marked, for there was no raw coal storage ahead of the washery. As a result the quantity of feed to the launder fluctuates from 10 to 50 tons per hour at different times during each shift. In addition, there were corresponding variations in the washing characteristics of the coal. At times the feed contained excessive amounts of mining-machine cuttings, which are largely bone, and at other times it was mainly composed of natural fines caused by breakage of the coal. To show the washing characteristics of the average raw coal, washability data are given in Table I and the curves in Fig. 3.

As a means of supplying specific information on the character of the washing problem at Nellis the method[1] [2] proposed by the senior author several years ago has been used. This consists of measuring the difficulty of the separation by the percentage of "near-gravity" materials in the feed, near-gravity materials being considered those within 0.10 sp.gr. above and below the specific gravity of the separation. For example, if the separation is being made at 1.45 sp.gr. the near-gravity materials are considered to be those between 1.35 and 1.55. To compensate for varying contents of roof rock and other high-gravity materials that do not affect the difficulty of a washing problem, this method provides that the percentage of near-gravity materials be recalculated as a percentage of the feed under 2.00 sp.gr. This procedure puts percentage of near-gravity materials in the same coal or in different coals on a comparative basis so that they are not distorted by the presence or absence of roof rock and other high-gravity materials that do not affect the cleaning problem.

In the application of this method to

Table I—Float-and-Sink of Feed to Launder at Nellis

Through 5/16 - In. Round-Hole Screen
Samples May 3, 1937

Specific Gravity	Weight Per cent	Ash Per cent	Cumul. Wt. Per cent	Cumul. Ash Per cent
Under 1.40...	57.4	6.5	57.4	6.5
1.40-1.45...	3.4	17.4	60.8	7.1
1.45-1.50...	2.4	24.0	63.2	7.8
Over 1.50....	36.8	73.1	100.0	31.8

Note: Moisture and ash percentages on air-dry basis

[1] Bird, B. M.: "Interpretation of Float-and-Sink Data," Second International Conference on Bituminous Coal, Carnegie Institute of Technology, vol. 2, 1928, pp. 82-111.

[2] Bird, B. M.: Third-International Conference on Bituminous Coal, Carnegie Institute of Technology, vol. 2, 1931, pp. 721-735.

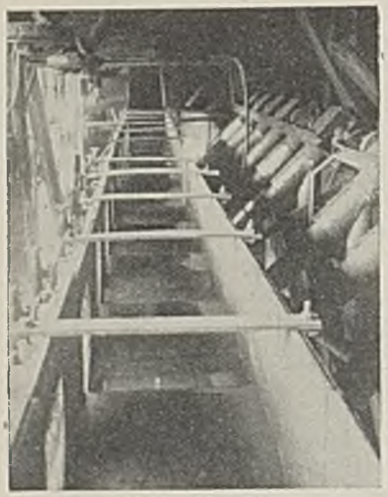


Fig. 4—Non-operating view of launder at Nellis showing screens, weirs and draw pockets.

a problem such as that of Nellis, the specific gravity of the separation is determined by the ash content of the washed coal and not by the specific gravity of the heavy solution used to control the uniformity of the operation. If, for example, the ash content of the washed coal is 7.2 per cent, the washing gravity is that gravity at which the raw coal would be separated with a heavy liquid to give a "float" product having 7.2 per cent ash. In Fig. 3, 7.2 per cent ash is seen to correspond to a cumulative weight percentage of 61.0. If the specific-gravity curve is read at 61.0 per cent it will be seen that the specific gravity at that point is 1.45. Thus this is the washing gravity corresponding to 7.2 per cent ash. The percentage ±0.10 for the separation at 1.45 sp.gr., or the percentage of near-gravity materials, is read to be 14.6 where the vertical line above 1.45 sp.gr. intersects the curve at the top of Fig. 3.

The evaluation of the degree of difficulty of various ±0.10 percentages[2] is as follows:

±0.10 Curve Per Cent	Degree of Difficulty	Preparation
0–7	Simple	Almost any process; high tonnages
7–10	Moderately difficult	Efficient processes; high tonnages
10–15	Difficult	Efficient processes; medium tonnages; good operation
15–20	Very difficult	Efficient processes; low tonnages; expert operation
20–25	Exceedingly difficult	Very efficient processes; low tonnages; expert operation
Above 25	Formidable	Limited to a few exceptionally efficient processes; expert operation

As measured by this scale of difficulty, a large proportion of all cleaning problems fall in the category of "simple" and separations in the range from 10 per cent upward are indeed unusual.

Table II contains the first results obtained with the launder after it was put into operation. Samples were taken on five different days over a period of two weeks. The average ash content of the washed coal is 7.2 per cent with a maximum variation of 0.5 per cent from the average. The average percentage of the reject material under 1.50 sp.gr. is 1.7. As just explained, this corresponds to a separation at 1.45 sp.gr. and that in turn corresponds to 14.6 per cent of near-gravity materials. In other words, the separation falls at the top of the "difficult" range in the classification.

Results of a series of tests more complete than the one just discussed are given in Table III. The samples were taken during the period June 8-15, 1937. On these samples a gravity of 1.45 was used for testing both the washed coal and the refuse. The average ash content of the washed coal is 7.54 per cent; the individual ash contents are within 0.64 per cent of this average value. In Fig. 3 it will be seen that 7.5 per cent ash corresponds to a separation at 1.48 sp.gr. and that at this gravity the ±0.10 is 12.0 per cent, which is about the middle of the "difficult" zone.

Table IV gives the results of a series of samples taken between June 16 and June 28, 1937. In this series of tests a 1.50-sp.gr. solution was used for testing the washed coal and the refuse. The average ash analysis of the washed coal is 7.35 per cent, but, since the ash anaylses of the samples for June 16 are so much out of line and are inconsistent with the float-and-sink results, it seems evident that they are incorrect and so a separate average ash content has been computed in which the samples for the 16th have been omitted. This new average is 6.37 per cent ash and the maximum deviation from the average is 0.44 per cent. In Fig. 3 this will be seen to correspond to a separation at 1.43 sp.gr. and a washing difficulty of 17.0 per cent ±0.10.

This would indicate that the launder during this period was handling a washing problem of exceptional difficulty. In spite of this fact, on the average only 3.28 per cent of the refuse was under 1.50 sp.gr., a gravity 0.07 above that at which the

Table II—Float-and-Sink Tests of Products From Launder at Nellis

			Washed Coal		Refuse		
Date of Sample	Shift	Hours of Sampling	Over 1.40* Per Cent	Ash Per Cent	Under 1.50 Per Cent	Under 1.45 Per Cent	Under 1.40 Per Cent
5/10/37	1	2	....	6.7	....	2.8	....
5/14/37	1	7	4.4	7.1	2.2	....	....
5/20/37	1	7	....	7.4	2.5	....	....
5/22/37	1	3	3.2	7.3	0.9†	0.4	0.0
5/24/37	1	4	....	7.3	1.2	....	....
Average	....	....	....	7.2	1.7	1.6	....

*Control gravity. No attempt was made to effect a separation at 1.40 sp.gr.
† Cumulative

Table III—Float-and-Sink Tests of Products From Launder at Nellis

			Washed Coal					Refuse				
Date of Sample	Shift	Hours of Sampling	Under Weight Per Cent	1.45 Ash Per Cent	Over Weight Per Cent	1.45 Ash Per Cent	Cumul. Ash Per Cent	Under Weight Per Cent	1.45 Ash Per Cent	Over Weight Per Cent	1.45 Ash Per Cent	Cumul. Ash Per Cent
6/ 8/37	1	7	96.0	6.60	4.0	35.70	7.80	3.9	7.95	96.1	77.05	74.36
6/10/37	1	1	96.4	5.80	3.6	35.70	6.90	2.2	8.50	97.8	77.20	75.69
6/11/37	1	7	95.8	6.20	4.2	52.90	8.16	1.6	9.15	98.4	82.20	81.03
6/12/37	1	7	97.6	6.75	2.4	37.75	7.49	1.2	9.25	98.8	83.55	82.66
6/15/37	1	5	96.9	6.65	3.1	40.65	7.71	2.1	11.75	97.9	83.45	81.94
6/15/37	2	2	97.6	6.05	2.4	53.05	7.18	1.8	10.45	98.2	81.20	79.93
Average	......	......	96.72	6.34	3.28	42.62	7.54	2.13	9.57	97.87	80.78	79.27

Note: Weight and ash percentages on air-dry basis.

Table IV—Float-and-Sink Tests of Products From Launder at Nellis

			Washed Coal					Refuse				
Date of Sample	Shift	Hours of Sampling	Under Weight Per Cent	1.50 Ash Per Cent	Over Weight Per Cent	1.50 Ash Per Cent	Cumul. Ash Per Cent	Under Weight Per Cent	1.50 Ash Per Cent	Over Weight Per Cent	1.50 Ash Per Cent	Cumul. Ash Per Cent
6/16/37	1	5	97.2	7.70	2.8	63.80	9.27	2.6	13.10	97.4	83.55	81.82
6/22/37	1	4	97.8	6.15	2.2	48.40	7.08	4.4	10.80	95.6	78.00	75.04
6/23/37	2	2	97.4	6.05	2.6	42.40	7.03	2.4	10.80	97.6	81.00	79.32
6/24/37	1	7	97.8	6.30	2.2	37.05	6.98	3.1	9.55	96.8	72.90	70.94
6/28/37	1	7	97.5	5.50	2.5	42.65	6.43	3.2	13.25	96.8	82.10	79.90
Average	......	......	97.54	6.34	2.46	46.86	7.35	3.14	11.50	96.86	79.51	77.38
Average (omitting sample 6/16/37)			97.62	6.00	2.38	42.63	6.87	3.28	11.10	96.72	78.50	76.30

Note: Weight and ash percentages on air-dry basis.

washed coal was separated. It is obvious, of course, that if the refuse had been tested on a solution of 1.43 sp.gr., that being the gravity at which the washed coal was actually prepared, the percentage of material that could fairly be considered as a loss in the refuse would have been small indeed.

The launder has prepared washed coal at a specific gravity as low as 1.43 with a low loss of coal in the refuse. Moreover, it has handled this difficult washing problem under conditions of widely varying quantity and quality of feed. Thus the launder may be considered to have made a successful debut and to have demonstrated its value in the coal-cleaning field.

Sixty-five per cent of the mine output goes to the steel plants of the American Rolling Mill Co., which controls the Nellis Coal Corporation, and the remainder goes to commercial markets, including railway, industrial and domestic. The operating office of the coal company is at Nellis, which is the headquarters of C. W. Connor, superintendent of mines. Emile Keenan is analyst and washer foreman. A number of men have contributed to the success of the development in the laboratory and in the field. Of these, the senior author wishes to mention especially the following: John W. Rea, Frank P. Smith, Bert D. Thomas, John G. Atwood and A. C. Richardson.

RUBBER TIRES CARRY COAL

+ In Mechanical-Loading Program At Moss Hill No. 2 Mine

By IVAN A. GIVEN
Associate Editor, Coal Age

SUBSTANTIAL modifications in practice and equipment have characterized the development of mechanical coal loading in the United States, of which the latest is the use of battery-powered rubber-tired tractors and bottom-dumping trail cars for transportation behind loading machines. Second to use this transportation medium was the Hart Coal Corporation, which incorporated it in its mechanization program for the Moss Hill No. 2 mine, near Mortons Gap, in western Kentucky. Operating in 56- to 61-in. coal, Moss Hill No. 2, now fully mechanized, averages around 20 tons per shift per man employed underground.

The work at No. 2 represents the culmination of mechanical-loading investigations initiated by Brent Hart, president of the company, in 1923. In that year, two Joy 4BU loaders were purchased, the caterpillar mountings of these machines, with some modifications, now serving as trucks for shortwall cutters. In later years, two supplementary investigations into the feasibility of mechanical loading were made. Both showed, however, that under conditions prevailing at the time the saving would not warrant the necessary investment. This situation continued until 1935, when the development of rubber-tired haulage and the availability of loading machines suited to the thinner seams, along with changes in other conditions, made the picture much more attractive.

Among the several Hart properties available for mechanization when the subject was last taken up was the third of the Moss Hill mine group, bearing the designation No. 2. Opened in 1933, about one-fifth of the available acreage had been worked out by hand loading, the remainder constituting a sufficient reserve to give the proposed system a thorough trial prior to its adoption in the development of another and larger tract in the same seam in the future. Consequently, the first mechanization unit was installed in No. 2 in March, 1936. Between that time and Nov. 22, 1937, when the unit began operation in a new section, a total of 156,000 tons was produced from what would have been under the hand-loading system 9th, 10th and 11th North entries off the Main East. Days operated for this tonnage totaled 131, while the loading-machine shifts (two machines two shifts per day) totaled 524.

Coal from No. 2 is sold under the Moss Hill trademark and comes from the No. 9 seam, ranging, as noted above, from 56 to 61 in. thick without partings or bands. Lying, as it does, in a hilltop, the No. 2 acreage is characterized by an irregular crop line, with most of the remaining reserves in the form of two fingers projecting out into points on the hill. Thickness of the cover ranges from 40 to 120 ft. Immediately over the coal is about 36 in. of black slate overlain by a gray shale. Roof conditions usually are good, but, even so, careful timbering is the rule. Under the coal is a medium-hard fireclay.

As indicated in Fig. 1, the first territory to be worked out mechanically was bounded on the west by worked-out hand-loading places and on the east by the crop line. Output from this territory was about 60,000 tons more than was expected, as it was found that roof conditions would permit going farther out toward the crop than originally was contemplated. Consequently, the round-trip haul for the tractor-trailor units was around 1,800 ft. at the last, as compared to the normal average of 1,500 ft. just before a move from one loading station to the next.

Upon completion of the original territory, this mechanization unit was transferred to the Northwest finger, expected to yield about 750,000 tons. In working out this finger, it is expected that five installations of the dumping station will be made. On Nov. 16, shortly before the original unit went into operation in its new territory, a second unit was started in the southeast finger, or what would have been 7th, 8th and 9th South-entry territory. Depending upon roof conditions as the outcrop is approached, production from this finger is expected to be 500,000 tons, probably requiring four dumping stations, or three moves after the origin installation, as indicated in Fig. 1. With the two units in operation, average production per seven-hour shift is 1,200 tons or more.

(Exide-Ironclad), one Electric Products Co. charging set, one battery-transfer station, three Goodman shortwall cutters with 6-ft. bars (all three already on hand and one used only part of the time), two Dooley Bros. post-mounted electric coal drills (transferred from another Hart operation), dump hopper (sectionalized for portability) and feeder, and one sectionalized belt-type mine-car-loading conveyor (manufactured by Barber-Greene). Including cost of digging the pit for the dump hopper, moving in and installing the equipment, cost of the necessary wire and cables and other minor outlays, a unit in place ready to operate represents a capital outlay (considering

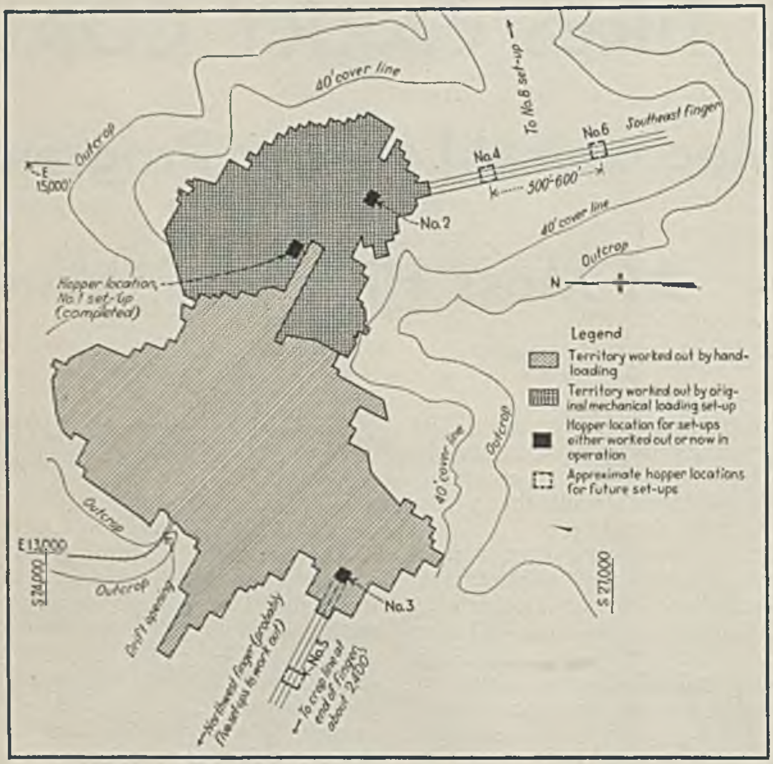


Fig. 1—Sketch of Moss Hill No. 2 coal acreage, showing territory worked out by hand compared with past and future mechanized mining; also present and proposed dumping stations for working out the northwest and southeast fingers.

Operation at Moss Hill No. 2 is based on the mining system developed by James H. Fletcher, consulting engineer, Chicago, who also originated the special equipment (tractors, trail cars, dump hopper and feeder, trip-loading belt, etc.) around which the system is built. Equipment constituting a unit at No. 2 (exclusive of shortwall trucks) is as follows: two Joy 8BU loading machines, five tractors (manufactured by the Baker-Raulang Co.), five trail cars (manufactured by Sanford-Day), ten tractor batteries

all the equipment listed above as purchased new) of around $55,000, or about $46 per ton day output. As noted above, two units now are used.

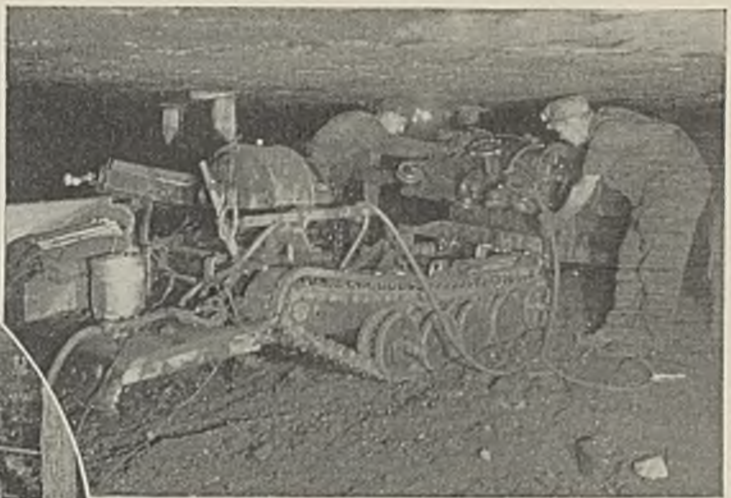
Height of the tractors is 42 in. Rated stalling drawbar pull is 1,500 lb., although the units will handle 1,900 lb. With a light trail car on the level, rated speed is 6 m.p.h.; speed on the level with a loaded trail car is 4 m.p.h. The frame is designed, as shown in the accompanying illustrations, to assure a more rigid fender than in earlier models and also to act as a bumper when going through doors. Dual rear wheels fitted with 30x7.50 8-ply tires provide traction and also take a part of the weight of the trail car through the hitching. Front wheels are equipped with 21x6.50 tires. With the pneumatic tires in use, the tendency is to roll the floor in transit, thus assuring a smooth roadway.

The tractors are powered by a battery made up of 24 19-plate Exide-Ironclad cells with a capacity of 300 amp.-hr. Contactor control with a master switch is provided, along with foot and parking brakes. Battery terminals are covered with a plate, and the batteries set on the tractor chassis without hoods, as experience has shown that the hoods are unnecessary in addition to the time lost in taking them off and putting them back when changing batteries. When in place on the tractors, batteries rest between angles in the front and rear, and are locked in place by rods on each side, the ends of the rods passing through holes in the angles.

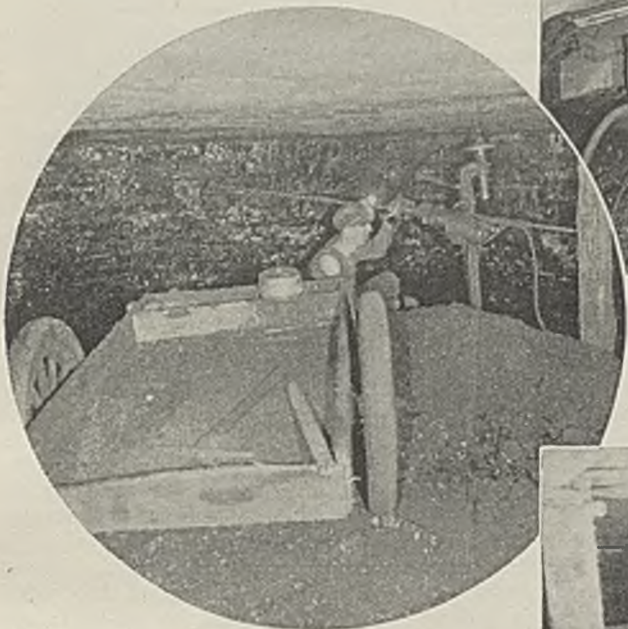
Six Charge Racks Per Station

Transfer stations usually are made large enough to accommodate six batteries on charge. While on charge, the batteries rest on small trucks consisting of wooden platforms with channel rails mounted on regular mine-car trucks. Each transfer station comprises six pairs of such trucks, or twelve in all, six on one side of a central aisle and six on the other. Batteries themselves are equipped with casters on both the front and rear to permit them to be rolled off a charging truck onto the chassis or off the chassis onto a truck. In changing a battery, therefore, the tractor is driven into the center aisle, and the retaining angles on the chassis are lined up with the angles on a pair of trucks, one on one side and one on the other. By means of a cam arrangement, the battery is raised slightly to permit the casters to operate, the retaining rod is removed, and the battery then is rolled onto the empty truck, which previously has been pushed up on its track to the side of the chassis. Two hinged extensions bridge the gap between the retaining angles on the chassis and the truck. After the used battery is rolled off, the charged unit is rolled on from the opposite side. This operation is shown in an accompanying illustration. The outer ends of the hinged extensions rest on legs permanently mounted on the tractor chassis.

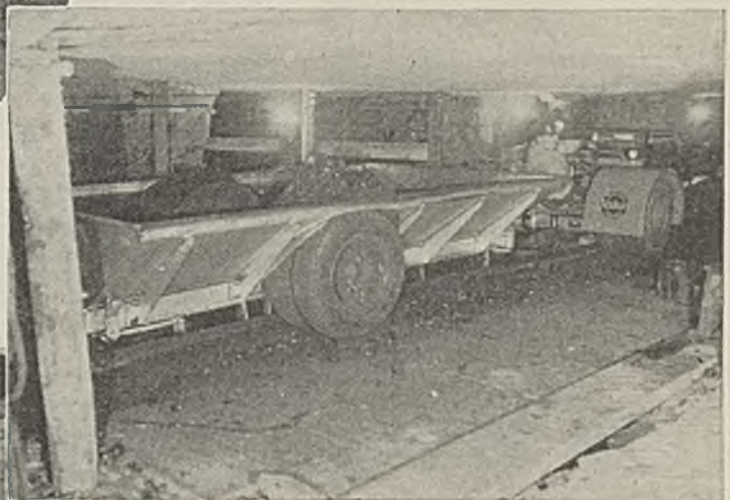
Trail cars, one per tractor, have



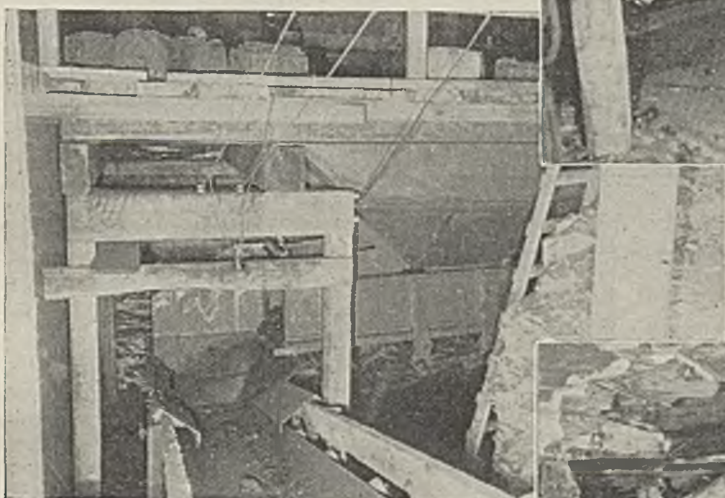
This cutting machine is transferred from place to place on a self-propelling truck made out of an old loading-machine mounting



Drilling a room face in No. 2. In the foreground is the two-wheeled drillers' cart



Tractor-trailer unit over the dump. The driver has just released the doors in the bottom of the trailer



Dump hopper and feeder are suspended from I-beams laid across a pit dug in the bottom

A 54-ft. belt conveyor with push-button control brings coal up from the dump hopper to the trip loading station. In the rear is C. C. ("Daddy") Wilson general superintendent, who opened No. 2 mine a capacity of 3 tons mechanically loaded. Height is 30 in. loaded and 31 in. empty, with a clearance of 6 in. under the doors, which drop down to dump. Outside width of a trail car is 6 ft. 3 in.; length, 10 ft. 6 in. The body of the car is supported on a single axle back of the center of gravity. Dual wheels with 30x7.50 tires on each side of the car carry most of the weight, with the rest on the back wheels of the tractor. Doors are opened over the dump by a hand lever and close automatically by passing over a buffer as the car is pulled off the dumping platform.

Dump hoppers are made of bolted-together steel-plate sections to facilitate disassembly for moving. The hopper is suspended from two I-beams across the pit excavated to accommodate it, and the reciprocating feeder, complete with 5-hp. motor, is in turn suspended from the hopper. The platform on which the tractor-trailer units come in to dump is made of 3x12-in. planks supported by the hopper I-beams and two additional cross members, also I-beams. A spill guard projects 5 in. above the opening in the platform, just clearing the sides of the trailer doors.

Coal is hauled from the working sections to the tipple at No. 2 in cars holding about 1¼ tons. Cars are loaded in trips, and the coal is elevated from the feeder to the cars by a 54-ft. (center-to-center of pulleys) conveyor set on a pitch of about 18 deg. Equipped with a 30-in. belt, the conveyor has a capacity of 150 tons per hour and is driven by a 7½-hp. motor. A pawl on the head shaft prevents the conveyor from running backward when stopped, which is done every time a car is changed. Consequently, conveyor and feeder motors are equipped with contactor controls and pushbuttons to facilitate starting and stopping. Pushbuttons are provided for operating either the belt or feeder motors separately, with another button for starting and stopping both motors simultaneously, as normally is the case. The conveyor is designed in 3-, 6- and 9-ft. sections for portability. As a result, the heaviest single item to be moved in changing from one section to another is the feeder with its motor, weighing about 1 ton.

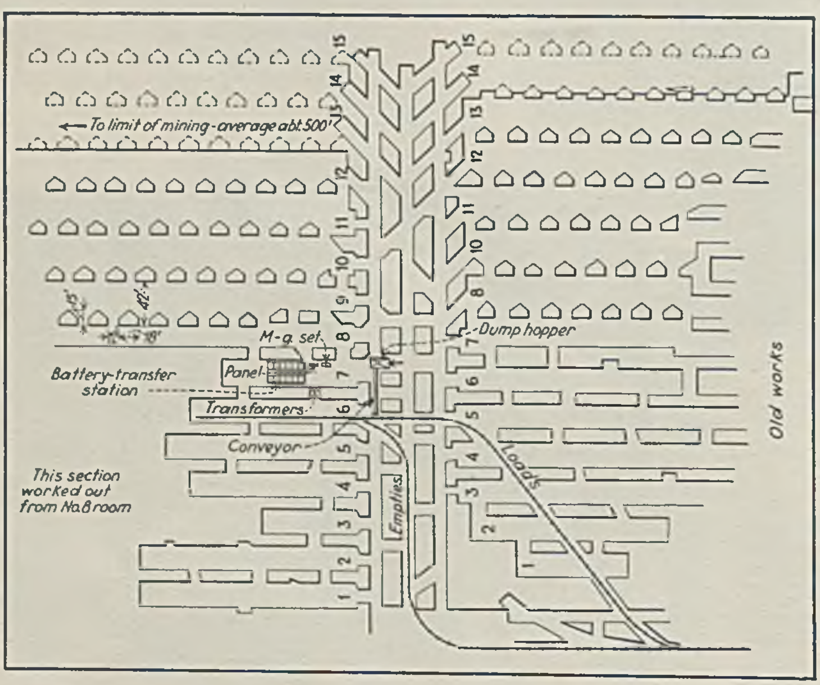
While only two mechanical-loading units are in operation, three hoppers, each costing about $300, are on hand. As digging the pit and installing the hopper is the operation that requires the most time in preparing for a move from one section to another, this work is done sufficiently in advance to assure completion before moving starts. Consequently, an extra hopper is necessary if no time is to be lost. By judicious design, disassembling, moving and installing all other equipment, including the feeder, can be done between the last working shift Friday and the following Monday morning, or during some other idle period of equal length, thus losing no possible working shifts unavoidably. With the pit dug and the hopper in place, all the equipment for the northwest-finger territory was loaded up (when necessary), moved inside and installed in seven shifts, four men per shift. Labor cost of digging a pit is about $200, while equipment installation represents about $100. When a section is completed, the pit is used as a sump. In digging a pit, the material is removed by a loading machine on the idle shift, thus materially reducing the time required and the cost of the excavation.

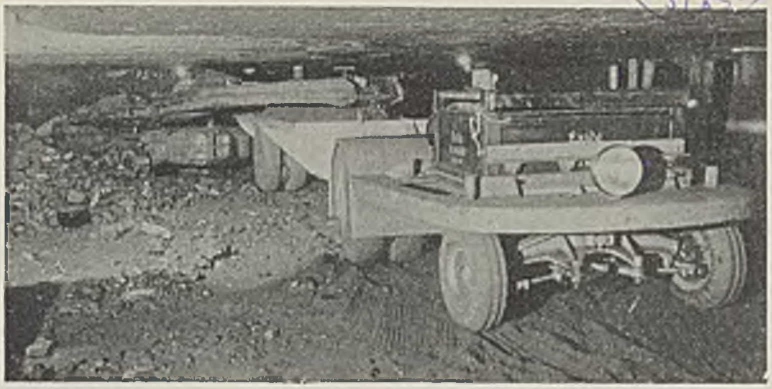
Arrangement of the dumping station, charging facilities, tracks, etc., for the first set-up in the northwest finger are shown in Fig. 2, which also illustrates the mining plan. While the conveyor is shown coming out from one side of the hopper, the design permits bringing the conveyor out front by digging the slope in that direction. From the initial set-up an entry made up of three headings 12 ft. wide on 32-ft. centers is being driven out along the finger as indicated in Fig. 1. In the new work (the dumping station is set in that part of the entry driven for hand loading) crosscuts are turned on a 45-deg. angle, with an extension of the crosscut serving as the room neck and giving a direct route to the middle heading. Entry-chain-pillar and room-stump size is adjusted to provide adequate protection for the entry until the finger is worked out.

Layout of Mining System

No distinction is made between heading driving and "room work" under the mining system in use, and development as a separate problem is not a factor in operation. What might be termed room work, however, is arranged to give a combination of crosscut and semi-longwall coal. As a starter, the first room to be turned off one side of the entry, which happens to be Room No. 8 on the left side in Fig. 2, inasmuch as this is the continuation of what strated out to be a hand-loading territory, is driven up to its limit. Then, as indicated in the figure, crosscuts on 30-ft. centers are started on one side of the place. The first cut in each crosscut is made 12 ft. wide, leaving 18 ft. of coal between crosscuts. The second and third cuts, however, are gripped out as indicated, so that the pillars between the

Fig. 2—Showing how semi-longwall faces are established under the mining plan at Moss Hill No. 2. This figure also indicates the arrangement of the tracks, dumping station and battery-charging facilities in the unit for the northwest finger.





Loading machine, served by a tractor-trailer unit, working in a crosscut at Moss Hill No. 2

crosscuts are cut off and a continuous long coal face is formed. This face then is slabbed five times, making a new room connecting up to the neck already driven while the entry was being advanced. Then the process of making crosscuts to establish a new semi-longwall face is repeated. Consequently, the larger part of the coal is produced under the ideal condition: that of a long face providing a large tonnage without machine moves. Recovery in the room area is close to 80 per cent under Moss Hill No. 2 conditions.

Rooms, as shown in Fig. 2, extend both ways from the entry. One loading machine and its attendant cutting machine and drill work on one side of the territory, with another loader, cutter and drill on the oposite side. The third cutter, operated only as needed, helps out on either side, as necessary. When five tractors are operating, two haul from the loader closer to the dump station, and the other three serve the loader farther away if there is an appreciable difference in the haul. Otherwise, each loader is served about equally. Loader service, however, varies somewhat with the haul. When places are close to the dumping station, for example, only four tractors may be used for a while.

Dumping stations will be advanced every 500 to 600 ft. in the present working territories. Thus, it is expected, the longest round trip just before a move is made will not average much over 1,500 ft. As most of the operating units, particularly the haulage equipment, are in multiple, and as several places, or a considerable section of long face with coal shot down, usually are available at one time, a serious loading-machine breakdown—a rather remote possibility—offers about the only possibility of a long continued interruption of operation back of the dumping station, outside of a power failure.

The standard crew for operating one mechanical-loading unit at No. 2 comprises 26 men, including one man pro-rated to each shift from the extra machine crew. By occupations, crew membership is as follows: two loading-machine runners, two helpers, four cutters, four drillers and shooters, two scrappers (taking up bottoms left by cutting machines), two timbermen, five drivers, two car trimmers, one boss and one mechanic, in addition to the extra machineman. With two units working and including main-haulage men and other men employed underground, between 60 and 65 men are employed in the mine per shift for an average output of 1,200 tons or more. Maximum output from a mechanical loading unit to date has been 714 tons, with four tractors hauling, in one 7-hour shift. Normally, each unit works two shifts every day the mine operates, with one hour between shifts. Batteries may be changed either at the end of the shift or during the lunch period.

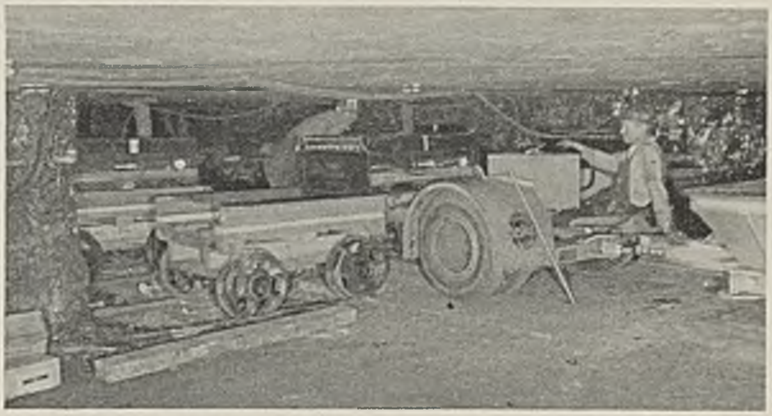
A timberman stays with each loading machine at all times. His duties are to keep an eye on the roof condition, keep up the regular timbering in a place and set safety posts both ahead and behind the loading head as the machine works across the face. In fact, it is normal practice for the loader to work between timbers where the clearance is less than a foot on either side. Naturally, complete clean-up requires moving timbers, but in this case a qualified man is present to examine the roof and set relief props in advance. And the high flexibility of the tractor-trailer units, either going forward or backing, and their ability to turn in a very short radius make it possible to follow a loading machine wherever it can go. As a rule, however, timbers are set back of the face so that a passageway about 12 ft. wide is available at all times, either up and down the room or through any open crosscut. Being equipped with pneumatic tires, the tractors and trailers can cross trailing cables with very little possibility of damage.

Mount Tip Frames on Trucks

After a place is cleaned up, the bottom is scrapped in preparation for cutting. Without the conventional mine tracks, some other means of moving the shortwall cutters was necessary. On one unit the problem was solved by mounting tip frames on the caterpillar trucks off the old 4BU loaders. The original loader motors were shifted to the tops of the loader frames and are used for propelling the cutters from place to place.

Two men follow the cutting machine and drill and shoot the place. Usually, one man operates the drill while the other bugdusts, prepares the charges and loads the holes, with assistance from his partner when drilling is completed. For the con-

Changing batteries on a tractor unit. The truck carrying the charged battery has been rolled up to the chassis, the extension members have been placed and the new battery partly rolled on in place of the old, whiich was taken off on a similar truck on the opposite side.



venience of the drilling and shooting crews, each one is provided with a light cart with two rubber-tired wheels from junk automobiles.

The principal supply item to be handled is timbers. These are brought in to the section in mine cars and unloaded at a supply station along the parting. To distribute props, a mule and a two-wheeled dray (again old auto wheels) are employed.

Power to operate the equipment in a section is brought in at 2,300 volts, using Trenchlay cables along the entry. Transformer stations in each section reduce the voltage to 220 for the loading machines, charging sets, feeder and conveyor. Cutters and drills still operate off 250 volts d.c., but the other equipment was chosen with an eye to the adoption of a.c. throughout in the contemplated new mine, at which time the cutters and drills will be converted to a.c. also. Main haulage is the only other major d.c. application in the mine. General Electric rubber-covered cables are employed for the distribution of both a.c. and d.c. in the working section, with the multiple-conductor types for trailing cables and single-strand types between the transformers and the points where the nips are attached. And, although dumping stations are to be moved every 500 ft. or so, transformer and charging units will be moved every 1,000 ft. or so instead, as bringing the tractors an extra 500 ft. for charging and then taking them back involves only a nominal expenditure of current.

DUST CONTROL

+ Makes Negley Preparation Plant Clean and Explosion-proof

WITH CLEANLINESS ranked equally with performance, the Champion No. 6 preparation plant of the Pittsburgh Coal Co. provides a concrete example of the possibilities of dust control in coal cleaning and screening. The air-cleaning section, in particular, is marked by almost complete absence of dust at all times, and, while the problem is less serious, revisions in the original washing and screening section have been made with the same goal in mind. And, in addition to provisions for preventing the escape of dust, the plant is characterized by a complete vacuum-cleaning system with outlets at convenient points for keeping all parts of the operation in spick-and-span condition.

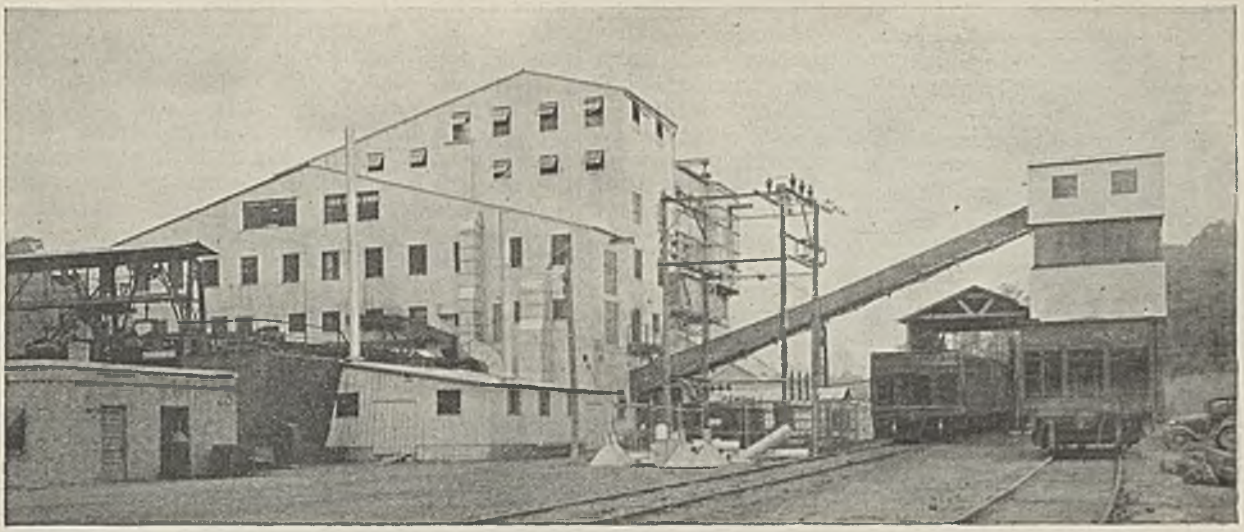
Champion No. 6 is located near Negley, Ohio, just west of the Pennsylvania-Ohio boundary. Champion No. 6 is employed primarily in the preparation of coal from Crescent Nos. 1 and 2 mines, with some Mongah coal in addition. All these mines are on the Monongahela River, and the coal is transported in barges down the Monongahela and Ohio rivers to Smith's Ferry, Pa., thirteen miles south and slightly east of the plant. At Smith's Ferry the coal is transferred to Pittsburgh Coal Co. railroad equipment for transit over the coal company's yard tracks to the preparation plant. North of the plant the yard tracks connect to the Pittsburgh, Lisbon & Western.

Design capacity of the plant was 350 tons per hour and the original intention was to hand-pick all coal down to around 4 in., wash the 4x½-in. fraction and load the resultant fines without preparation. On this basis, the washing and screening section was designed and built by the Koppers-Rheolaveur Co. An increase in mechanical mining, however, was reflected adversely in the quality of the raw fines, with the result that an air-cleaning plant, at present handling minus ½-in. material, was decided on. Design and construction of the air plant, to coal-company specifications, went to the Roberts & Schaefer Co.

Coal was run through the original washing and screening section on Sept. 13, 1933, and the air plant, with a capacity of approximately 100 tons per hour, went into operation on July 20, 1937. Improvement in operating technique, coupled with some revisions in equipment and utilization of reserve capacity, has brought normal plant capacity up to 450 to 475 tons per hour, with 520 tons per hour as the peak for short periods.

A major factor in the increase in capacity was the discovery that mine-run railroad cars could be dumped at a substantially higher rate than the original figure of seven per hour. Ability to empty cars faster than was expected was an important element in this increase. Platforms are built at car height for the cleaners, who are supplied with steel spades with 1¼-in. aluminum-tube handles to reduce weight. Using these tools and working from the tops of the cars, the dumping crew has handled as many as eleven railroad cars an hour.

Although the usual product is metallurgical mine-run made up of hand-picked and mechanically cleaned coal combined in a mixing conveyor, Champion No. 6 is equipped to ship four primary sizes simultaneously. These usually are: 4-in. block, 2x4-in. furnace and 1⅛x2-in. stove—all boom-loaded—and 1⅛-in. slack (chute-loaded). Also, any desired combination of two or more sizes can be made in the mixing conveyor. Block is



Champion No. 6 from the loading-boom side. The new air plant is behind the main structure at the right, with the sludge tank and heating plant in front. The refuse hopper and unloading station for raw mine-run are at the extreme right. Lying on the ground in front of the transformer station are hoods for installation over the primary shakers, conveyor discharges and other points in the washing and screening section.

picked on the horizontal run of a pan-type picking table-loading boom, while a second pan-type table, arranged to discharge either to the furnace boom or the mixing conveyor, is available for picking a part or all of the material between block and stove. At present, however, the furnace table handles only a portion of the 4x⅜-in. size: i.e., the 4x3⅜-in.

A Rheolaveur coarse-coal washer, comprising primary and rewash launders in one unit, cleans the 3⅜x⅜-in. size, while minus ⅜-in. material, separated by vibrating screens, is routed to the air-cleaning plant, equipped with three 4-ft.-wide Stump Air-Flow cleaners (primary) and a fourth unit of the same size for retreating middlings and refuse from the primary units. High-speed shakers size the washed coal, with supplemental vibrating equipment for additional dewatering of the 1¼x⅜-in. fraction.

Sludge in the wash water is recovered in a settling tank, and provision was made for mixing this material with dry fines in perhaps the first of the so-called "paddle mixers" (a small unit) ever installed in a bituminous preparation plant. After mixing, the sludge is loaded out with the rest of the coal, and the same applies to all dust collected in both the washing and air plants, including dust picked up by the vacuum-cleaning system, thus increasing recovery.

Dust had for some time been a concern of the Pittsburgh Coal Co. preparation department, and when air cleaning was scheduled for Champion No. 6, preparation officials resolved that one of the major objectives would be its elimination. In attaining this end it was considered that preventing escape into the air was the most important consideration, in turn involving the use of dust-tight inclosures and an efficient collection system. Then, to take care of that portion which, though small, did escape, a cleaning system was felt to be essential.

Although making the air-cleaning plant practically dustproof presented a number of problems, they proved to be not insurmountable. At the same time a program was set up to render the original washing and screening section also as dustproof as possible, even though such a step had not been contemplated in the original design beyond the conventional measures usually found in well-built plants. In the original plant, however, the dust problem was not so great and officials had the advantage of certain construction standards set up for other purposes but which, nevertheless, also served to keep down flying material. Among these was the practice of covering conveyors, particularly chain-and-flight types, to prevent men from stepping or falling into them.

Additional measures taken in the original plant included inclosing conveyor discharges or equipping them with suspended hoods connected to the cyclone separators in the air cleaning plant Canvas covers on light wood frames were mounted on the mine-run shakers, with suspended hoods over the openings. The covers are shown in an accompanying illustration, which, however, was made before the hoods had been installed. Another major step was constructing a room of corrugated siding to inclose the vibrating screens separating the air-plant feed. A duct connects this room to the cyclone system. Outlets for the vacuum-cleaning system were another measure in the washing and screening sections.

Raw mine-run at Champion No. 6 is dumped into a 70-ton steel hopper. This hopper is sunk in water-bearing gravel, which is utilized for the plant water supply. Originally it was contemplated that water would be pumped in from a more distant point, but when it was encountered in the gravel, agricultural-drain-tile lines were laid around the dump hopper. These tile lines discharge into a well 24 ft. deep, from which the fresh-water pump (4-in., 150-g.p.m.), set under the dump hopper on the feeder floor, pumps to a 50,000-gal. steel storage tank set on the hill above the plant. Make-up water, flowing by gravity from the storage tank, usually runs about 20 g.p.m., and is added intermittently through sprays on the washed-coal screens, or to the water in the sludge-settling tank.

From the dump hopper the coal is fed out onto a 48-in. pan conveyor with 5-in.-high retarding flights on a pitch of 30 deg. by a 40-in.-wide double-acting reciprocating feeder. A four-speed motor controlled from the washer floor gives a speed variation ranging from 24 to 73 6-in. strokes per minute. Still further capacity adjustments are available by varying the gate openings in the dump hopper. Usually, gates are opened wide with the feeder on second speed.

From the main pan conveyor raw

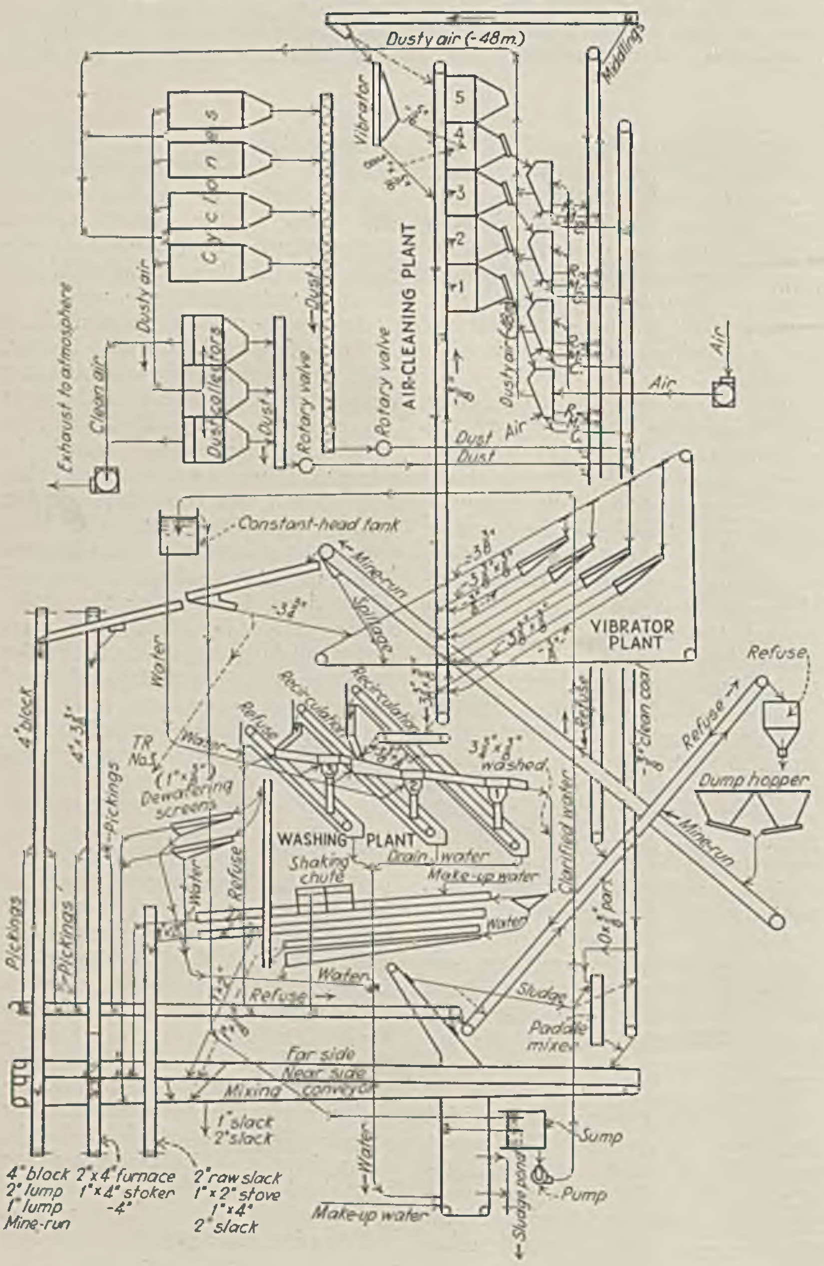
mine-run is discharged onto two 6-ft. wide shaker screens, each 23 ft. 2⅛ in. long, with steel hangers and connecting rods. With a slope of 3¼ in. per foot and operating at 110 6-in. strokes per minute, these screens are fitted with 16 ft. (upper) and 8 ft. (lower) of lip-screen plate for making block (60-in. beaded-pan picking section of block boom and table), 4x3⅜-in. coal (60-in. beaded-pan furnace table) and a minus 3⅜-in. resultant.

A 36-in. three-cornered raw-coal conveyor carries the minus 3⅜in. coal up to four FB-4 Traylor vibrators with Ton-Cap No. 963 cloth (5/16x⅜-in. openings) for separating minus ⅜-in. material for treatment in the air plant. Traylor oversize (3⅜x⅜-in.) goes to the top strand of the 0x⅜-in. raw-coal conveyor to the air cleaning plant, which feeds the primary launder of the coarse-coal washer through a 24x6-in. flight conveyor. If desired, however, the minus 3⅜-in. raw coal can be bypassed around the Traylors to the slack track, as indicated in the accompanying flowsheet.

The primary coarse-coal launder at Champion No. 6 (32 in. wide at the boxes and 40-in. wide between boxes, the latter representing a revision in the original design) is equipped with two Rheo boxes. Material from the No. 1, or lower, box is recirculated, while material from the No. 2, or upper, box goes to the 20-in.-wide one-box rewash launder, the coal end from this launder discharging into the primary launder. Material through the rewash, or No. 3, Rheo box goes to a 30-in. bar-flight refuse conveyor, in turn discharging into a similar conveyor leading up, on a pitch of 4⅝ in. in 12, to a 50-ton hopper with single rack-and-pinion gate for loading the refuse either into a truck or a standard-gage car. The gate is equipped with electric space heaters to prevent freezing in cold weather. This same refuse-conveyor system also handles pickings, air-plant refuse and, if desired, sludge from the settling tank.

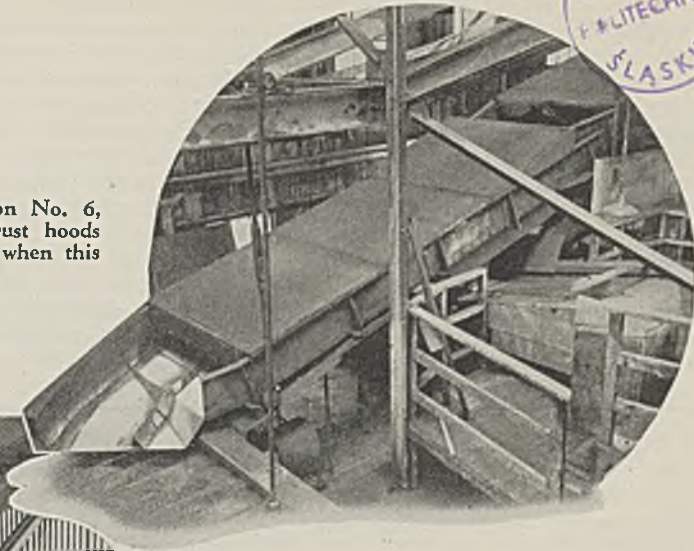
Clean coal from the Rheolaveur installation flows through a flume to Parrish-type washed-coal shakers, first passing over a section of 1¼x1/16-in. slot screen to unload water. Operating at 155 4½-in. strokes per minute and with an inclination of 1⅝ in. in 12, the washed-coal shakers comprise three decks, as follows: upper, 6 ft. wide x 39 ft. 4 in. long, 15 ft. (length) of screen surface (1½-in. round perforations); second deck, 6½ ft.x38 ft. 8 in., 18 ft. of screening surface (1-in. round perforations); lower deck, 7 ft.x25 ft. 9 in., 21 ft. of screening surface (No. 12 gage stainless steel plate with ¼-in. round perforations). Included in the screening surfaces on the two upper decks is one section of Ton-Cap cloth each (top deck, No. 1248, equivalent to a ¾-in. round-hole screen; second deck, No. 881, equivalent to ½-in. round-hole screen). Placed about midway of each deck, the Ton-Cap cloth has a tendency to hold back the coal and turn it over, thus giving moisture a better opportunity to drain off and through the deck.

Fig. 1—Flowsheet, Champion No. 6 preparation plant.

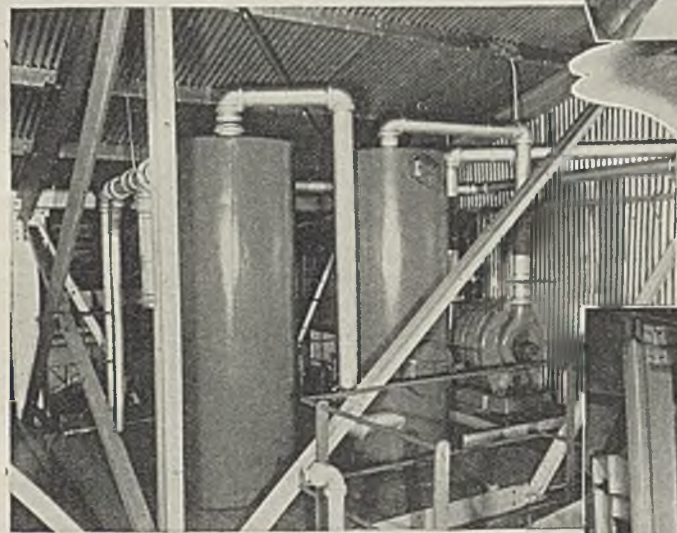


Screening Water from Coal

To reduce still further the moisture content of the coal as loaded, auxiliary elevating and screening equipment has been added to the original plant facilities. Taking ¼x1-in. coal from the lower deck of the washed-coal screens, a 19-in. four-cornered Redler conveyor-elevator raises it to two 3½x12-ft. Hendricks "Whipping" screens fitted with 3/32x⅛x⅝ bronze lip screens. These screens reduce the moisture from around 7 per cent to about 4 per cent. Water and fine coal from these screens, from the lower deck of the washed-coal screens and from the screen section in the washed-coal flume all flow to a settling tank. Sized coal from the primary washed-coal and auxiliary dewatering screens goes to the mixing conveyor or the 42-in. pan-type stove boom for final disposal as indicated in the accompanying flowsheet.

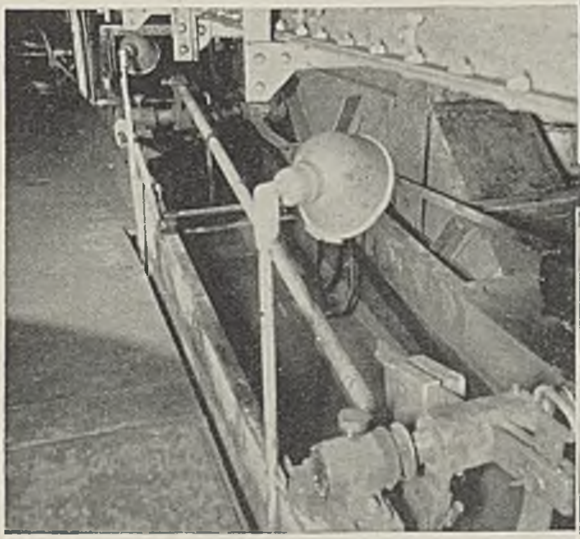


Mine-run shakers, Champion No. 6, showing canvas covers. Dust hoods had not yet been installed when this photo was taken.

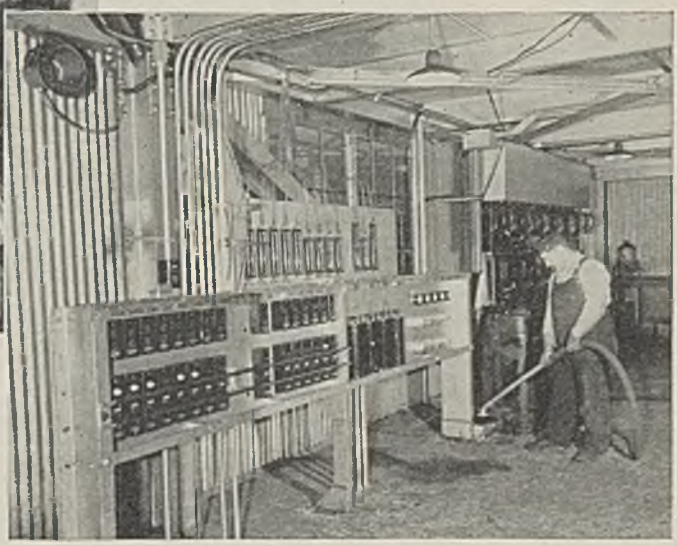


The heart of the vacuum-sweeping system at Champion No 6. The vacuum unit is at the right of the secondary and primary dust collectors.

Four air cleaners treat minus $\frac{3}{8}$-in. coal. Note the absence of dust; this is the normal condition in this plant.



This washing unit cleans $3\frac{3}{8}$-in coal at Champion No. 6.



Control station and starter panel in the Champion No. 6 air plant, with an attendant using a vacuum-sweeping attachment to pick up stray dust.

Fines are settled out of the wash water at Champion No. 6 in a 30,000-gal. steel tank with wood sheathed and mineral wool insulating cover. Depth of the tank is 10 ft., with a 60x12-ft. settling surface. The settling tank is fitted with a three-cornered sludge conveyor 6 ft. wide with 6-in. channel flights operating at 20 f.p.m. Length between centers is 89 ft. 8 in. and dewatering to about 18 to 20 per cent moisture is done on a 30-deg. inclined section.

Water and minus 48-mesh coal overflowing the tank are pumped to a constant-head tank serving the washer by a Morris 8-in. 2,500-g.p.m. pump. Sludge usually is returned to a "paddle mixer," consisting of two 12-in. paddle screws 10 ft. 8 in. long operating opposed at 85 r.p.m. in a steel trough. In the paddle mixer the sludge is mixed with dry clean coal from the air plant to prevent segregation of the fine wet coal in the railroad cars. If desired, however, the sludge may be run to the refuse conveyor. To eliminate freezing difficulties, the sludge tank is equipped with steam coils fed from an American Radiator Co. No. 3F7 "Red Flash" hand-fired boiler in the adjacent heating plant.

As indicated above, controls for the reciprocating feeders and the raw-coal moisture sprays are concentrated on the washing floor. Boom-hoist and boom-operating controls are placed on the loading platform. Booms are equipped with 7½-hp. Milwaukee (Harnischfeger) hoists, and cars are controlled by Fairmont retarders.

Minus ⅜-in. coal through the Traylor screens in the original washing and screening section is transported to the air cleaning plant on the bottom strand of a 36x3-in. chain-and-flight conveyor. The coal is discharged through gates into 25-ton surge bins, one for each of the three primary Stump cleaners. Each bin is equipped with high and low "Bin-Dicators" with indicating lamps on the control board. Coal is fed out of the bins by independently driven feeders, each with separately controlled four-speed motor. As compared with control of feeding rate by gates, the independent feeders facilitate regulation and, together with the bin-level indicators, make it possible to adjust feeding rates so that all cleaners have coal at all times.

Two-Product Separation

Although a three-product separation can be made with the primary cleaners, normally only two products are taken off: clean coal and a middlings-refuse fraction. The clean coal goes back to the mixing conveyor, while the middlings-refuse fraction is discharged into a 11-in. Redler elevator with loped boot, which lifts it to an Allis-Chalmers 4x10-ft. horizontal vibrator or to a bypass chute to the 25-ton surge bin, also with Bin-Dicators, ahead of the middlings cleaner. The Allis-Chalmers screen, fitted with No. 1210 Ton-Cap cloth (¼x⅜-in.), is installed to screen out minus $\frac{5}{16}$-in. material from the ⅜-in. feed for re-treatment in the middlings cleaner, thus reducing the size ratio of the material to be treated in this cleaning unit. The oversize from the vibrator, nominally the difference between ⅜ and $\frac{5}{16}$ in., is discharged onto the top strand of the ⅜-in. raw-coal conveyor for transportation to the surge bins ahead of the primary air cleaners to the Rheolaveur-feed conveyor in the washing and screening section. The vibrator is totally inclosed, with a duct to the dust-collecting system.

Air to operate the Stump cleaners is supplied by a No. 3½ Type W Clarage single-width single-inlet fan with a capacity of 38,400 c.f.m., 9-in.

Table I—Motor and Drive Details, Champion No. 6 Preparation Plant

	Speed, Feet or Strokes per Minute	Motor Details (a) Number	Type	Horsepower	R.P.M.	Drive (b)
Duplex feeder (40-in.)	24 to 73	1	KG	30	600-1,800 (c)	Reducer
Mine-run conveyor (48-in. pan, 121 ft. 6 in. c. to c., 30-deg. pitch)	80	1	KT	50	900	Reducer and equalizing gears
Mine-run screens (6 ft. wide, 23 ft. 2½ in. long, 3½ in. in 12 pitch)	110	1	KG	20	600	V-belts
Block picking table-loading boom (60-in.; 34 ft. hor.; 32 ft. inclined)	60	1	KG	7½	1,200	V-belts and gears
Furnace table (25½ ft.) and boom (16 ft. hor.; 32 ft. inclined) (60-in. beaded pan)	60	1	KG	7½	1,200	V-belts and gears
Stove boom (42-in. beaded pan 13 ft. hor.; 32 ft. inclined)	80	1	KG	5	900	Reducer
Boom hoists	..	3	MC	7½	1,550	
Raw-coal (−3⅜-in.) conveyor (3-corner 36-in. c. and f., 68 ft. c. to c.)	60	1	KG	30	900	Reducers and gears
No. 1 vibrator	..	1	PP	¼	1,800	Direct to generator
No. 2 vibrator	..	1	MG	½	1,800	Direct to generator
Nos. 3 and 4 vibrators	..	1	L	3	1,800	Direct to generator
Washer-feed conveyor (24 x 6-in., c. and f.)	80	1	KG	10	900	Reducer and chain
Washer and three auxiliary conveyors	..	1	KG	15	900	Reducer and chains
Washed-coal sizing screens (see text)	155	1	KG	20	900	V-belts
Conveyor-elevator (19-in. 4-cornered Redler)	85	1	K	30	900	Reducer, chain and gears
Auxiliary dewatering vibrators (2)	..	2	K	5	1,200	V-belts
Mixing conveyor (48-in. 3-cornered c. and f., 69 ft. c. to c.)	85	1	KG	20	900	Reducer and chain
Sludge conveyor (3-cornered, 6 ft. wide, 6-in. flights, 89 ft. 8 in. c. to c., 30-deg. incl. section)	20	1	KG	10	900	Reducer and gears
Paddle mixer (see text)	85 (d)	1	KG	7½	1,200	Reducer, gears and chain
Fresh-water pump	..	1	KT	20	1,800	Direct-connected
Recirculating pump	..	1	KF	50	1,200	V-belts
No. 1 refuse conveyor (30-in. low-flight)	60	1	KG	5	900	Reducer and chain
No. 2 refuse conveyor (30-in. low-flight, 4½ in. in 12 inclination)	60	1	KG	10	900	Reducer and chain
Air-plant feed conveyor (36 x 3-in. c. and f.)	80	1	K	30	900	Reducer and chain
Air-cleaner feeders	..	4	K	1⅓-1½ (c)	1,800-440 (c)	Reducers and chains
Flutter valve	..	1	K	5	900	V-belts
Clean-coal conveyor (24 x 8-in. c. and f.)	80	1	K	25	900	Reducer and chain
Refuse and middlings conveyor (24 × 3 in. c. and f.)	60	1	K	10	900	Reducer and chain
Middlings elevator (11-in. Redler)	95	1	K	15	900	Reducer and chain
Middlings vibrator	..	1	K	5	1,800	V-belts
Air-plant blower (see text)	..	1	MT	75	1,200	V-belts
Air-plant exhaust fan (see text)	..	1	KT	125	1,200	V-belts
Rappers, dust collectors	..	4	K	2	900	Gears
Dust conveyor (7-in. Redler)	55	1	K	7½	900	Reducer and chain
Dust screw from cyclones (12-in.)	..	1	K	10	1,200	Reducer and chain
Rotary dust valves (2)	..	2	K	1½	900	Reducers and chains
Automatic sample cutter	..	1	KT	¼	1,800	V-belts
Sample crushers (2)	..	2	KG	5	900	V-belts
Sample crusher	..	1	K	20	1,800	V-belts
Sample crusher (hammer mill)	..	1	KT	10	1,800	V-belts
Vacuum cleaner	..	1	KF	20	3,600	Direct-connected
Tubular heater stoker	..	1	K	2	1,800	V-belts
Tubular-heater exhaust-gas fan	..	1	K	3	425	Direct-connected
Tubular-heater blower	..	1	K	15	900	Direct-connected
Gas exhaust and blower fans, direct-fired heater	..	1	K	5	1,200	Direct-connected
Drill press	..	1	KT	1½	1,200	Belt
Air compressor	..	1	K	15	1,200	V-belts
Welder	..	1	CS (f)	20	1,800	Direct-connected
Grinder	..	1	KT	1	1,200	Belt
Total	..	60	....	830½	.....	

(a) General Electric motors except as noted. (b) In addition to spur gears, drives utilize Jones speed reducers, Tex-rope V-belt drives and Link-Belt roller chains. (c) Four-speed motors. (d) R.p.m. (e) With certain motors figured at full-speed horsepower. (f) Westinghouse.

water gage, 1,231 r.p.m. The fan is equipped with a "Vortex" control for varying volume and pressure, this control giving a large saving in power at reduced volumes as compared with damper control. Air is exhausted from the cleaners and the dust-collecting system by a similar No. 4¼ fan with "Vortex" control and 61,000 c.f.m., 8½-in. 8 gage capacity.

All dust from the Stump cleaners (minus 48-mesh) and from other equipment (screen, etc.) in both the original washing and screening and the later air plants is routed to a Blaw-Knox four-unit dust-collecting plant made up of four No. 66 standard flat-roof collectors into a unit 35 ft. long and 16 ft. wide. Capacity of the collectors, containing 21,120 sq.ft. of cloth in 264 bags, is 61,000 c.f.m. Air for the collectors first passes through four auxiliary cyclone units, leaving them with a loading of 98 per cent minus 200-mesh material. Larger dust drops out of the cyclones into a screw conveyor which discharges into either the clean-coal or refuse conveyors.

Rappers Shake Down Dust

Air leaving the bag systems in the dust collectors, of course, is free of dust. Rappers are installed on each of the four collectors and are started once or twice a day to shake the dust down out of the bags into the hoppers beneath. From these hoppers the dust feeds out into a 7-in. Runaround Redler conveyor to the clean-coal or refuse conveyors. Chutes from the Redler, as well as from the cyclone dust screw, are fitted with motor-operated rotary valves to prevent short-circuiting the collecting system when running dust.

To facilitate plant operation and adjustment, a complete system of water gages is installed to indicate the distribution of the air to the various air-plant units. Lines are tapped into the following: plenum chamber ahead of the cleaners, under and over each cleaner, in the risers to the cyclones; inlet and outlet, each cyclone; inlet and outlet, each dust collector and the inlet to the exhaust fan. The load condition of the main conveyor in the air plant is shown by ammeters at the central control station, which also includes the water gages, indicating lights for the surge bins, feeder controllers and motor-starting switches.

In addition to the collecting system, elimination of dust in the air plant involved inclosing conveyors, screens, chutes, cleaners and other equipment to prevent the escape of dust. Welded joints, of course, were installed where possible, but where bolted joints were necessary, usually where equipment might have to be opened, the joints were pitched or fitted with rubber gaskets. Rubber, for example, was used around the viewing doors on the air cleaners, around light reflectors in the air-cleaner hoods and in other places frequently subject to opening. Felt seals were used on the head shafts of conveyors, with sliding seals in grooves at the take-up ends. Inspection doors were provided on both the drive and tail ends of conveyors. Closures also included rubber diaphragms around the eccentric arms driving the cleaner feeders and zoning plates.

Design of the closures presented some problems not encountered in conventional construction. Extra cost was made up primarily of the additional cost of plate and fastenings plus the extra time necessary for pitching or gasketing joints and installing the covers or closures.

In addition to the safety covers noted above, what might be termed standard Pittsburgh Coal non-dust-proof conveyor construction, to carry the example still further, also includes spring-steel track bars (1.05 C., 0.50 Mn., found to give the maximum service at the lowest per-ton cost), all outside bolts, clearance where possible to drop out conveyor bottoms, sectional head and tail construction to permit moving for taking off sprockets, 24-in. track-bar bolt spacing and 12-in. angle bolt spacing to facilitate taking out one without disturbing the other, rivetless chain on all chain-and-flight units and carry-back plates to return spillage to the circuit. All conveyor drive and tail sprockets are made with cast-steel centers and removable cast- or alloy-steel rims to permit building up in case of wear.

Cleaning Dust in Structure

Chasing down any dust which may escape in either the original washing and screening plant or in the new air plant is facilitated by the installation of a United States-Hoffmann two-outlet vacuum-sweeping system; i.e., with sufficient capacity to serve two 2-in. hose outlets simultaneously. A rotary exhauster pulls the dust into the system and passes it to two 36x96-in. collectors (one primary and one secondary, the secondary including cloth tubes for final settlement of the dust). A trap ahead of the primary collector takes out any metal scraps, chunks of coal or rock or other pieces of hard material small enough to go through the attachment nozzles. The sweeping system serves a total of 25 outlets, ten in the air plant and fifteen in the washing and screening plant. Attachments embrace types for cleaning not only floors but also walls, machinery, beams, piping and other spots where dust might collect. Dust reclaimed in the collectors drops into the raw-coal conveyor leading to the air plant.

The plant is operated by 60 General Electric motors. Motor and drive details are given in Table I. Across-the-line starters (General Electric CR7006D33 for motors under 25 hp. and CR7051 for motors over 25 hp.) predominate, with remote-control pushbutton stations with indicating lights. Trumbull safety switches are used in all motor circuits which head up at copper busbars in an inclosed box at the general switchboard panel serving the plant. Conduit is used throughout. Motor circuits are 440 volts; lighting circuits, 110 volts.,

Plant Heating Arrangements

The original washing and screening section is heated in cold weather by a Lee tubular-type heater with a capacity of 3,200,000 B.t.u. per hour. This heater is fired by an Iron Fireman Size 4 (300 to 350 lb. per hour) stoker using minus 1-in. coal, and gases are exhausted from the heater by a Type 40-E American Blower fan with a capacity of 2,500 c.f.m., 1¼-in. static pressure. Heated air is circulated by a No. 6½ Type AHS American Blower fan with a capacity of 20,000 c.f.m., 2½-in. static pressure. Temperature of the air leaving the heater is 100 to 125 deg. F., and the temperature of the plant always is kept above 40 deg. As far as possible, air from the plant is recirculated through return ducts from each floor back to the heater. Hence, stoker and heater firing door need to be in a separate room to prevent the circulating fan from interfering with the induced draft of the unit.

The air plant is heated by a separate Lee direct-fired unit heater with a capacity of 700,000 B.t.u. per hour. This heater, with shaking grates, is hand-fired. Combustion products are removed by a No. 10 ME New York Blower Co. exhauster with a capacity of 1,000 c.f.m., 1-in. static pressure. Heated air is circulated by a No. 17 ME New York Blower Co. fan with a capacity of 7,500 c.f.m., 1¾ in. static pressure. The buildings are inclosed with the usual sliding and roofing and no special insulating material has been installed. All openings, however, have been sealed with rubber and canvas.

PLANE MOTORIZATION

+ Returns Cost in Less Than Two Years At Blue Diamond Bonny Blue Mine

ELIMINATION of delays during severe weather and of wrecks, which occurred regardless of season, have saved the cost of motorizing a monitor plane at the Bonny Blue mine of the Blue Diamond Coal Co., Bonny Blue, Va., in less than two years. The motor, which is rated 600 hp. and is the largest in use in this country on a coal-lowering incline, acts both as a drive and as a regenerative brake to maintain uniform speed of the 38-ton gross load over both steep and slight-grade sections of the 3,700-ft. incline. Power returned per day to the line has a value of approximately $7; a further advantage accrues by lower maintenance of the hoist, particularly of brake blocks. Total investment in motor, gearing and control equipment, and labor to make the change was close to $18,000.

Production from Bonny Blue mine is 2,900 to 3,200 tons per day (single-shift operation) from the No. 9 and 10 seams, which lie practically level and high in Little Black Mountain, a natural border between Lee County, Virginia, and Harlan County, Kentucky. Elevations above sea level at Bonny Blue are as follows: railroad track at tipple, 1,700 ft.; floor of dump house, 2,650 ft.

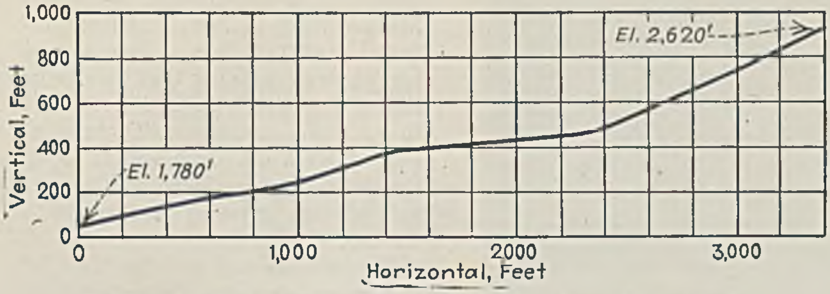
The mine was opened in 1923, using 25-ton drop-bottom monitors gravity operated in balance and controlled by friction brakes operating on a Millholland hoist or incline machine of the double-cylindrical pulley type with shafts horizontal. Drums are 9 ft 11¼ in. in diameter and have seven rope grooves. Provision for emergency drive of the hoist for unusual spotting and in case of stalling consisted of a 150-hp. 440-volt 460-r.p.m. wound-rotor motor with suitable spur gearing to move the rope at 132 f.p.m. Replacing bolts or pins in a flanged coupling was necessary if the motor was to be put into temporary use.

As indicated by the accompanying profile, the incline has a slight-grade section of considerable length along about the center where the monitors pass and is of less than average grade at the bottom but has its steepest section at the top. The average grade is close to 14 per cent and the maximum and minimum grades are 27 per cent and 6 per cent, respectively. Total travel is 3,700 ft. and the track consists of three rails except for a double-track section at the passing point; 85-lb. steel is used. Monitors are of the drop-bottom type, 66-in. gage, and the empty weight is 26,000 lb. Normal loads per trip are 25 tons and the rope now being used is $1\frac{5}{8}$ in. in diameter.

Now the monitors, weighing 13 tons and carrying 25-ton loads, operate at a speed held practically constant at 1,750 f.p.m. by a 600-hp. "motor and generator"

In the past high speeds, sometimes exceeding 3,000 f.p.m. over the steepest section of the run, caused wrecks. Normally it was necessary to allow the monitor to gain an unsafe speed in order to coast through the "flat" without excessive slowing; i.e., slowing below 600 f.p.m. In the hottest weather, when frictions dropped to a minimum, the brakes, whose wood blocks usually were in a slightly charred condition, due to excessive use, would not limit the speed over the steep place as much as desired. In general the normal difficulty was a lack of proper control. During cold snaps—especially if accompanied by a fall of snow or drifting—the first runs of the morning required emergency connection of the 150-hp. motor to pull through the flat. The first three or four trips took as much as an hour on account of the time required to apply and remove the flange bolts and because the motor-drive speed through the flat was but 130 f.p.m.

Although tracks were kept in good condition, excessive speeds over the steep section caused three to four



Profile of incline from loading-chute tracks to dump bin at tipple

wrecks per year. Since December, 1935, when the 600-hp. motor was added to the hoist, no wrecks have occurred. Speed now is held practically constant around 1,750 f.p.m. regardless of season. During that part of the run while acting as a motor the new unit takes 700 hp. from the line and while acting as a brake it returns a peak of 1,200 hp. Average kilowatt-hour figures for a day are as follows: total taken from the line, 192; total returned to the line, 742; net amount delivered to the line, 550.

Central Metering Provided

Power for the Bonny Blue mine and for the company's adjacent Mayflower operation is purchased through a central metering point and usually the combined demand is sufficient to consume the power generated by the incline. Therefore most of the 550 kw.-hr. net return per day represents a gain to the coal company. As is a usual practice in such cases, the power company has equipped its meter with a ratchet to prevent giving credit for any power received from the coal company.

Trips per day average 135 and the usual time for a single run is 2¼ minutes. Normally the motor is never "plugged"; i.e., reversed to take line current while drifting in the opposite direction. Plugging is avoided because it is considered to be an unnecessary strain on the equipment and it would increase power cost.

Usual procedure is to release the air brakes and allow the monitor to accelerate for 30 to 40 seconds to 1,500 f.p.m., then to operate the master control switch which connects the motor to the line and which in rapid sequence short-circuits the steps of rotor resistance. The motor then alternates in its functions as a brake and a drive and near the end of the run the controller is returned to the off position in time to allow slowing and stopping by application of the gravity-set air-controlled brakes on the hoist drums.

Induction motor and control are General Electric. Specifications of the motor are as follows: type MT, 600 hp. continuous at 40 deg. C.; rise, 2,300 volts, 3 phase, 60 cycles; primary current, 140 amp.; secondary volts, 483; secondary current, 561 amp.; speed full load, 885 r.p.m.; coils insulated and braced to allow plugging at synchronous speed; motor pull-out torque, not less than 1,400 hp. Geared to the end of the motor shaft is a small separately excited 100-volt 1,725-r.p.m. d.c. generator which supplies current to a rope-speed indicator mounted in the operator's booth beside the monitor loading chutes.

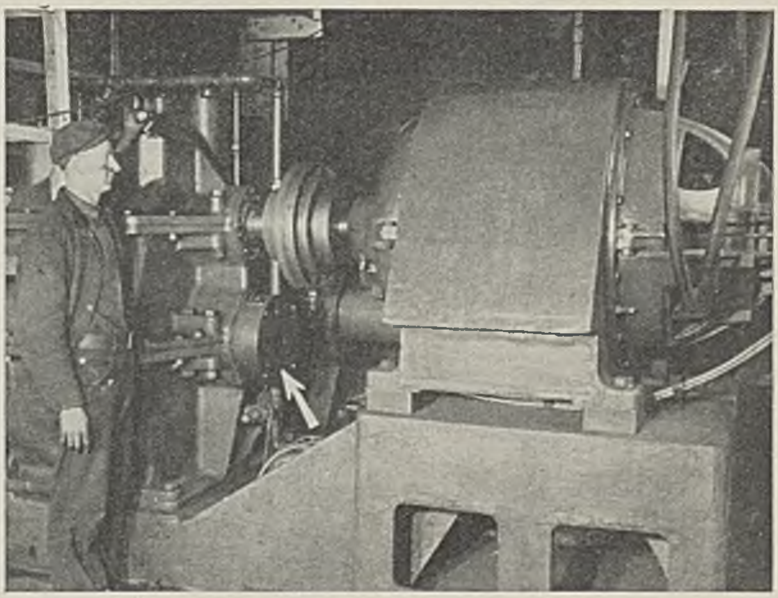
Mechanical connection to the hoist and speed reduction are effected by an inclosed Falk gear unit. The end of an intermediate shaft of this gear is equipped with a General Electric speed-limiting contactor of the same type as used on rotary converters, this for operating a solenoid valve to set the air brakes automatically. Lubrication of the Falk gear is normally a splash feed, but for use in starting after a prolonged shutdown the unit has a 2-hp. gear-type oil-circulating pump.

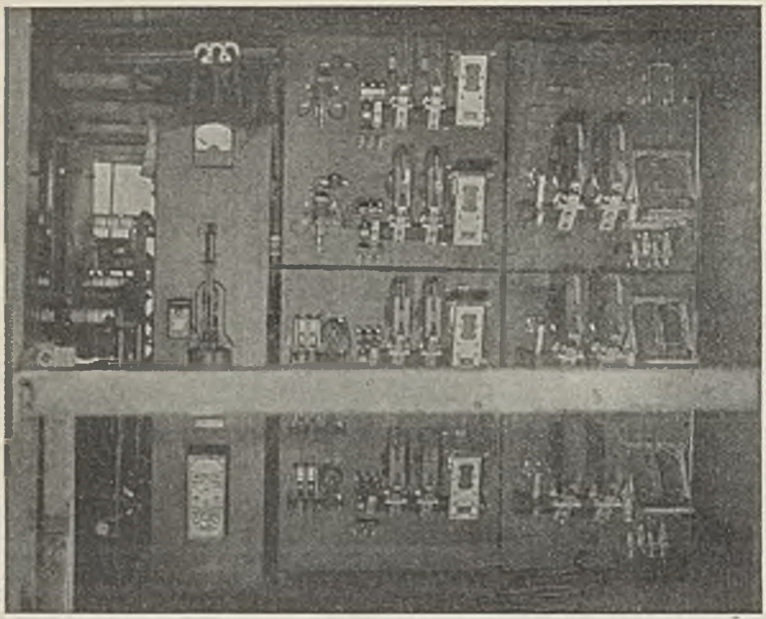
To provide minimum electrical resistance between motor slip rings and the secondary short-circuiting contactors of the control, which is on a platform above the motor, three leads of 1,250,000-circ.mil copper cable are used. The "mine service" controller has air-break contactors on both primary and secondary and the control voltage of 440 is rectified by copper-oxide cells to d.c. for the contactor holding coils. Secondary resistance is cast grid type and is proportioned so that on the first control step the motor torque at standstill is limited to approximately one-third of the full-load torque.

A six-point cam-operated master control switch with vertical handle provides six hand-controlled speed steps, but when this master control switch is thrown instantly to full running position the control contactors close in successive steps controlled by current-limit relays. An auxiliary foot switch provides for closing accelerating contactors so the motor will develop maximum starting effort for extraordinary loads. Voltage failure as well as overspeed will cause the solenoid valve to function and set the brakes. Normal release of the brakes is controlled by the standard-type-control air valve mounted beside the electric controller.

Mounted on the master controller is an auxiliary limit switch which automatically opens the circuit to the air valve solenoid and thus begins to set the brakes when the controller is started back to the off position from

Motor and reduction gear are mounted on a unit base. The arrow points to an overspeed switch mounted on the end of an intermediate shaft of the gear.





The mine-type controller is mounted on a balcony in the hoist house

the full position. A backing-out switch—an emergency feature—provides for making the return without this automatic setting of the brake. In the operator's cab, in addition to the tachometer, which has a 0-2,000-f.p.m. scale, there is mounted an a.c. indicating watt-meter having zero center and a 1,000-kw. scale.

The original 150-hp. motor was left undisturbed, so it still serves as an emergency drive, although it is unlikely that it will ever be needed. It does, however, provide a convenient slow-speed drive for maintenance work or rope changing. Couplings between the new motor and reduction gear and between the gear and the hoist are the Falk type which utilize a steel lacing. Original two-section cast-iron drums of the hoist were replaced several years ago with cast-steel drums having rope-groove and brake sections cast integral. The whole drum, however, consists of two halves for convenient replacement on the shaft, which is 14 in. in diameter at the drum fit.

The rope now in use, a 1⅝-in. 6x17 filler-wire hemp-center plow-steel American Cable Tru-Lay type, was put into service in February, 1937. Length of a new rope is 4,150 ft. The present rope is the eleventh that has been applied to the incline since its start in 1924. Service lives have been increased from around 300,000 tons for the first few ropes to about 825,000 tons for the last ones and rope costs have been reduced from 8 mills to 3 mills per ton of coal handled.

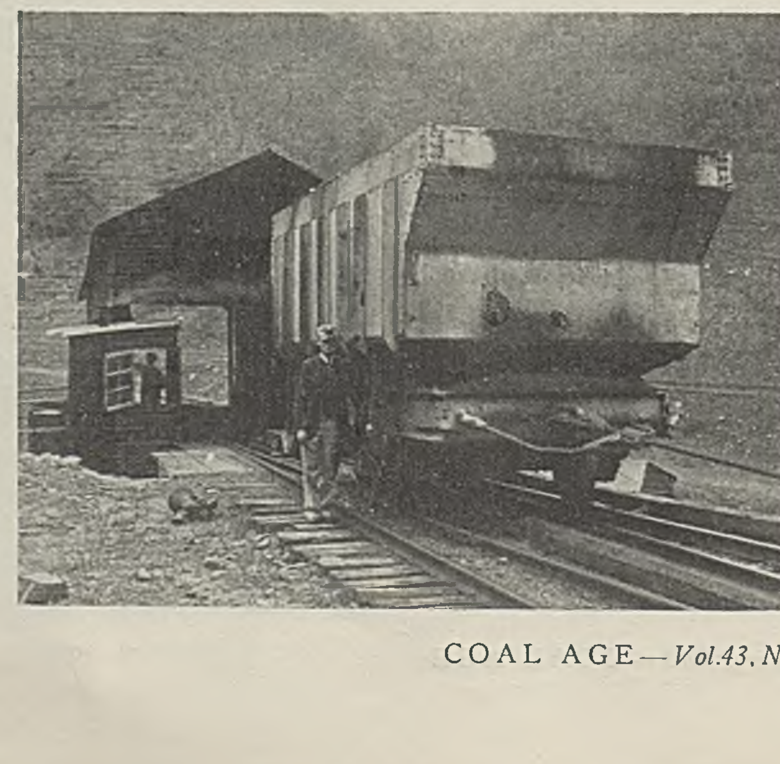
This improvement in service life and in per-ton cost is credited to several changes. The original rope size of 1¾ in. was changed to a specification of 1⅝ in., which reduced renewal cost per rope. The use of special rope dressing that had to be heated to be applied was discontinued in favor of a continuous-drip lubrication of black oil. Iron rollers along the incline were replaced with renewable wearing strips of wood nailed to the ties.

It is not claimed that the black oil is a better lubricant for the rope but the improvement appears to be due to the more frequent and generous application. Too much labor was involved in applying the special dressing. The black oil keeps the rope well covered so that the wood strips soon become saturated and consequently do not wear the rope appreciably. Also it is reasonable to assume that at points where the rope drops or hammers down against the track the injury is less by striking the wood strips instead of iron rollers.

Sufficient time has not elapsed to indicate definitely what improvement, if any, in rope life may accrue due to the lower maximum speed and smoother operation by regenerative braking. Probable gain from that factor was not included in the estimate of benefits to be derived, therefore the motor installation has already amply fulfilled expectations. Smith Williams, superintendent, credits Chief Electrician H. W. Bryson and J. W. Wightman, of the General Electric Co., with bringing to his attention the possibilities for improved operation by motorizing the hoist.

◆

Smith Williams, superintendent, standing beside one of the 25-ton drop-bottom monitors on the 6-deg. section of track approaching the dump bin



ROOF-CONTROL PROBLEMS

+ In High-Speed Mechanization Answered by Barodynamics

By PHILIP B. BUCKY
Associate Professor of Mining
School of Mines, Columbia University

MUST ROOF CONTROL *be a matter of trial and error or is it possible to predetermine with reasonable accuracy how wide a roof span may be carried and how long a face may be worked with safety? For years the majority of the mining fraternity has believed that actual experience was the only guide—and that the experience in one mine or section was no indication of what might be expected. Philip B. Bucky, who has been studying the subject for a long time, takes sharp issue with this view. It is his contention that barodynamics—the science of the behavior of weighty structures—will furnish a dependable answer for every case. How barodynamic principles are applied to the solution of a specific problem is told in the article which follows.*—THE EDITORS.

FROM an individual with a long and varied experience in the mechanical mining of coal comes the following statement and sketch (Fig. 1): "If the coal operator can definitely determine the total roof span which might be carried from the back of a kerf cut to a timber line or line of breaker cribs, long faces can then be laid out to give a full shift loading with one machine, at a standard rate of tonnage per hour, and a continuous flow of coal obtained by running a line of track or face conveyors inside the prop or breaker crib line, so that the rear conveyor can swing over the cars or conveyor without interference."

The problems to be solved may be stated as follows:

1. How long a face may be safely operated?
2. How wide a roof span—UP_1 Fig. 1—may be carried?
3. What size prop or crib and spacing shall be used?
4. How long a time can faces be held open before caving?

With these questions safely answered there is no reason why equipment types now on the market producing from 400 to 600 tons per shift by room-and-pillar methods cannot average from 1,000 to 2,000 tons per machine shift, with the same number of men in the operating crew.

Answering the Questions

The answers to the preceding questions may be stated briefly as follows.

1. There is no limit to the length of a longwall face that can be operated from the standpoints of safety and roof control. When longwall faces become too short, difficulty is experienced.

2. The roof span—UP_1, Fig. 1—may be approximated with reasonable accuracy by calculation or model experiments.

3. A properly designed and supported mine will keep the roof span. UP_1, open indefinitely so that, should work be discontinued, the face will always be found ready for the resumption of operations.

Prop and/or crib size and spacing are intimately connected with the determination of the span, UP_1, and may be approximated by calculation or model experiment, with the attendant checks of one on the other. Whether a property may be worked longwall depends to a large extent upon the span, UP_1, that may be kept open and the size and spacing of props in lines P_1 and P_2 to insure it.

These questions bring home the important relationship between mine operation and a knowledge of the behavior of mine structures. The stresses and failures in mine structures are primarily due to the weight of the structure and they are therefore referred to as weighty structures. The science which deals with the behavior of weighty structures is termed barodynamics[1] and consists in applying the known laws of mechanics to determine the behavior of the structure, and/or the application of the principles of similitude to the behavior of a small-scale model of the mine structure in order to determine how the full-scale structure or prototype will behave.

Method of Approach

For an understanding of our problem and the method of approach let us assume a section through a property at right angles to a longwall face. It has advanced a certain distance but not enough to induce a roof break. This is shown in Fig. 2. The section through the property is assumed as follows: 5 ft. of coal overlain by 5 ft. of sandstone; 15 ft. of shales, bony coal and then layered material; 30 ft. of strong sandstone; and 40 ft. of thin shales, soils, etc.

The geologic beds A and B constitute our underweight because, as the face retreats, they are the first beds to load the props P_1 and P_2. The geologic beds C and D constitute the

[1] A research project of the Engineering Foundation and Columbia University.

overweight because their weight does not at present act on the props, but it must be remembered that they do act on the coal faces *F* and *S*. In certain localities the underweight may consist of all the geologic material to the surface; in other cases the underweight may be comparatively light, then increase many additional times, depending upon the geologic structures and methods of mining. To solve this problem intelligently requires a determination of what the underweight and overweight are, which, in turn, means a knowledge of the geologic structure and the structural characteristics of the rocks composing that structure.

From a consideration of Fig. 2 it is evident that it is desirable that prop lines P_1 and P_2 support the underweight only. *U C* being an undercut, the strength of roof *A* and prop lines P_1 and P_2 should be such as to allow a distance, $U\ P_1$, to be kept open of sufficient width for conveyors or tracks to be placed parallel to the face, for men to work, and for an undercut, *U C*, to be made. If one assumes a 5-ft. undercut and 5-ft. span for conveyor, it means that distance $U\ P_1$ is 10 ft. Prop line P_2 will be placed a distance equal to the depth of undercut from P_1, or 5 ft., so that as each cut is made and loaded, the track or conveyor may be shifted and the prop line P_2 moved.

Why Two Prop Lines?

The reason for the use of two lines of props, P_1 and P_2, is as follows: When the distance P_2S has reached a value determined by calculation or model experiment for failure, cracks will occur at 1 and 2. Theoretically, crack 2 should occur over the prop line P_2. It may, however, take place somewhere else. If prop lines P_1 and P_2 are present, the break will come beyond P_1, insuring safety between P_1 and U. There is a possibility, therefore, of losing the props in line P_2 when the face has advanced a distance that stresses the roof beyond its ultimate strength. (In placing props in lines P_1 and P_2 it is important that headboards be used to allow the underweight to sag away from the overweight. Otherwise one will support the overweight, which, if very heavy, will call for mammoth props.) The prop strength and size may then be determined on the basis of supporting the underweight instead of the whole structure. It might also be pointed out that the load on the prop P_2 varies, being a maximum when the distance P_2S is such that failure occurs.

Time Effects—When span P_2S, Fig. 2, is such that the roof stress over P_2 exceeds the ultimate strength in tension, the roof does not immediately fail completely. The time for complete failure, as personally observed in laboratory experiment and in the field, depends upon the thickness of the roof, its proportionate strength in compression, and the load it carries. Thicker beams take longer to fail completely than thinner beams. If the roof starts to fail in tension and the rock is strong in compression, the time for complete failure is increased. Increasing the load on a roof beam hastens the time of complete failure.

PHILIP B. BUCKY, professional engineer and associate professor of mining at the School of Mines, Columbia University, was born in Chicago in 1899. He received his B.S. degree from the University of Illinois in 1921, his mine foreman's certificate from the State of West Virginia, and his E.M. degree from Pennsylvania State College in 1927, where he also served as assistant professor of mining. He has had practical and consulting experience in coal and metal mining, is acquainted with mining practice in Great Britain and South Africa, has carried on research in barodynamics and published numerous articles on the behavior of mine structures.

★ ★

After the first failure in the underweight, it continues to break as a series of cantilevers and finally comes to a condition illustrated in Fig. 3 where the overweight—i.e., beds *C* and *D*—is now over such a span that the bed *C* is failing in tension at points I and II. With a thick bed *C*, the time of its failure may be such that the coal face *F* has advanced to F_1 before it fails. This may at present be determined only by model or field experiment, and if this condition exists, prop lines P_1 and P_2 need not take much of the overweight load. If conditions are such that bed *C* will not allow this procedure, then lines of cribs, filling, or support of another nature paralleling the face may be placed so as to take the overweight load from prop lines P_1 and P_2 partially off the coal face. This is illustrated in Fig. 4.

How to Determine Weights

Determination of Overweight and Underweight in Mining—In all mining very important factors in determining artificial support and spans to be worked are the underweight and overweight. The procedure is as follows:

From boreholes determine the geologic section. From the cores, which preferably should be of large diameter, determine the structural characteristics of all geologic beds; i.e., tensile strength, modulus of elasticity, compressive and shear strengths, and modulus of rupture. Keep portions of core for model experiments. List the structural characteristics of the geologic structure as in Table I.

An inspection of the geologic section, Fig. 2, will show that sandstone roof *A* will be loaded by layers *B*, and sandstone layer *C* will be loaded by materials *D*. If the open span at which roof *A* and its load will fail is less than the open span at which layer *C* and its load will fail, then sandstone roof *A* and its load is the underweight and sandstone layer *D* and its load are the overweight.

The span at which the roof will fail in tension may be approximated from the following formulas:

$$S_PF = \sqrt[2]{\frac{2D^2S_T}{W}} = (1)$$

Where S_PF = span for failure.

Table I—Structural Characteristics

	Bottom Rock	Coal	Sandstone	Shales and Bony
Tensile strength *St*...........	400 lb. per sq. in.	200 lb. per sq. in.	200 lb. per sq. in.	0
Compressive strength *Sc*...........	5000 lb. per sq. in.	2000 lb. per sq. in.	2000 lb. per sq. in.	2000 lb. per sq. in.
Shear strength *Ss*...........	3000 lb. per sq. in.	1000 lb. per sq. in.	2000 lb. per sq. in.	0
Modulus of elasticity E...........	5×10^6	5×10^5	10^6	0
Modulus of rupture *Sr*...........	800 lb. per sq. in.	300 lb. per sq. in.	500 lb. per sq. in.	0
Weight per cubic foot *d*...........	150 lb.	80 lb.	150 lb.	150

D = Thickness of roof beam in feet.
S_T = Ultimate tensile strength of roof beam in pounds per square foot.
W = roof load per foot width and length.

For sandstone *A*, S_PF =

$$\sqrt[2]{\frac{2 \times 5^2 \times 200 \times 144}{20 \times 150}} = 22 \pm \text{ft.}$$

For sandstone *C*, S_PF =

$$\sqrt[2]{\frac{2 \times 30^2 \times 200 \times 144}{70 \times 150}} = 70 \pm \text{ft.}$$

Roof *A* and its overlying load therefore constitute the underweight and layer *C* with its overlying load constitutes the overweight. It may be pointed out that variations in the geologic structure and structural characteristics may cause variations in underweight and overweight which will affect mining methods and support.

Scales Model Gives Answer

Determination of Underweight and Overweight by Model Experiment[3]—In the previous method, calculations were based on experimental constants; i.e., moduli and various ultimate strengths. If the material is available, a scalar model made of the same material as in the mine structure will give the same results. If, for example, a model built to a 1 to 480 scale, as shown in Fig. 5A, is placed in a centrifuge and rotated at such a speed that the centrifugal forces acting on the model are 480 times gravity, it will behave exactly as one in the field. The time effects in the model will also be the same as those in the field. Fig. 5B would show that the underweight failed when its model span was 11/20 in., equivalent to

$$\frac{480 \times 11/20 \text{ in.}}{12}$$

or 22 ft.; Fig. 5D would show that the overweight failed at a model span of 1¾ in., equal to 70 ft.

Model experimentation has advantages in that its results are applicable to materials stressed within and beyond the elastic limits, where mathematical analyses do not hold and time effects are important.

Determination of Length of Face—For longwall work it is desirable that breaks in the roof strata and the overlying material parallel the working face at or beyond the prop line P_2, Fig. 2. If one assumes a coal bed overlain by material as in Fig. 6 and an opening, SP_2, is driven in the coal and widened sufficiently, cracks will occur at 1 and 2 parallel to the ribs S and P_2 only, if the length of the opening at right angles to SP_2 is large as compared to SP_2. As an opening becomes oblong in shape the load carried by

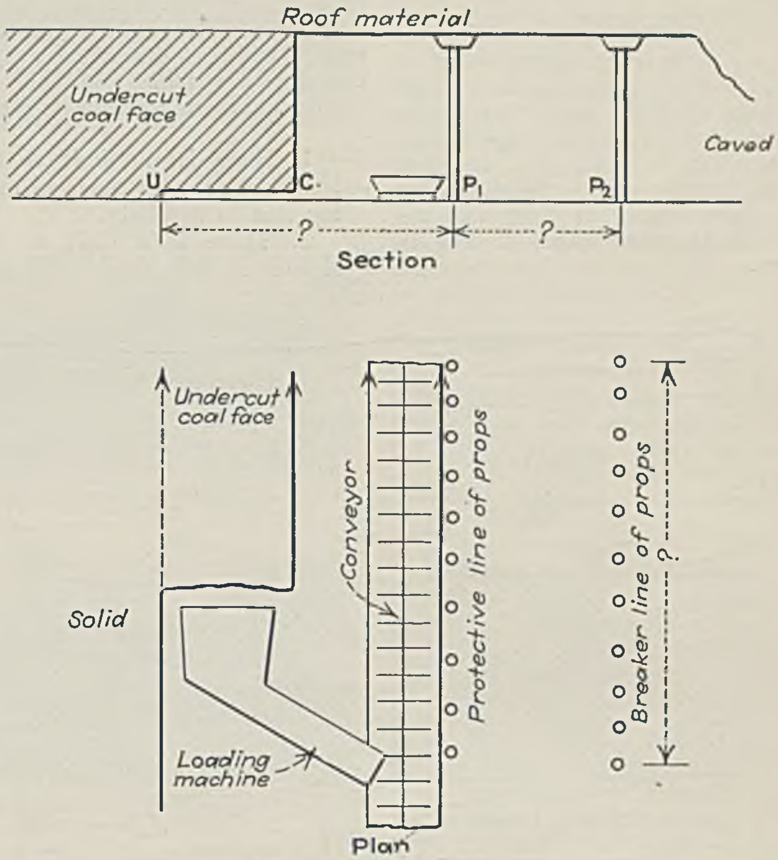


Fig. 1—Posing the problem

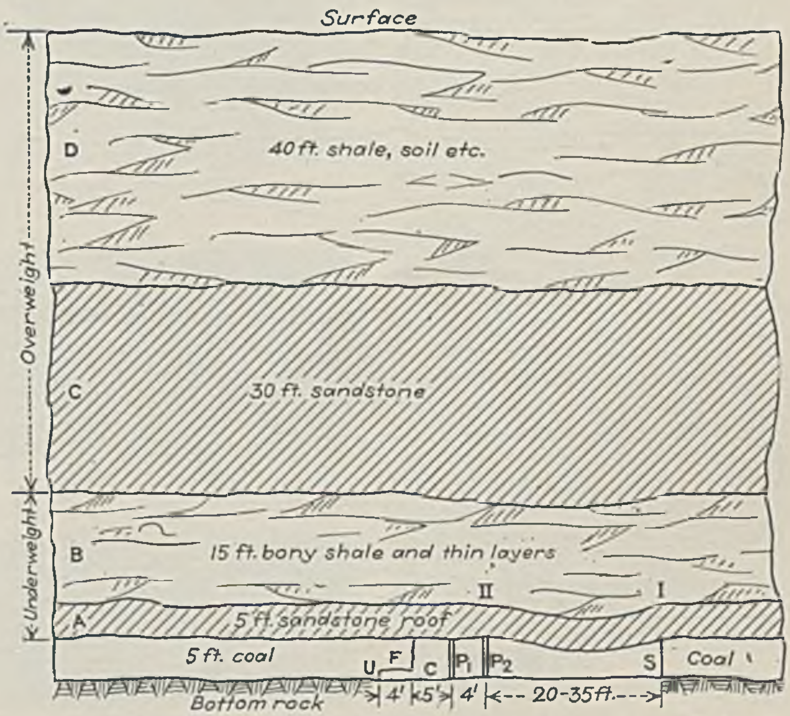


Fig. 2—Overburden and workings at right angles to a longwall face

[3] A.I.M.E. Publications: Technical Papers 425, 529, and Contribution 4.

the longer roof span becomes rapidly less. This is illustrated in a long entry gangway or drift, where the load is carried by the short span; i.e., the width of the entry instead of the length. In structural work the following formula is used.

$$R = \frac{L}{SP_2} - 0.50$$

Where R is the proportion of the total load carried by the shorter span.

L for this case is the dimension at right angles to SP_2; i.e., the longer spans or length of face in feet.

SP_2 is the shorter span in feet as illustrated. Then for $\frac{L}{SP_2}$ equal to 1.5, R equals 1, which means that if the length of face is 1.5 or more times the span necessary to produce a break in the roof, the breaks will tend to parallel the ribs, or support lines S and P_2.

It is therefore desirable to state:

1. There is no limit to the length of face for longwall mining and its corollary.

2. There is a limit to the shortness of face desirable, which for practical purposes we will put at 5 times the span necessary to produce failure in the roof.

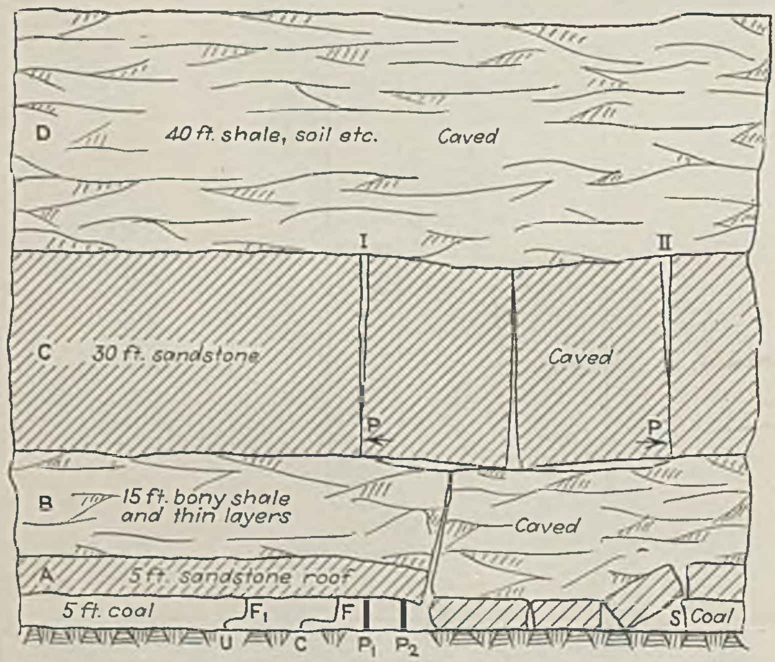


Fig. 3—After underweight has broken in series of cantilevers

Fig. 4—Taking overweight load from prop lines

If it is desired that the breaks in overweight and underweight parallel the working face, then for the conditions assumed the minimum length of face desirable is determined by span at failure of the overweight. This was determined as 70 ft., so that the minimum length of face desirable for these conditions is 5 × 70, or 350 ft.

Approximating Face Advance for First Break.—This span, P_2S, Fig. 2, at which a break may be expected, may be determined in two ways: (1) By mathematical approximation; (2) by model solution.

For mathematical approximation the various structural characteristics of the roof overlying and underlying material are required. It may be assumed that samples have been taken and the results are available in Table I.

P_2S, or the distance for cracks to occur at 1 and 2 (Fig. 2), is then

$$\text{equal to } \sqrt[2]{\frac{2D^2\ S_T}{W}} = (1)$$

Where D is the depth of roof in ft.

S_T = Ultimate tensile strength in pounds per square foot = 144 × 200 = 28,000 lb.

W = Total load per foot length and width of roof beam.

Then for the 5-ft. sandstone roof

$$SP_2 = \sqrt[2]{\frac{2 \times 5 \times 5 \times 200 \times 144}{150 \times 20}}$$

= 22± ft.

Complete failure will not occur immediately on reaching this distance. One is certain to obtain complete failure if, in formula (1), S_r, the modulus of rupture, is substituted for the determination of SP_2; then

$$SP_2 = \sqrt[2]{\frac{2 \times 5 \times 5 \times 500 \times 144}{150 \times 20}}$$

= 34½± ft., which we will call 35 ft.

A closer approximation may be obtained by treating spans UP_1, P_1-P_2 and P_2S as a continuous beam with restrained ends and applying the three-moment theorem[3].

A model solution would consist in using a piece of the same sandstone about ⅛ in. thick with the overlying material in the same proportion and rotating in a centrifuge at a speed equivalent to a model ration of $\frac{5 \times 12}{\frac{1}{8}} = 480$; and cutting back on

[3]Any text on continuous beams.

coal face and moving supports until failure occurred. This has been illustrated in Figs. 5A, 5B, 5C and 5D.

Determining Advance for Succeeding Underweight Failures—The mine roof and underweight have now failed as a restrained beam. From now on a cantilever induces the stresses that cause the failure and the distance the face and prop line will retreat may be approximated by the following formulas:

$$S_P F = \sqrt[2]{\frac{D^2 S_T}{3W}}$$

$S_P F$ for $S_T = 200$ lb. per square foot

$$= \sqrt{\frac{5 \times 5 \times 200 \times 144}{3 \times 20 \times 150}} = 9\pm \text{ ft.}$$

$S_P F$ for $S_r = 500$ lb. per square foot

$$= \sqrt{\frac{5 \times 5 \times 500 \times 144}{3 \times 20 \times 150}} = 14.1\pm \text{ ft.}$$

Succeeding breaks may therefore be expected on prop line P_2 for face advances between 9 and 14 ft., depending to some extent on the rate of advance of the working face.

Determination of Open Spans at Face—These are the distance $U P_1$ and $P_1 P_2$, Fig. 2. Refinements of calculations may be entered here, but a fair approximation may be made by considering the maximum moment as $\frac{W L^2}{8}$ where L is the span, or $U P_1$.

This portion of the working must be safe, so that a safety factor of 4 will be required, and the maximum stress allowed in the roof here is $\frac{S_T}{4}$ or $\frac{200}{4}$ $\times$ 144, or 7,200 lb. per square foot.

$U P_1$ or L therefore $= \sqrt{\frac{4D^2 S}{3W}} =$

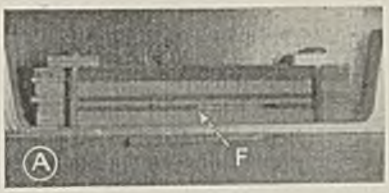
$$\sqrt{\frac{4 \times 5 \times 5 \times 7{,}200}{3 \times 150 \times 20}} = 9\pm \text{ ft.}$$

$U P_1$ may therefore consist of a 3-ft. undercut and 6 ft. of room for conveyor or a 4-ft. undercut and 5 ft. of room for conveyor. In other words, $U C$ and $C P_1$, Fig. 1, may be varied at will provided their sum is 9 ft. or less. The distance between prop lines P_1 and P_2 will equal $U C$, or depth of undercut.

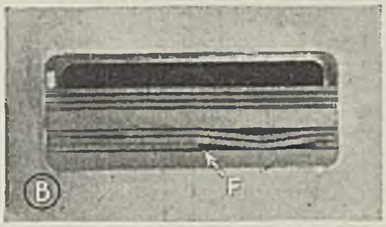
Determination of Prop Dimensions and Spacing—The maximum prop load occurs for the conditions as stated when the first break in the underweight is to take place. From previous calculations, a roof break is possible when $P_2 S$, Fig. 2, is 22 ft. A roof failure is certain to occur at P_2 and S when $P_2 S$ is equal to 35 ft. The load on prop P_2 is due to spans $P_1 P_2$ and $P_2 S$. If headboards have been used over the prop this load is due to the underweight only.

Fig. 5—Behavior of model in centrifuge tester

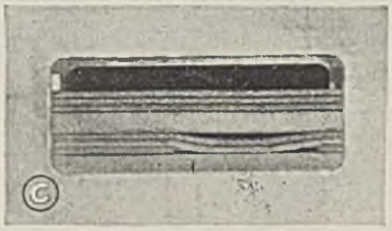
(Illustrations B to E photographed at 1,500 r.p.m.; model ratio 480±)



A—Model in holder before test. Beds colored with ink to increase visibility. Other illustrations show other side of model. F is working face

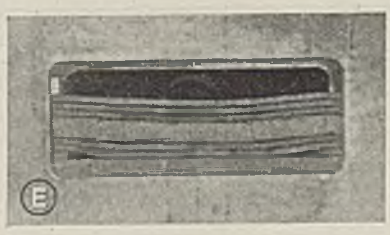


B—Note behavior of underweight in this test

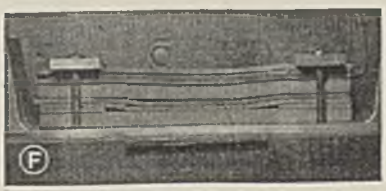


C—Underweight behavior after additional face retreat

D—Underweight and overweight failure after further face retreat



E—Another step in face retreat



F—Model after test run

The maximum load on prop P_2 to be expected from spans $P_2 S$ and $P_2 P_1$ per foot length of face equals $\frac{W}{2}$ $(P_2 P_1) + \frac{W}{2} (P_2 S)$ or $(\frac{1}{2} \times 20 \times 150 \times 4) + (\frac{1}{2} \times 20 \times 150 \times 35)$ = 58,500 lb. per foot. With props placed at 4-ft. centers the load per prop is 4 $\times$ 58,500 lb., or 234,000 lb. From the steel handbook we find that an 8x8-in. H column C B 83 weighing 58 lb. per foot, or 290 lb. per prop, will carry the load. Since our prop is eccentrically loaded a larger prop for this load would be required unless we consider shaping the top of the prop or so placing our headboards that the line of maximum load and center line of prop coincide. It therefore becomes evident that the underweight may be so heavy that the size of prop to be handled and moved may definitely limit a property as far as longwall mining is concerned.

Placing the Props Closer

Again considering what can be done with this proposition, let it be assumed that props are placed at 2-ft. intervals parallel to the face. The maximum load per prop is now 2 $\times$ 58,500 lb., or 117,000 lb., and on referring to the steel handbook one finds that a 6x6-in. H column (3A) and weighing 27.5 lb. per foot will carry the load. The weight of this prop will be 5 $\times$ 27.5 lb. or 137.5 lb., which may be handled very nicely. If one goes a step further and considers the use of aluminum props, the weight per prop having the same cross-section and strength as the 6x6, 27.5-lb. H beam would be $\frac{2}{3}$ of 137.5 lb., or 92 lb. It might be stated also that other methods may be used to cut the size and weight of the movable props in lines P_1 and P_2 still further. Space and time considerations will not permit a complete presentation of possibilities here.

The prop and roof should now be investigated for possible shear failure immediately over the prop; i.e., the possibility of the prop punching a hole in the roof. Since a 6x6-in. prop has been chosen let welded bearing plates 6x6x$\frac{1}{2}$ in. be used on both ends of the prop. Assuming that shearing takes place along half the perimeter of the bearing plate, due to eccentric loading, then the perimeter for shear equals 12 in. and the shear area equals the product of the perimeter and roof thickness, or $\frac{12 \times 5 \times 12}{144}$, or 5 sq.ft. The roof strength in shear being 288,000 lb.

per square foot, the load required for shear failure = 5 × 288,000, or 1,440,000 lb. Since the load per prop is 117,000 lb., it will not fail in this manner.

The props chosen, therefore, are steel or aluminum 6x6-in. H columns with 6x6x½-in. plates welded to each end. The over-all length of prop is 4 ft. 9 in. Each of these props when placed must have wooden headboards to allow some roof deflection.

The roof should now be investigated for a possible failure in shear. Assuming maximum shear at 58,500 lb. per foot length along prop line, the unit shear stress in roof is $\frac{58,500}{5}$ = 11,700 lb. per square foot. The roof strength in shear is 144 × 2,000 = 288,000 lb. per square foot. The roof will, therefore, not fail in shear. One may, therefore, mine a face 350 ft. or more long with a 4-ft. undercut and two lines of 6x6 in. H-beam props placed in parallel rows 5 ft. from the face, 4 ft. from each other and on 2-ft. centers for a distance approximating failure of the overweight, or 70 ft. (Fig. 3). The pressure on the coal face has been increasing constantly up to this time.

The problem now becomes one to be attacked by the application of the principles of similitude to model experiment. If the overweight sandstone is thick and strong enough so that the time of deformation is great when stressed to failure in tension—i.e., so that the face *F* has advanced to F^1 before failure occurs—then it may be allowed to fail with very little additional load being thrown on the props and the act of failure will release some of the pressure on the coal face. This is shown in Figs. 3 and 5E. When bed *C* caves, pressure is exerted by forces *P*, due to the failure of *C*. In experiments where the loading of bed *C* is not too great it is evidenced by a rise in bed *C*. This effect is quite pronounced with thick beds, but very little with thin ones.

Cribs or Filling Slow Action

If bed *C* is such that failure takes place rapidly, some means of support to slow it must be used. Timber, cribs or filling are ideal for this purpose, as they give with load. For these conditions assume the placing of timber cribs at ¾± the distance calculated for overweight failure. This equals ¾x70 ft., or 52.5 ft. The load on crib per foot length of face at this span = 525 × 70 × 150 = approximately 551,250 lb. If crib strength is assumed at 100,000 lb. per square foot, then the width of cribbing = 551,250 ÷ 100,000 = 5.5± ft. And for this assumption, lines of cribbing 5.5 ft. wide and on 52.5-ft. centers are to be built paralleling the working face.

The general method of handling a longwall or long face mining proposition has been here presented. A good bottom and fair roof have been assumed.

There are certainly as many solutions as there are geologic districts where this method of mining may be employed and no doubt variations in each district may be desirable. Model experiments with sandstone roofs show that height of coal bed is a very important factor, as, for example, in Fig. 5B the roof with cracks showing is supported by the bottom. A clay bottom in which cribs and props and filling will sink also offers some interesting possibilities, as the author has observed in parts of England. With a good bottom and the assumption that no filing material is available, the general solution presented here holds.

Methods have been presented for approximating: (1) length of face, (2) open span between face and supports, (3) size and spacing of supports, and (4) time of failure for longwall mining operations. These approximations being scientifically sound must be the result of a trained interpretation and analysis of data made available from both structural and model tests of the geologic materials in the structure where the mining takes place. The effects of the application of these procedures on safety, profits and progress in mining are matters that merit the attention of the leaders in the industry.

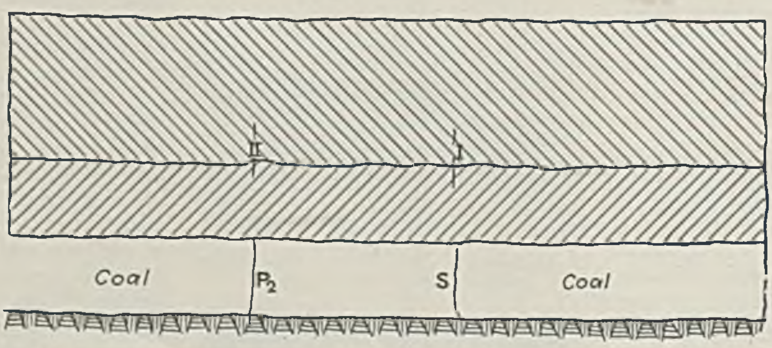


Fig. 6—Ideal section through long opening

◆

General view of the Old Glory pit, showing how the dragline works from a bench made by tkaing the clay off down to the gray slate

12-YD. ELECTRIC DRAGLINE

+ Strips 2½- to 3-Ft. Seam at Old Glory Under 40 to 58½ Ft. of Cover

EXTENSION of the life of the Old Glory No. 17 mine of the Maumee Collieries Co. by about six years was the major result of the replacement of steam stripping equipment with the largest electric dragline yet to be installed at an open-pit operation. Of the walking type, this dragline is equipped with a 12-cu.yd. bucket and 165-ft. boom. Supplementing changes in stripping equipment, railroad haulage has been eliminated in favor of truck and trailer haulage, with a consequent reduction of about 50 per cent in transportation cost, and a diesel-electric loader has been installed to replace the original steam loader. And finally, preparation has been improved by the construction of a five-track all-welded steel tipple, which was erected in 30 days.

Old Glory mine is about 5½ miles northeast of Clay City, Ind., on the Monon Ry. The seam being recovered is the Brazil Block, and the coal is sold under the trade name of "Old Glory Brazil Block." Seam thickness ranges from 2½ to 3 ft. Under the coal is a very hard fire-clay which, however, disintegrates when moist and consequently will not support loaded trailers in wet weather. Except as mentioned later, all haulage is done on the coal.

Thickness of the overburden ranges from 40 to 58½ ft. Very little of the total, however, comes less than 50 ft. thick, and consequently the ratio between thickness of overburden and thickness of coal seldom is less than 20 to 1. A major factor making operation possible at this high ratio is the high yield of prepared sizes from the Block seam and the favorable position which the Brazil Block coal enjoys in the domestic market. A very hard gray slate lying directly on the coal constitutes about 35 ft., on the average, of the total thickness of the overburden, with clay and surface soil making up the remainder.

In the earlier work at Old Glory, stripping was limited to territory where the cover was less than 40 ft. thick, employing a Marion 300 steam stripping shovel with a 7-cu.yd. dipper, steam-locomotive haulage and a Marion 36 steam loader with 1¾-cu.yd. dipper. With the approaching exhaustion of coal with a 40-ft. cover in 1936, however, the Maumee organ-

Old Glory No. 17 is served by a five-track all-welded steel tipple with three loading booms

ization was faced with the alternative of discontinuing operations or adopting new equipment with sufficient range to cope with the materially thicker overburden on the remainder of the available acreage. Available shovel equipment, it was felt, could not operate economically in overburden much over 48 ft. in thickness, whereas the dragline, in spite of certain limitations not applying to shovel equipment, possessed the ability to go considerably deeper. In fact, the Old Glory dragline theoretically is able to operate in overburden 80 ft. thick.

Upon completion of some preliminary development work, the new dragline, a Bucyrus-Monighan unit with Ward Leonard control, began stripping coal in October, 1936, and was moved into the present pit in February, 1937. Lower ground pressure and maximum stability during operation dictated the choice of the walking type. The circular platform on which the dragline rests while stripping has a diameter of 45 ft. Walking shoes are 7 ft. wide and 44 ft. long, and the machine has a walking speed of 800 to 1,000 ft. per hour. Weight of the dragline is 1,335,000 lb. Production averages around 270,000 cu.yd. per month and, as compared with the original steam stripper in much lighter overburden, the dragline uncovers about 1 acre more per month.

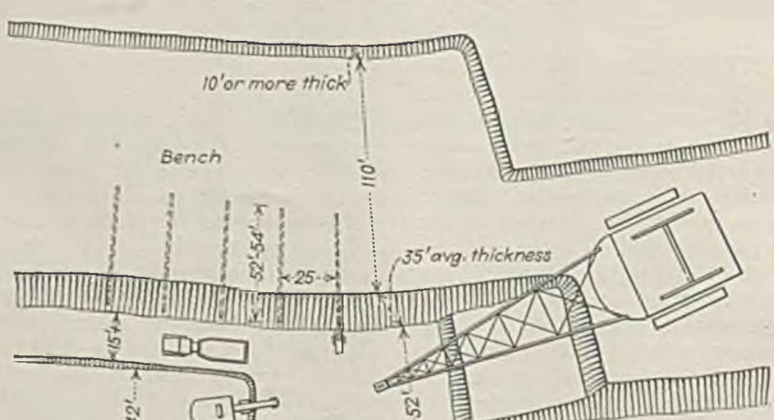
The new pit at Old Glory, roughly in the form of an elbow, is about 1 mile long and adjoins the original workings on the south. To insure the firmest possible footing, the dragline works from a bench made by removing the clay and top soil down to the slate, where possible. In spots where it is not possible to get all the way down to the slate, a 2-ft. layer of slate is dumped on the top of the clay as the bench is made. The slate keeps the machine from sliding around in wet weather when working on clay.

Bench making, stripping and coal-loading operations are shown diagrammatically in Fig. 1. The dragline makes a cut 52 ft. wide in the slate as it moves along the pit on the bench. After the slate is removed by slicing it off from the top down, and before the dragline is moved up, a cut is taken off the next bench line, as indicated, working from behind the dragline. Thus, the bench always is kept one cut ahead of the one being used. Under this system, the clay is deposited on top of the slate in the spoil bank, thus reducing the possibility of slides. As natural conditions are such that an entrance into the far end of the pit is not feasible for haulage, the dragline is walked back to the starting point when a cut is completed. This increases somewhat the idle time for the dragline, which runs about 25 per cent for all causes, including repairs and other delays, but was the most practicable solution under the conditions prevailing in the present pit.

The slate naturally must be shot at Old Glory. Holes 25 ft. apart are put in with a horizontal drill and are loaded with a combination of 30- and 40-per-cent Hercules gelatin, L.F. Half of the load for each hole is made up of 40-per-cent gelatin, placed in the back, with the other half of the charge (30-per-cent gelatin) in front. Holes are drilled 52 to 54 ft. deep, giving an equivalent dragline cut. One shooting difficulty is the presence of slips in the slate in spots, which release the pressure of the shots and leave large masses of slate unbroken. As yet, however, the dragline has been able to roll these unbroken chunks into the spoil without pop shooting.

Coal is loaded without shooting by a Marion 461 diesel-electric shovel with rheostatic control equipped with a 2½-cu.yd. dipper fabricated in the Maumee shops. Before loading, however, the top of the coal is cleaned off with a LaPlante-Choate bulldozer on a Caterpillar RD-7 tractor, followed by hand-shoveling and brushing. The maximum width of cut which can be taken by the loader is 42 ft., leaving a difference of 10 ft. of coal if the stripper is taking the normal 52-ft.-wide cut. At Old Glory, this strip of coal is left until a full cut is completed and then is removed in one continuous operation. Starting at the back end of the pit while the dragline is walking back to the starting point and commencing a new cut, the loader takes out the coal strip, leaving just enough berm along the wall for the trucks to pass around the machine. During this stage of loading, the haulage units usually come in empty on the bottom and go out

Fig. 1—Diagrammatic plan of bench-making, stripping and coal-loading activities at Old Glory No. 17 mine



loaded on the berm, although, if the fireclay is dry, the routing may be reversed as desired.

Coal is hauled at Old Glory by two 20-ton Austin-Western trail cars pulled by Walter four-wheel-drive tractors, with a third International 10-ton dump truck serving in the dual capacity of coal hauling and gob disposal, bringing a load of refuse out to the pit and taking a load of coal back. The Walter tractors are equipped with an automatic-locking transmission so that traction is available even with two wheels off the ground. A short wheelbase permits the tractor-trailer units to make a full circle in a 60-ft. space.

Counting pit length and approach, the average round-trip haul is close to 2 miles. Over this distance, each tractor-trailer unit makes about 30 trips a shift on the average, these two units and the dump truck producing an average of 1,250 tons (shipped coal) in seven hours, which is about the normal capacity of the stripping and loading units. Including the tipple force, construction men, etc., employees for this tonnage total 40. Gasoline consumption is about ½ gal. per mile. Oil is changed about every 500 miles, and none is added between changes. Truck and tractor-trailer haulage was inaugurated in September, 1937, and in October transportation cost was 7.2c. per ton. This compares with about 16c. per ton for the year ending Aug. 31, 1937, during which steam haulage was used.

As noted above, natural conditions made an entrance into both ends of the pit impracticable, and this, coupled with the fact that moisture makes the fireclay under the coal impossible for loaded haulage units to run on, required the use of a coal berm and also made it necessary to work the dragline in one direction only as a general rule. Entrance to the pit is by a gravel road laid on a sub-base of red dog. This road utilizes a part of the old steam-railroad grade, from which the ties and rails were removed. Haulage units also use the same dump house and hopper at the tipple.

A ground-cable system supplies power to the electrically operated pit units. Dragline equipment (General Electric) is designed to operate at 4,000 volts, with pumps, overburden drill, etc., operating on 440 volts. The main ground cable, which receives power at 4,160 volts at the incoming transformers, is a Simplex wire-armored unit wrapped with jute. Two General Electric portable junction boxes are inserted in the ground cable at 900-ft. intervals. These boxes, with oil switches built on the side, have three outlet plugs serving the dragline and one or two auxiliary transformer sets for reducing the voltage to 440 for the pumps, drill, etc. The dragline is equipped with a 1,000-ft. General Electric rubber-covered trailing cable, with smaller similar cables for other pit equipment. Dewatering is done with five 3- and 4-in. portable pumps, four electrically and one gasoline operated. Hoses are used for suction and discharge lines, the latter leading out to drainage ditches in front of the pit.

Loading in the pit with the new diesel-electric shovel and tractor-trailer haulage units

The Old Glory No. 17 preparation plant was designed by company engineers. Major equipment, such as screens, conveyors, loading booms, chutes, etc., were built in the company's shops at Jasonville, Ind., by welding and then were trucked to the tipple site for installation in the structure, also completely welded, including columns, beams, struts, etc., as well as an A-frame support for the boom hoists. In the construction of conveyors, flights on scraper types were cut out of plate with a cutting torch and then welded to the links. Using welding and prefabricating equipment where possible, the Old Glory tipple was erected, as noted above, in 30 days.

Trucks and trailers at Old Glory dump into a 75-ton hopper, formerly used with steam haulage. From this hopper, a scraper conveyor elevates the coal to a pair of sizing shakers. By inserting a bar screen in the opening in the conveyor bottom, plus 4-in. coal, however, can be carried on up to a crusher set over the upper shaker, which receives the crusher product for sizing. Four sizes are made on the main sizing shakers: 6-in. lump, 6x4-in. furnace lump, 4x2-in. egg and 2-in. modified screenings. (An alternative preparation is 6-in. lump, 6x2-in. egg and 2-in. modified screenings.) Lump, furnace lump and egg are discharged onto the picking sections of apron-type picking table-loading booms and, after being inspected and picked, go out onto the boom sections for loading. Degradation screens on the end of the lower shaker and in the back chutes to the furnace-lump and egg tables remove breakage, which a belt carries back to the screenings track.

Minus 2-in. coal from the main shakers falls onto an auxiliary high-speed shaker operating in the opposite direction from the main shakers. This shaker is used for dedusting screenings, which, after dedusting, are loaded on No. 5 track. No. 4 track is reserved for loading dust and at present is used only when orders for dust are available. In the past, however, this track was used regularly in wasting dust, which was loaded into cars and hauled away to the pit for disposal. With the advent of automotive haulage, however, a separate bin for dust, and also refuse from the picking tables (previously handled separately), was built and truck disposal was inaugurated. With facilities as at present, therefore, screenings may be loaded with all the dust taken out, part taken out or none taken out, depending upon the desires of the customer.

Rounding out the facilities at Old Glory, the "Dustlix" process of rendering coal dustless has been installed for treating all four sizes shipped. Sprays on the ends of the booms treat the three largest sizes, while screenings are sprayed in the chute to the railroad car.

NOTES

From Across the Sea

"HAS rock dust been overrated as a preventive of mine explosions?" some people are beginning to ask. While enthusiasts have been too hopeful of it, those who have had expert knowledge of its advantages and limitations have long recognized its inability to cope adequately with methane and have acknowledged that a small explosion may fail to raise enough rock dust into the air entirely to suppress an explosion, especially if the dust is weathered, damp, trampled hard or covered with coal dust.

After the explosion at Mulga, Ala., the committee headed by W. B. Hillhouse, chief State mine inspector, declared that in that well rock-dusted coal mine, coal dust, nevertheless, had taken part in the explosion, as was evidenced by the coke found along the headings. However, if a flame from burning methane passes along a coal gangway, some coking is inevitable, both of dust and coal in the bed. When the latter is coked, one does not say the coal in the bed is explosive, and perhaps one should not say the coal dust exploded when it is well mixed with inert dust, even though it has been coked and, therefore, must have given out some combustible gas and thus have entered in a degree into the explosion. At Mulga, the rock dust evidently almost suppressed the explosion, whether of gas or coal dust; there was little violence, and death came largely from afterdamp.

At the Wharncliffe-Woodmoor Colliery, in England, where, as at Mulga, methane accumulated because a door was left open for tramming, the explosion extended to parts of the mines not short-circuited by the door; hence in places it probably was a coal-dust explosion activated by a little methane and partly suppressed by rock dust, which dust had been made by grinding dolomite. The rock dust evidently failed to rise sufficiently to put out the flame. Here again was little violence, and in most cases death came from burns and asphyxiation.

Though the Safety in Mines Research Board (British) has been studying for five or six years the dispersion or raising of dusts by an explosion, only recently has it given details of its results and conclusions. Addressing the Midland Institute of Mining Engineers, F. W. Tideswell and R. V. Wheeler said that on a roadway of 50 sq.ft. cross-section a layer of coal dust of average flammability, no more than 1/500th of an inch thick, will provide a cloud of sufficient density to propagate flame.

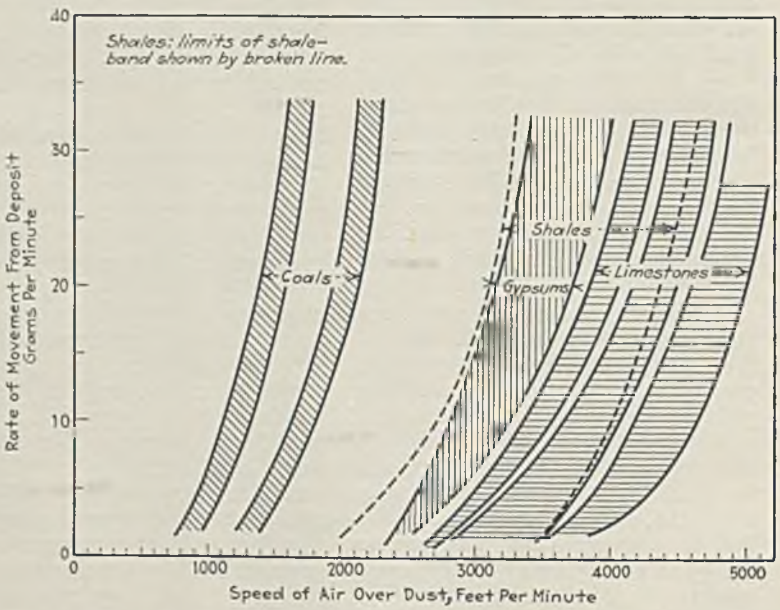
In the experiments made on the flame propagation by mixtures of coal dusts and incombustible dust, the least speed at which flame can travel with assurance that it will not die out through lack of fuel is about 6,000 ft.—somewhat more than a mile—per minute. In judging the dispersability of dusts, therefore, under the most critical conditions in a mine explosion, the speed of air currents should not be much less than that figure. Three consecutive, but overlapping, phases of dust dispersion should be distinguished: (1) the moving of the dust from rest; (2) the dissemination of the moving dust into the air; (3) the immediate tendency of the cloud to settle according to size and density of particles. Dusts that are most readily moved from rest are not necessarily also the most readily disseminated into the air.

Of most practical importance in limiting an explosion is the ease with which the dust can be moved from rest during the early, least violent, stages of the explosion. The ability of a dust to rise may be determined by the readiness with which it will rise when a sudden blast of air is directed vertically downward from a rose jet into a layer of dust in a tray, either soon after the dust has been deposited or after it has been exposed for some time to a normally dry or moist atmosphere.

Much more information can be obtained by passing a steady current of air over a deposit in a tray at the bottom of a small gallery. A gallery of 4 x 4 in. cross-section and 3 ft. long has been constructed for these tests with a fan blowing through a flat jet 1½ in. long and ⅜ in. wide, 6 in. from and ¼ in. above the surface of the dust. The quantity of dust moved from the tray is directly proportional to the time of exposure to the air current. A Pitot tube between the fan and jet measures the speed. The velocity of currents needed to raise dusts depends on the kind of dust. Thus coal dust is more readily raised than gypsum dust, and the latter is more readily raised than limestone dust, whereas shale dusts, which vary greatly in their action like limestone dusts, are for the most part intermediate between gypsum and limestone dusts.

However, exposure of dust renders it more difficult to disperse. This usually is ascribed to absorption and adsorption of moisture, but the decrease in dispersability occurs slowly and progressively when the air is not moist and so may be explained as a result of the settling of the dust into a compact mass. This effect has been observed particularly with limestone dusts. Loss of dispersability, however, bears no relation to quantity of water absorbed or adsorbed. Thus a shale dust that has absorbed 2 or 3 per cent of water may have suffered no greater loss of dispersability than a limestone dust that has absorbed only 0.1 per cent.

Absorption of water makes the particles heavier. As shale and coal readily absorb water this action is important with such dusts. Surface adsorption on the particles forms films which modify the adhesive or electrostatic forces acting between the particles. These are physical changes. The dust also may change its chemical condition — thus anhydrite (anhydrous gypsum) may be hydrated—and alternate solution and recrystallization on the surfaces of particles of materials soluble in water, like common salt, or in less degree gypsum, may bind the particles to each other. These chemical changes cause true caking, with resultant structural rigidity.



Dispersability of coal, gypsum, shale and limestone dusts under a rose air jet

Under the test with dust on a sunken pan in a gallery, only the gypsums were shown to lose their dispersability during exposure to an atmosphere 95 per cent saturated at 77 deg. F. Limestones and shales were less affected. No difference was observed between dolomite and calcareous limestones. Under the rose-jet test, the critical speed of air current required to move dust from the deposits was increased after weathering by several hundred feet per minute. All the weathered deposits tested, however, regardless of character of dust, were dispersable by air currents of lower speed than 6,000 ft. per minute. Expressing relative dispersability by weight in grams of dust per minute moved by the pan test, it was shown, as

Table I—How Dispersibility of Unmined Dust Depends on Its Condition

Condition of Dust Deposit	Relative Dispersability Grams per Minute Gypsum	Shale
Fresh	7 to 9	7 to 9
Weathered by exposure to moist air and undisturbed	1	6
Weathered by exposure to moist air and disturbed	8 to 10	10 to 12

Table II—How Action of Dusts Depends on Mixtures

Incombustible Dust	Relative Dispersability in Grams per Minute Fresh Deposit	Weathered Deposit
Gypsum		
Alone		1
With 20 per cent shale		5
With 20 per cent limestone	8 to 10	5
With 20 per cent talc		6
Magnesian Limestone		
Alone		3
With 20 per cent shale	8 to 10	4
With 20 per cent talc		6

in Table I, that the dispersability is essentially a property of the heap as a whole and not of the dusts themselves.

A deposit of dust, particularly after weathering, disperses less readily with increasing fineness. The authors do not add here that a fine dust is needed for putting out an explosion, but the finer it is, the more readily is it lifted. Hence, the determination of fineness is subject to two opposing requirements. They declare, however, that, if the pile contains a proportion of relatively large particles, the removal of dust by an air current occurs preferentially at and around these particles. The dispersability of a fine dust can be improved by adding coarser particles to it.

Prevention of caking and increased ease of flow of powders—for example, common salt—by the addition of a small proportion of some other substance is frequent commercial practice. Mixtures have been found to be more readily dispersed than any one kind of dust. Thus the resistance of gypsum dust to weathering is increased by admixture with coal, limestone, shale or talc, and the dispersability of limestones and shales is increased by mixing them together or with talc.

In Germany, say the authors, rock dust must remain capable of forming a cloud after exposure for one month in the return and, after exposure, for a week in a saturated atmosphere, and the prescribed test is to blow a sample off the hand by a puff of the breath; the dust then should disperse and remain suspended in the air as a cloud. But this is disturbed dust, and the puff of breath is variable and its direction uncertain. The authors recommend using a compressible bulb and blowing diagonally on the surface of a deposit of dust *in situ*. The area of surface of a layer of stone dust should be as great as possible, as it is not all raised at once.

In discussion, B. H. Pickering declared that rock dust should be distributed by machinery and this should be applied "little and often." The reason why coarse dust mixed with fine dust causes the latter to rise more freely is because it creates eddy currents, asserted Currer Briggs. It is not well to have 50 and 100 per cent of the dust fine enough to pass a 200-mesh sieve, as has been thought, and the new regulations for British mines recognized that fact. Weak coal-dust explosions are essentially vibratory, and one vibration will cancel another, so that in places there would appear to be no disturbance at all. It will not help the dispersability of shale dust to add limestone dust to it, but it will increase the dispersability of limestone dust to add more than 20 per cent of shale dust to it.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

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

Minerals Yearbook 1937, Review of 1936, U. S. Bureau of Mines. 1502 pp., 5¾x9¼ in.; cloth. Price $2.25.

In this volume 186 pp. are devoted to coal and kindred products, including coke and byproducts, fuel briquets and peat. A. C. Fieldner, in his usual illuminative manner, covers recent developments in coal preparation and utilization, including new uses for coal. It may be noted with interest that about as much anthracite and semi-anthracite (423,000 tons) is produced in Virginia, Arkansas, Colorado and New Mexico as is produced by dredges in the Pennsylvania region (517,304 tons) and is imported from Russia (395,413 tons, 1935). The United States probably produced 42 per cent of the world's tonnage, which is less than the proportion of the world's resources which the United States is believed to possess.

—◆—

Permissible Electricity Operated Rock-Dust Distributors, by L. C. Illsley, E. J. Gleim and H. B. Brunot, U. S. Bureau of Mines, R.I. 3345, 16 pp.; mimeograph.

All the rock-dust distributors approved to date by the U. S. Bureau of Mines are described in this report of investigations. They comprise nine machines made by three manufacturers, the first of which received approval Nov. 5, 1926.

—◆—

Geology and Fuel Resources of the Southern Part of Oklahoma Coal Field. Part 2—The Lehigh District, Coal, Atoka and Pittsburg Counties, by M. M. Knechtel, U. S. Geological Survey. 149 pp., one pocket map; paper. Price, 20c.

All the rocks exposed in this area, comprising a depth of 5,000 ft., are of Pennsylvanian age, except for scattered Pleistocene (?) and recent deposits. The Pennsylvanian beds are of the Pottsville and Allegheny series, with the coal beds all in the latter. Coal has been mined in this field for more than 50 years, most of it from the Lehigh coal bed, but some from the Lower Hartshorne, notably at the Hickory Hill strippings.

All the coal is of high volatile content. Ash and sulphur content are higher than in the near-by McAlester district, where ash runs from 4.9 to 5.7 per cent. Ash in the Lehigh district ranges from 6 to 14 per cent. McAlester's sulphur percentage lies between 0.6 and 1.1 and Lehigh's between 0.8 and 5.2. In the Lehigh district many of the mines have been cut off by real faults; the coal dips from 5 to 65 deg.; thicknesses of beds range from 3 ft. 4 in. to 5 ft. and softening temperatures of ash are low, from 1950 to 2340 deg. F.

—◆—

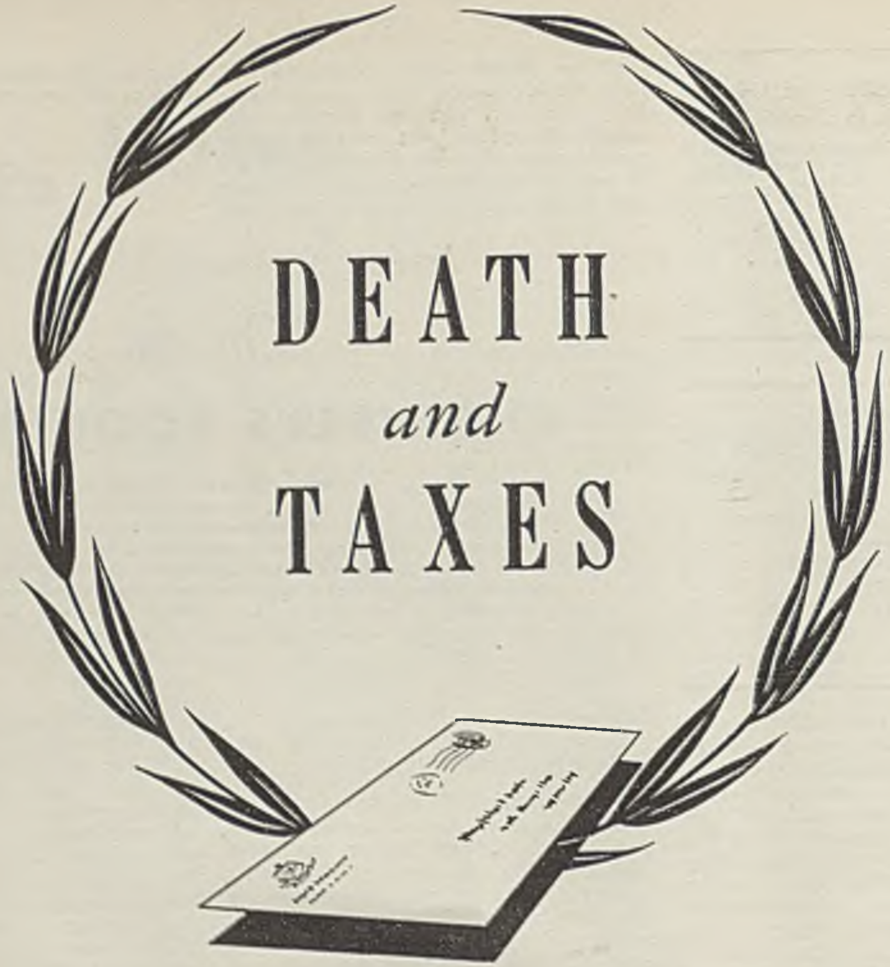
Fifteenth Annual Report of the Secretary of Mines for the Year Ended 31st December, 1935, and the Twenty-Eighth Annual Report of H. M. Chief Inspector of Mines for the Same Period, with a Statistical Appendix to Both Reports. British Library of Information, New York. 252 pp., 6⅛x9¾ in.; paper. Price, $1.10.

This publication briefly covers fuel treatment and utilization, Part 1 of Coal Mines Act of 1930, wages and profits, hours of labor, legislation, Miners' Welfare Fund, minerals other than coal, health and safety of all mines, petroleum tract licensing, mineral production and value, men employed, days worked, wages, distribution; consumption and prices of coal, coke, briquets, gas coal and other minerals; plant and equipment, and accidents.

—◆—

National Silicosis Conference, U. S. Department of Labor. Bulletin No. 13, 56 pp., 5⅞x9¼ in.; paper. Price, 10c.

This report, which is introduced by a preface and summary, contains the reports, Feb. 3, 1937, of the several committees on prevention of silicosis by medical control and by engineering control; on economic, legal and insurance phases of the silicosis problem, and on regulatory and administrative phases of the same, which reports were summarized in *Coal Age*, March, 1937, pp. 136–137.



...both can result from Unprotected Eyes

Every unguarded eye in your mine is a vulnerable spot for a wound that may prove fatal. And rare though fatal cases are, the chance of even one is not worth taking. For the human and economic consequences are much the same, whether death occurs or not. Impairment or loss of sight can mean death to a miner's hopes of livelihood for himself and his family — may mean adding the weight of several people to the tax burden for unemployment.

But the taxes that weigh heaviest are levied *directly on you*. Taxes for compensation, lost time and production. For administrative, clerical, medical costs. And *hidden taxes* that go on and on, that can't be checked or defined. All of which have to be charged against cost-per-ton.

Yet all it takes to save an eye, to protect a family's living . . . perhaps even to save a life . . . is an inexpensive pair of American Goggles. And experience has conclusively proven the dollar-value of a human attitude toward planned eye-protection. So call in your MSA representative . . . have him look over your operations and recommend the right American goggles for every man and his job

FOR COMPLETE EYE PROTECTION

The F-[illegible] Ful-Vue Goggle (patented)—effective eye safety . . . all-round visibility . . . comfort . . . good looks . . . self-adjusting nose pads . . . 6-curve Super Armorplate Lenses (patented) are made of tough, optical quality crown glass . . . have extra strength. Ful-Vues are made in sizes to fit all faces . . . may be furnished with wire mesh side shields if desired.

AMERICAN OPTICAL COMPANY

REPRESENTED IN THE MINE INDUSTRY BY MINE SAFETY APPLIANCES COMPANY

4335

OPERATING IDEAS

From Production, Electrical and Mechanical Men

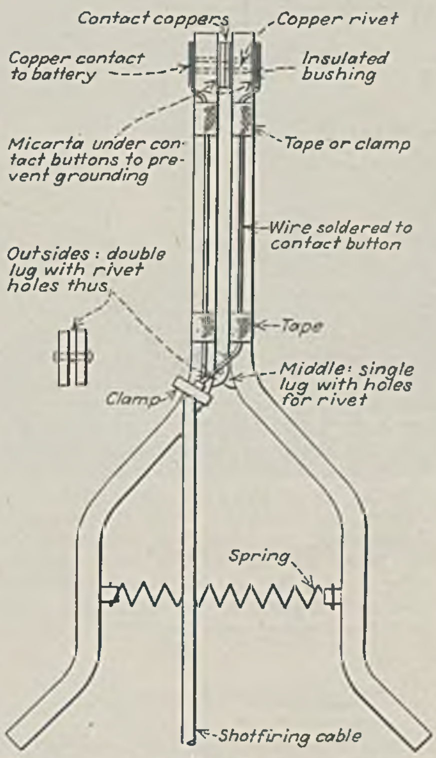
Old Rubber Belting Makes Insulated Coupling

"To comply with our insurance code," writes James Thompson, foreman, No. 1 mine, Reid Coal Co., New Bethlehem, Pa., "we were compelled to furnish some sort of insulated coupling to fasten our man trips or powder car to the electric locomotive. Trying out the strongest wood (supported by bolts) that we could find, we soon were convinced of its short life. In the search for a material that would furnish the strength, flexibility and insulating qualities necessary for a good, substantial coupling, we finally lit on discarded rubber belting.

"The belting was cut in strips the width and length of the links ordinarily used to couple cars and locomotive together. We then took four thicknesses of the belting and cut a round hole in each end for the coupling pin. Around this hole we ran strap iron—both sides and at each end of the home-made link. The strap iron at each end covered about one-fourth of the entire length of the link. By means of four bolts the four thicknesses of belting were drawn firmly together, forming a strong insulated coupling that has proved quite satisfactory in service and at the same time complies with the insurance code."

Shotfiring Cables Shorted By Special Tongs

To assure automatic shorting of shotfiring cables when permissible shotfiring units are employed, Charles Parker, assistant foreman, Ocean mine, Pittsburgh Coal Co., Smithdale, Pa., suggests the use of the tongs shown in the accompanying illustration. These tongs keep the outer end of the cable shorted at all times unless pressure is applied to the handles to open the jaws. And, in addition to their automatic operation, the tongs also are more convenient than twisting the ends of the wires together after each shot and then untwisting them, or using some other means of applying and removing a short. Furthermore, it is impossible with the tongs to omit shorting through forgetfulness or carelessness. Also, there is much less likelihood of a shotfirer forgetting and leaving the firing cable attached to the shotfiring unit, as the tongs must be held in the hand and pressure exerted before the contacts can be applied to the terminals.



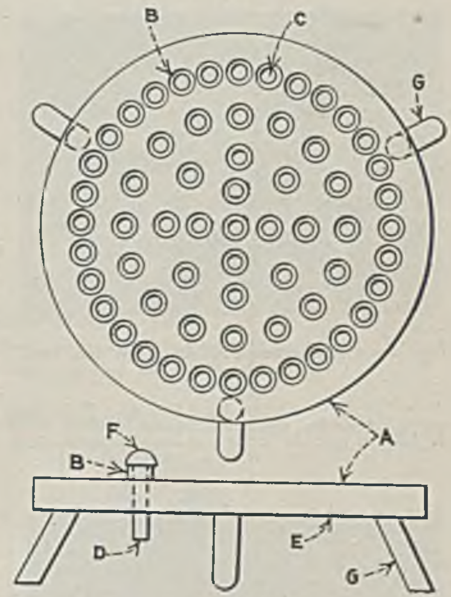
Construction details of tongs for automatically shorting shotfiring cables

Rivet Heater Promotes Efficient Use

On occasions when it is desired to use riveted construction in new work, or when it is necessary in maintenance, it may be quite difficult to heat rivets as they should be unless specific means are at hand for this purpose. Heads should be kept relatively cool, states John E. Hyler, Peoria, Ill., concentrating the heat as far as possible on the opposite end, where the other head is to be formed. The heating stand shown in the accompanying illustration, says Mr. Hyler, is excellent for this purpose, as it holds the ends of the rivets directly over a forge fire or other source of heat while the heads are masked and receive only that heat which is transmitted by conduction.

In constructing the heater, circles are scribed on the circular plate, *A*. These large circles serve as guides in marking smaller circles at points where short lengths of shaft or pipe, *B*, are to be located. Pieces *B* are best made of pipe somewhat smaller in outside diameter than the heads of the rivets usually handled, and are welded to Plate *A*. If pieces of round stock or shaft are used instead of pipe it will be necessary to drill through both the round or shaft and Plate *A*, whereas if pipe is used, only Plate *A* need be drilled.

The length of Pieces *B* is determined in advance to govern the amount the rivets will extend through the bottom of



Details of rivet-heating stand

Plate *A*, as at *D* in the figure. The diameter of the holes, of course, is somewhat larger than the diameter of the rivet body, so that the rivets can be readily removed after they are expanded by heating. Drilling oversize might well be determined by trial, as it is best not to make the holes any larger than necessary.

To avoid undue loss of heat and check

convection through Plate *A*, the lower surface may be covered by one or more thicknesses of asbestos paper, *E*, cemented in place by silica soda or otherwise fastened (the edges of Plate *A* may be drilled and tapped with small holes at intervals, if preferred, and tabs of the asbestos paper turned up over the edge where they can be fastened with small screws and dished-type washers).

As the rivet head, *F*, is larger than the pipe, it can be grasped easily by the tongs for removal. Spacing of the holes and rivet supports in Plate *A* should be adjusted to provide sufficient room for insertion of the tong jaws between the rivet heads. Rivets may be closely spaced in individual rows, as in the outside in the figure, if space is left between rows to accommodate the tong jaws. This system probably is best where maximum plate capacity is desired. Otherwise, the more open spacing, as in the center of the sketch, may be employed. As three legs offer a rigid support under all conditions, this is the number that should be installed, welding them in place with an outward flare.

1938

• What the new year holds will be revealed as the months go by. But there is no reason to expect a recession in the drive for lowering costs and increasing efficiency and safety at coal-mining operations. Major steps in these directions will be, as usual, the subject of articles in our feature section. Large-scale efforts, however, are not the whole picture in coal-mine operation, as less-spectacular improvements by operating, electrical, mechanical and safety men may amount to a substantial saving in the aggregate. This department will continue to present selected examples of such improvements in the next twelve months. To do this in the best possible manner, it solicits your help. If you have developed something that has saved money, eliminated delays or increased safety, send it in. A sketch or photograph should accompany the item if it will help to make it clearer. For each acceptable item Coal Age will pay $5 or more.

★ ★

Hints From a Shopman's Notebook: Forming Auger Spirals

By WALTER BAUM
Master Mechanic, Perry Coal Co. O'Fallon, Ill.

TO WIND ⅛x⅝-in. mild-steel bars 16 ft. long into coils as the first step in the construction of 3- and 6-ft. coal-auger extensions, using extra-strength 1-in. pipe, I have developed the jig described below. Use of extensions of this type was started with the adoption of Cardox shooting, employing shells about 42 in. long. I make three 3-ft. and nine 6-ft. extensions for a material cost of $9.60.

The body of the jig was made out of a piece of 4 15/16-in. shafting 6½ in. long, which was chucked in a lathe and a hole 1 21/32 in. in diameter bored through it, followed by boring out one end to a diameter of 2⅞ in. for a distance of 2¼ in. (Fig. 3). One side of the shaft then was cut off to make a flat bottom 3½ in. wide and a recess was made in one end to accommodate the lug on the coil guide. This coil guide (Fig. 4) is cut out of 1½-in. plate so that it will fit around the jig body as in Fig. 2, with the lug on the guide just clearing the mandrel on which the coils are wrapped. When made, the guide was placed on the jig body, leaving a ⅛-in.-wide opening (Fig. 2) for the coil bar to enter. Holes to hold the guide to the body then were drilled and tapped with ½-in. USS tap.

Fig. 1—Jig disassembled to show the various parts

B is the body of the jig (Fig. 3); *G* is the guide (Fig. 4); *M* is the mandrel (Fig. 5); *N* is the nut (Fig. 6); *D* is the lathe dog (Fig. 7); and *C* is a completed coil

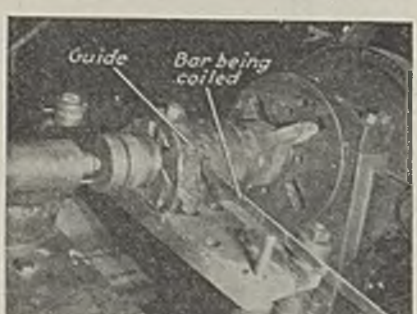
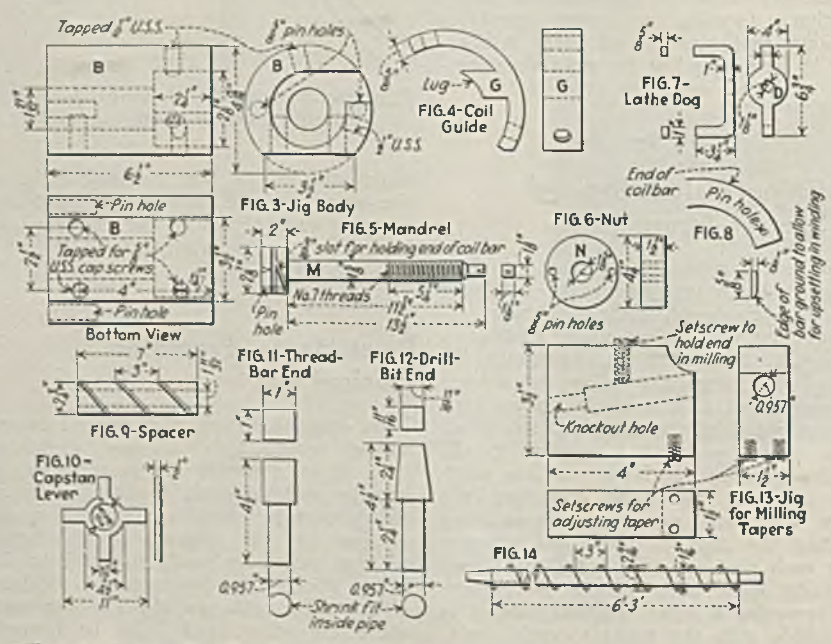
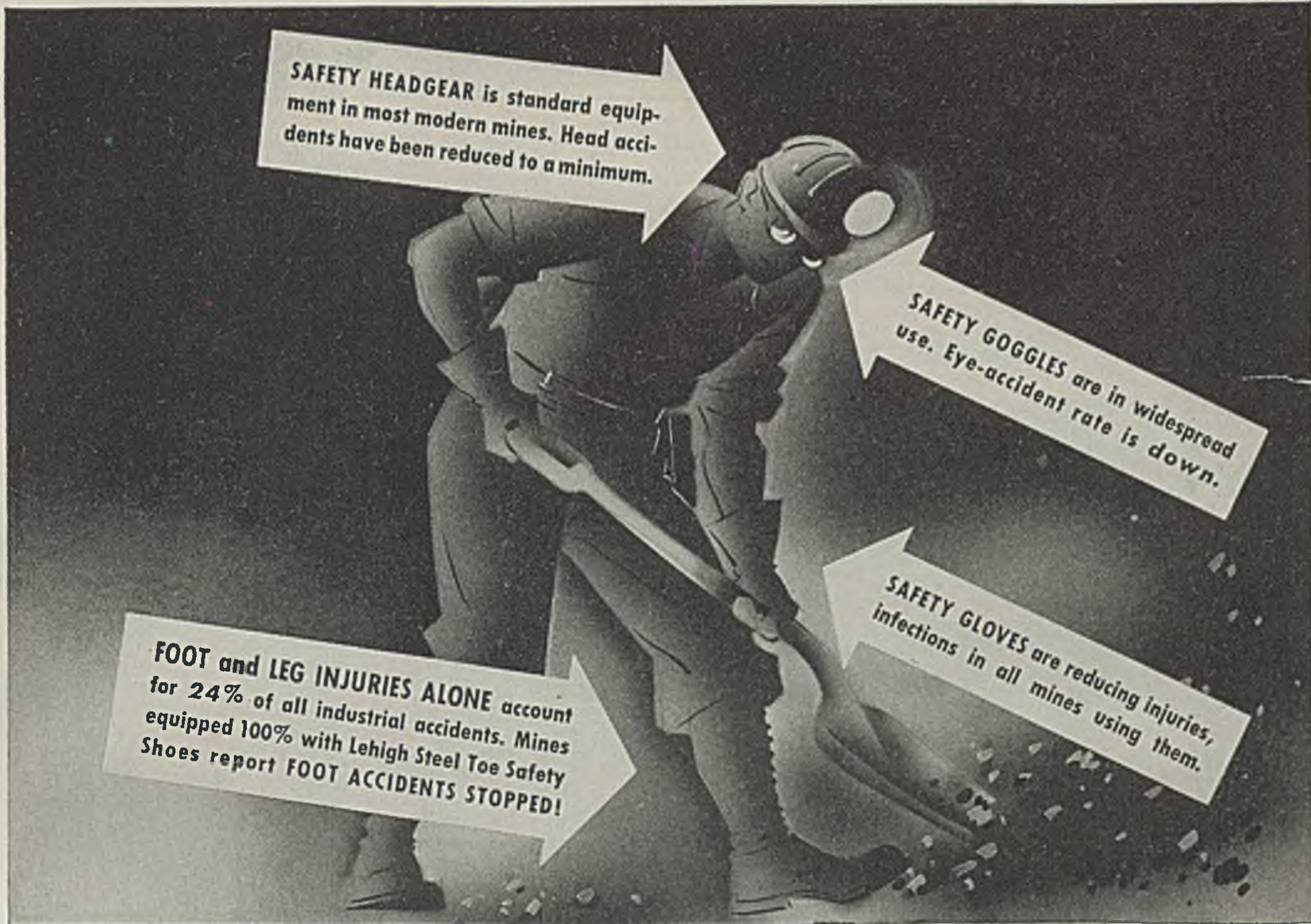


Fig. 2—Showing jig in operation, with coil being wound on mandrel

In making the mandrel, a piece of heat-treated steel was used with centers in both ends and one end made 1⅛ in. square (Fig. 5). Then a slot was cut in the large end to hold the end of the coil bar during wrapping, followed by cutting 5¼ in. of No. 7 threads on the squared end. Then a nut was made as in Fig. 6 to fit the threads and the mandrel was put in the jig body and the nut run onto the mandrel until it rested against the body. Afterward, ⅝-in. holes were drilled through the nut and into the jig body to accommodate pins for holding the nut from turning. Next, the lathe dog shown in Fig. 7 was



Figs. 3 to 14—Details of coil-winding jig, spacer for applying spirals to pipe, ends for auger extensions and jig for milling tapers, and sketch of completed extension.



STOP COSTLY FOOT INJURIES IN 1938!

● It will chop your accident frequency rate by as much as 24%. It will save you up to 20% of your compensation expenditure. It increases production by increasing man-hours. It lowers production costs by stepping up efficiency. ● It will take our representative just 10 minutes to lay the entire Lehigh Safety Program before you. Write him to call . . . TODAY.

MINER'S HICUT...A815
Natural retan 8 inch hicut blucher, leather storm welt, grid rubber outsole, chrome leather middlesole, whole rubber heel, brass rivets in shank, *steel toe box*.
Sizess EE 6 to 12

LEHIGH MAKES A SAFETY SHOE FOR EVERY MINING HAZARD

SPECIAL MINER'S PAC...101...White rubber 10 inch pac, black gum crepe cord sole, *steel toe box*, genuine leather insole. Sizes 5 to 12.

Note These Points of Lehigh Superiority

SAFETY ENGINEERS:
Send for our folder *"Stop Foot Accidents"* Free copy on request.

LEHIGH SAFETY SHOE CO. INC. ALLENTOWN, PA.

cut out of 1-in. steel plate and bent to shape.

To hold the jig on the lathe a cold-finished plate, 1¼x6 in. and long enough to span the T-slots on each side of the carriage, was selected and drilled with holes to match the T-slots. The mandrel was placed in the body of the jig and the assembly then was placed on the lathe centers. Keeping the holes in the end of the plate in line with the T-slots, the plate was blocked up under the jig body and marked along the sides so that the four holes to hold the body on the plate could be drilled and tapped in the bottom of the body with a ⅝-in. USS tap.

At this stage, the ¼x⅝-in. bar used in making the coils was bent at one end as in Fig. 8 and placed in the slot on the mandrel. To take care of the upsetting

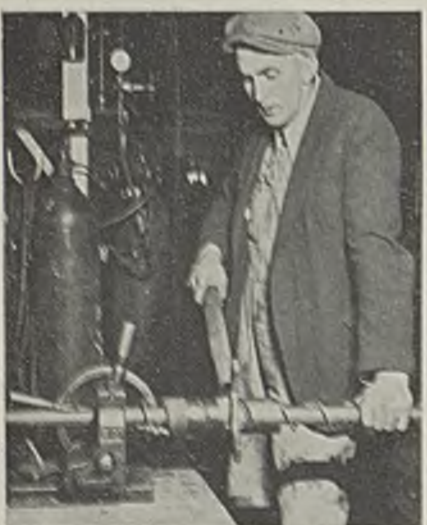


Fig. 15—Wrapping spiral on the pipe, using the spacer shown in Fig. 9

action in winding, one edge of the bar is ground off. With the jig body bolted to the plate and the plate bolted to the lathe carriage, the mandrel, with the bar in palce on the lathe centers the lathe through a hole in the end, was placed in the jig. Then the nut was run on the mandrel, drawing the head of the mandrel back in the body, and the pin was put in a hole in the nut and the body to hold the two stationary with respect to each other. Next, the lathe dog was put on the squared end of the mandrel, the guide was bolted in place as in Fig. 2, and with the mandrel in place on the lathe centers the lathe was started running in back gear at a slow speed to wind the coil bar on the mandrel (Fig. 2). A completed coil is shown in Fig. 1. While the jig is on the lathe, I usually wind 24 bars into coils, which last quite a while.

Putting the spirals on the pipe is a rather simple operation, requiring primarily only a spacer such as is shown in Fig. 9. This spacer is made out of a piece of 2⅞-in. shaft 7 in. long with a 1⅝-in. hole in the center. To lay out the spiral, a piece of stiff paper 3 in. wide was wrapped around the shaft on the desired spiral, after which the shaft was marked with crayon. Then the spiral was cut out with a hand torch—a neat job can be done without much difficulty. To complete the job, a capstan lever was cut out of 1½-in. steel plate as in Fig. 10 and welded to the middle of the spacer as in Fig. 15.

Starting the coil in the spacer the first time is a somewhat difficult task. This requires spreading the coils, cutting a ⅛-in. groove in the end of the pipe on the same angle as the spiral and then bending the end of the coil bar edgewise into the groove, where it is welded inside the pipe. The spacer is then turned onto the pipe. After a coil is threaded into the spacer it is never removed, additional coils being welded on to make the operation continuous. When the spiral is wound on a full-length pipe it is electric-welded in place, after which the pipe can be cut into the desired lengths.

Ends used in the auger extensions are shown in Fig 11 (fitting the drill thread-bar) and Fig. 12 (fitting the drill bit). These ends are turned out of 1x1-in. cold-finished steel, one end of each with a diameter of 0.957 in., providing a shrink fit inside the auger pipe. The taper on the end fitting the bit is made with the jig shown in Fig. 13. This jig is made out of a piece of 1¼x3½x4-in. mild steel drilled with a 0.957-in. hole on the same angle as the taper. Two safety setscrews in the bottom of the jig make it possible to raise or lower the jig to change the angle of the taper. A sketch of a completed extension with the ends in place is given in Fig. 14.

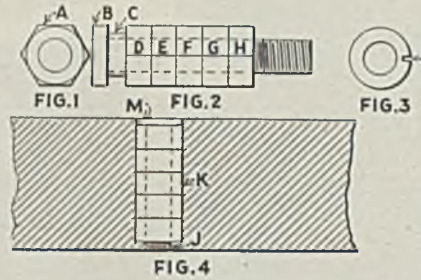
—◆—

Restoring Stripped Threads To Original Size

Generally, when the threads in a hole have been stripped it is tapped out to take a bolt of a somewhat larger diameter, thus restoring a full, clean thread. But in certain cases, points out John E. Hyler, Peoria, Ill., a special bolt may be involved or the threads must be kept the same diameter in order to keep the equipment in question standard. Where this is the case, an interesting method of restoring stripped threads is the insertion of a bushing made up of a number of nuts, although a specially made solid bushing may be employed. In most cases, nuts will be found the most convenient, first facing them on both sides in a lathe or grinder.

Fig. 1 shows an ordinary hex nut. In Fig. 2, five such nuts are strung on a bolt after facing, and are held away from the bolt head by a short bushing, *C*, to facilitate turning them in a lathe. While the corners of the nuts may not match, a thread match automatically is assured, and turning in a lathe will assure perfect cylindrical shape regardless of corner position. Bolt and nut threads, of course, match the original stripped threading. After the nuts are turned in the lathe, a light saw cut is run across them before they are removed from the bolt. This saw cut, *L*, Fig. 3, makes it possible to press the nuts in the hole in the proper relationship.

Fig. 4 shows a mass in which the threads are assumed to be stripped, with a small portion of the original hole threads left at *J*, the rest of the hole having been counterbored to receive the five nuts, pressed in lightly, as indicated by *K*. A strip of light sheet metal in the saw cuts insures registration of the threads of the various nuts. Finally, a light fillet of weld metal is run around the top of the hole wall as indicated at *M*, fastening the bushing in the hole and thus restoring the original thread. A tap may be run through the bushing to give the threads a finish cleaning, if desired.

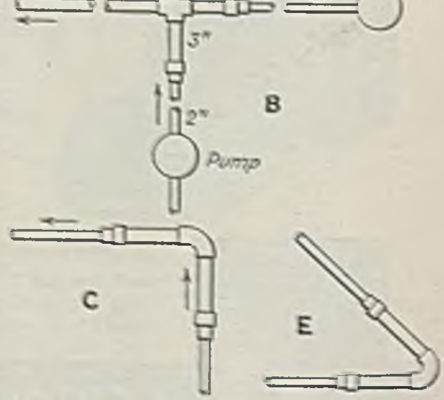


Showing method of restoring threads by using nuts as a bushing

—◆—

Eliminating Friction Head At Turns and Tees

Providing adequate room for the free flow of water at branch intersections and turns will eliminate the extra expense involved in laying straight water mains or in the higher power consumption growing out of friction in tees and turns where no free-flow provisions have been made, writes E. A. Smith, chief engineer, Cen-



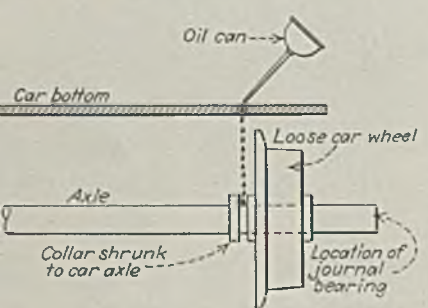
Showing diagrammatically how larger fittings and extensions can be used to eliminate friction head

ral Elkhorn Coal Co., Estill, Ky. For example, in View *A* in the accompanying illustration, the friction head would not be eliminated with even a 3-in. tee f both pumps were in operation. However, if the 3-in. pipe were extended one ength, or, say, 20 ft., into each branch ine all undue friction head would be liminated. This practice is shown diagrammatically in View *B* of the illustration.

In the case of View *C*, "it readily can be seen that a larger elbow can be used and a larger pipe extension made to eliminate all such friction head as would be nherent with the smaller pipe and fittings now in use. A similar enlargement of pipe extensions and fitting can be made at acute angles of intersection, as shown n *D*, with perfect results in friction-head elimination."

Holes in Car Bottom Aid n Oiling Wheels

Where loose wheels and outside journals are employed on mine cars, it quite frequently is difficult to get sufficient oil to work through the hub of the wheel to lubricate the axle collars unless the journals are overlubricated, remarks Charles W. Watkins, Kingston, Pa., in proposing the oiling method shown n the accompanying sketch. This in-

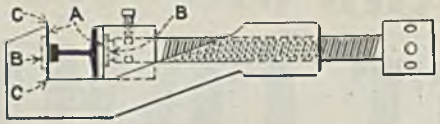


Holes in the car bottom get oil to the proper places

volves only drilling a hole through the car bottom directly over the axle so that oil can be dropped on the edge of the collar, on the edge of the wheel hub or directly between the two. If the running gear is in proper condition so that wheels and axles usually turn as a unit, only a small quantity of oil will be required. Oiling should be done in a place where the air is quiet so that the oil will not be blown away from the proper spot.

Straightener Would Salvage Surface-Bent Rails

To cut down the losses resulting from the surface bending of rails, Charles Parker, assistant foreman, Ocean mine, Pittsburgh Coal Co., Smithdale, Pa., suggests the use of a straightener such as that shown in the accompanying illustration.

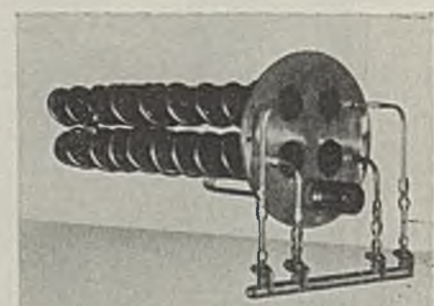


Suggested design of a straightener for surface-bent 60-lb. rails

Such straighteners, Mr. Parker points out, could be made in different sizes for different weights of rails. Also, they could be used on rails surface-bent in either direction by changing the screwhead and the hooks for holding the rail. The straighteners should be stronger than the usual rail bender and should be made of aluminum alloys for lightness.

Flexibility and Accuracy Feature Moisture Oven

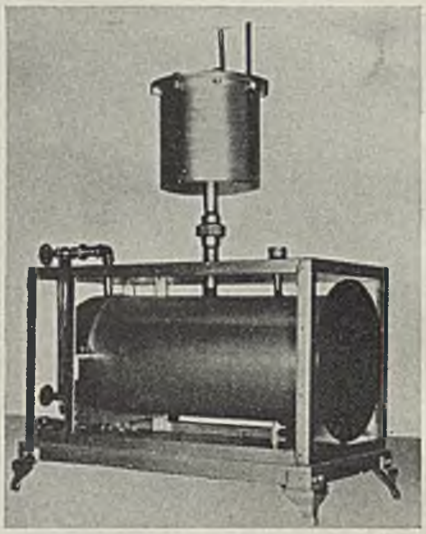
Flexibility, accuracy and ease of operation feature the moisture oven used at the testing laboratory of the Bell & Zoller Coal & Mining Co. at Zeigler No. 2 mine, Zeigler, Ill. The oven in question is patterned after the single-unit oven of the same type used by the U. S. Bureau of Mines and is the same size as a larger-than-Bureau unit employed by the Illinois Geological Survey. In many respects the Zeigler unit is similar to the Survey unit with the major difference that the former is electrically heated, whereas the Survey unit and the original Bureau of Mines units are gas heated, for which purpose insulation was omitted from the bottom of the solution cylinder.



Drying chambers in place on front flange of oven, showing compressed air coils around each chamber and the electrical immersion heater (beneath drying chambers)

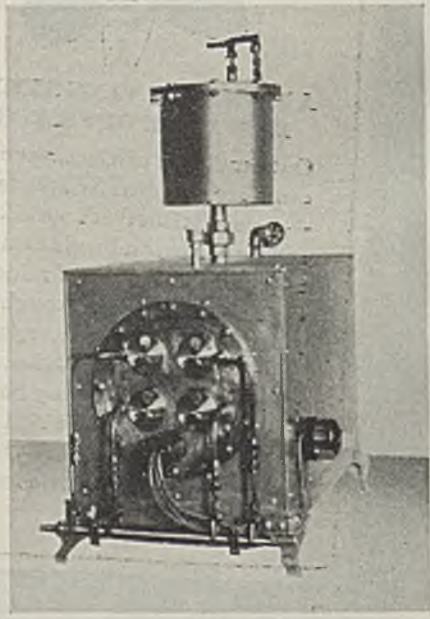
The Zeigler oven and its progenitors consist of drying chambers immersed in a solution of Prestone and water contained in a solution tank. In operation, water is returned to the solution tank by a reflex condenser, thus keeping the temperature of the solution at 105 deg. C. at all times. In the Zeigler unit, heat is supplied by a 2-kw. General Electric heater immersed in the solution inside the tank. With a 2-kw. input, about one hour is required to bring the solution up to temperature, after which it can be held at 105 deg. C. with a 500-watt input. By using an immersion heater, it is possible to fully insulate the solution tank with rock wool packed in a Transite case.

The Zeigler oven includes four drying chambers, each holding twelve samples. Chambers are entirely separate, and each can be used alone without interfering with any of the others. Moisture is carried out of the chambers by compressed air, which escapes through vents at the front. Air is introduced at the back of each chamber, first passing through coils to bring its temperature up to 105 deg. C.

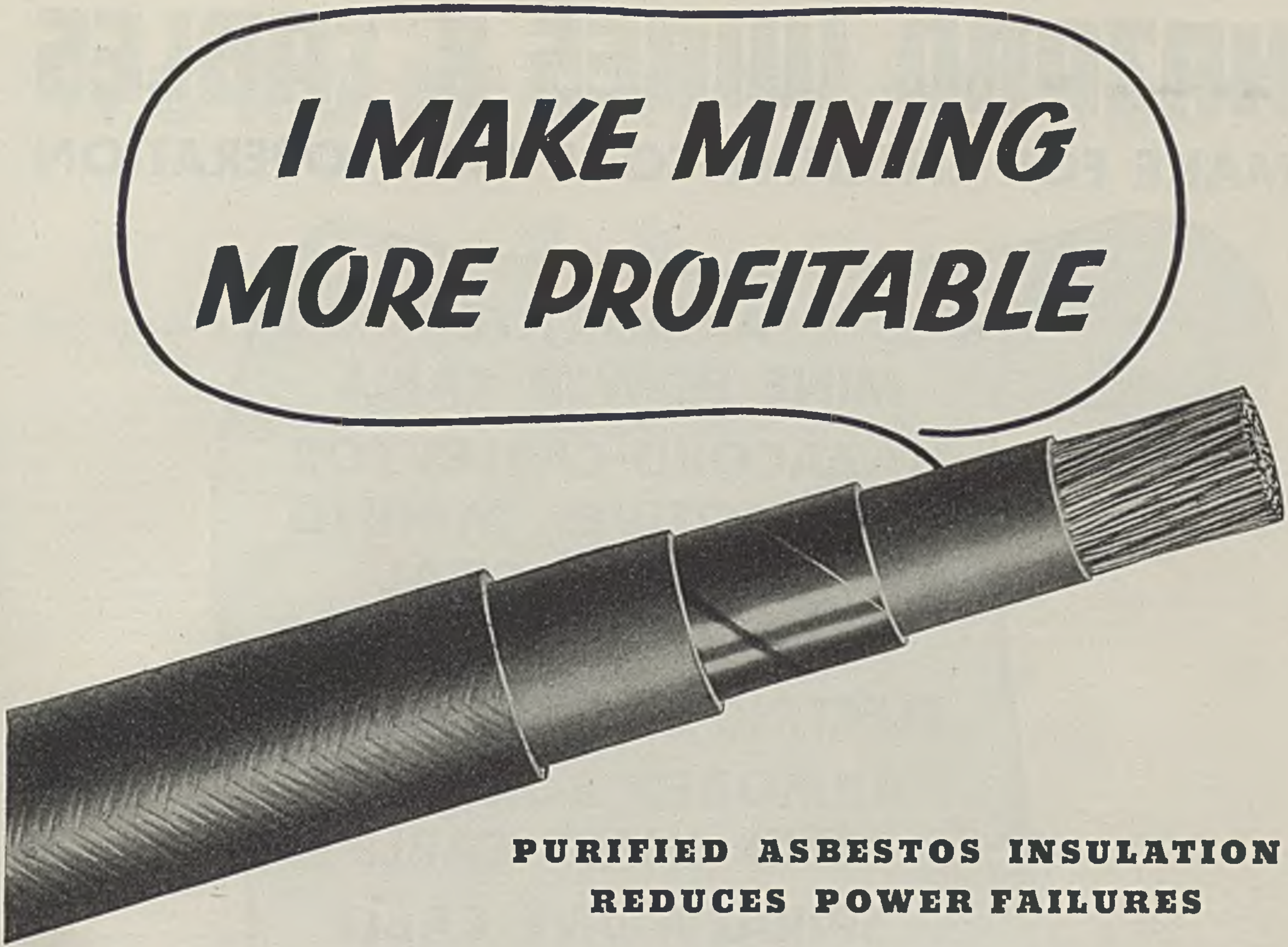


Solution tank in place in frame with reflex condenser installed

Adjusting cocks in the compressed-air lines permit regulating the flow of air to the four chambers so that each gives the same results as the others. A sulphuric-acid trap is employed to remove moisture from the compressed air, followed by a supplementary trap to remove any traces of acid.



Front view of completed oven



PURIFIED ASBESTOS INSULATION REDUCES POWER FAILURES

Consider the insulation on your motor lead cable — and the work it has to do. It must be immune to the damaging effects of heat, moisture, oil and grease. Above all, it must eliminate fire hazard — completely and lastingly.

Deltabeston Motor Lead Cable is insulated to assure your mine equipment of absolute protection. *Purified* Asbestos resists flame, heat, moisture and oil. Insulation, *felted to the conductors* by an exclusive process, eliminates joints and seams. Bending is easier and operation far safer.

Small wonder that engineers and maintenance men are enthusiastic about Deltabeston Motor Lead Cable. Small wonder, too, that they appreciate the completeness of the Deltabeston line. For, all Deltabeston Wire and Cable is insulated with Purified, Felted Asbestos.

Deltabeston Wire and Cable is distributed by General Electric Merchandise Distributors and Graybar Electric Company. The coupon below will bring you Deltabeston samples and descriptive bulletins.

Section Y-8183, Appliance and Merchandise Dept.,
General Electric Company, Bridgeport, Conn.
Gentlemen:

Please send me samples and literature on:

☐ Deltabeston Motor Lead Cable
☐ The complete Deltabeston Line

Name..

Street..

City..

GENERAL ELECTRIC

DELTABESTON WIRE AND CABLE

APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

WORD FROM THE FIELD

Basic Standards Proposed To Promote Safety

Eight basic standards for incorporation into State statutes to promote greater safety in mining have been proposed by John B. Andrews, secretary, American Association for Labor Legislation. These standards are the outgrowth of a series of conferences held in recent weeks by Mr. Andrews, acting in a private capacity, with representatives of mine labor, operators and federal and State officials and engineers interested in improved administration of mine safety regulations. The standards proposed would provide:

1. Selection of mine inspectors by a carefully safeguarded system of competitive merit tests. Such a system is now operative in Colorado, Maryland and Ohio and certain non-coal-producing States.

2. Provision for a one-year probationary period of training and experience for newly appointed inspectors, with a final qualifying examination by the board administering the merit system before permanent appointment.

3. Permanent retirement age-limit and removal on charges after public hearing before the board administering the merit system.

4. Requirement that before appointment and annually thereafter each inspector must submit a satisfactory medical certificate showing that he is physically fit to perform his duties.

5. A very considerable increase in minimum salaries in practically all States plus provisions for graded increases based on merit and term of service.

6. Provision for old-age and disability annuities for inspectors and extension of the State workmen's compensation laws to protect mine inspectors.

7. Maintenance of adequately financed and effectively organized State mine inspection service.

8. Adoption of a general safety law which in broad terms will make it the primary responsibility of the management to provide safe employment and which will empower the administrative department under proper procedure to make detailed mine safety regulations having the force of low. The statute also should include effective penalty provisions, making use of the cumulative civil penalty and encouraging compliance through accident-benefit differentials and adjusted compensation-insurance premiums.

Seeks Comment and Suggestions

"It is hoped," says Mr. Andrews, "that these tentative standards will serve immediately as a basis for further discussion and that ultimately they may suggest needed improvements in existing laws." To this end, Mr. Andrews, who acted as secretary of the conferences, invites comment and suggestions on the proposals briefed in the foregoing paragraphs. His address in 131 East 23d Street, New York City.

Philadelphia Mayor Pledges To Bar Gas Line

Mayor Wilson and the City Council of Philadelphia, Pa., were warned on Dec. 7 by a delegation of miners and merchants from the Pennsylvania anthracite region that introduction of natural gas into that city would ruin its large merchandise market in the hard-coal area. The Mayor promised that he would veto any bill providing for natural gas in the Quaker City and added that the city would take over the municipal gas plant and serve as its own operator beginning on Jan. 1.

The plant will use Pennsylvania anthracite, the Mayor said, stating that the United Gas Improvement Co., then operating the gas works, had been using West Virginia coal for ten years. Mr. Wilson made his promises while members of the City Council were attending a hearing on a proposal by John T. Cunningham, of Rixford, Pa., to pipe natural gas to the city and supply it for 60c. per 1,000 cu.ft., as against the existing Philadelphia gas rate of 90c.

COAL AGE was founded in 1911 by the Hill Publishing Co. In 1915 *Colliery Engineer,* with which *Mines and Minerals* previously had been consolidated, was absorbed by COAL AGE.

When, in 1917, the Hill Publishing Co. and the McGraw Publishing Co. were consolidated to form the present McGraw-Hill Publishing Co., COAL AGE became a member of this larger publishing enterprise. On July 1, 1927, the journal was changed from a weekly to a monthly.

During twenty-six years the editorship has been held successively by Floyd W. Parsons, R. Dawson Hall, C. E. Lesher, John M. Carmody and Sydney A. Hale. The editorial staff of COAL AGE consists of: Sydney A. Hale, R. Dawson Hall, Louis C. McCarthy, Ivan A. Given, J. H. Edwards and Walter M. Dake.

TVA Back-Door Move Opposed By Alabama Coal Men

Efforts to bring Tennessee Valley Authority power to the Birmingham (Ala.) district via the back door have met outspoken objections from the coal industry. Months ago the city of Birmingham proper turned thumbs down on a proposal to erect a municipal distribution system and purchase power from Muscle Shoals. Since then, however, three of its incorporated industrial suburbs—Bessemer, Tarrant and Fairfield — have voted for municipal ownership and tie-in with TVA lines.

Initial opposition from the coal industry was expressed by I. W. Rouzer, secretary, Alabama Mining Institute, who emphasized, in letters to mayors of the three cities, the danger of increasing unemployment in coal mining, one of the State's major industries. Another protest, entered by Henry T. DeBardeleben, president, DeBardeleben Coal Corporation, pointed out that mines supplying coal for the Gorges steam plants of the Alabama Power Co. employ 1,500 men while in operation. The power company supplies electricity for the three cities about to embrace TVA.

William Mitch, district president, United Mine Workers, declared to the mayors: "If power is secured from TVA and brought into this section it will displace a great number of coal-burning plants and therefore injure this community to the extent of taking away from the workers producing coal money that would otherwise be earned by them and spent in these localities. I sincerely hope you will give this matter due consideration before deciding to carry out the plans which I understand are now under consideration."

Asks Probe of Coal Rates

A joint resolution directing the Interstate Commerce Commission to investigate the effect of increased freight rates on bituminous coal and coke on the consumption and production of those products was introduced in Congress during the first week in December by Representative Henry Ellenbogen of Pennsylvania. The Commission also is directed to determine the effect on the use of substitute fuels, on the use of substitute methods of transportation and on employment and unemployment in the coal and related industries. The I.C.C. is to report the result of its investigation to Congress not later than Jan. 3.

Referred to the Committee on Interstate and Foreign Commerce, the resolution calls attention to the coal-carrying railroads having increased freight rates on coal and coke from 3 to 15c. a ton as of Nov. 15 and points out that the roads have petitioned for further rises. These increases, according to the resolution, will drive much coal traffic from the railroads by increasing the use of substitute fuels and the utilization of trucks for transportation, in turn depriving thousands of employment in the coal and other industries.

Mid-Western Consumers Inspect New Stripping Operation

Several hundred industrial buyers and retail coal merchants were guests of the United Electric Coal Cos. at an inspection trip to the new Buckheart mine of the company at Dunfermline, Ill., on Dec. 1. Special trains and buses brought the visitors to the operation, where Louis Ware, president of the company, and his fellow officers guided them along the strip pit and through the cleaning plant. Luncheon was served in what normally is the company garage for housing the big tractor-trailer units used in hauling coal from the strip pit to the cleaner.

The Dunfermline property approximates 1,500 acres, with coal reserves, it is estimated, for fifteen to twenty years. Overburden is removed with a 30-cu.yd. Bucyrus-Erie shovel and the coal is dug with a shovel of the same make having a 5-cu.yd. dipper. Walter tractor trucks with Austin-Western tandem trailer units with a capacity of 50 tons per unit carry the coal to a dump, from which it is conveyed to the cleaning plant, where Koppers-Rheolaveur launders and Carpenter dryers are installed. Provision also has been made for dustless treatment.

Rated capacity of the mine is 5,000 tons per shift. The Koppers-Rheolaveur launders, which wash all coal 4-in. and under, have a capacity of 500 tons per hour. A battery of loading booms ease the cleaned product into cars and serve seven loading tracks. Development work on the Dunfermline operation started early last year and the first coal for commercial shipment was loaded out on Nov. 15, 1937. The detailed story of the Buckheart mine will be presented in a series of feature articles which will appear in the March issue of *Coal Age*.

To Hold Safety Jubilee

The 1938 National Safety Congress will be held in Chicago, Oct. 10–14, at the Stevens Hotel. This is the silver jubilee year of the National Safety Council. There will be 200 sessions and more than 400 speakers. Every conceivable phase of safety will be considered.

Holmes Council Formed

Colorado's first district council of the Joseph A. Holmes Safety Association has been organized in Routt County by the Colorado & Utah Coal Co., Victor-American Fuel Co., Hayden Coal Co., Moffat Coal Co., Keystone Coal Co. and Bear River Coal Co. in cooperation with representatives of the State Coal Mine Inspection Department, the U. S. Bureau of Mines and the Routt County Coal Operators' Association.

Coal Commission Prices Put Into Effect Despite Deluge of Protests

WASHINGTON, D. C., Dec. 18—Despite a storm of protests, minimum prices fixed by the National Bituminous Coal Commission under the Guffey-Vinson coal control act went into effect at 12.01 a.m. Thursday, in Districts 1-13, covering producing territory east of the Mississippi as well as Iowa. Prices for District 13, announced on Dec. 9 ,were effective Dec. 27, and those for Districts 15-20 and 22 and 23, released the day before yesterday, are to take effect Jan. 3. Initial announcement of the figures by the Commission on Nov. 30 provoked outbursts not only from producers and consumers, requesting postponement of the effective date, but Senator Walsh of Massachusetts attacked the price-fixing order and urged abolition of the Commission unless it "adopts a very different policy."

Prices for District 13, announced on Dec. 9, were effective Dec. 27, and those for Districts 15-20 and 22 and 23, released the day before yesterday, are to take effect Jan. 3.

As a result of complaints, however, the Commission on Wednesday lowered prices about 5c. a ton on about 80 per cent of the coals produced in District 1 (eastern Pennsylvania) and on low-volatile slack shipped to the South from District 7 (Southern No. 1). There also were modifications in Districts 4 (Ohio), 6 (West Virginia Panhandle), 8 (Southern No. 2), 9 (western Kentucky), 10 (Illinois), 12 (Iowa) and 13 (Southeastern). Temporary relief granted on a petition of District Board 11 (Indiana) permits the Enos and Binkley companies, located on short lines, to deliver locomotive coal to connecting trunk lines at an "on-line" price. An order also was issued temporarily permitting a producer in an emergency to substitute a higher grade or size of coal than was ordered.

Mine-worker employees of code members have been exempted from price provisions of the control act to the extent that they are permitted to purchase coal for use in their own homes at customary reduced rates. Continuance of this privilege was allowed by a ruling of the Commission on Dec. 13, investigation having shown that such arrangement is part of the miners' working agreements, constituting part of their compensation for their labor.

As spokesman for the Pocahontas Fuel Co. and its subsidiaries, H. R. Hawthorne objected to the Commission rule forbidding contracts for longer than 30 days and attacked the requirement that coal treated with chemicals, oil or wax must be sold for at least 10c. a ton more than the price for the same size and grade not so treated. Asking a suspension of the price schedule, Joseph M. Messnig, Assistant Attorney General of New York State, alleged that the prices discriminated against New York consumers. John Carson, Consumers' Counsel, asked a hearing for examination of the factual data on which prices were based, alleging it to be necessary for "a proper basis for making adequate objections to individual prices which are injurious to consumers." Counsel for the Association of American Railroads asserted that the published prices would result in an average increase of 20c. a ton for railroad fuel and would add $21,000,000 to the fuel bill of the carriers.

Carter Company Fully Informed

A total of 40 formal hearings had been scheduled by the Commission on Tuesday as a result of requests by producers, though seven of these later were cancelled at the request of the petitioners. Others were taken under advisement in executive session. After oral hearings, however, the Commission dismissed a number of complaints including those of the Rochester & Pittsburgh Coal Co., Barnes & Tucker Co., Helvetia Coal Mining Co., Ebensburg Coal Co., Kent Coal Mining Co. and the Carter Coal Co. Although the last-named company, whose suit in the Supreme Court nullified the Guffey-Snyder coal act of 1935, asserted that it would lose 40 per cent of its business unless the price schedule was suspended and alleged that the time allowed for study of the prices was insufficient for preparation of a proper complaint, the Commission declared, in denying a suspension of prices, that the petitioner "had full knowledge and information of every step taken by the district board pertaining to the establishment of minimum prices and sufficient opportunity to ascertain the effect of the order" on his business. A public hearing on the Carter complaint, however,

(*Turn to page 86*)

Keeping Step With Coal Demand

Bituminous Production

Week Ended	1937 (1,000 Tons)	1936* (1,000 Tons)
November 6	8,600	9,647
November 13	8,688	10,106
November 20	7,908	10,317
November 27	7,218	9,825
December 4	8,080	10,581
Total to Dec. 4	415,822	400,312
Month of October	**40,675**	**43,321**
Month of November	**35,300**	**41,879**

Anthracite Production

Week Ended	1937	1936*
November 6	952	868
November 13	999	855
November 20	983	1,267
November 27	954	1,110
December 4	859	1,298
Total to Dec. 4	46,169	51,111
Month of October	**4,684**	**4,608**
Month of November	**4,273**	**4,334**

* Outputs of these two columns are for the weeks corresponding to those in 1937, though these weeks do not necessarily end on the same dates.

Bituminous Coal Stocks

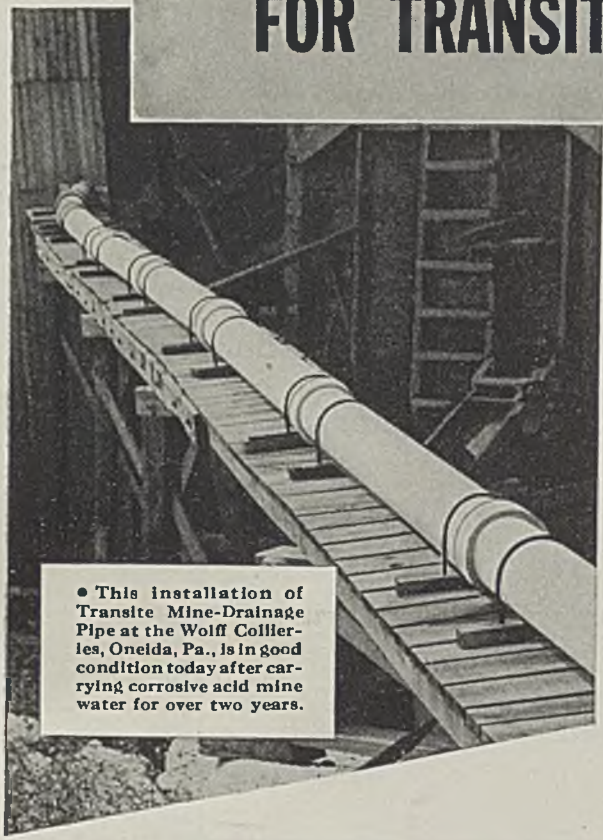
	(Thousands of Net Tons) Nov. 1, 1937	Oct. 1, 1937	Nov. 1, 1936
Electric power utilities	9,266	8,944	6,473
Byproduct coke ovens	8,067	7,761	7,296
Steel and rolling mills	1,290	1,292	1,033
Railroads (Class 1)	6,740	6,926	4,865
Other industrials*	14,581	13,969	9,736
Total	39,944	38,892	29,403

Bituminous Coal Consumption

	(Thousands of Net Tons) Oct., 1937	Sept., 1937	Oct., 1936
Electric power utilities	3,822	3,872	3,735
Byproduct coke ovens	5,723	6,284	5,844
Steel and rolling mills	928	1,000	1,168
Railroads (Class 1)	7,650	6,868	7,547
Other industrials*	11,176	10,075	10,684
Total	29,299	28,099	28,978

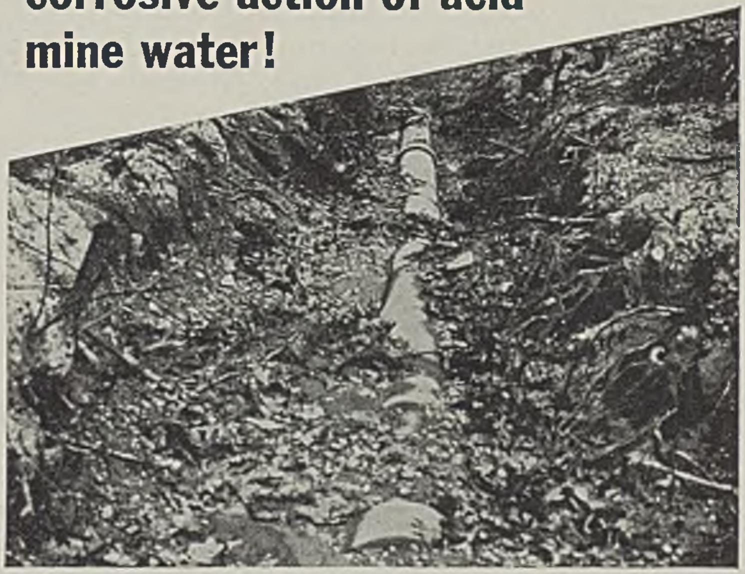
* Includes beehive ovens, coal-gas retorts and cement mills.

ANOTHER OUTSTANDING SERVICE RECORD FOR TRANSITE MINE-DRAINAGE PIPE



• This installation of Transite Mine-Drainage Pipe at the Wolff Collieries, Oneida, Pa., is in good condition today after carrying corrosive acid mine water for over two years.

Transite again proves its unusual resistance to the corrosive action of acid mine water!



THIS TRANSITE LINE, LAID IN AN OPEN TRENCH and carrying acid mine water, remains strong and durable because of its asbestos-cement composition, its inherent resistance to internal and external corrosion.

IN 1935, the Wolff Collieries installed 3200 feet of Transite Mine-Drainage Pipe to carry corrosive acid mine water to their "wet" breaker jigs.

Today, after more than two years of this severe service, this corrosion-resistant asbestos-cement pipe is still strong and durable—apparently good for a much longer period of virtually maintenance-free service.

This performance record is typical of many similar installations that are earning for Transite Pipe a reputation for being the most practical material ever developed for carrying acid mine water.

In addition to its long life and durability, Transite offers many other advantages. Light in weight, it is quickly, easily installed, even in restricted quarters and with unskilled labor. The use of Simplex Couplings assures bottle-tight joints, permits deflecting the line around curves or obstructions and enables rapid relocation, whenever necessary, with virtually 100% salvage.

If short life of mine-drainage pipe is one of *your* problems, why not get complete details on Transite? Just ask for the Transite Pipe brochure. Address Johns-Manville, 22 E. 40th St., N.Y.C.

ANOTHER VIEW OF THE ONEIDA INSTALLATION. Transite's Simplex Couplings assured rapid assembly . . . low installation costs. And, although the line is supported here only by wood blocks, these flexible couplings kept joints bottle-tight.

JM Johns-Manville Products

JOHNS-MANVILLE TRANSITE MINE DRAINAGE PIPE

Announcing

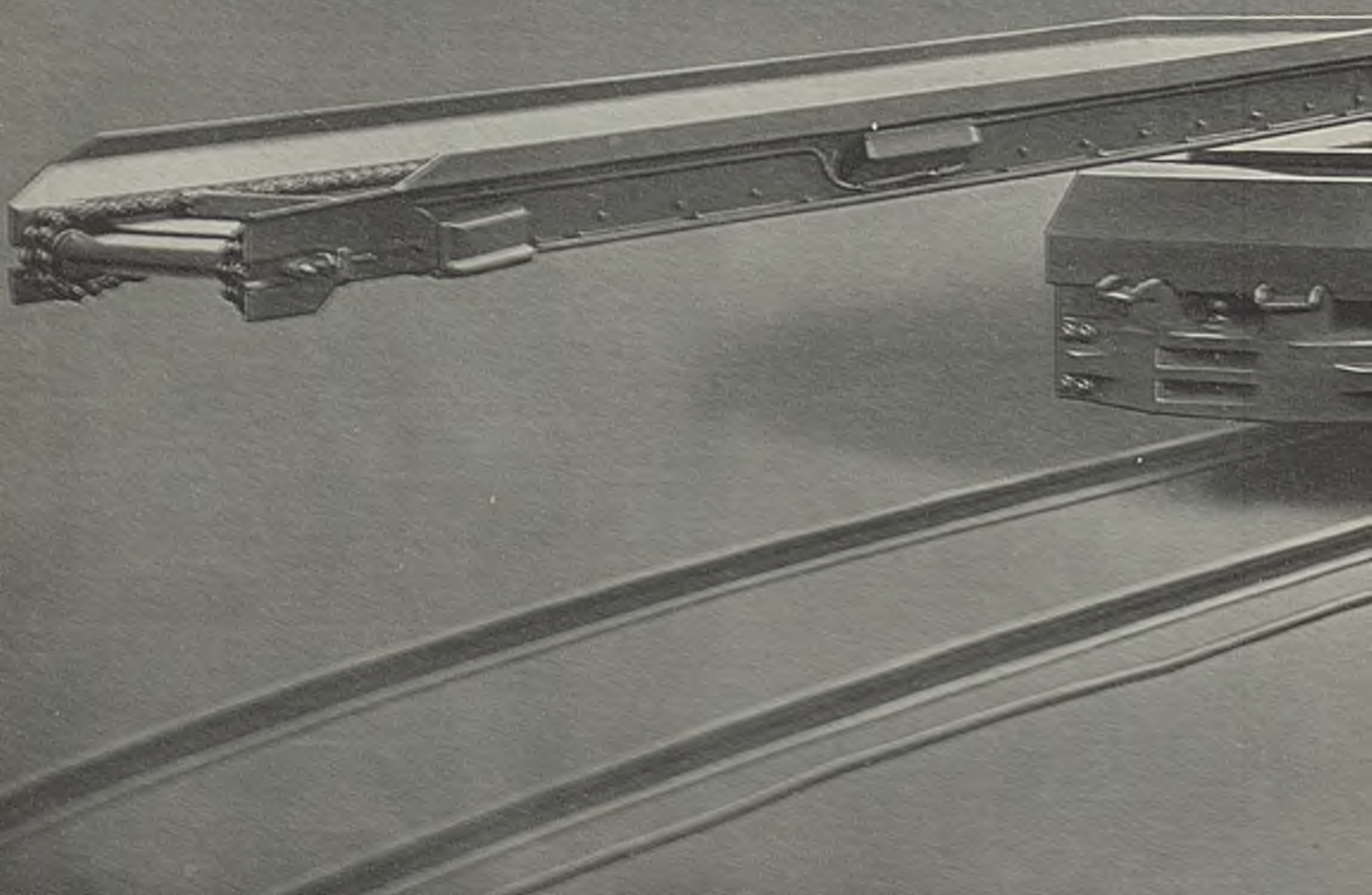
SINCE the first of the Goodman 260 track-type loading machines went into service five years ago, these loaders have established remarkably fine tonnage records under a variety of service conditions.

The excellent performance of the "260" brought an insistent demand for a loader that would be effective in low coal. The new Goodman 360 is the answer to that demand.

This modern loading machine for low coal, with its convenient control and powerful digging head, offers

Fast Maneuvering • Fast Loading • Fast Tramming

For additional information, write to the Goodman Manufacturing Company, Halsted Street at 48th, Chicago, Illinois.



was set for Dec. 28. Other hearings have been set for Dec. 20 and 21 and Jan. 17 and 20.

In announcing minimum prices on Nov. 30 the Commission stated that the prices for industrial and railroad fuel are somewhat higher than heretofore, "being brought into line with the cost of production as provided for in the Bituminous Coal Act." Conversely, however, the figures for domestic sizes, it said, are generally lower than average prices for such grades in the past. Prices were established on a basis, according to the Commission, which will permit adjustment of existing freight differentials limited to not more than 35c. per ton. Though such adjustments in the past have amounted to as much as $1 a ton, the limited adjustment was adopted on the principle that a producing district so situated that it could not reach a market without reducing its f.o.b. mine prices more than 35c. per ton was reaching too far for its markets. With approximately 150 marketing areas established, the Commission pointed out that the prices, shown in the accompaning table, showed the high and low prices in each district, for the most important classes of coals.

Initial classifications for coals for code members in all districts except No. 21—one of the final steps preceding the fixing of minimum prices—had been completed by the Commission on Dec. 11. The classifications proposed by the district boards took cognizance of the following factors: (1) proximate analyses: namely, moisture, ash, volatile matter, fixed carbon and sulphur, B.t.u. and ash softening temperature, analysis of ash and ultimate analysis of coal; (2) physical characteristics; (3) characteristics of performance. In the case of District 21 (North and South Dakota), the Commission has before it for adjudication the question of whether the coal produced there should not be exempt from the provisions of the act as lignite.

Coincident with the announcement of minimum prices, the Commission issued regulations that will govern the sale of all bituminous coal, effective Dec. 16. Boiled down from about four thousand rules suggested by the district boards, the regulations have been simplified into eleven sections covering: definitions, sales agents, registration of wholesalers, farmers' cooperative organizations, discounts and allowances, limitations of orders, agreements and quotations, spot orders, use of coal analyses, terms of payment, crushing and pulverizing coal and miscellaneous.

The definition of distributors has been reduced to the simplest form possible, that of sales agents and wholesalers, which, together with farmers' cooperative organizations, constitute the entire set-up.

Only two sources of remuneration for distributors are permitted under the rules: commissions to sales agents and discounts to wholesalers and farmers' cooperatives. Any person or group desiring to receive commissions or discounts must have registered with the Commission and proved his or their bona fides. The order prescribes the exact procedure which agents and wholesalers as well as farmers' cooperatives must follow in order to obtain recognition as such, and the compliance agreements to which each must subscribe.

Included in the rules and regulations is all that portion of the act [Sec. 4, Part 2, Subsection (i)] which lists thirteen general unfair methods of competition, which constitute violations of the code. These include consignment of unordered coal; methods by which secret and unfair rebates have been granted; obtaining information by bribes or gifts; misrepresentation of coal analyses, and splitting of commissions. Supplementing these prohibitions are others, one forbidding the payment of any commission or discount allowance on coal sold for locomotive purposes, and another eliminating discount from minimum or other prices on coal sold to any person for retailing by that person.

All agreements or orders for coal are restricted until further notice to a period of 30 days and no prices shall be less than the minimum prices in effect at the time of delivery. Exception, however, is made in the case of contracts with the Federal Government, States and local governments, with whom contracts may be made not to exceed one year, and options not to exceed 45 days.

Definite steps were taken by the Commission to prevent fraud through the use of false analyses of coal, no analyses being permitted to be used unless they are on file with the Commission and substantiated by fact. "All analyses so filed," the rules read, "shall be subject to inspection at the office of the statistical bureau . . . by any interested person." At the same time the Commission retains strict supervision over "premium and penalty" sale agreements.

Provision Covers Payment

Provision also is made for the terms of payment for coal, and failure to abide by and enforce these rules will constitute a violation of the code. Sec. 10 of the rules provides for registration of all crushing and pulverizing machinery and for the filing of complete data on the quantity and sizes of coal so treated to insure against evasion of minimum-price regulations.

The Commission suspended on Dec. 11 until further notice a provision reading "no code member shall sell any coal crushed or pulverized at a price less than the minimum price established for the grade and size of coal before the crushing or pulverizing process, plus 5c. per net ton." This action was taken in response to a large number of protests, most of which were presented informally. Similar action was taken on the regulation prohibiting the payment of commissions or discounts by members on coal sold for locomotive fuel purposes. Public hearings were set for January to decide whether these provisions should be modified or permanently abrogated.

A petition of District Board 12 (Iowa) asking for a division of Minimum Price Area No. 2, was dismissed on Dec. 8 by Commissioner John C. Lewis without prejudice. Iowa strip-mine operators had contended they needed a minimum price differential of $1 or more to enable them to compete with other mines in the State more advantageously situated with regard to transportation and markets. Previous testimony indicated that these operations are 1-20 miles off the beaten track.

The need for regulation of commerce in intrastate as well as interstate coal in Alabama was stressed by witnesses at a hearing held by the Commission Nov. 9-13 at Birmingham. Herbert S. Salmon, chairman of District Board 10, said that unless all traffic in coal in the State was regulated there would be cut-throat competition, lower wages, lower living standards for the workers, and inevitable suspensions. At the end of a two-day hearing at Dallas, Texas, Nov. 15-16, lignite producers asked exemption from the code on the ground

Basic Minimum Prices Under the Guffey-Vinson Coal Act

(As announced by National Bituminous Coal Commission Nov. 30)

	Domestic Lump	Egg	Nut and Pea	Railroad Fuel	Industrial Slack	Stoker Coal
Minimum Price Area No. 1						
District 1	$2.90–$2.60	$2.80–$2.50	$2.60–$2.30	$2.15	$2.40–$2.10	$2.60–$2.30
District 2	2.50– 2.20	2.35– 2.05	2.25– 1.95	2.15	1.86– 1.56	2.25– 1.95
District 3	2.50– 2.20	2.35– 2.05	2.25– 1.95	2.15*– 1.95*	1.96– 1.56	2.25– 1.95
District 4	2.40– 2.10	2.25– 1.80	2.15– 1.80	2.15	1.76– 1.41	....
District 5	4.55	4.05	3.60	3.60	2.80	....
District 6	2.20	2.05	1.95	2.15	1.56	1.95
District 7						
Low-volatile	3.20– 2.80	3.30– 2.90	2.25– 2.10	2.35	2.05– 1.55	....
High-volatile	2.60– 2.50	2.50– 2.40	2.15– 2.00	2.15*– 1.95†	1.90– 1.50	....
District 8	3.20– 2.25	2.50– 1.85	[1]	2.15*– 1.95†	1.90– 1.35	....
Minimum Price Area No. 2						
District 9	2.25– 2.05	2.05– 1.90‡	[2]	1.95	1.35– 1.00	....
District 10	2.75– 2.10	2.65– 2.00§	[3]	2.15	1.85– 1.30	....
District 11	2.75– 2.10	2.65– 2.00§	[4]	2.10	1.85– 1.30	....
District 12	3.80– 2.85	3.60– 2.70	[5]	2.70	2.50– 2.05	....
Minimum Price Area No. 3						
District 13	4.85– 2.35	4.85– 2.35	[6]	2.35– 2.15[8]	2.85– 2.10	....
Minimum Price Area No. 4						
District 14	4.75– 3.50	4.95– 3.60[0]	[7]	[7]	[7]	....
Minimum Price Area No. 5						
District 15	5.82– 1.90	4.95– 1.90	3.70– 1.80[8]	2.65– 1.70	1.55– 0.70	2.15– 1.10
Minimum Price Area No. 6						
District 16	5.10– 3.40		3.85– 2.65[9]			
District 16	4.75– 4.25		3.35– 3.15[10]		2.00– 1.60	2.60– 2.50
District 18	4.65– 3.75		3.75– 3.50[11]		1.70	
Minimum Price Area No. 7						
District 19	3.50– 3.15		3.10– 2.60[12]	2.50– 1.30	1.85– 0.90	
District 20	4.00– 3.50[13]	3.10– 2.55		2.70– 1.70	1.85	
Minimum Price Area No. 9						
District 22	4.75– 2.50			1.75– 1.55	2.50– 1.55	
Minimum Price Area No. 10						
District 23	5.25– 4.25	5.60– 4.10	3.35– 3.25[14]		3.90– 2.10	

* On line. † Off line. ‡ Furnace egg. § Large egg. [0] Grate, $4.70–$3.60; furnace, $4.85–$3.60; mine-run, $3.90–$2.70. [1] Nut, $2.25–$1.95; pea, $2.25–$1.95. [2] Nut, $1.90–$1.60; pea, $1.75–$1.40. [3] Nut, $2.45–$1.90; pea, $2.45–$1.90. [4] Nut, $2.45–$1.90; pea, $2.45–$1.90; [5] Nut, $3.50–$2.75; pea, $3.50–$2.75. [6] Nut, $2.85–$2.35. [7] Smaller sizes and industrial slack range from $5.20 for best grade of No. 4 nut to $1.05 for lowest grade slack in small sizes; smithing coal, $5; $6.50 if sacked. [8] Lump or double-screened, $2.50 on line; $2.30 off line.

[8] Quotation shown is for nut; chestnut, $2.45–$1.05; industrial nut, $2,65–$2.55. [9] Quotation shown is for nut; pea, $3.65–$2.40. [10] Quotation shown is for nut: pea, $3–$2.85. [11] Quotation shown is for nut; pea, $2.15–$1.75. [12] Quotation shown is for nut: pea, $2.60–$1.50. [13] Quotation shown is for 8-in. lump; 3-in., $3.85–$3.25. [14] Quotation shown is for chestnut; pea, $4.90–$2.10.

FOR THE NEXT JOB

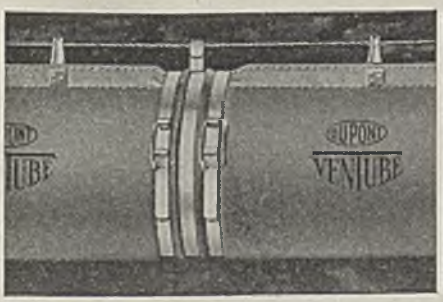
"Ventube" saves money!

Abandoned workings usually mean abandoned ventilating systems. But *not* when "Ventube" is used! All you have to do is take it down, roll it up and carry it to the next job. You salvage "Ventube"—and you save money!

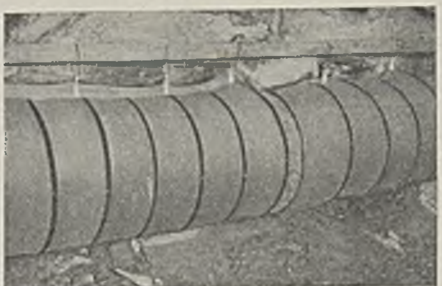
Flexible "Ventube" ventilating duct is made of extra-heavy, long-fibered Hessian cloth. It's *both coated and impregnated* with resistant rubber. It'll stand up under toughest mining conditions. "Ventube" is highly resistant to acid water, damp or dry rot, fungus, moisture, gases and concussion.

The new detachable coupling makes "Ventube" even more economical. Should machinery or heavy firing ever damage the tubing, merely cut out the mutilated piece and fasten the ends together with the coupling.

"Ventube" hangs fast! Assures adequate fresh air to remote faces! Gets rid of dust *faster!* Install a few sections and see for yourself how "Ventube" speeds up work and saves money!



The new-type detachable coupling permits economical cutting of tubing to any desired length. Eliminates purchase of expensive "Els." Provides quick and easy salvage of damaged duct. Makes possible elimination of whipping and slashing of duct due to concussion at working face.



"Ventube" aids in preventing dust explosions. The non-collapsible "Ventube," shown above, sucks out dust and stale air. The regular type "Ventube" gets rid of dust by blowing air into the rooms. Both types make work easier and safer . . . provide adequate fresh air to remote faces.

DUPONT
REG. U.S. PAT. OFF.

VENTUBE
REG. U.S. PAT. OFF.

THE FLEXIBLE VENTILATING DUCT

E. I. DU PONT DE NEMOURS & CO., INC.

"Fabrikoid" Division

Fairfield, Connecticut

that their product was not bituminous and therefore not subject to the provisions of the coal control act.

At a hearing held Dec. 9-11 in Kansas City, Kan., F. G. Tryon, director of the market statistics division of the Commission, testified that coal mined and consumed within Kansas was in constant competition with coal shipped in from neighboring States and elsewhere. Statements by S. A. Bramlett, executive secretary of Board 14; H. J. Kemspter, Southwest Coal Bureau; Henry Gould, Midland Coal Co.; A. F. McElhenie, vice-president, Pittsburg & Midway Coal Mining Co., and others bore out Mr. Tryon's contention. Similar hearings have been set for Arkansas at Fort Smith and for Oklahoma at Muskogee.

A resolution presented in the Senate on Dec. 1 asking that a committee be named to investigate allegations that the Commission has not functioned properly resulted in the naming of a subcommittee of the Senate Interstate Commerce Committee consisting of Senators Donahey, Ohio; Minton, Indiana, and Davis, Pennsylvania. Representative Byron N. Scott of California took similar action in the House on Nov. 22 following charges by George E. Acret, also of California, who resigned as acting director of the division of trial examiners of the Commission on Nov. 16.

In his letter of resignation Mr. Acret charged that Senators Guffey and McAdoo were "chiefly responsible for the almost complete breakdown of the Commission." He also alleged that fundamental differences between the members were involved in a plan by Chairman Hosford "to have the Commission grant, at the expense of general consumers, a special below-cost price on coal to the railroads." Mr. Acret was a member of the Commission under the Guffey-Snyder coal control act of 1935, but was not reappointed to the new Commission. L. R. Via, an examiner for the Commission, has been appointed acting director of the division of trial examiners.

U.M.W. Convention Set

The United Mine Workers has called a constitutional convention to be held in Washington, D. C., on Jan. 25. The meeting, which will be the 35th in the history of the organization, will be held in the Rialto Auditorium beginning at 10 a.m.

Sahara Dewatering Started

Dewatering of the No. 3 mine of the Sahara Coal Co., Harrisburg, Ill., drowned out in the flood of last spring, started early in December. Water is being removed by three Pomona deep-well turbine pumps, each driven by a 300-hp. Type C S Westinghouse 2,300-volt motor. Capacity of each unit, operating against a 240-ft. head, is 3,200 to 3,500 g.p.m. Operating 24 hours a day, about six months will be required to remove the estimated 3,000,000,000 gal. of water in the mine.

Pumps were purchased and installed by the Illinois Department of Mines and Minerals, and are set in one compartment of the hoisting shaft. A drainage ditch and flume were constructed by the coal company. Cost of power, it is expected, will be defrayed partly by the company and partly by the city of Harrisburg.

Crowded Sessions Deliberate Progress At American Coal Mining Institute

ALMOST all phases of mining were covered at the 51st annual meeting of the Coal Mining Institute of America, held at the Fort Pitt Hotel, Pittsburgh, Pa., Dec. 9 and 10. Sessions were devoted to safety, legislation, ventilation, mechanization, coal cutting, explosives, coal dust and mining methods. Over 300 persons were in attendance.

Rarely are cutting-machine bits guarded, though guards have been designed for this purpose and the Pennsylvania Bituminous Coal Mine Compensation Rating and Inspection Bureau levies a charge of 30c per $100 of payroll on those insurees who do not guard their cutter bars in accord with standards, as explained by L. C. Illsley, electrical engineer, U. S. Bureau of Mines, at the opening session, with W. R. Chedsey, director, School of Mines and Metallurgy, University of Missouri, in the chair. Bottom-cutting breast, shortwall and longwall chain mining machines must have their cutter chains protected by guards kept in places whenever machines are in operation to obtain a reduction in rates. Such guards should cover the cutting side of the cutter bar to within 18 in. of the end. Top-cutting chain mining machines must be hooded or guarded at the end of their cutter chains with a guard not less than 30 in. long whenever the machine is being moved or is not in operation. Contact buttons of starting boxes on all types of mining machines must be covered with protective seals. Because of compensation legislation, the charge will on Jan. 1, 1938, be raised from 30c. to 50c.

Between 15 and 20 minutes is lost on account of accidents for every ton of bituminous coal mined in the United States, thus increasing indirect costs, declared R. N. Hostler, superintendent, coal mine section, Pennsylvania Compensation Rating and Inspection Bureau. The new compensation rates under the act coming in force this year (1938) in Pennsylvania may add 70 per cent to the direct costs of accidents, but perhaps it may be in the 60s. Widows, in case of a fatality, will be paid for 500 weeks instead of, as now, for 300 weeks. Total disability will draw as much compensation as a fatality. Companies with good safety records will pay $4 per $100 of payroll and those with poor records will pay from $12 to $15.

In the new law, cited W. L. Affelder, vice-president in charge of operations, Hillman Coal & Coke Co., superintendents must not only direct foremen and employees to comply with the law but must "provide the means and see to it that they do so." Competent mine foremen must be employed in all mines having five or more employees instead of ten or more, as formerly. Shelter holes must be cut not less than 4 ft., instead of 2½ ft., and not more than 4 ft. wide instead of "at least 4 ft."

All firebosses, continued Mr. Affelder, must be certificated. Examinations of gas must be made three hours previous to each shift and danger signals must be placed across every entrance to a dangerous place. All conveyor entries must be of minimum width and height of not less than 4 ft., unless track is provided, when it may be not less than 2½ ft. high. Many other changes also were cited.

Electrical Rules Mandatory

All electrical rules have been made mandatory, said P. J. Callaghan, State mine inspector. In the old act, the classification of a gassy mine as a whole or in part for the exclusive use of closed lights was at the discretion of the inspector and a commission, but now open lights are excluded from any air split where explosive gas is detected. Long shelter holes, added P. F. Nairn, State mine inspector, furnish no protection against derailed cars, but under the law he had the right to demand that they be shortened even in work done prior to the date on which the act becomes operative; C. N. Pollack, general superintendent, Ford Collieries Co., demurred.

Should there be four switches in a substation underground, said one, it would be necessary to have more than "20 gal. of inflammable liquid" present, the limit under Art. XI, Sec. 22 of the new act. On it being stated he could use Inertine or Pyranol, non-flammable liquids, A. L. Barrett, electrical engineer, Pittsburgh Coal Co., asserted they could not be thus used; they were available only for transformers. Mr. Chedsey declared even then they could not be mixed with oil, and Mr. Illsley added that other transformers must be provided if the fluids thus were to be used.

In 1918, several shotfirers in the coke region lost their lives by explosions, and a mine inspectors' committee was formed to find cause and cure, recalled Richard Maize, Deputy Secretary of Mines of Pennsylvania, discussing under the chairmanship of C. W. Pollack, the first inquiry in the Question Box: "Do present regulations unduly favor the use of the flame safety lamp underground?" It was thought, Mr. Maize said, that these shotfirers made contact between the shorted metal parts of the electric lamp clips or

Coming Meetings

- Colorado Mining Association: annual meeting, Jan. 10 and 11, Pueblo, Colo.
- American Engineering Council: annual meeting, Jan. 13-15, Washington, D. C.
- College of Mines, University of Washington: annual meeting, Jan. 17-22, Mines Laboratory, University of Washington, Seattle, Wash.
- Fifth International Heating and Ventilating Exposition: Jan. 24-28, Grand Central Palace, New York City.
- American Institute of Mining and Metallurgical Engineers: annual meeting, Feb. 13-17, 29 West 39th St., New York City.
- Canadian Institute of Mining and Metallurgy: annual meeting, March 14-16, Royal York Hotel, Toronto, Ont., Canada.

battery casings and the unshorted detonators they were about to use.

The company which had these explosions ordered all detonator leads shorted at the several mine magazines at which they were stored and insisted on the explosives manufacturers shorting the leads of all newly purchased detonators. Later, other explosions occurred, and Mr. Maize's committee recommended the shotfirers be allowed to carry no lights other than flame safety lamps. Some inspectors required this in their districts.

Since that time, two new types of electric safety lamps for mine officials have been developed. Both have bulbs that incandesce only when the user presses a button on top of the battery. One is a cap lamp and the other has a light that the user carries in his hand and can direct where he will. Mr. Maize declared that this prevented the official from using the electric lamp when testing for gas and thus being blinded and unable to read the cap on his flame safety lamp. Also, having to keep his finger on the button would prevent him from using the electric lamp except when needed to examine the roof.

He might tie the button down, but this would be an act patent to everyone and would subject him to reprimand. Mr. Maize advocated a battery of one-third capacity which would give the wearer continuous service for only part of the day, compelling him to use it only for certain kinds of work. Too many officials with an electric lamp become oblivious to the flame safety lamp hanging from their belts.

Roof Falls Shotfirer's Care

In the ten years 1926–1935, asserted H. P. Vance, general superintendent, Butler Consolidated Coal Co., fatalities from roof-and-coal falls were 1.637 and from gas and dust 0.377 per million tons produced; thus four to five times as many were killed from the former group of causes. Hence, inspection of the roof is the most important of the shotfirer's duties. Belief that shotfirers neglect to test for gas is said to be the reason for prohibiting them from carrying an electric lamp, an evidence not of legal defect but of discipline. The tool he needs for ascertaining the condition of the roof, in Mr. Vance's opinion, is taken away. Electric lamps give 25 to 40 times as much light as the flame safety lamp, and work with the latter causes defective sight. In darkness, electric caps and explosives may be lost in the coal. How will the fireboss now examine the roof in haulageways to prevent falls of roof on man-trips?

As regards the shotfirer provision, asserted G. A. Shumaker, superintendent, Renton Collieries, Union Collieries Co., much depends on the roof, to examine which the shotfirer, in a gassy mine, should have an electric cap lamp. Is it not questionable, however, whether a shotfirer, who still has to face the electric lamps of other workmen at the face, will detect gas more efficiently when he does not carry a cap lamp? Why not leave this to the State mine inspector? he concluded. Shotfirers have too many duties, countered Mr. Callaghan. Too many shotfirers are so electric-light-conscious that they neglect the flame safety lamp. A superintendent who had a safety lamp on a hook from his belt went for two hours through the mine and did not once use it to find gas.

"Never have I heard of a shotfirer being killed by a roof fall in an area which produces a third of all the tonnage in Pennsylvania," said F. W. Howarth, State mine inspector. "All my inspections are made exclusively with the flame safety lamp, and I will not let any shotfirer do otherwise," asserted F. B. Dunbar, superintendent, Pickands, Mather & Co. "So do I," added P. F. Nairn, State mine inspector, "and they say I see more than the management would like me to see." In one mine he found all safety lamps out. They would not have been, if the men had carried no other light.

Permissible explosives bring down about 50 per cent of all coal blasted in mines of the United States, declared J. E. Tiffany, explosives testing engineer, explosives division, U. S. Bureau of Mines, and the mines which use these explosives include those with most gas and coal-dust hazards. Moisture and coal dust reaching the interior of shooting batteries are the indirect cause of many misfires. At some mines, shotfirer or miner must turn in his firing battery when he reaches the surface; a place is provided in which it is dried. Magazine floors should be swept regularly. If woodwork becomes stained with nitroglycerin, it should be scrubbed with a solution of ½ gal. of water, ½ gal. of wood alcohol and 2 lb. of sodium sulphite; a stiff broom, hard brush or mop should be used with plenty of the liquid to decompose the nitroglycerin thoroughly.

W. R. Chedsey
Retiring President

Irritants, asserted W. P. Yant, director of research and development, Mine Safety Appliances Co., attack membranes of eyes and nose severely, so persons breathing them usually leave before the gases attack the lung lining. When irritant gas is breathed, the nervous system inflames and closes the glottis by a flow of moisture.

Oxides of nitrogen are produced by incomplete detonation of explosives and, with slow combustion, as much as 10 per cent of oxides of nitrogen may be formed. Two parts per million are really injurious, but, unfortunately, with three parts per million one could continue working, and after a while the smell would not be noticeable. The gases may cause coughing, or a severe irritation of the lungs, with swelling due to the escape of watery fluid from the blood vessels, known as "delayed oedema"; still one might continue at work. However, in 10 or 12 hours water would rush into and drown the lung, suffocating the victim. In large concentrations, however, these nitrogen oxides may cause sudden death without much damage to the lung. Breathing these oxides causes colds which simulate pneumonia.

Hydrogen sulphide, continued Mr. Yant, is generated from iron sulphide by mine fires. It may come from sewage or other organic matter, probably in all cases through bacterial action. Possibly, it often exists in the strata and is exposed by mining. Five to seven per cent will lay a man out. Hydrogen sulphide causes conjunctivitis and inflammation of the nose.

Initial cost of pipe and reservoir to furnish adequate pressure at working faces to keep the coal wetted down for a 1,500- to 7,500-ton mine costs between $10,000 and $25,000, which, with depreciation, will be a fixed charge of 2 to 5 mills per ton of coal, estimated C. H. Dodge, safety engineer, Buckeye Coal Co. Maintenance charges with extensions on development including labor and material will be much higher, depending on the thoroughness with which the coal is wetted. Section maintenance labor will be at least a man-shift for each 500 to 750 tons of coal, plus additional labor for the heavier pipe lines.

One-inch pipe is used in rooms and working places, 2-in. in butt and room headings, 4-in. in cross headings and 6-in. in main headings with 20- to 50-ft. lengths of ½-in. hose in working places, the longer hose being provided for mining and loading machines; sometimes 20-ft. is insufficient for the hand loader. Mining machines have hose attachments to direct a stream of water along cutter bits into kerf. Ten to twenty hours later, on turning over the coal, little or no dry coal dust will be found. By wetting down coal dust, added Mr. Dodge, not only will the health of the workers be protected but visibility will be increased.

Water Cuts Rock-Dusting

Rock-dusting costs from 5 to 10 mills per ton of coal where water at the face is used and must be doubled in quantity and repeated five or ten times more frequently when dust is not laid by water. Water systems with a supply of rock dust have been found helpful in fighting mine fires. The underground worker appreciates this air conditioning; once initiated, he will not willingly forego it.

In Ohio, with meager figures available, declared J. W. Woomer, chief mining engineer, Hanna Coal Co. of Ohio, mobile-loading-equipment failure varies between 0.9 and 3.5 per cent of working time and locomotive failures 0.9 to 3 per cent when all 15-minute-or-less delays are eliminated. For delays shorter than 15 minutes, unit replacement by spare equipment is not justified. In Illinois, with accurate figures, the loss of time in mobile loading runs from 7 mills to 3 cents per ton, and delays in haulage dissipate between 5 and 6 per cent of the shift. There, usually, standby units are kept in their own working territories, and men are moved rather than machines. With standby loading and haulage equipment needed only 1 to 4 per cent of the time, obsolete or low-cost secondhand units may be the answer. Such provisions prevent inadequate "hurry-up" repairs being made.

"We put it up to our mechanical department," declared L. E. Young, vice-president, Pittsburgh Coal Co., "to keep our equipment in condition to run 105 hours (5 days and 21 hours per day) without equipment delays, so that reconditioning can be done at the week end."

The conventional chain or shaker conveyor, regretted T. F. McCarthy, general superintendent, Clearfield Bituminous Coal Corporation, has many faults. Hence, for a year, a large-capacity mobile Goodman self-propelling conveyor operating on a mine track between working face and heading has been used for room-and-pillar mining and the development of headings. Large capacity being desirable, the unit has been built for a 6 ft. 5½ in. track gage. Its length is 23 ft. over all and it measures 34 in. to top of side boards and 30 in. to top of conveyor from top of rail, but side boards can be adjusted to suit thickness of the seam, and a hinged side-board section at the rear of the conveyor can be dropped to facilitate loading. Extension sections of this unit are 6 ft. long and length used may vary from 14 to 26 ft. Conveyor length usually is governed by gradients encountered and radius of track curves installed. Capacity will range from 5 to 10 tons, depending on seam thickness and length of unit.

Delay-Absorbing Capacity

The equipment, he stated, is quiet, simple in itself and in operation; no one has to stay on the heading with it while working, and no heavy pans and materials have to be dragged to the face; also it has large storage capacity, thus eliminating delays. It has (1) small power consumption (a 5-hp. flame-proof motor suffices); (2) flexibility in operation; (3) low maintenance cost, rope being principal item of expense; (4) ready applicability to mining systems and conditions that require mounted cutting machines; (5) usability in more than one working place if desired; (6) suitability to places where gradients are too variable for conventional conveyors, and (7) usability in rooms on wider centers than are generally provided.

However, its width makes it difficult to use under bad roof and, where crossbars must be used, clearance is inadequate and capacity of conveyor is reduced. Width of advancing room also is limited to about 25 ft. unless track is moved across face. The crew is limited to three men if large daily earnings are to be maintained. Coal thickness where equipment is used is 3 ft. 8 in. With that height the conveyor will hold from 5 to 10 tons and more with thicker seams. It passes from room to room through the first crosscut from the heading. The four-wheel trucks being pivoted, it readily can be moved around curves.

Scraper-type loaders, continued Mr. McCarthy, have been made more movable and better suited for servicing with cars. The new development is a Goodman entry loader having a sectional boom extension attached to, and a part of, a wheel-mounted power unit. This extension has a solid bottom, except for openings graduated in size from the power unit to the front end, which is supported over the trip of mine cars by adjustable legs mounted on flat-faced, large-diameter wheels that rest on the mine bottom outside the mine tracks. Number of cars so accommodated is based on the number of cars a cut will produce.

At the beginning of the cycle, the loader is placed 15 to 18 ft. from coal face, and the rock has been brushed just ahead of the approach apron. In a 10- to 12-ft. heading, a two-man crew prepares and loads two to three cuts daily. As the extension section will accommodate all cars needed for loading the entire tonnage of a cycle, the crew keeps continuously at work. The heading advances in the coal 60 to 100 ft.; the loaders meanwhile drilling inclined holes in the roof, which on completion is brushed. The same two men shoot, trim and load out 30 to 40 ft. of rock, averaging 30 in. in thickness, per shift and complete the advance of 100 ft. in this rock in five to six man-shifts.

Two rows of holes 4 ft. apart are shot at one time and the rock is loaded. While cars are being changed, a second row of holes is tamped and shot and the roof trimmed preparatory to loading. On completion of the rock cycle, ties and rails are laid for permanent track. Seven man-shifts will lay, spike and bond this 100 ft. of 80-lb. track, extend the trolley line and advance the blower. In a man-shift, the scraper loader can be advanced and pipes extended for air and pumping. In moving ahead, the unit pulls itself along the track to its new position, to be held in place by roof jacks. Final cost of rock brushing, track, trolley, pipe lines and moving ahead is within 2c. per yard of the contract rate for this rock with hand methods, allowing no credit for the savings effected by loading coal at less than the mechanical rate. In a 10-ft. cycle about 46 per cent of the deadwork is for track and trolley-line advances. Though used only in top rock, it should give better results in the floor, for the entire 100 ft. can be shot before loading begins, hence the loader will wait only for car changes.

The Question Box being resumed, with W. L. McCoy, State mine inspector, in the chair, the question was presented: "To what extent does rapid extraction of pillars improve roof conditions and reduce roof-fall hazards?"

In Somerset County, coal is mined, by the Consolidation Coal Co., in the E (Upper Freeport) and C (Middle Kittanning) seams by driving rooms 275 ft. long and 40 ft. wide and leaving about a 10-ft. pillar, which is recovered promptly after the room is driven, explained L. H. Schnerr, division manager. His discussion was limited to the E seam, which is non-gassy. Almost all the pillar is removed by taking successive 30-ft. cuts with a 7-ft. cutter bar. This coal is loaded directly onto the main room conveyor, which is shortened on the completion of each cut. Two good crews will bring back a pillar to the room stump in two shifts, though others take three. Usually a full room is driven and pillar removed in twelve working days each of two shifts.

As soon as a room is completed, the face conveyor is removed and the pillar is extracted without regard to days otherwise idle. Over the E seam are sequently 8 in. of bone, 14 ft. of black slate, 32 ft. of sand rock, 91 ft. of shale and 55 ft. of sand rock; average cover is about 300 ft. This single-room system with narrow pillar has been used almost exclusively with 25 or 30 units for nine years. Other methods, however, have been tried.

With fair or good working time the roof fractures rarely overrun extraction. Trouble in a new panel occurs only in drawing pillars; two or three full rooms and pillars may have to be completed before a high break is obtained, hence weighting ensues. In rare cases, only part of the pillar of the third room can be cut, and the pillar is allowed to crush. With irregu-

1938 Institute Roster

President: C. N. Pollack, general superintendent, Ford Collieries Co., Curtisville, Pa.

First Vice-President: J. V. McKenna, State mine inspector, Waynesburg, Pa.

Second Vice-President: N. G. Alford, mining engineer, Eavenson, Alford & Auchmuty, Pittsburgh, Pa.

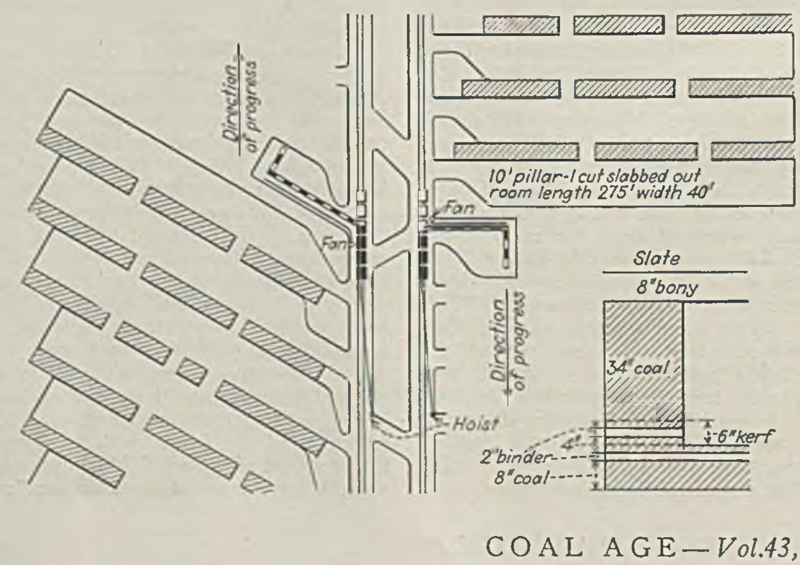
Third Vice-President: E. A. Siemon, general division superintendent, Hillman Coal & Coke Co., California, Pa.

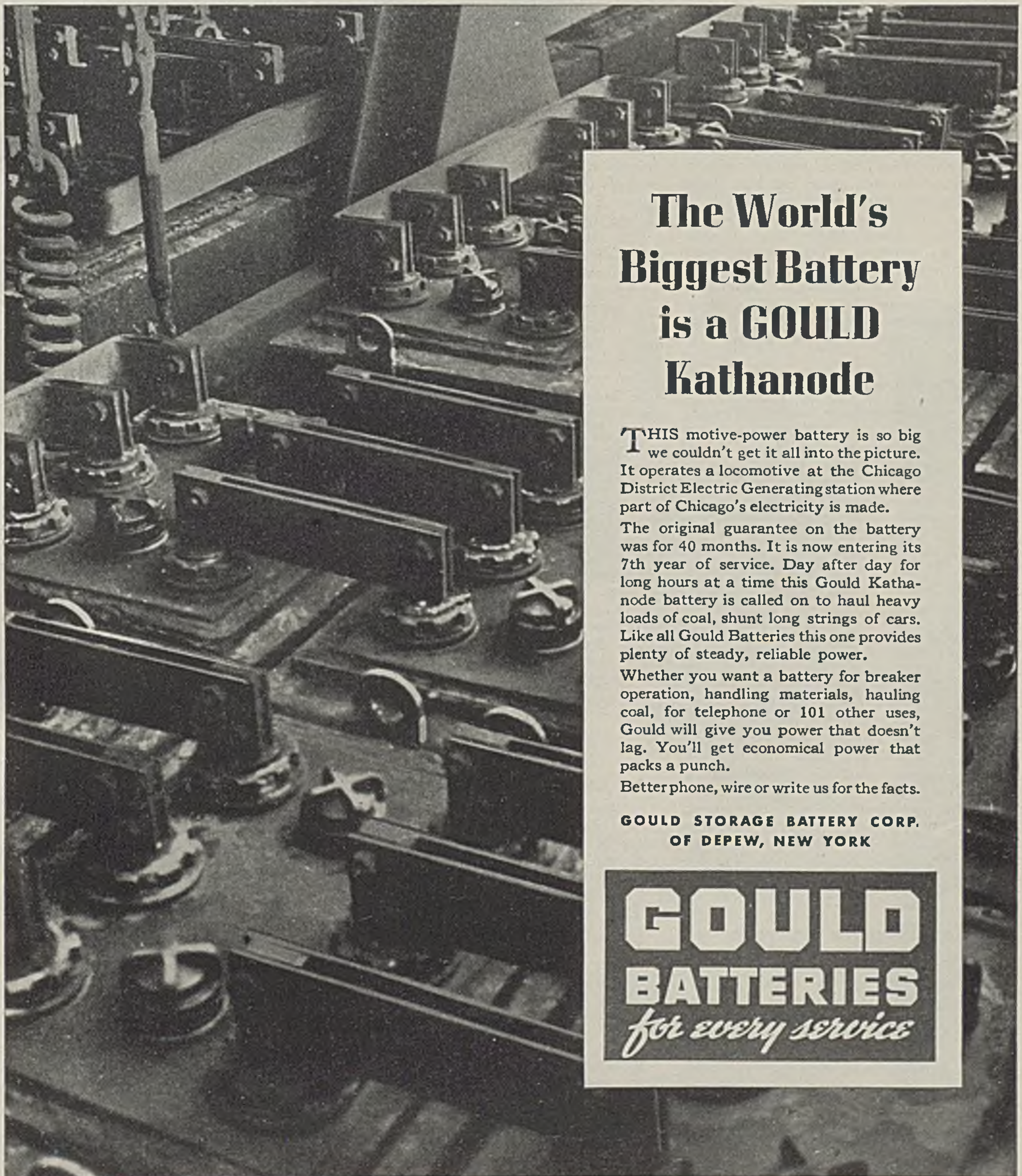
Secretary-Treasurer: G. W. Grove, associate mining engineer, U. S. Bureau of Mines, Pittsburgh, Pa.

Managing Directors: F. E. Bedale, safety engineer, Consolidation Coal Co., Fairmont, W. Va.; F. W. Howarth, State mine inspector, Republic, Pa.; J. M. Conner, general superintendent, Allegheny-Pittsburgh Coal Co., Pittsburgh, Pa.; W. R. Chedsey, director, Missouri School of Mines and Metallurgy, Rolla, Mo.; R. M. Black, professor of mining, University of Pittsburgh, Pittsburgh, Pa.

★

Layout and seam section at mines of Consolidation Coal Co., Somerset County, Pennsylvannia





The World's Biggest Battery is a GOULD Kathanode

THIS motive-power battery is so big we couldn't get it all into the picture. It operates a locomotive at the Chicago District Electric Generating station where part of Chicago's electricity is made.

The original guarantee on the battery was for 40 months. It is now entering its 7th year of service. Day after day for long hours at a time this Gould Kathanode battery is called on to haul heavy loads of coal, shunt long strings of cars. Like all Gould Batteries this one provides plenty of steady, reliable power.

Whether you want a battery for breaker operation, handling materials, hauling coal, for telephone or 101 other uses, Gould will give you power that doesn't lag. You'll get economical power that packs a punch.

Better phone, wire or write us for the facts.

GOULD STORAGE BATTERY CORP.
OF DEPEW, NEW YORK

GOULD
BATTERIES
for every service

lar working time, rooms may be narrowed and a few feet added thereby to pillars, in which is made only one cut, leaving a narrow strip to be crushed. Speed alone makes the system workable. With a few exceptions, unless several rooms are driven promptly after a room heading is started, the entire length of the heading will give trouble. The only fatality in conveyor mining in the Pennsylvania division was in an experimental set-up in which a much wider pillar than standard was being brought back "open ended."

In retreating entry stumps, the coal was hand-loaded into a room conveyor, but hand loading into cars is preferred. Rooms are timbered with two lines of posts for each 7-ft. cut, set at 4-ft. centers, and no posts are recovered. Only entries are triple-shifted. The falls are good, but, if the upper sandstone breaks, the surface fails to show it. When, in departure from the approved method, pillars are over 10 ft. wide, 3 to 5 ft. of coal is left. Two rooms have been driven together with a 15-ft. pillar between them, cut later from both sides, but this brought much grief.

Room entries vary greatly in length, but are made not over 2,400 ft. long. If conditions are favorable, the first room in an entry is provided with a 25-ft. pillar. Room work is never retreated from the end of the entry because the roof would collapse as the headings advanced. No gas comes from roof breaks; hence pressure is ascribed to water.

Rapid Extraction Cuts Falls

Not enough experience has been obtained as to the effect of rapid extraction on protection against roof falls, asserted E. R. Maize, assistant mining engineer, U. S. Bureau of Mines. Frequently, with rapid pillar extraction, changes in advance methods are made to aid retreat, and these modify the effect of rapid retreat, which in itself should be favorable to increased safety. As the time a pillar stands, as well as its size, determines its strength, immediate rapid extraction is better than delayed, but other factors are more important than speed and must not be overlooked. Safe rates of retreat have been found abroad to vary with type of roof. With rapid extraction, the maintenance of a straight break line is difficult, for a machine failure may put one portion of a rapidly retreating rib line out of step. It would be better to lose a few tons production than to allow this to happen. Methods of hand-loading at the mines of the Allegheny Pittsburgh Coal Co. were described by J. M. Conner, general superintendent (see *Coal Age*, November, 1935, pp. 442-443), and those of the H. C. Frick Coke Co., by B. J. Murphy, assistant safety director.

Test Plant for Colorado

The Colorado School of Mines, Golden, Colo., has been chosen by the U. S. Bureau of Mines as the site of a government testing plant for coals of the Rocky Mountain region. According to M. F. Coolbaugh, president of the School of Mines, four to six government fuel technologists will be employed on the project, under the direction of Engineer V. F. Parry. A laboratory will be erected at a cost of $100,000 to the federal government, with the State providing facilities costing $14,000 in addition to space for the plant.

Cleaning Large and Small Sizes Discussed At Ohio Valley A.I.M.E.

DEVELOPMENT and operation of the Battelle launder oprating at Nellis, W. Va., and testimony that hand picking may cost much more than mechanical cleaning, yet in many cases is considered indispensable, were the "rise" topics at the Charleston (W. Va.) meeting, Nov. 20, of the Coal Division, Ohio Valley Section, American Institute of Mining and Metallurgical Engineers. A. C. Fieldner, chief, technological division, U. S. Bureau of Mines, read a paper on "Fuels of Today and Tomorrow," which was his presidential presentation at the 40th annual meeting of the American Society for Testing Materials (*Coal Age*, August, 1937, pp. 383, 386). The status of coal preparation in Illinois was outlined by William C. McCulloch, chemist, United Electric Coal Cos. Julian E. Tobey, chairman of the Ohio Valley Section, presided.

The large number of re-treatments required to accomplish complete separation in the widely used type of trough launder, according to A. C. Richardson, concentration engineer, Battelle Memorial Institute, who presented the paper, led to the institute's inaugurating an investigation of flowing-current separation. That investigation resulted in development of the Battelle launder now in commercial use by the Nellis Coal Corporation and described on pp. 43-46.

Coal smaller than ½-in. presents the greatest difficulty, so the investigation was made using raw coal from southern Ohio, minus-⅜-in., and containing about 6.0 per cent material above 1.55 sp.gr. First tests were with a launder 20 ft. long, 6 in. wide and 10 in. deep, equipped with six sealed-discharge draws and designed to circulate a large percentage of middlings. First among several pertinent facts observed as governing the operation was that the material deposited between draws became highly compact and that the only parts of the material which had mobility were the small areas over the refuse draws.

Best operation, it was found, occurred when operating at slightly less than competent slope; i.e., the slope which for a given feed and water volume results in neither deposition nor erosion, but, as expressed by Mr. Richardson, "when deposition took place at relatively low rates." After a brief departure to include the use of a classifier, the study was confined again to the launder, and it was from this investigation that the Battelle self-contained launder was developed.

Emile Keenan, analyst and washer foreman at Nellis, to whom C. W. Connor, superintendent of mines, referred questions asked regarding practical operation of the Battelle washer, explained that the Nellis preparation plant is equipped with Carpenter dryers which reduce the moisture in the Battelle-washed ⅜ x 0-in. coal to about 7 per cent; that clear water only is used and that the draw approach plates, which have 1/16-in. holes, are cleaned "every ten days to two weeks." Water requirements amount to approximately 1½ lb. per pound of coal, or about 150 g.p.m. when washing 27 tons of coal per hour.

Byron M. Bird, of the Battelle Institute and secretary of the Ohio Valley Section, A.I.M.E., explained that the Nellis performance of 2 per cent float in the refuse running about 30 per cent by weight means 0.6 per cent coal lost which might otherwise be recovered and therefore an efficiency of 99 to 99½ per cent. He said that the investigation of existing launders disclosed that 90 per cent of the problem is getting the deposited material out and 10 per cent obtaining stratification. The Battelle investigations revealed a way to draw out a cleaner refuse than it was possible to segregate.

Costs of Cleaning Lowered

Hopeful of stimulating interest among preparation men to assist in working up data along a similar line, J. B. Morrow, preparation manager, Pittsburgh Coal Co., in a paper read by S. B. Barley, of the same organization, outlined preliminary information based on eight or ten mines, four of which are in the Pittsburgh seam, which indicates that the labor cost per ton of refuse removed from coal by hand picking exceeds the usual costs by mechanical removal and in some cases runs to several times that cost. Moreover, hand methods may be less than 50 per cent efficient. In reduction of cost and better efficiency of cleaning of the sizes now being hand picked, it was stated, lies a great opportunity for mechanical cleaning.

Discussing the economics of coal cleaning, the paper stated that the specifications of a plant hardly outlive the construction period and, although most of the advantages of such a plant benefit the coal user, the cost still falls principally on the operator. In selecting equipment, considerations such as efficiency required, amount and character of refuse and capacity automatically eliminate certain processes. Cost of the cleaning alone averaged about 20 per cent of the total investment in the several plants analyzed. Dividing the total invest-

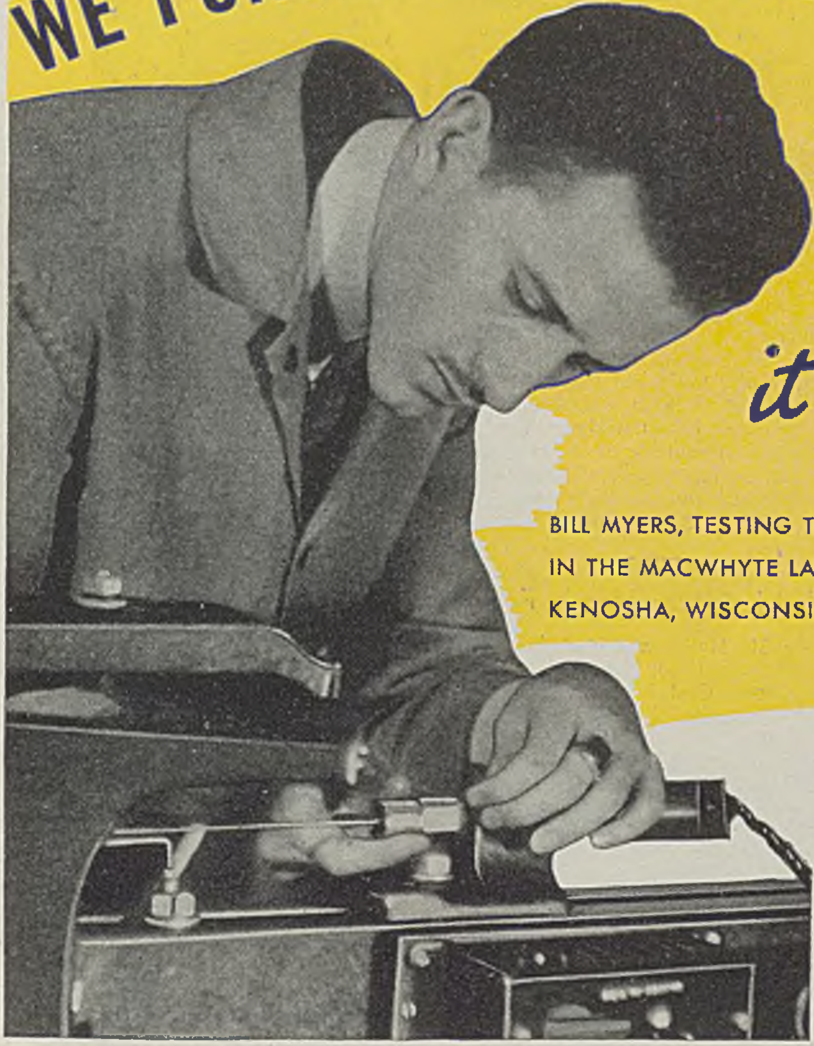
★ ★

SALES OF STOKERS WANE

Sales of mechanical stokers in October last totaled 16,756 units, according to statistics furnished the U. S. Bureau of the Census by 108 manufacturers (Class 1, 69; Class 2, 45; Class 3, 44; Class 4, 38; Class 5, 15). This compares with sales of 18,993 units in the preceding month and 18,371 in October, 1936. Sales by classes in October last were: residential (under 61 lb. of coal per hour), 14,492 (bituminous, 12,946; anthracite, 1,546); small apartment-house and small commercial heating jobs (61 to 100 lb. per hour), 1,181; apartment-house and general small commercial heating jobs (101 to 300 lb. per hour), 920; large commercial and small high-pressure industrial steam plants (301 to 1,200 lb. per hour), 287; high-pressure industrial steam plants (over 1,200 lb. per hour), 76.

WE PUNISH A WIRE TEN MILLION TIMES

..and still it won't BREAK



BILL MYERS, TESTING THE FATIGUE LIFE OF WIRE IN THE MACWHYTE LABORATORY, KENOSHA, WISCONSIN

"That sounds like a lot of punishment," says Bill Myers—Macwhyte Metallurgist—"but this Haigh Robertson Fatigue Testing Machine actually rotates the wire, and through this rotation, subjects the wire to bending stresses. These bending stresses are repeated 10,000,000 times without failure of the wire. Then we're sure the wire will really resist fatigue on your job.

"Fatigue has always been one of wire rope's worst enemies. Every time a rope passes over pulleys, or twists, or when it's coiled on a drum, a condition of fatigue is set up. Fatigue can actually fracture some of the wires in a rope even when the breaking strength hasn't been reached.

"We've made a lot of progress in checking fatigue here at Macwhyte. By constant testing and experimenting we've found out how to make wire with the highest possible fatigue resisting properties. *That* means when you buy Whyte Strand PREformed, you get a wire rope that gives the best of service."

LOOK FOR THE

Whyte Strand

MACWHYTE WHYTE STRAND IS *BETTER* BECAUSE IT'S MADE BY SPECIALISTS

MACWHYTE COMPANY
KENOSHA, WISCONSIN

Manufacturers of wire rope and braided wire rope slings. Distributors and stock throughout the U. S. A. for quick service.

MACWHYTE

Whyte Strand – PRE *formed*

THE WIRE ROPE WITH THE INTERNAL LUBRICATION

Harry M. Moses
President, H. C. Frick Coke Co.

ment cost into two groups, 52½ per cent will cover the cleaning units, screening, dryers, piping and water settling and 47½ per cent the raw coal, loading, refuse, structure, laboratory, shop and so on.

Mr. Bird voiced an opinion that the coal industry should extend mechanical cleaning to larger sizes. For this job large units are required; hence the problem is to provide sufficient tonnage to operate to capacity. At present the return from an investment in mechanical cleaning must be looked for in more continuous operation of the mine and in wider markets.

In tons-per-hour cleaning capacity in Illinois, jigs of the Baum type rank first, Rheo launders second and Chance cones third, said Mr. McCulloch, whose paper outlined the history of Illinois cleaning, beginning with an East St. Louis installation of 1870, and described the equipment of the various steps of an Illinois present-day "typical" plant. In some of the plants coal up to 6-in. is being washed, but in practically every such case the washed egg is hand picked to eliminate pieces objectionable in appearance.

No Illinois mine, he stated, is now recovering "dust" from wet washing by filters. Hand picking is considered somewhat less costly than washing. Answering questions regarding the Fidelity strip mine of the United Electric, Mr. McCulloch said that since the washer was built the annual tonnage has increased steadily in contrast to a decrease for each of the five years previous. Eight pickers are employed to clean 175 tons per hour of egg and six for an equal tonnage of lump. About 6 per cent of each size is rejected.

Discussion shifted to the problem of maintaining the equipment of multiple-shifted cleaning plants to hold delays within reasonable bounds. A. C. Dittrick preparation manager, Hanna Coal Co. of Ohio, which operates 22½ hours per day six days per week, gave as the formula: "inspection and actual replacement before breakdown takes place." J. E. Norton, Pittsburgh Coal Co., said that by "over-maintaining" they are able to hold delays to 1 to 3 per cent in plants which are multiple-shifted.

Gas and oil obtainable by present methods, predicted Dr. Fieldner, will be exhausted in less than 100 years and a domestic shortage may begin in ten to twenty years. Coal will continue as the principal fuel for generation of public-utility and major industrial power. No substitute has appeared for industrial coke. Further displacement of coal for house-heating by oil and natural gas probably will take place in the next few years, but coal will continue as the major fuel.

Further improvements in efficiency of the steam locomotive and an increase of electrification will retain the use of coal for freight traffic through the age of oil and gas. The trend to diesel engines for marine transportation will continue. Recurring threats of shortage of motor fuels, Dr. Fieldner pointed out, have been met by finding new pools and improving technique through research and development, "and the end has not been reached." Therein lies an example to the coal industry, which by research should find a way to obtain heat automatically from coal as effectively as from gas or petroleum.

H. M. Moses Heads Frick

Harry M. Moses was elected president of the H. C. Frick Coke Co. and the United States Coal & Coke Co., subsidiaries of the United States Steel Corporation, on Dec. 15, succeeding his father, Thomas Moses. The elder Mr. Moses, who headed the coal units for the last ten years, was on Dec. 9 elected vice-president of the United States Steel Corporation of Delaware, in charge of raw materials. He has been associated with the coal industry more than sixty years.

Harry Moses began his career in the coal industry with Steel Corporation subsidiaries, became assistant mine foreman in 1919 and held various other supervisory positions until 1933, when he was made general superintendent of the Kentucky and West Virginia operations of the United States Coal & Coke Co. His latest appointment is effective Jan. 1.

Charles L. Albright, secretary of the Frick company, becomes vice-president and secretary of that company and vice-president of the United States Coal & Coke Co. on the same date.

Personals

Leslie Adair has been made top foreman at the Keystone mine of the Keystone Coal Co., Routt, Colo.

Frank Andrews, who was superintendent of the Keystone mine of the Keystone Coal Co., Routt, Colo., several years ago, has returned as mine foreman.

C. R. Barclay, assistant superintendent of maintenance and construction, Hudson Coal Co., Scranton, Pa., has been made maintenance foreman at the Pine Ridge colliery, Parsons, Pa.

William Brown has been appointed mine foreman, night shift, at Wylam No. 8 mine of the Tennessee Coal, Iron & Railroad Co., Wylam, Ala.

William D. Bryson, of Castlegate, Utah, has been made general manager of

Thomas Moses
Vice-president, United States Steel Corporation of Delaware

properties of the West Virginia Coal & Coke Corporation, succeeding Lee Ott, retired. The company headquarters are at Omar, W. Va., with operations in Barbour, Braxton, Randolph and Logan counties. Mr. Bryson resigned the post of manager of operations of the Colony Coal Co., Rock Springs, Wyo., on Aug. 28 last to become general superintendent for the Utah Fuel Co.

P. M. Cassidy has been made mine foreman, day shift, at the Docena mine of the Tennessee Coal, Iron & Railroad Co., Adamsville, Ala.

John C. Cosgrove, Johnstown, Pa., was reelected for a fourth year as chairman of the Committee of Ten—Coal and Heating Industries at the annual meeting of the organization's general council. J. Harvey Manny was chosen secretary and the following also were reelected: Harry H. Kurtz, treasurer, and Marc G. Bluth, assistant treasurer and executive secretary.

W. J. Cunningham, president, Crummies Creek Coal Co., has been elected president of the Harlan County Coal Operators' Association, succeeding S. J. Dickenson, general manager, Mary Helen Coal Corporation. Other officers named were: vice-president, R. E. Lawson, general manager, Cornett-Lewis Coal Co.; secretary, George S. Ward (reelected).

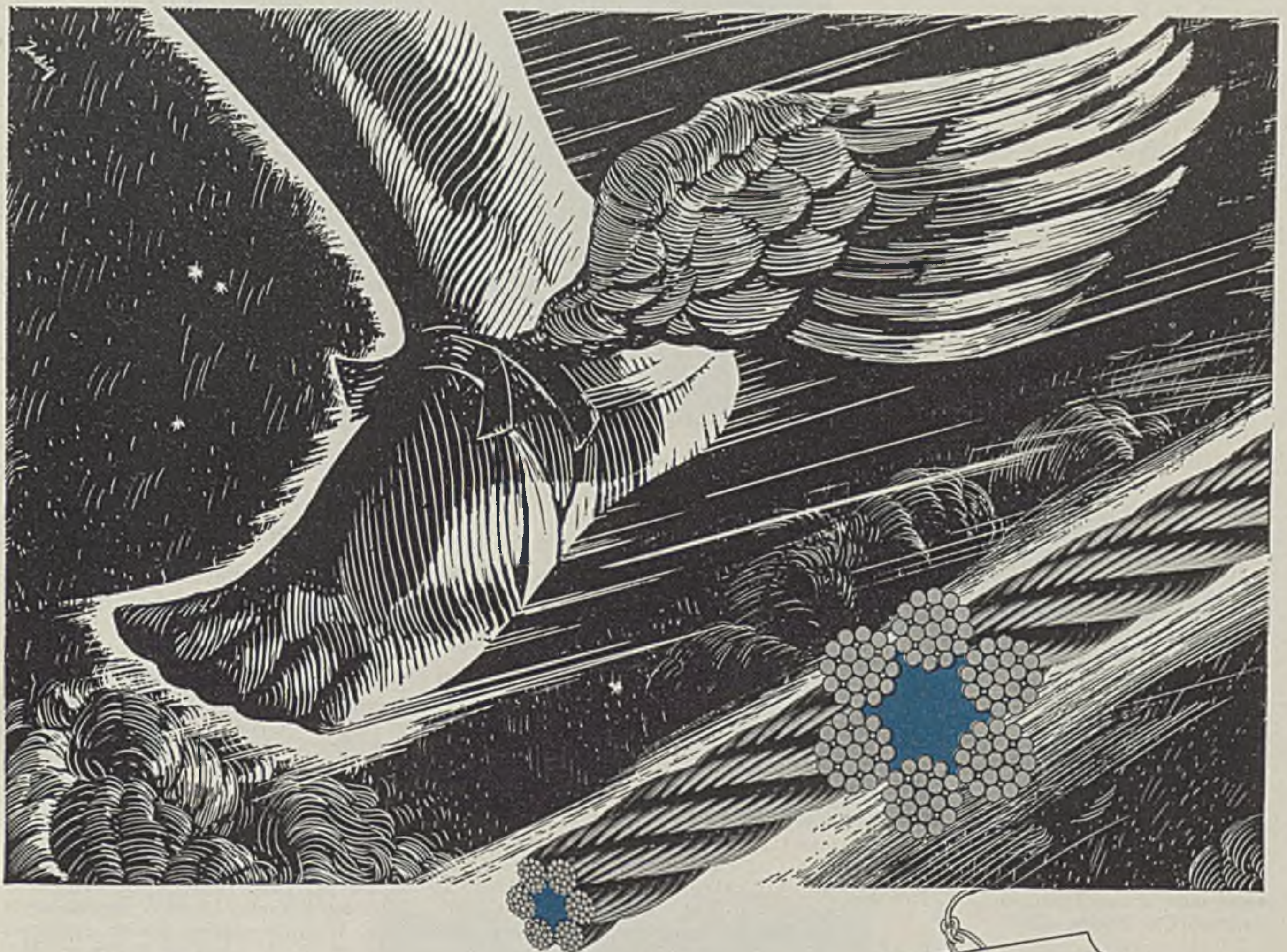
R. B. Easton has been appointed foreman at the No. 4 mine of the Anchor Coal Co., Highcoal, W. Va.

A. E. Gabany has been made foreman at No. 4 mine of the Colcord Coal Co., Montcoal, W. Va.

L. C. Gunter, who for four years has been executive vice-president of the Southern Appalachian Coal Operators' Association, was elected president at the association's annual meeting. He succeeds W. G. Polk, president, Tennessee Jellico Coal Co. and Block Coal & Coke Co. B. E. Cheely, general manager, Southern Collieries, Inc., was reelected first vice-president, and John W. Williams, president, Williams Coal Mining Co., was renamed second vice-president. The board of directors was

Speed! Speed! Speed!

CRIES INDUSTRY



Today's severe demands on equipment call for utmost wire rope stamina

Industry must reduce costs—to make profits. More work from existing equipment—and faster.

Roebling "Blue Center" Steel Wire Rope has more than met these exceptionally severe requirements.

Roebling "Blue Center" combines the highest strength with the maximum resistance against fatigue and wear. For a wide variety of applications where service conditions are exceptionally severe, *it has proved conclusively that it assures lowest general average operating costs.*

JOHN A. ROEBLING'S SONS CO., TRENTON, N. J. *Branches in Principal Cities*

ROEBLING ✱ BLUE CENTER

augmented with the addition of R. L. WILHELM, general superintendent and purchasing agent, New Jellico Coal Co.

WALTER COCHRANE has been appointed mine superintendent of the Spring Canyon and Royal coal companies, operating in Carbon County, Utah. Mr. Cochrane, who succeeds the late David Brown, has had more than twenty years' experience in the coal industry, the last two as mine foreman with the Royal company.

WIRT GOODLOE has been named foreman at the Booth Bowen mine of the Booth Bowen Coal & Coke Co., Freeman, W. Va.

W. W. GUY has been appointed foreman at the Darby No. 1 mine of the Keith Coal Mining Co., Keith, W. Va.

R. P. HOGAN has been appointed chief engineer of the Colony Coal Co., Dines, Wyo., and the Colorado & Utah Coal Co., Mt. Harris, Colo. (It was erroneously stated in the December issue that Mr. Hogan had been appointed general superintendent of the Peacock and Mt. Harris plants of the Colony company in Wyoming.)

R. E. HOWE, president of Appalachian Coals, Inc., has been elected to the board of directors of Bituminous Coal Research, Inc.

S. A. JONES has been named foreman at the Eagle mine of the Monitor Coal & Coke Co., Wilkinson, W. Va.

KENNETH LAMBERT, superintendent at the Coalbrook colliery of the Hudson Coal Co., Carbondale, Pa., has been placed in charge of the company's northern division.

LOUIS LASALLE has been made general superintendent of the Colony Coal Co., operating in Sweetwater County, Wyoming. (It was incorrectly announced in the December issue that Mr. LaSalle had been made superintendent of the company's Dines and Megeath mines.)

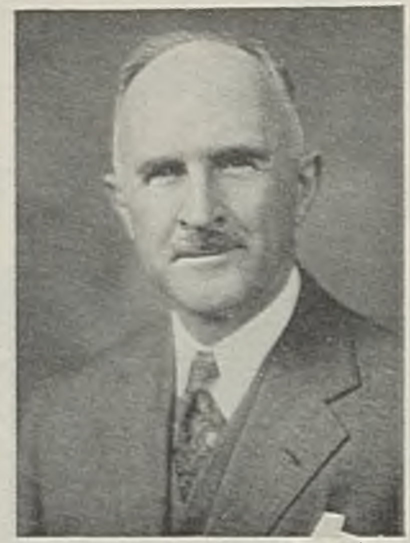
PETER S. MCCRORIE has been named mine foremean, night shift, at the Edgewater mine of the Tennessee Coal, Iron & Railroad Co., Ensley, Ala.

C. STEVENSON NEWHALL, president of the Pennsylvania Company for Insurances on Lives and Granting Annuities, Philadelphia, Pa., has been elected a director of the Westmoreland Coal Co., operating in Westmoreland County, Pennsylvania.

PATRICK O'HARA, superintendent of the Delaware colliery of the Hudson Coal Co., Hudson, Pa., has been appointed to head the company's southern division.

M. L. PATTON, sales manager, Truax-Traer Coal Co., has been elected a member of the board of directors of Bituminous Coal Research, Inc., succeeding John A. Howe, resigned.

G. B. PRYDE, vice-president and general manager, Union Pacific Coal Co., replaces Graham Bright, sales engineer, Mine Safety Appliances Co., whose term expires as a member of the mining standardization correlating committee of the American Institute of Mining and Metallurgical Engineers, which reports to the American Standards Association. E. A. HOLBROOK, dean, School of Engineering and Mines, University of Pittsburgh, succeeds himself in the same committee, and CAREL ROBINSON, manager of mines, Kelleys Creek Colliery Co., is appointed alternate in place of Otto Herres, Jr., mining engineer, whose term also expires.



Harris & Ewing

Matthew Van Siclen

ERSKINE RAMSAY, chairman of board, Alabama By-Products Corporation, is listed among those to be awarded the Legion of Honor of the American Institute of Mining and Metallurgical Engineers in 1938.

WALTER REED has been appointed foreman at the Richland mine of the Wheeling Valley Coal Corporation, Ohio County, West Virginia.

JOHN RISKO has been made foreman at the Puritan mine of the Puritan Coal Corporation, Puritan mines, W. Va.

C. P. SCHRECONGOST has assumed the duties, effective Dec. 1, of traffic manager of the following companies: Emerald Coal & Coke Co., Hecla Coal & Coke Co., Hillman Coal & Coke Co., Pittsburgh Coke & Iron Co., Pittsburgh & Ohio Valley Railway Co., Allegheny River Limestone Co. and Green Bag Cement Co. His headquarters will be at the Neville Island plant of the Pittsburgh Coke & Iron Co.

F. H. STANLEY has been named superintendent at Eccles Nos. 5 and 6 mines of the Crab Orchard Improvement Co., Eccles, W. Va.

MATTHEW STRANNIGAN, assistant mine foreman at the Colony Coal Co., Rock Springs, Wyo., has been appointed safety engineer for the Southern Wyoming Coal Operators' Association, succeeding Lyman Fearn, resigned.

J. M. STANLEY has been made foreman at the New Howard mine of the Dayton Coal Corporation, Sprigg, W. Va.

JOHN THOMAS has been made mine foreman, night shift, at the Hamilton mine of the Tennessee Coal, Iron & Railroad Co., Pratt City, Ala.

W. A. THOMPSON has been named foreman at the Edwight mine of the Raleigh-Wyoming Mining Co., Edwight, W. Va.

MATTHEW VAN SICLEN has been appointed chief engineer of the coal economics division of the U. S. Bureau of Mines, succeeding F. G. Tryon, now chief of the market statistics division, National Bituminous Coal Commission. Born in New York City, Mr. Van Siclen received A.B. and M.A. degrees at Amherst and took his E.M. degree at the Colorado School of Mines in 1906. For the next eleven years he was engaged in the examination and operation of mines in the United States, Canada and Mexico, including the examination of a number of Pennsylvania coal mines. After seventeen months' service in the air corps during the War he joined the Bureau of Mines to assist in administering the war materials relief act. In 1921 he became assistant to the chief mining engineer and had immediate supervision over the coal-mining section, making observations of efficiency and safety methods being employed in mines in all parts of the country. In 1926 he represented the Bureau at the International Geological Congress held in Spain. For the last ten years he has been in private practice.

JOSEPH E. WARD has been named mine foreman, day shift, at Wylam No. 8 mine of the Tennessee Coal, Iron & Railroad Co., Wylam, Ala.

MARSHALL WHALEY has been named superintendent at the Panther mine of the Panther Red Ask Coal Corporation, Panther, W. Va.

Hanna of Delaware Merged

In order to simplify the corporate structure, M. A. Hanna Co., Cleveland, Ohio, has liquidated into the parent company the Hanna Coal Co. of Delaware. The latter company, which sold the output of the Hanna mines in eastern Ohio (*Coal Age*, December, 1934, p. 490), was a sub-agent of Northern Coals, Inc.

Obituary

JOHN WALTER GALLOWAY, 64, president of the Maryland Coal Co. of West Virginia for a number of years, died suddenly Nov. 17 while visiting friends in Jersey City, N. J. A native of Baltimore, Md., he started as a messenger boy for the Baltimore & Ohio Railroad and afterward served as an officer in the transportation department. He had long been active in the coal industry, disposing of his Simpson Creek Coal Co. properties in West Virginia in 1924 but maintaining his interest in the Maryland company.

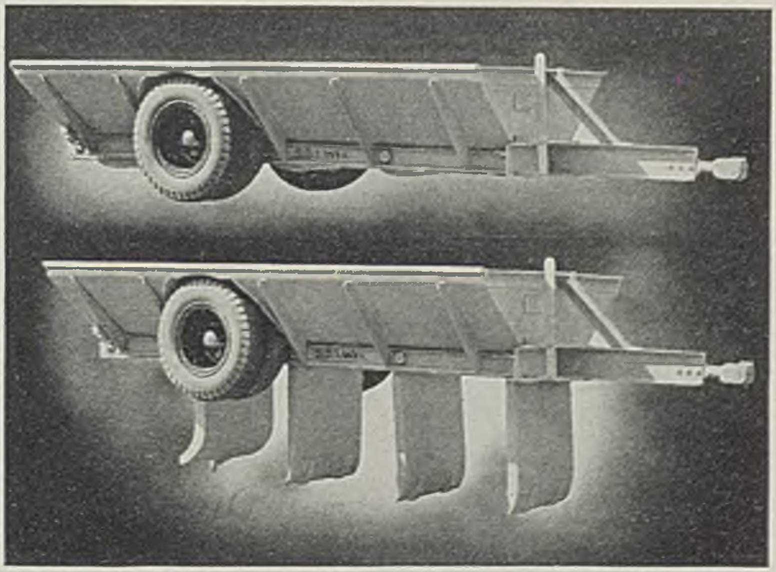
JAMES BAGLEY, president of the Bucoda Coal Mining Co., Palmer, Wash., and general manager of the Big Four Coal Co., Palmer, Wash., died during the first week of December in Seattle. During his long career in the coal industry he was connected with a number of companies as well as with the State Department of Mines of Washington and was for many years president of the Coal Producers' Association of that State.

LEE S. TAYLOR, 60, chief engineer of the Elk River Coal & Lumber Co., Widen, W. Va., died there suddenly on Nov. 24. He had been chief engineer for the Elk River company for sixteen years.

JAMES ROBERT CRAY, 77, pioneer in the development of the coal and coke in-

MR. SANFORD-DAY SAYS:

STOP.. *where you are*



Have you read the story of HART COAL CORPORATION'S Moss Hill No. 2 Mine? This mine is equipped with S-D Rubber-Tired Trailers . . . the "S-D UNDER-GROUND HOG."

Have you investigated this trailer? NEW? Yes, comparatively, but old enough to have proved that, through its simplicity of operation, its automatic dumping and its low initial cost and fast production possibilities, it is one of the greatest money savers ever produced for under-ground transfer of coal. 550 tons of coal per 7-hr. shift with only three S-D Under-ground Hogs, is what one operator is getting in a vein 5 ft. to 5 ft. 6 in. high.

Perhaps you need S-D Under-ground Hogs. But, in any event, you should have the facts—the complete story. It's high-powered "Pork" which you should know about.

Action Photos taken in the Hart Coal Corporation's Moss Hill No. 2 Mine.

TOP PHOTO . . . at the loader. And when this trailer moves away another is immediately ready for loading. No costly tracks to lay—none to take up. No time lost in switching cars. CENTER PHOTO . . . at pit. Trailer about to be dumped automatically. BOTTOM PHOTO . . . just after automatic dumping is completed. The trailer is now ready for automatic closing and locking of doors, and then on its way for another load.

SANFORD-DAY IRON WORKS, Knoxville, Tenn.

dustries in Fayette and Greene counties, Pennsylvania, died Dec. 11 in the West Penn Hospital, Pittsburgh. An attorney and banker, of Uniontown, Mr. Cray was president, director and stockholder in various coal companies, including the old Union Connellsville Coke Co., Wallace Coal & Coke Co. and Puritan Coke Co.

Earl A. Bartlett, 40, purchasing agent of the McNeal Coal Corporation, Denver, Colo., died in a hospital in that city on Dec. 8 after a month's illness. A grandson of the president of the company, Mr. Bartlett had been connected with the organization since his graduation from the University of Colorado in 1920.

Virginia Rate Cut Upheld

The Virginian Ry. lost in its appeal to the West Virginia Supreme Court to set aside the rate reduction ordered by the State Public Service Commission on coal hauled over the company's White Oak branch, in Fayette County. The high court affirmed the Commission's order of a cut from 88c to 45c per ton. The reduction was ordered after the New River Co. filed a complaint involving four mines. The carrier contended that the cut upset the rate parity in the field.

New Preparation Facilities

Alabama By-Products Corporation, Colta, Ala.: Contract awarded Deister Concentrator Co. for a No. 7 Deister-Overstrom "Diagonal-Deck" coal-washing table to handle 14 x 48-mesh product.

Antioch Power Co., Linton, Ind.: Contract awarded Deister Machine Co. for two new type Deister Plat-O-Coal washing tables to treat 3/16 x 0-in. coal; maximum capacity, 40 tons per hour; completed.

Clemens Coal Co., near Mulberry, Kan.: Contract awarded Jeffrey Manufacturing Co. for complete preparation plant, comprising tipple and washery; equipment includes two-compartment 6 x 6-ft. Jeffrey Baum type jig and three-compartment 7 x 7-ft. Jeffrey Baum type jig; total capacity, 350 tons of 6-in. x 0 coal per hour.

Emerald Coal Co., Emerald mine, near Hillsboro, Pa.: Contract awarded Morrow Manufacturing Co. for five-track railroad tipple and three-barge river tipple equipped with trip feeder, trip maker, rotary dump, conveyors, screens, wet cleaning plant for ½ x 4-in. coal, loading booms, etc.; capacity, 400 tons of mine-run per hour.

Jermyn-Green Coal Co., No. 14 colliery, Plainsville, Pa.: Contract awarded Deister Concentrator Co. for a No. 7 Deister-Overstrom "Diagonal-Deck" coal-washing table with Concenco anti-friction head motion for treatment of No. 1 buckwheat.

Phelps Dodge Corporation, Dawson, N. M.: Contract awarded Jeffrey Manufacturing Co. for a single-compartment Jeffrey diaphragm jig to wash pea coal; maximum capacity, 60 tons per hour; to be installed in existing plant. It was erroneously stated in the November issue (p. 94) that this equipment was for the American Smelting & Refining Co.

Safety, Mid-West Seams and Lubrication Engross Indiana Mining Men

GATHERED at the Terre Haute House, Terre Haute, Ind., Indiana coal men discussed safety, coal seams in the Middle West and lubrication questions at the sixth annual meeting of the Indiana Coal Mining Institute, Dec. 11. Ringmaster at the two technical sessions was H. P. Smith, retiring institute president. M. J. Grogan, Lynch Coal Operators' Reciprocal Association, Terre Haute, was toastmaster at the annual banquet.

"The fact that explosions of electrical origin have increased during the past ten years in about the same ratio as the increased use of electrical equipment in our mines should cause some apprehension in the mining industry," declared W. J. Fene, mining engineer, U. S. Bureau of Mines, Pittsburgh, Pa. "The rapid introduction of electrical equipment underground has multiplied many times the hazard of electric arcs as a source of explosion initiation. It is obvious, therefore, if we are to avoid disastrous mine explosions in the future, that we must do everything possible to safeguard underground electrical equipment."

In some 2,866 explosions killing 13,880 men since 1839, the origin was electrical in 132, or 4.6 per cent. In the past ten years, however, nearly 50 per cent of the explosions were electrical in origin, with electricity in 1936 responsible for 60 per cent, and 85.5 per cent of the resultant fatalities. Evidence of carelessness in the maintenance of ventilation has been found in most electrical explosions in the past ten years. "In many cases, evidence is found following an explosion that a door had been left open or a line brattice was in poor condition or not near enough to the face, or there was some other defect in ventilation." Another consideration in explosions is the human factor, which can be best controlled by adequate supervision and proper safety education.

"The outstanding cause of electrical ignitions in coal mines is sparks or arcs from non-permissible cutting machines and from trolley and cable-reel locomotives; this equipment is responsible for more than 40 per cent of the electrical explosions that have occurred in the last several years. Many—possibly all—of the explosions caused by non-permissible mining machines could have been avoided if permissible mining machines had been used or if proper tests for gas had been made before moving the machines into the working places. Explosions caused by trolley or cable-reel locomotives could have been prevented by the use of storage-battery or compressed-air locomotives for gathering.

"The prevention of electrical explosions requires keeping any spark or arc away from a place where any possible accumulation of gas may occur. Many explosions of coal dust alone have been initiated by electric arcs." The hazard of ignition of dust electrically also is present in tipples and cleaning plants, as well as underground. "Electricity also is the source of far too many mine fires. During the last nine years 31.5 per cent of the mine fires occurring in the United States were of electrical origin. . . .

Explosions Can Be Prevented

"It has been well demonstrated," said Mr. Fene in conclusion, "that coal-mine explosions can be prevented. By providing adequate ventilation, by providing permissible electrical equipment, including lighting; by using water in the face regions, especially on the cutter bars of mining machines; by thorough rock-dusting; and by adequate supervision and proper education of workers coal-mine explosions can be reduced to a minimum." Mr. Fene followed his address by demonstrating how many electrical devices used around mines can ignite gas.

Coals of the Eastern Interior Basin were discussed by Harold R. Wanless, Department of Geology, Illinois State University, Urbana, Ill. Studies thus far completed have shown the existence of about 58 different coals in this region, "and a few additional thin coals probably remain to be discovered. Of these coals, about 39 attain a maximum thickness of 2 ft. in some part of the basin and have been used at least locally for fuel. There are fourteen or fifteen different coals which are worked in large commercial mines. According to available information there are 50 coals in Illinois, of which 20 are locally and seven are commercially mined; 32 in Indiana, of which 16 are locally and 9 commercially mined; and 36 in western Kentucky, of which 11 are locally and 7 commercially mined. The accompanying table shows a correlation of some of the more important coals in western and southern Illinois, Indiana and western Kentucky."

Dr. Wanless concluded his paper with a description of fifteen of the principal coals in the region; i.e., the Baker (No. 14), Danville (No. 7, Indiana VII), Kentucky No. 12 (Millersburg), Herrin (No.

★ ★

Indiana Officers

New officers for the Indiana Coal Mining Institute were elected as follows at the sixth annual meeting:

President — Charles A. Herbert, supervising engineer, Vincennes (Ind.) station, U. S. Bureau of Mines. Mr. Herbert succeeds H. P. Smith, general manager, Princeton Mining Co., Terre Haute, Ind.

Vice-Presidents — H. G. Conrad, general manager, Knox Consolidated Coal Corporation, Bicknell, Ind.; Thomas W. Faulds, Binkley Mining Co., Terre Haute; and R. A. Templeton, vice-president, Templeton Coal Co., Sullivan, Ind.

Secretary—Harvey Cartwright, commissioner, Indiana Coal Operators' Association, Terre Haute.

In addition to Mr. Smith, the new executive board is made up of the following: H. A. Cross, general superintendent, Walter Bledsoe & Co.; James S. Anderson, superintendent, Saxton Coal Mining Co.; A. K. Hert, superintendent, Snow Hill Coal Corporation; F. M. Schull, Binkley Mining Co.; David Ingle, Jr., superintendent, Buckskin Coal Corporation; and D. W. Jones, superintendent, Princeton Mining Co.

6, Kentucky No. 11, Indiana VI?), Grape Creek, Springfield and Harrisburg (No. 5, Kentucky No. 9, Alum Cave or Petersburg V), Linton (IV), Colchester or LaSalle (No. 2, Indiana IIIa), Staunton (III), Davis (No. 6), Rock Island (No. 1, Minshall, Lead Creek), Mannington (Murphysboro?), Upper Block, Lower Block, and Cannelton (Hawesville).

Defining lubrication as the complete separation of moving parts, G. C. Hazard, Socony-Vacuum Oil Co., Inc., St. Louis, Mo., in a discussion of some of the principles underlying the theory and practice of bearing lubrication, pointed out that the lubricant is introduced as a means of effecting this separation. The lubricant, therefore, becomes a load-carrying member of the machine and in addition serves the purpose of permitting relative motion between the machine parts.

"A bearing for a shaft consists of a smooth hole slightly larger than the shaft that is put into it. In the clearance space is introduced a lubricant so that one surface can slide over the other one easily. . . . When the journal starts to turn, the oil clinging to the upper part is drawn in underneath very much in the manner in which a man rolls himself in a blanket. The oil that clings to the surface of the journal is forced under the shaft and lifts it. . . . The oil that is being drawn under can get out from under the shaft in two directions. It can go endwise and escape from the ends of the bearing or it can go on through and go around over the top of the journal again. We must have a sufficient supply of oil of the correct body and character so that there always will be enough oil drawn in under the journal to lift it clear of the shaft. . . . On a high-speed bearing, such as on electric motors, the oil is drawn in under the journal in such large quantities that it tends to crowd it over to one side of the bearing. . . .

"Naturally, anything that interferes with the free flow of oil down into the pressure area is undesirable. This includes sharp edges on the oil grooves, which tend to scrape the oil off the journal surface. In addition, we must not do anything to assist the oil in escaping from underneath the shaft. This means that we must not put any drainage ditches in the bearing in that area where the load is

R. L. Ireland, Jr.
Mining Congress Program Chairman

the heaviest. Oftentimes we find that a rather elaborate system of oil grooves has been placed in the pressure area with the object of leading the oil into that point. Unfortunately, the result is just the opposite, as the oil is enabled to escape readily through these grooves instead of being forced to get under the shaft and lift it. . . .

"Two conclusions may therefore be drawn from the above. One is that the grooving and chamfering in a bearing should assist in supplying a uniform spread of oil over the entire length of the bearing surface in such a position as to help in the formation of the oil wedge that lifts the shaft, and also should offer no interference with correct wedge formation. The second rule is that the oil should be applied to bearings in a place where the pressure on the oil film is the least," allowing the motion of the shaft to carry the oil underneath without the assistance of grooves in the pressure area.

"Now, what type of oils are we to use in various bearings? Are we to use the same-body oil on all types or must we use heavy oil on some and light oil on others? Well, if the oil is pumped rapidly into the pressure area by the rapid motion of the journal, we can use a lighter-bodied oil, because it will have less time to be squeezed out and run out at the ends of the journal. On the other hand, with low-speed, heavily loaded bearings, there is more opportunity for the oil to escape endwise and less chance of it being carried through underneath the journal. We must, therefore, employ a heavier-bodied oil in order to insure sufficient film thickness in the pressure area to avoid metallic contact."

Mr. Hazard followed his address with a talking motion picture showing just what happens in bearings, cylinders and gears and how they may be lubricated. Then, in response to questions from the floor, he stated that oil itself does not wear out and can be used over and over again if it can be cleaned. Graphite, being an extremely hard material, mildly abrasive and having a tendency to build up a hard surface, is an excellent remedy for a sick bearing, but should not be used every day. On the subject of cooling a bearing and at the same time keeping it in operation, Mr. Hazard made the point that the bearing was not properly lubricated in the first place. Steam cylinder oil should be poured in until the bearing returns to normal. If badly cut, graphite may be introduced. To clean a bearing where the machine cannot be taken down, Bon Ami mixed with oil may be employed, although it does not work so well with babbitt.

Ammonia cools hot bearings, probably for two reasons. One is that it evaporates and absorbs heat and the other is that it combines with the fatty material in the bearing to form soap, which sticks in place. Sulphur is an anti-welding flux and will prevent metals from joining together. Consequently, it is good in high-pressure lubricants, but only where contacts are steel to steel. In all cases the oil supply should be introduced where the pressure is low, and bearing should be studied to determine this point and consequently the proper location of the oil hole.

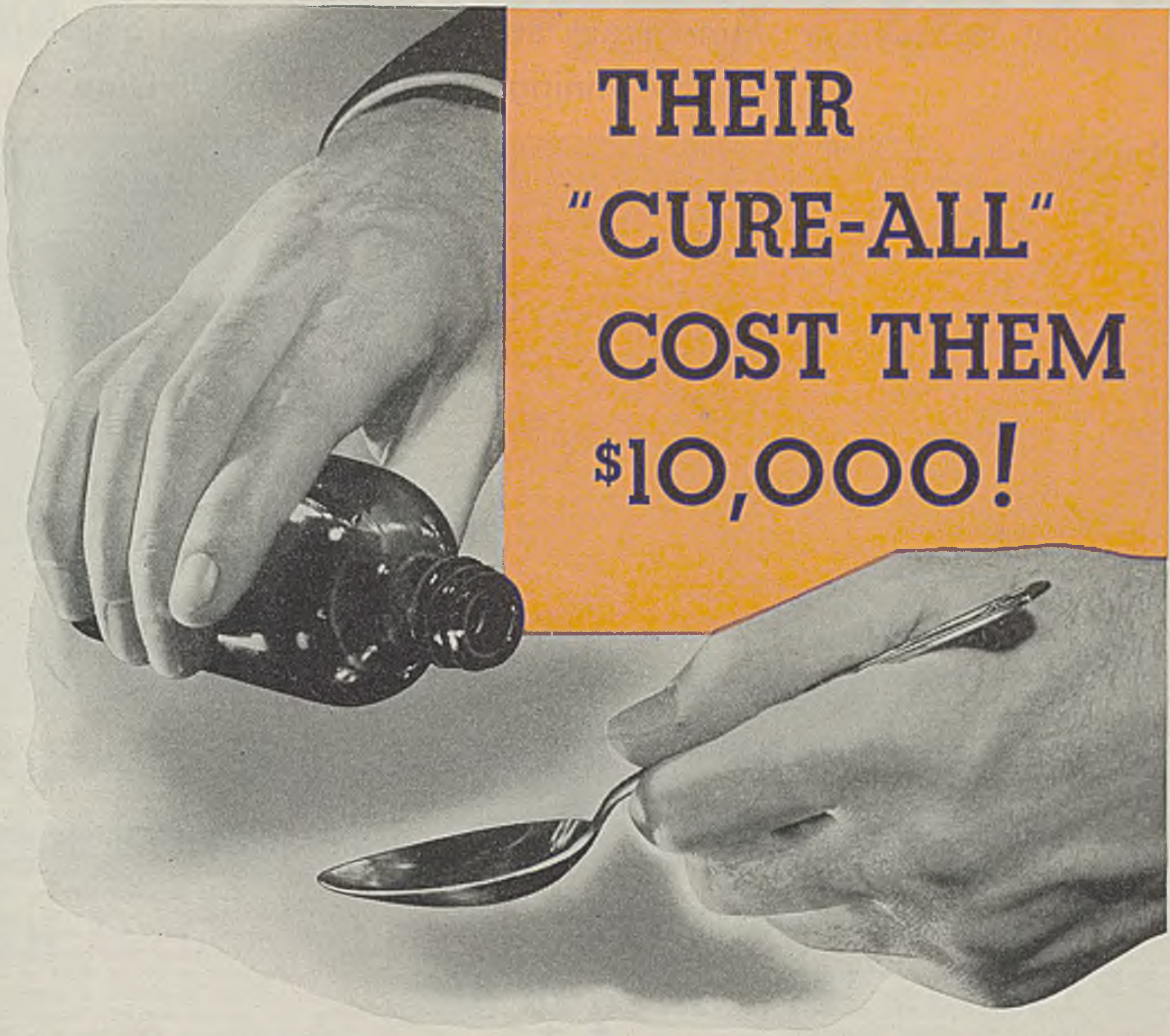
Table I—Correlation of Principal Coals, Lower Pennsylvanian, Eastern Interior Basin

Northern and Western Illinois	Southern Illinois	Western Kentucky	Indiana
Trivoli (No. 8)	Present	?	Parker (VIIIa)
Absent	Present	No. 15	Brouillott (VIII)
Present	Cutler	Present	Present
Absent	Bankston	Baker (No. 14)	Absent?
Danville (No. 7)	Absent	No. 13?	VII
Absent	Jamestown	No. 12	Millersburg
Streator (No. 6)	Herrin (No. 6)	No. 11	VI?
Absent	Briar Hill (No. 5a)	No. 10	Grape Creek (E. Illinois)
Springfield (No. 5)	Harrisburg (No. 5)	No. 9	Petersburg (V)
Summun (No. 4)	No. 4	Goshen (No. 8b)	Houchin Creek (IVa)
Kerton Creek	Absent	Absent	Absent
Lowell?	Local	No. 8?	Linton (IV)
Colchester (No. 2)	Present	Schultztown	Velpen (IIIa)
Lower Liverpool	Present	Present	Staunton (III)
Greenbush	Dekoven	Dekoven	Present
Wiley	Davis	Davis	Present
Seahorne	Present	Present	Present
Present	Stonefort	Lewisport	Holland
Upper DeLong	Bald Hill	Present	?
Lower DeLong	Curlew	Mining City	II
Rock Island (No. 1)	Murphysboro?	Mannington	Minshall
Pope Creek	Present	Elm Lick	Upper Block
Tarter?	Willis	Bell	Lower Block
Absent	No. 1a	Hawesville	Cannelton
Babylon?	Battery Rock	Main Nolin	Present
Absent	Absent	Absent	1a
Absent	Absent	Absent	I

Ireland Is Program Chairman For A.M.C. Convention

R. L. Ireland, Jr., executive vice-president, Hanna Coal Co. of Ohio, Cleveland, Ohio, has accepted chairmanship of the national program committee for the fifteenth annual convention of Practical Coal Operating Men and National Exposition of Coal Mining Equipment. The technical sessions and exposition, according to Julian D. Conover, secretary of the American Mining Congress, sponsor of the meeting, will be held, as in past years, in the Music Hall, Cincinnati, Ohio, during the week beginning May 2.

The dominant theme of the convention will be cost-reducing methods. The growth of mechanization and the modernization of preparation methods, Mr. Conover points out, have created a demand not only for clean coal but for oil-treated and waxed coal and even fuel wrapped in cellophane. In keeping with this movement, arrangements are under way for the presentation of papers and the exhibition of equipment of interest not only to producers but to consumers. With the expansion of coal



Read How Shell Engineers Solved This Coal Company's "Cure-All" Problem

THE G. & F. Coal Company of Brazil, Indiana, operates a number of strip coal mines in Clay County. Diesel-powered draglines and shovels produce about 3,000 tons daily.

At the height of their busy season —February, 1937—the company was prevailed upon to try a "cure-all" lubricant. This oil was "guaranteed" to end ring-sticking forever in their Diesels.

Six months' operating with this lubricant told the story. One by one, these engines went out of commission. Complete overhauling cost $1,000 per machine! Production fell off 50%! Orders amounting to $10,000 were lost!

Shell was called on to stem the tide of losses. Working with the G. & F. maintenance men, a complete survey of the engines was made. The answer was obvious. Not a "cure-all," but the proper Shell Diesel Lubricant for this type of equipment.

Results were immediate. Ring-sticking was reduced to a minimum. Production returned to normal and again orders were being filled on time.

• • •

In thousands of American mines, mills and factories, Shell men, working with Shell Lubricants, are achieving results like this. For Shell applies to your problem the ingenuity and resourcefulness gained from solving countless problems of industrial lubrication—and the finest lubricants being refined. This "plus" in lubrication is always available to you. Simply call or write your nearest Shell office.

SHELL

SHELL COAL MINE LUBRICANTS

production during the past year and intensified competition with other fuels, an even larger turnout is expected than last year.

36 Progressives Convicted In Illinois Bombings

Springfield, Ill., Dec. 18—Thirty-six members of the Progressive Miners defendants in a conspiracy charge growing out of the Illinois mine union warfare between 1932 and 1935 were declared guilty today by a jury in the federal District Court here. The verdict ended a long and involved trial before Judge Charles G. Briggle.

The specific counts on which the convictions were brought were interfering with interstate and foreign commerce and bombing freight trains and mines in southern and central Illinois. The reign of terror started as an aftermath of the secession of an anti-Lewis faction of the United Mine Workers, the disgruntled ones forming the rival Progressive union and initiating efforts to win over a majority of Illinois mine workers to membership.

Anthracite Conference Called

A conference on the technology and utilization of anthracite will be held April 29–30 at Lehigh University, South Bethlehem, Pa. The purpose of the conference, according to President C. C. Williams, will be to collate the results of research in the combustion and economy of anthracite together with experience in its production, preparation and distribution. Reports on some of the non-fuel uses of hard coal also will be included on the two-day program.

Authorities in the field are expected to attend the conference, which has been assured the support and cooperation of leaders in the industry. Prop. Howard Eckfeldt, head of the mining department at Lehigh, and Allen J. Johnson, director of the Anthracite Institute laboratory, Primos, Pa., are in charge of program arrangements for the conference.

Harlan Men Choose Union

A poll of employees of the Black Star Coal Co., operating extensively in Harlan County, Kentucky, has revealed that 485 out of 629 wished to be represented by the United Mine Workers in collective bargaining. Philip G. Phillips, regional director of the National Labor Relations Board, who announced the result of the poll, said that 131 voted against the union. Mr. Phillips expressed surprise at the heavy majority in favor of the union because several weeks previous, when a petition was circulated among the employees asking them to go on record as opposing representation by the union, about 80 per cent signed it.

Shortly after the poll was taken, according to William Turnblazer, president of District 19, United Mine Workers, the company signel a contract with the union. The new agreement, it was announced on Dec. 8, follows the Appalachian pact, signed in New York last April.

Mine Track and Dewatering Coal Studied By Mining Congress Coal Division

FORMAL organization of a Coal Division with bylaws similar to those of the Western and Manufacturers' Divisions was approved at the 40th annual meeting of the American Mining Congress, held at the Mayflower Hotel, Washington, D. C., Dec. 1-3, 1937. Such an organization was discussed some years ago and since that time the coal membership of the congress has functioned in many respects as a separate group. Official status for the division, however, was not formally accorded until the meeting last month.

Under the new set-up, all representatives serving on the various coal-operating project committees are ex-officio members of the division as also all members of the congress who request membership. The divisional board of governors will consist of the chairmen of the several project and district committees with the secretary and the chairman of the advisory committee. The latter committee is a body of advisers and consultants to the governors appointed by the Mining Congress' own board of directors. The board of governors elects a chairman and vice-chairman to serve one year. Annual meetings are to be held to review studies and accomplishments of committees, to outline the work to be done and to transact other business.

Project committees got busy on Dec. 3 to discuss the work of the year. Only the committee on haulage roads had any completed program to submit. This comprised specifications for main-haulage mine ties, and reports on mine-haulage ties, tie subcommittee inspection trip, and rails and track accessories. Reports also were rendered by committees on dewatering and drying washed bituminous coal and on conveyor mining. The power committee prepared questionnaires to obtain information on portable cables for high voltage underground and on trolley line and feeders for direct current underground. Eighteen basic rules for general use were presented by the project committee on safety.

"Careful check inspections of treated ties which have been in mine tracks inside the mines seven to seventeen years showed the treated ties in good condition without evidence of decay," declared A. R. Joyce, Wood Preserving Co., chairman, subcommittee on ties. "When the expected life of a main-haulage track is longer than the average life of the available untreated ties, it is economical to use pressure-treated ties. Under varying conditions in many mines the average 'spot' tie renewals in main-haulage tracks studied varied from 12 to 25 ties for two men in one 7-hour shift.

How to Spike Mine Track

"All ties on tangent track should be spiked with the inside spikes opposite each other and the outside spikes ahead in the direction of traffic." On a single-track line, the outside spikes should be ahead in the direction of the loaded trips, because derailed loaded cars work a greater damage than empties. With this arrangement, Mr. Joyce explained, a derailed car in hammering the track outside the rail and thus beginning to slew the tie, causes the spikes to grip the rail more firmly. To leave room for tamping, no less than 10-in. spacing should be provided between ties. To prevent mechanical destruction, shortleaf pine mine ties should be provided with tie plates. Tie plugs will carry infection to the heart of the tie either at the time of insertion, if infected, or afterward when they become infected; hence, they should be creosoted where the mine ties are treated.

Although, immediately on its application, broken limestone has been found to give the best results of any track ballast, declared C. C. Hagenbuch, Hanna Coal Co. of Ohio, at one mine little difference was found between limestone and mine-refuse ballast when both had been in the track for eleven years and had been covered with the dribblings from loaded mine cars. Sandstone and slag ballasts, ranking next to limestone ballast, disintegrate and absorb water as do also cinders and ashes, but more rapidly. The two latter pack quickly. Ties laid on a well-drained bottom, even where there is no ballast beneath the ties, give good results, though at many mines 3 to 6 in. of ballast under the ties are regarded as minimums with more where gradients require such additional material.

Nevertheless, asserted Mr. Hagenbuch, ballast should be tamped beneath ties, particularly under the ends and immediately below the rails, so that the road will not undulate in front of the locomotive and each car, thus increasing tractive effort. Packing of ballast in center of track under ties is undesirable, for it causes misalignment and tie breakage. Such center packs should be broken up. With four steel ties to a rail length, to supplement wood ties, so as to maintain gage, rolling stock causes

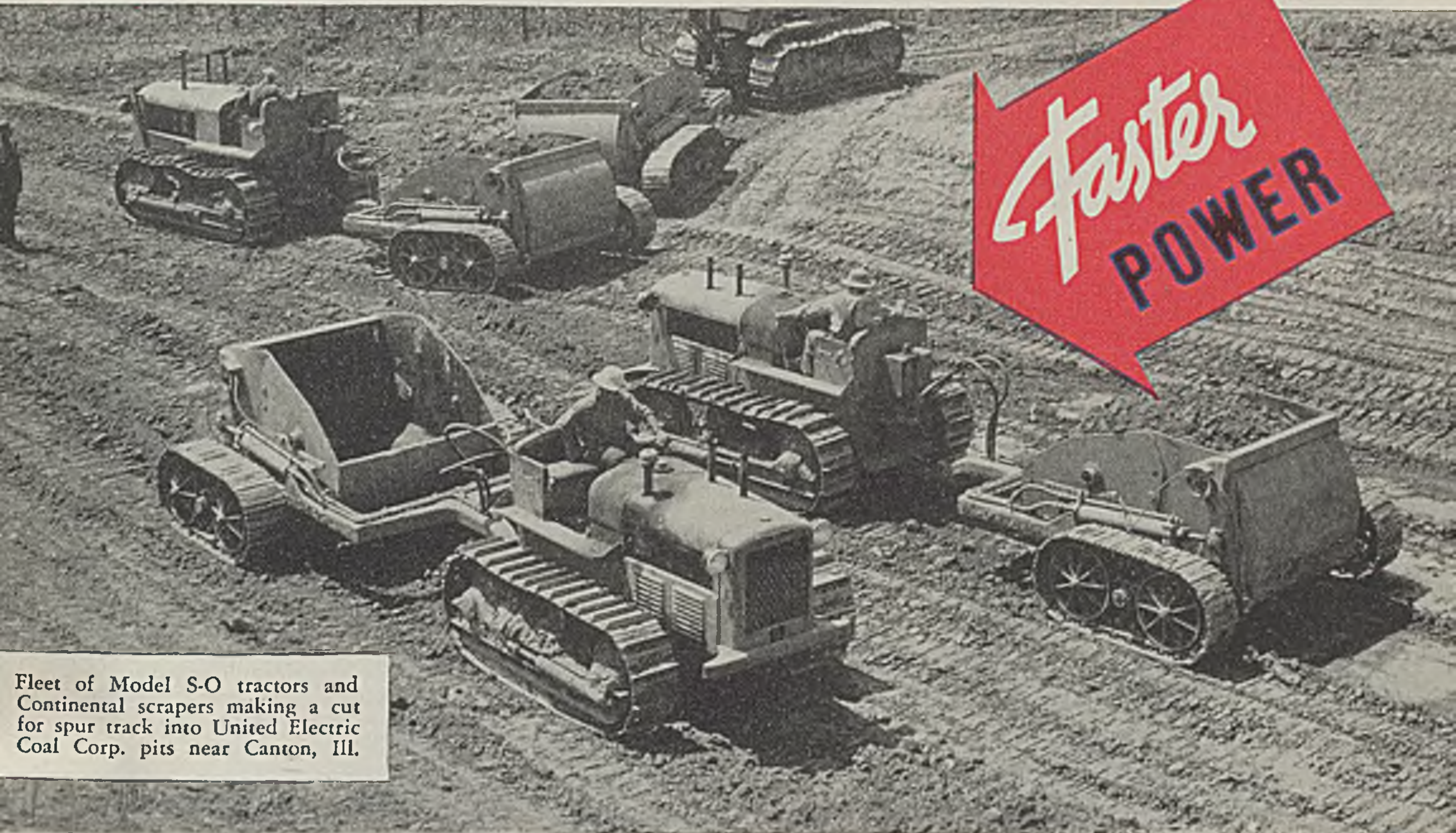
★ ★

TEACHES HOW TO BURN COAL

A comprehensive consultation service for users of coal and coke has been inaugurated by the Chicago Coal Merchants' Association, of which Joseph D. Biety is president. The new service is designed to assist home owners and other consumers to obtain adequate results, to assure better efficiency in the use of their fuel, and to help them receive the full dollar value of their investment.

The program was undertaken with the appointment as consultant combustion engineer of Stewart Orgain, a graduate of Georgia Tech and with 20 years' experience as consulting engineer on industrial and domestic problems for power plants, architects and real estate firms in various sections of the country. Mr. Orgain emphasized the importance of a consultation program for the public by pointing out that less than 2 per cent of inability to obtain full return from the use of coal and coke is due to the fuel itself, whereas 98 per cent of the trouble is caused by faulty burning equipment or improper firing methods.

CUT STRIPPING COSTS

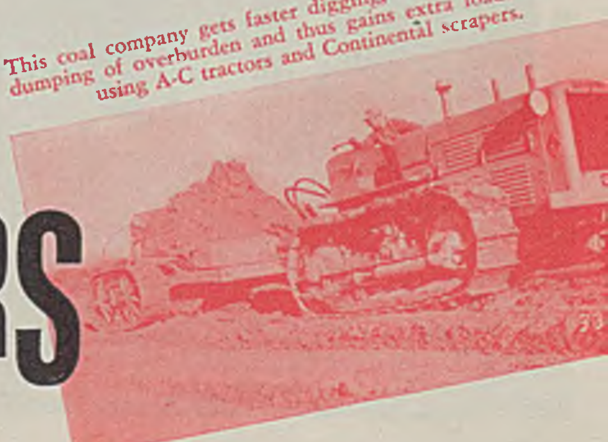


Fleet of Model S-O tractors and Continental scrapers making a cut for spur track into United Electric Coal Corp. pits near Canton, Ill.

WITH ALLIS-CHALMERS TRACTORS AND CONTINENTAL SCRAPERS

Many open-pit operators today keep shovels employed almost continuously on the productive work of coal removal by using Allis-Chalmers Tractors and Continental Scrapers for all or the bulk of overburden stripping and spoilbank removal. This combination handles such work faster than is possible with any other like combination on the market. It's *faster* because A-C tractors start instantly and go right to work — no fussing with or waiting on auxiliary motors . . . *faster* because A-C has more and higher speeds — that means greater flexibility and the right speed for every task . . . *faster* because A-C tractor design eliminates speed-robbing deadweight — extra payload is gained by saving tractor weight. Finally, there's ample reserve power for lugging in tough going at low speeds, plus FASTER POWER in those speeds at which you do 90% of your work. It's this Faster Power which enables A-C tractors to climb steep grades faster, to maneuver easily and quickly in tight spots, to strip overburden in a hurry, to cut the cost not only of stripping but of such other extra jobs as building truck roads, grading for spur tracks, cleaning up slides, etc. Ask your nearest A-C tractor dealer to show you how FASTER POWER can help you.

This coal company gets faster digging, faster hauling, faster dumping of overburden and thus gains extra loads daily by using A-C tractors and Continental scrapers.



ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition OIL TRACTORS

the steel ties to destroy the ballast, so that the shape of each steel tie is outlined in the ballast by the dust which works up against it.

Heavy rails have wider heads than light; hence locomotives running on them have more tractive effort, stated J. B. Haskell, West Virginia Rail Co., speaking for the track and accessories committee for underground track. They are helpful also when, on steep gradients, cars have to be retarded by sliders placed under the car wheels. Maintenance is more essential than heavy rail, for lighter rail with good maintenance gave better track than heavy rail with little maintenance.

Rail heads tend to wear most on the side toward the track center line and when relaid should be placed so that the low edge is still on the inside of the track; then tires will contact with more rail surface and have more tractive effort. Rails should be placed in contact end for end, and bolt holes should so provide. In joining two rails of different size, a plate can be welded on the webs to 2-ft. lengths of both rails, but it would be better to use 10 or 12 ft. of rail, so that the joints at the far ends of the rails would not be too close to each other. Plates are made ¼ in. thick and are fitted to bottom of ball of rail above and to top of base flange of rail below. If rail ends, added Mr. Haskell, have become worn and battered by indifferent rail-joint maintenance, the joint must be welded so as to fill up the depression in the top of the rail.

For mean sizes above ⅛ in., percentage of the surface moisture, which still is held by coal after dewatering, increases in proportion to decrease in surface of mean size of coal or as reciprocal of mean size, declared T. W. Day, consulting engineer, Charleston, W. Va., speaking for the committee on surface preparation. Though sufficient data are not available, it is evident that fine sizes cannot hold as much water per unit of surface as those above ⅛ in. It is obviously impossible for 0.01-in. pieces to hold 100 times as much water per pound as 1-in. pieces.

Since the meeting of the congress N. G. Alford, of Eavenson, Alford & Auchmuty, has accepted chairmanship of the committee on mechanical loading.

Resolutions condemning restrictive legislation for its hampering effects on the expansion of private industry, immediate repeal of the undistributed profits tax, and substantial modification of the capital-gains tax provisions were adopted at the general meeting of the congress on Dec. 2. The members also went on record in condemnation of government competition with private business. Use of social security tax payments for ordinary government expenses was denounced. Failure to curb labor violations of agreements made under the Wagner act was scored. Turning to water pollution, the congress held that in many cases it is impossible to conduct the industrial functions of a region and "at the same time maintain the wholesomeness of its natural waters." Legislation "which would effect federal regulation and control of the pollution of such waters" was opposed.

H. I. Young, president, American Lead, Zinc & Smelting Co., and J. R. Robbins, executive vice-president, Anaconda Copper Mining Co., were reelected directors. M. E. Shoup, Golden Cycle Corporation, and W. E. Goodman, vice-president, Goodman Manufacturing Co., were chosen to succeed Eugene McAuliffe, president, Union Pacific Coal Co., and D. B. Gillies, vice-president, Republic Steel Corporation. Mr. Young was reelected president of the congress at a later meeting of the board of directors.

To Reopen Mine

Plans are reported under way for reopening the No. 1 mine of the Simpson Creek Collieries Co. in northern West Virginia. This operation has been idle for several years. Approximately $50,000 is to be spent in installing new machinery and equipment preparatory to the reopening.

Ingenuity Transforms Basement

That it is easily possible to have a clean, convenient and modern basement in connection with the use of solid fuel was strikingly shown in a recent "modernize your basement" contest sponsored by the Philadelphia Coke Co. for its employees. A small outlay of money with some ingenuity in providing new floors, partitions to divide furnace room and laundry, ceiling board to cover pipes, and wooden table tops to cover laundry tubs when not in use brought about the transformation shown in the accompanying "before" and "after" scenes.

Labor Board Sustains Union On Violation Charge

The Clover Fork Coal Co., Kitts, Harlan County, Kentucky, violated the National Labor Relations Act by discriminatory discharge of 60 miners for union organization activity, by espionage on the United Mine Workers, and by contribution of funds used for the anti-union activities of the Harlan County Coal Operators' Association, according to a decision released by the Board on Nov. 29. On the basis of these findings the Board has ordered the company to offer full reinstatement with back pay to the 60 discharged employees.

Orders also were issued to the company to cease and desist from contributing to or cooperating with the Harlan County Coal Operators' Association, from threatening to close its mine if employees join any labor organization, and from encouraging anti-union activities. The cases of 21 other employees were dismissed on the ground of insufficient proof. The Board's complaint against the Clover Fork company was issued last July 24 after investigation of charges filed by William Turnblazer, president, District 19, U. M. W.

The Board also has certified the United Mine Workers, District 17, as the exclusive bargaining representative of about 615 employees of the McKell Coal & Coke Co., Glen Jean, W. Va. Union witnesses identified 380 authorization cards as having been signed in their presence by employees eligible to indicate a preference.

Industrial Notes

Link-Belt Co. has appointed Laurance O. Millard as district sales manager at Pittsburgh, Pa. He has been with the company 24 years, the last four as district sales manager at Cleveland, Ohio. Paul V. Wheeler has been made sales manager at Cleveland, after being connected for sixteen years with that office. Harold Hoefman has been named manager of the plant, warehouse and sales office at Atlanta, Ga., succeeding I. H. Barbee, deceased. George A. Paige has been appointed manager of the warehouse and sales office in Detroit, Mich.

Worthington Gamon Meter Co. has appointed W. C. Flanders sales manager

Before

After

succeeding G. H. Gleason, formerly vice-president in charge of sales, recently resigned.

Lincoln Electric Co., Cleveland, Ohio, has opened a welding sales-engineering office at 412 Title Building, Atlanta, Ga., under the management of Robert Daniels.

American Hoist & Derrick Co., St. Paul, Minn., has appointed Stanley M. Hunter manager of sales after two years' association with the company.

Marmon-Herrington Co., Indianapolis, Ind., has named C. Alfred Campbell as general sales director.

Iron & Steel Products, Inc., Chicago, announces the addition to its staff of Louis H. Dimick, formerly connected with Clapp, Riley & Hall, and C. William Benz, for eight years with Cudahy Packing Co. and CRLX lines.

Roots-Connersville Blower Corporation, Connersville, Ind., has appointed as representatives F. W. Bartling and G. T. Oberklein, 950 East Court St., Cincinnati, Ohio. They will cover the southwestern section of the Buckeye State as well as north central Kentucky and adjacent counties in Indiana.

Harnischfeger Corporation, Milwaukee, Wis., has made Ralph B. Holcomb, formerly sales engineer, district sales manager of its Memphis (Tenn.) territory.

Marlin-Rockwell Corporation, Jamestown, N. Y., has appointed Charles W. Rauch as advertising manager, succeeding A. A. McGowen, deceased. Mr. Rauch has been with the company for twenty years, successively as designer, chief draftsman, sales engineer, consulting engineer, and manager of the technical publications department.

Coal-Mine Fatality Rate Shows Sharp Rise

Accidents at coal mines of the United States caused the deaths of 128 bituminous and 21 anthracite miners in October last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With production totaling 40,040,000 tons, the death rate among bituminous miners was 3.20 per million tons, compared with 1.81 in the preceding month, when 38,620,000 tons was produced, and 2.31 in October, 1936, when output was 42,935,000 tons. The pronounced advance in the rate for October last was due to the occurrence of major disasters in Alabama and Alaska.

The anthracite fatality rate in October last was 4.59 per million tons, based on a production of 4,579,000 tons, as against 3.14 in the preceding month and 1.30 in October, 1936.

For the two industries combined, the death rate in October last was 3.34, the highest for any month thus far this year. The figure for October of last year was 2.21.

Fatalities during October last, by causes and States, as well as comparative rates for the first ten months of 1936 and 1937, by causes, are given in the accompanying tables.

To Make P. & R. Survey

Eavenson, Alford & Auchmuty, mining engineers, Pittsburgh, Pa., have been engaged by representatives of the committees acting for bondholders of the Philadelphia & Reading Coal & Iron Co. to make a survey of the company's properties and operations. After the engineering firm has made its report, the findings and recommendations will be submitted to the various security holders of the mining company, which has asked permission to reorganize under Sec. 77b of the federal Bankruptcy Act.

Ohio Collieries Co. Merged

Ohio Collieries Co., Glouster, Ohio, has been absorbed, effective Dec. 24, by the George M. Jones Co., of which it was a subsidiary. The parent organization has taken over all assets and liabilities of the subsidiary but has made no changes in personnel or operation.

Whitwell Mine Transferred

Mining properties of the Whitwell Smokeless Fuel Co. at Whitwell, Tenn., have been transferred to the Tennessee Products Corporation, effective Dec. 1. The land, which is owned by the Tennessee Coal, Iron & Railroad Co., was formerly leased to the Black Diamond Coal Mining Co. Carl McFarlin, president of the Whitwell company, will be division manager under the new set-up.

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*
January–October, 1936 and 1937

	Bituminous				Anthracite				Total			
	Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons	
Cause	1936	1937	1936	1937	1936	1937	1936	1937	1936	1937	1936	1937
Falls of roof and coal	490	450	1.414	1.226	103	102	2.265	2.492	593	552	1.513	1.353
Haulage	153	188	.442	.512	18	24	.396	.587	171	212	.436	.520
Gas or dust explosions:												
Local explosions	17	16	.049	.044	11	...	.242	.....	28	16	.071	.039
Major explosions	18	95	.052	.259	5	...	.110	.....	23	95	.059	.233
Explosives	20	22	.058	.060	13	13	.286	.318	33	35	.084	.086
Electricity	30	43	.087	.117	6	3	.132	.073	36	46	.092	.113
Mining machines	14	13	.040	.035	...	1	.....	.024	14	14	.036	.034
Other machinery	9	5	.026	.014	2	1	.043	.024	11	6	.028	.015
Miscellaneous:												
Minor accidents	35	30	.101	.082	17	11	.374	.269	52	41	.133	.100
Major accidents	9	...	.026	.....	...	...	.....	.....	9	....	.023	.....
Shaft	8	13	.023	.035	7	3	.154	.073	15	16	.038	.039
Stripping or open-cut	7	5	.020	.014	7	5	.154	.122	14	10	.036	.024
Surface	31	49	.090	.133	12	16	.264	.391	43	65	.110	.159
Grand total	841	929	2.428	2.531	201	179	4.420	4.373	1,042	1,108	2.659	2.715

*All figures subject to revision.

COAL MINE FATALITIES, OCTOBER 1937, BY CAUSES AND STATES

	Underground										Surface						
State	Falls of Roof	Falls of Face	Haulage	Gas or Dust Explosions	Explosives	Electricity	Mining Machines	Suffocation	Other Causes	Total Underground	Persons Falling Down Shafts	Mine Cars	Railway Cars	Machinery	Electricity	Other Causes	Grand total
Alabama	3	..	1	34	..	..	...	..	..	38	...	..	..	..	..	..	38
Alaska	..	..	..	14	..	..	...	..	..	14	...	..	..	..	..	..	14
Arkansas	1	..	..	4	..	..	...	..	1	6	...	..	..	..	..	..	6
Illinois	5	..	2	...	..	..	...	..	..	7	...	..	..	..	1	..	8
Indiana	3	..	..	...	..	1	...	..	..	4	1	..	1	..	..	..	6
Kentucky	8	..	1	...	..	..	...	..	..	9	...	..	..	..	..	..	9
Maryland	..	..	1	...	..	..	...	..	..	1	...	..	..	..	..	..	1
New Mexico	1	..	..	...	..	..	...	..	..	1	...	..	..	..	..	..	1
Ohio	5	..	..	2	..	..	...	..	..	7	...	..	..	..	..	..	7
Pennsylvania (bit.)	5	..	4	...	..	..	...	..	1	10	...	1	..	..	..	1	12
Tennessee	..	..	1	...	..	..	1	..	..	2	...	..	..	..	..	..	2
Utah	..	..	..	...	..	1	...	..	..	1	...	..	..	..	..	..	1
Virginia	3	1	1	...	..	..	...	..	..	5	...	..	..	..	..	..	5
West Virginia	10	1	2	...	2	1	1	..	..	17	...	..	1	..	..	..	18
Total (bituminous)	44	2	13	54	2	3	2	..	2	122	1	1	2	..	1	1	128
Pennsylvania (anthracite)	7	2	3	...	3	1	...	1	1	18	...	..	..	2	..	1	21
Total	51	4	16	54	5	4	2	1	3	140	1	1	2	2	1	2	149

Trade Literature

Bearings—Fafnir Bearings, Inc., New Britain, Conn. Bulletin tells about Fafnir roller journal bearings for all types of railway and other car journals; points out advantages of installing friction-free journal boxes not only on newly authorized equipment but on existing equipment as well.

Bearings—New Departure, Division General Motors Corporation, Bristol, Conn. (20 pp.). Booklet entitled "Sealed" gives the principles involved in the N-D-Seal bearing, and the need for this type of unit, citing case histories.

Bearings — Norma-Hoffmann Bearings Corporation, Stamford, Conn. (Catalog F-958, 84 pp.). Covers complete line of precision ball, roller and thrust bearings with tabulated data on sizes, dimensions and load ratings of 108 series of bearings embracing over 3,000 cataloged sizes. Cross-sectional drawings of typical applications, full bearing tolerances; instructions for mounting, lubrication and protection also included.

Bearings—Timken Roller Bearing Co., Canton, Ohio (294 pp., illustrated). Timken Engineering Journal includes a general discussion of design and types of Timken bearings available, ratings and bearing selection, methods used for calculating bearing loads for a wide range of fundamental applications, and gives detailed information as to bearing sizes and load-carrying capacity.

Belts—Manhattan Rubber Manufactur-

ing Division, Raybestos-Manhattan, Inc., Passaic, N. J. (4 pp., illustrated). Sets forth reasons for compensating rubber belts and the compensated principle, besides explaining advantages of this type of belt. Engineering data essential to proper selection, application and supervision of belts are included.

Belt Maintenance—B. F. Goodrich Co., Akron, Ohio (Catalog 2,800, 20 pp., illustrated). Manual on installation, care and maintenance of conveyor and elevator belting discusses such topics as: saving belt wear at loading points; protecting belts from trapped lumps; how reduced speeds save belts; belt wear as affected by idler spacing; excessive tension; effects o light, heat, cold and moisture; splicing and repairing; tension formula.

Cables — General Cable Corporation, New York (14 pp., illustrated). Points out principal characteristics and differences in Concentric Trenchlay and Ruralay cables, summarizing the advantages of both.

Coal-Preparation Equipment — McNally-Pittsburg Manufacturing Corporation, Chicago (Catalog No. 637, 80 pp., illustrated). Describes the company's service "from excavation to operation," including design, engineering, manufacturing, construction and tested operation. Equipment sections include: washers, pumps, breakers and crushers, "Centriflex" pulverizers, rotary dumps, car retarders, picking tables, conveyors, loading booms, conveyor chains, screens and screen plates, elevators and buckets, chutes, gates, feeders, power-transmission machinery and parts, cages-skips and mine cars.

Conveyors — Stephens-Adamson Manufacturing Co., Aurora, Ill. (Catalog No. 47, 124 pp., illustrated). Concisely describes the complete S.-A. line of belt conveyors, carriers, trippers, pulleys, shafts, bearings, belting, and bucket elevators for handling bulk materials. Engineering data in condensed form also are presented.

Corrosion-Resisting Steel — United States Steel Corporation subsidiaries (66 pp., illustrated). Sets forth the advantages and applications of Cor-ten, with special emphasis on the saving of deadweight in its use. Among users for it in the mining industry are listed chutes, conveyor belts, fan blades and mine cars.

Couplings — Baldwin-Duckworth Chain Corporation, Springfield, Mass. (Bulletin 63, 8 pp., illustrated). Gives descriptions and outlines the uses of B.-D. roller-chain flexible couplings as well as semi-flex and twin-flex units, with tabulations of dimensions, horsepower and service factors.

Crushing and Feeding Equipment—C. O. Bartlett & Snow Co., Cleveland, Ohio (Catalog No. 77, illustrated). Gives complete details of roll crushers swing-hammer pulverizers, rotary crushers, disintegrators, ball mills, etc., and plunger, plate, screw, apron, pocket, cutting and table feeders. Also contains engineering diagrams, capacity tables and suggestions for use.

Deep-Well Turbine Pumps—Fairbanks, Morse & Co., Chicago (Bulletins 6,920 and 6,920R, illustrated). Describe inclosed-impeller oil-lubricated and water-lubricated units, respectively, the latter for use where the water must be kept pure and clean and oil lubrication is not permissible.

POLICE! SMOKING CHIMNEY!

Educational material on proper methods for firing home furnaces is being distributed in Cincinnati, Ohio, through the police and fire departments. Believing that the Department of Safety of that city can play an important role in smoke abatement activities, Director of Public Safety Harry J. Wernke obtained permission from Appalachian Coals, Inc., to distribute to smoke violators that company's booklet of firing instructions entitled "Which End?" When a policeman or fireman sees a smoking chimney he calls at the home, points out that the city ordinance is being violated, and asks the householder to read the book of instructions, a copy of which is left for perusal.

★ ★

Deep-Well Turbine Pumps—Peerless Pump Division, Food Machinery Corporation, Massillon, Ohio (Catalog P-227, 64 pp., illustrated). Explains design and construction of various types Peerless pumps. There also is a section containing engineering and hydraulic data.

Direct-Fired Unit Heaters—Dravo Corporation, Pittsburgh, Pa. (20 pp., illustrated). Explains advantages of Lee system of heating, describes various types for particular applications, and pictures a number of installations.

Dusts—Mine Safety Appliances Co., Pittsburgh, Pa. (16 pp., illustrated). Answers important questions regarding the nature and effects of dusts in simple and, in so far as possible, non-technical language, and describes M.S.A. respirators, abrasive mask and clean-air blower.

Explosives—E. I. duPont de Nemours & Co., Inc., Wilmington, Del. (Bulletin A-7855, 4 pp.). Lists and describes brands of DuPont explosives and tells the uses to which they are adapted.

Electrical Maintenance Helps—Ideal Commutator Dresser Co., Sycamore, Ill. (12 pp., illustrated). Describes new products for the repair and maintenance of electrical equipment, particularly motors and generators.

Friction Clutches—Link-Belt Co., Chicago (Catalog 1532, 16 pp., illustrated). Gives sizes, dimensions, weights, horsepower ratings, and other pertinent tabular data on both Meeseco and Twyncone types of clutches. Also devotes two pages to the problem of selecting and ordering the right clutch for a given service.

Hard Facing—Haynes Stellite Co., Kokomo, Ind. (104 pp., illustrated). Sets forth more than 500 applications of the hard-facing process, among which is a long list of uses in the coal-mining industry.

Insulating Material — Continental-Diamond Fibre Co., Newark Del. (20 pp., illustrated). Explains the characteristics of Micabond as an insulator against the conduction of electricity, gives specific uses, and tabulates properties, sizes and specifications.

Insulations — Johns-Manville, New York (52 pp., illustrated). Booklet entitled "Heat" gives a history of heat and accomplishments in its conservation, describing materials for this purpose and specific uses of these materials. How the economical thickness of an insulation is figured and why certain insulations are better for one purpose than another are discussed in detail.

Liquid-Oxygen Explosive—Don B. McCloud, DuQuoin, Ill. (38 pp.). Booklet containing rules for preparing and handling Airmite, a liquid-oxygen type of explosive for use in strip pits.

Motors—Louis Allis Co., Milwaukee, Wis. (Bulletin No. 700, 58 pp., illustrated). Describes various types of motors including splashproof, explosion-proof, totally inclosed fan-cooled and self-cleaning types; also gives complete engineering data on the various types, their uses, advantages, limitations, etc.

Oil Pumps—DeLaval Steam Turbine Co., Trenton, N. J. (Catalogs L-32 and L-32-10, 8 pp. each, illustrated). Present the DeLaval IMO pump, having only three moving parts, designed to run at conventional motor and turbine speeds.

Perforated Metals — Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (Bulletin 1,832, 24 pp., illustrated). Covers wide range of screening equipment for all manner of applications, in all common commercial grades of steel plates or sheets, or in any other metal material used in screens, in thicknesses up to $\frac{3}{4}$ in.

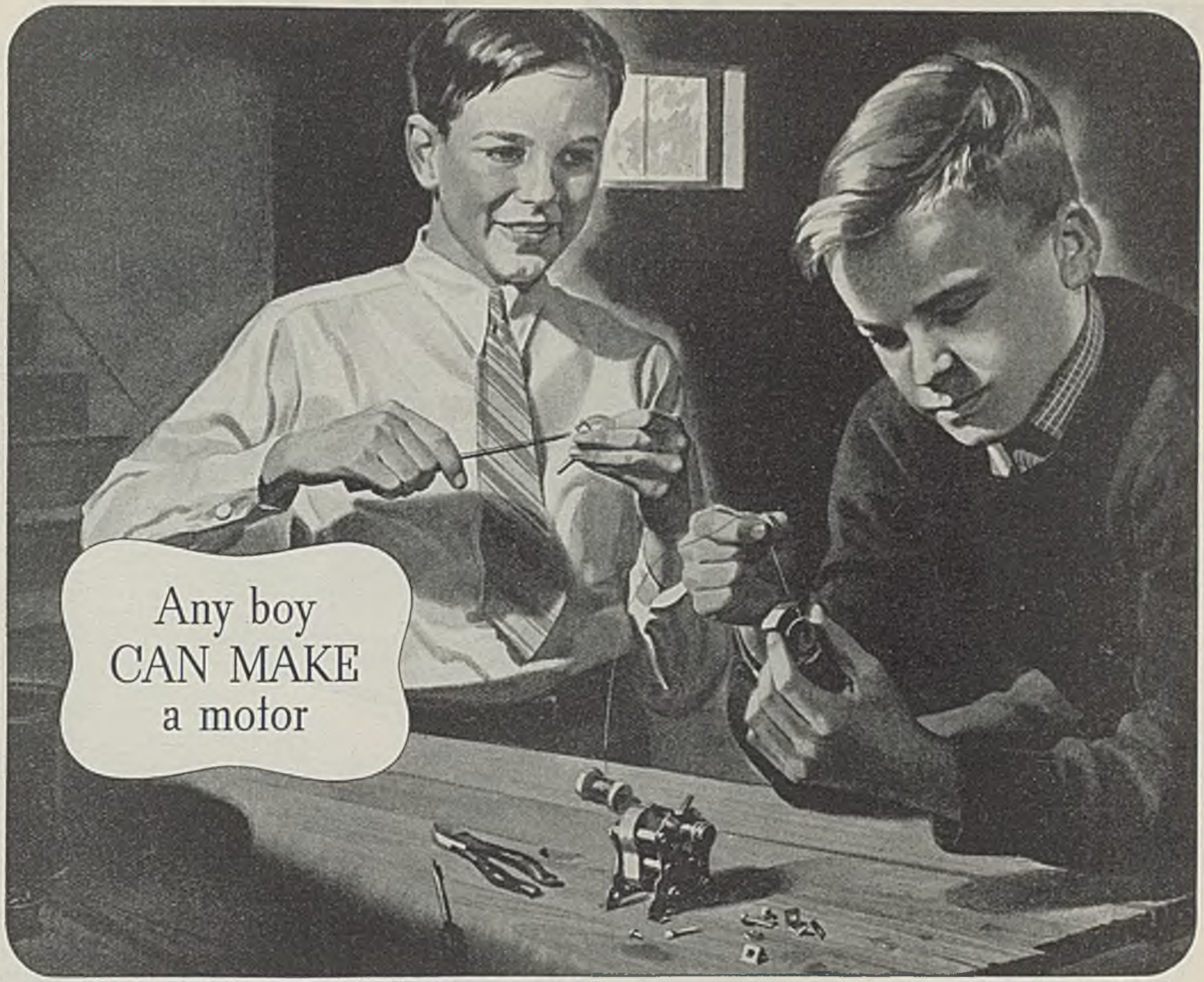
Portable Compressors—Sullivan Machinery Co., Michigan City, Ind. (24 pp., illustrated). Catalog entitled "Sullivan Plus Portable Compressors" describes the company's line of two-stage units with specifications and other useful data.

Pumps—Dayton-Dowd Co., Quincy, Ill. (Bulletin 805, 16 pp., illustrated). Describes Type "DC" close-coupled centrifugal pumps for various purposes, giving features of design, details of construction, dimensions, rating tables and useful data.

Safety Apparel—Industrial Gloves Co., Danville, Ill. (20 pp., illustrated). Catalogs "Steel-Grip" line, including gloves, mittens, hand leathers, arm protectors, sleeves, aprons, chaps, leggings, shin guards, spats, coats, pants and fire-fighting suits made of chrome leather, asbestos and fireproofed duck materials.

Screens—W. S. Tyler Co., Cleveland, Ohio (Bulletins 725 and 726, illustrated). List woven-wire screens of all meshes and metals for separation of both wet and dry materials; contain information on Tyler standard screen-scale testing sieves operated by Ro-tap and Ty-lab sieve shakers in determining the proportion of each size material in the products of screens and grinders. Also inclosed are direct and logarithmic plotting papers for comparison and study of the results of sieve tests.

Steam Pumps—Fairbanks, Morse & Co., Chicago (Bulletin 6,205, 8 pp., illustrated). Deals with both general-service and low-service units of the duplex-piston-pattern type designed to pump water, oil and similar liquids at pressures up to 420 lb. per square inch in quantities up to 461 g.p.m.



Fitting them to the world's work is a man-size job

FOR a thing so important to modern life, an electric motor is an amazingly simple device. Just a few pieces of steel and iron, wound with coils of wire. Any bright boy can follow instructions and make one that will run.

Yet the most romantic story ever told could be written about the electric motor. It runs practically every mechanical device in use today. It turns the wheels of industry — carries people to work from the suburbs to the topmost floors of tall buildings. The daily lives — even the livelihood — of most of us depend in some way upon it.

The job of fitting electric motors to the world's work is an exacting one. What makes it complicated is that every task, to be done efficiently, requires a certain kind of motor. Westinghouse, for example, offers over 20,000 different types, sizes and ratings. If none of these is exactly what is needed, a special model will be built to order.

The electric motor is "bread and butter" to Westinghouse — and to just about everyone else. Fully conscious of its responsibility, Westinghouse research continues each year to seek improvement in motor design — so that the world's work may be done better, faster, and at less cost.

Westinghouse

The name that means everything in electricity

Why spend *BIG MONEY* to check Pipe Corrosion?

When only a Few Pennies Extra can more than double the Life of your Mine Drainage Lines.

TO check corrosion is easy if cost is no object. But to check corrosion and do it economically is a job which has been solved by engineers and metallurgists of National Tube Company, only after years of ceaseless research and experiment.

NATIONAL offers you these two types of pipe, made expressly to check the two most common kinds of corrosion, atmospheric and internal, without adding materially to cost.

Whatever your problems involve in handling mine waters, you can rely on the experience and engineering talent of National Tube Company to provide the most practical solution at lowest cost. Hundreds of successful installations of NATIONAL Pipe, serving mines in all parts of the country, are standing proof of our ability to help solve difficult problems. Write for more data.

*NATIONAL COPPER-STEEL PIPE

resists atmospheric corrosion due to alternate wetting and drying in humid mine atmosphere. Such conditions cause speedy corrosive attack on ordinary pipe, but NATIONAL Copper-Steel lasts 2½ to 3 times longer, by actual test.

**To check both atmospheric and internal corrosion, National Copper-Steel Duroline Pipe is available.*

*NATIONAL DUROLINE PIPE

resists internal corrosion. Mine drainage waters are often active, tend to attack drain pipes internally, causing rapid tuberculation and premature failure of the pipe. DUROLINE eliminates internal corrosion once and for all, simply by keeping the corrosive water away from the pipe metal. An impervious lining does the trick, more than trebles the life of the pipe in corrosive-water service.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

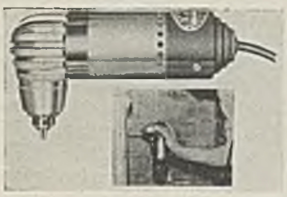
UNITED STATES STEEL

WHAT'S NEW

In Coal-Mining Equipment

ELECTRIC DRILL

Ample power, compact design, light weight and ability to work "around corners" are the principal features claimed for the new "Shorty" electric drill of the Black & Decker Mfg. Co., Towson, Md. The chuck spindle is



mounted at right angles to the motor, reducing tool length to $4\frac{1}{2}$ in. Motor housing dimensions have been cut to a minimum so that the tool fits snugly in the operator's hand and requires no extra handle. It is equipped with a universal motor for 110, 220 or 250 volts, a.c. or d.c., and is available in $\frac{1}{4}$- and $\frac{5}{16}$-in. sizes.

ELECTRIC PLIERS

Ideal Commutator Dresser Co., 1012 Park Ave., Sycamore, Ill., offers a new and smaller unit in its line of "Thermo-Grip" electric pliers. This No. 2 "Midget" type, according to the company, is suitable for such tasks as soldering small lugs and terminals up to 150 amp. in close quarters on switchboards, motors, generators, etc., sweating joints on small copper tubing and fittings up to $\frac{5}{8}$ in. in diameter, and similar tasks. The unit, according to the company, can be used on any standard lighting circuit.

CUTTING TOOL

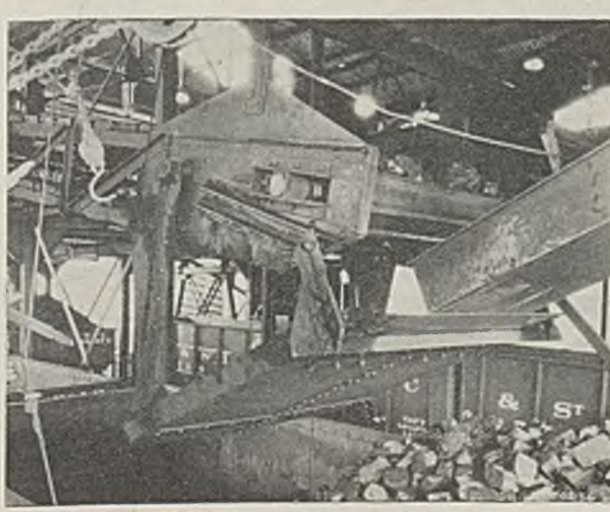
Haynes Stellite Co., Kokomo, Ind., offers a new cobalt-chromium-tungsten alloy for cutting tools, known as "Haynes Stellite-2400." Advantages of the new tools, according to the company, are greater edge strength and economical tool life at even higher speeds than with "Haynes Stellite J-Metal" without reductions in feeds or depths of cuts. "Haynes Stellite-2400" tools are available in various sizes in solid square and rectangular bits, welded-tip tools, milling-cutter blades and special small tools to suit requirements. Uses include roughing and finishing cast and forged steels; nitrided, stainless and other alloy steels; cast iron; and other malleable iron.

DIVERSION CHUTE

An automatic diversion chute which permits continued operation of loading booms while cars are being changed has been introduced by the Jeffrey Mfg. Co., Columbus, Ohio. This diversion chute can be applied to either chain- or belt-type booms.

The chute proper, of steel plate, is supported at its forward end by rollers running in angle tracks on the loading boom. At its rear end the chute is pivoted on a yoke attached to a cable and counterweight. With the boom in loading position, the chute lies in retracted position against the under side of the boom frame.

To change cars, the operator raises the boom a few feet. This automatically causes the chute to roll to the end of the boom while the rear drops, thus swinging the chute directly under the stream of coal coming from the boom. In this position the chute bridges the gap between the cars and diverts the coal backward, allowing the loaded car to be dropped down the track while an empty is moved forward without stopping the flow of coal. Lowering the boom automatically returns the chute to its retracted position.



PUMPS

Fairbanks, Morse & Co., Chicago, offers a new line of duplex power pumps (Fig. 6130) for service requiring pressures up to 800 lb. and capacities up to 187 g.p.m. These pumps are available with a fluid-end piston stroke of 10 in. and cylinder diameters of from $2\frac{1}{2}$ to 5 in., providing a capacity range of from 40 to 187 g.p.m. at pressures of from 250 to 800 lb. The pumps can be furnished alone, with pulley for belt drive or with top-mounted Fairbanks-Morse motor and silent-chain drive.

CONVEYOR BELTING

B. F. Goodrich Rubber Co., Akron, Ohio, offers a new conveyor belting characterized by a carcass built up of weftless cords such as are used in the modern heavy-duty truck tire. The result, it is stated, is a belt carcass in which every tension member is completely surrounded and insulated with rubber to increase its ability to absorb and withstand shock. Considerably longer wear than with the best belts of the fabric-carcass type is claimed for the new "Cord" conveyor belting, along with extreme transverse and longitudinal flexibility and greater resistance to impact, cutting and gouging, as well as to moisture and acid penetration. Goodrich "Cord" belting is available in any length, width and number of plies. In installation, it must be spliced endless on the conveyor by means of portable electric vulcanizing equipment.

ELECTRODE

A new mild-steel arc-welding electrode designed particularly for use with small alternating-current transformer-type arc welders and said to simplify welding with this type of equipment while providing a high-quality weld metal, is announced by the Lincoln Electric Co., Cleveland, Ohio. Designated as "Transweld," the new electrode is recommended for making all types of welds in flat, horizontal, vertical or overhead positions, also operating equally well with either straight- or reversed-polarity direct current. Sizes are: $\frac{3}{32}$ in. (12-in. lengths) and $\frac{1}{8}$ and $\frac{5}{32}$ in. (14-in. lengths).

ANATOMICAL SHIRT; GAS INDICATOR

Mine Safety Appliances Co., Pittsburgh, Pa., offers the M-S-A "Anatomical Shirt" for practical and graphic instruction in the location of arteries, bones and organs of the torso and arms. Stated to be vastly su-

perior to charts, the shirt is true to life and provides an unforgettable picture of the physical features constantly referred to in instruction in first aid.

Mine Safety also offers the M-S-A "Explosimeter," which it describes as a pocket-sized instrument for quickly and easily determining the presence of combustible gas hazards.

The instrument is designed to be carried around, and in size and weight is said to compare with a small folding camera. It shows whether gas concentrations are within or above the

explosive range. Dependability, compactness and ease of operation are stated to give the instrument a wide range of application.

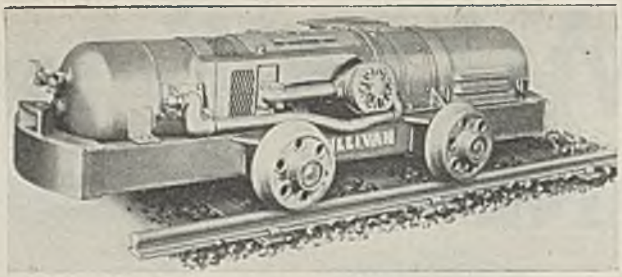
TORCH CUTTER

Oster Mfg. Co., Cleveland Ohio, offers the new No. 222 torch-cutting machine, which supersedes the original No. 212 model. The new machine duplicates in design any pattern required for pipe-welding jobs without the use of cams, templets or special fixtures and, according to the company, with a surface having the appearance of a lathe cut. It will cut pipe from 2½ to 12 in. and, in addition to hole cutting, will make tees, 90-deg. reducing tees, 45- and 90-deg. branch reducing tees, elbows, miters, Ys and blunt bull plugs, it is asserted. Floor space is 3 ft. 4 in. x 9 ft.

Rounding out its list of "Tom Thumb" portable pipe machines, the company also offers the No. 512A unit, completing a line of ½- to 2-in. equipment. Over-all length of the new machine is 34 in.; width, 21 in.; height, 24 in. Net weight is 375 lb.

DETONATOR

Ensign-Bickford Co., Simsbury, Mass., offers a new flexible "detonating fuse" under the trade name "Primacord." The new fuse, according to the company, has a faster detonating wave than Cordeau-Bickford, while its fabric covering affords greater flexibility with minimum weight, suitable tensile strength and excellent waterproof qualities. It can be handled quickly and easily, and main lines can be laid much closer together than with Cordeau, inasmuch as there is no metal covering on "Primacord" to fly and cause injury to adjacent lines of fuse.



COMPRESSOR

Sullivan Machinery Co., Michigan City, Ind., offers the new "Mine-Air" mine-car compressor, said to offer greater convenience and higher efficiency than hitherto obtainable. The unit is described as a low, compact, strong, cool machine giving high air delivery in proportion to power consumption. Operation is said to be practically automatic and trouble free and is matched by the ability of the compressor to stay on the rails.

SPEED CONTROL

Supplementing its line of accessory equipment for use with the Reeves variable-speed transmission, the Reeves Pulley Co., Columbus, Ind., offers the MDB-3 differential control for a variety of requirements in automatic speed control, such as the synchronization of two or more machines or parts of a single machine, and mainte-

nance of uniform peripheral winding and unwinding speed. The control also may be used as primary driving equipment for loads not exceeding its rated torque and speed capacity. Over-all dimensions are: width, 8 in.; length, 11 in.; and height, 6⅝ in. Shafts are extended on both sides so that installation may be made as desired.

WAGON DRILL

A new light-weight wagon drill, the FM-2, has been announced by the Ingersoll-Rand Co., Phillipsburg, N. J. Built for continuous, heavy-duty operation, the unit is said to be extremely light in weight with, at the same time, the versatility of a "Jackhamer." One feature is a ratchet by means of which one man can quickly raise or lower the drill guide in the uprights. Automatic positive feed at any angle is provided by an air-motor-control unit providing feed pressures ranging from 1 to 1,000 lb. A worm gear, which transmits power from the air motor to the feed chain, is self-locking, eliminating thrust

on and shock to the motor and preventing the drill from dropping or jumping forward. The FM-2 drill will accommodate a 6-ft. drill change and will handle steels 20 ft. long.

VALVES

Three new valve lines have been announced by the Crane Co., Chicago. One line comprises brass screwed-end globe (62P) and check (78E) valves for a steam pressure of 350 lb. at 550 deg. F. These valves, with Crane nickel-alloy plug-type disks and Exelloy (specially heat-treated chromium iron) body seat rings, also may be used on non-shock cold-water oil and gas lines up to 1,000 lb. Sizes range from ½ to 2 in. To round out the companion line of gate valves a 350-lb. 550-deg. unit has been added to the No. 230-H brass gate types.

For severe service on small lines carrying steam, hot and cold water, oil, gas and similar fluids, Crane offers a line of brass globe (No. 14½P) and angle (No. 16½P) valves with Crane nickel-alloy plug-type disks and Exelloy body seat rings. Made in sizes from ⅛ to 3 in., these valves are recommended by the company for working pressures of 150 lb. of steam or 300 lb. of cold water, oil or gas. Disks and seats are interchangeable with those in 14P and 16P brass valves.

Iron-bodied globe and angle valves for severe service are another offering utilizing Crane nickel-alloy disks and Exelloy body seat rings. These valves are recommended by the company for 150 lb. of steam and 300 lb. of cold water, oil or gas, as well as for throttling service. They are offered in sizes from ¼ to 3 in. and feature interchangeability of parts. Designations are: 314½P, globe, and 316½P, angle.

The Crane Co. also has reinstated its line of brass fittings for flared copper tubing, including 45- and 90-deg. elbows, tees, couplings, reducers, adapters and flanging tools in sizes from ⅜ to 1¼ in.

BLASTING UNITS

Portable Lamp & Equipment Co., Pittsburgh, Pa., offers two permissible single-shot blasting units bearing the approval of the U. S. Bureau of Mines and developed to meet the new provisions of the Pennsylvania Bituminous Mining Code. The units consist of wooden cylinders slightly under 2 in. in diameter and 9⅜ and 7 in. in length containing three or two No. 950 "Eveready" unit cells, respectively. A cap, sealing pin and sealing wax hold the unit together. Spent cells may be removed and new ones inserted.

DRAGLINE

A new P & H 2½-cu.yd. dragline for long-range low-ground-pressure work is a new offering of the Harnischfeger Corporation, Milwaukee, Wis. Designated as the Model 955-LC dragline, the new unit, employing an 80- to 100-ft. aluminum boom, provides a wider working range. Principal fea-

tures cited by the company are: exceptionally long crawlers accommodating 30-, 36- or 42-in. shoes for lowest-possible ground pressures and maximum mobility with greatest stability; new swiveling-type fair-lead for faster operation and less rope wear; all-welded alloy construction for lighter weight and greater strength; simplified deck design; and diesel power (185 hp. 8-cylinder engine).