

COAL AGE

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

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March, 1938



Modern Stripping

FROM the most primitive method of mining reaching back to the earliest days of mineral extraction, bituminous coal stripping has become one of the most efficient and modern systems known. This transformation, which has taken place in the life span of less than two generations, is the direct result of mechanization. Initiative in this development came directly from the stripping pioneers of the '80s and their successors have been both ready and eager to junk good equipment for something newer and better.

Judged by 1938 standards of performance, some of the earlier adventures in mechanization perhaps were crude; some of them fell short of high expectations. But failure and success alike were used as stepping stones to further improvement. The $\frac{3}{4}$ -yard bucket grew first by easy progressions and in recent years by bounds until 30- and 32-yard dippers are not uncommon. And operating technique has kept pace with the machine.

Ability to strip increasing depths of overburden has greatly enlarged the acreage recoverable and, because the percentage of extraction is high, has contributed materially to the true conservation of a great natural resource. Strip mines were the first to welcome mechanical cleaning in Illinois, Indiana and the Southwest. Once a stepchild which fed well only when deep mines were down or gorged with business, the strip pit has since won a deserved place in its own right at indus-

try's table. Strip mines and the highly mechanized underground operations offer the only effective bulwarks against competition from other fuels—if those defenses are not weakened by carrying the burden of prices designed to protect the inefficient.

Progressive management can learn much from the history of the growth of stripping and the reasons back of that development touched upon so briefly here. The early struggles and what constitutes a modern stripping operation are well illustrated in the story of the United Electric Coal Cos., which began in the Danville district—the cradle of bituminous stripping in this country. This story is told in six articles in this issue of *Coal Age*.

Two Fans or One?

WHEN air is driven into a heading through a pipe, as is customary with rock headings under construction, the nitric fumes from blasting and the untrapped dust from operations of all kinds float back from the face along the heading past face workers and haulage men. It is necessary to wait a long time between blasts for the air to clear because in the heading it travels slowly and has a long way to go. But this wait will not correct the evils due to mucking and drilling dusts. When, on the other hand, the air is exhausted through a duct by a fan, the air entering the heading rarely goes to the face, which is filled with stagnant polluted air, but takes the shorter course to the mouth of the air duct. Consequently it has no scavenging effect.

With two ducts and two fans, one of each for exhaust and the other two for pressure ventilation, the disadvantages of both systems are obviated and work can be speeded. The pressure pipe can be shorter than the exhaust duct and often of smaller diameter; the pressure fan can be of smaller dimensions and less capacity than if it had to overcome the resistance and leakage of a long line of pipe. It can take air from some point back of the mouth of the exhaust duct, for, up to that point, the air is free of dust and fumes. The pressure fan need be placed only far enough back to protect it from injury in blasting, against which it can be barricaded.

Why not use, therefore, two fans and get the desired purity of air? Exhaust ducts now can be made of fabric and yet retain their shape and capacity. The pressure duct can be arranged to blow fumes and dust down and the exhaust duct to catch both as they fall. A washbowl is cleaned best by stirring its contents and providing a duct for carrying the water waste away; so with a heading the pressure fan will do the stirring and the exhaust fan will evacuate the foul air.

More Nostrums

DETAILED discussion of the proposal for nationalization of the anthracite mines sponsored by Governor Earle is not possible at this time because the plan so far has been publicized only in generalities. Let Uncle Sam, he is reported as suggesting, purchase all the hard-coal lands and improvements—or maybe just the lands—and lease them back to their quondam owners for operation under government regulation. This done, production would be allocated, bootlegging would disappear, coal would be cheaper and, presumably, everybody would be happy.

Just how this arrangement would lower prices is left delightfully vague. The idea that the taxation burden of the industry might be lightened or even eliminated meets with no kindly reception from boroughs that have existed on such revenues. Wage rates, of course, would be

left untouched. Since average production costs at legitimate operations are now higher than average realizations, clearly there is no fat there to be trimmed even if funded-debt charges were wiped out.

Nothing in the proposal as so far revealed gives any concrete foundation to support a belief that it would help in the slightest in the recovery of markets anthracite has lost in the last twelve years. If the "fair" price to be paid for the properties had any relation to equity, administration of this panacea might conceivably ameliorate some of the financial pains of the present owners of anthracite enterprises. But, unless it is assumed that the burden is to be shifted to the government for the public at large to pay, the plan promises no relief to the anthracite industry itself. And simple shifting is hardly a sound solution.

Putting Theory to Work

Few theoretical conclusions are practically proved until the force of economic circumstances builds sufficient pressure to warrant their solution. This is particularly true in all natural-resource industries, where history and precedent have long governed operating procedure. But, given theoretically proved formulas to guide such procedures with a sufficient amount of economic pressure to justify expenditures and practical solutions invariably result.

Lower-cost coal, for example, demands increasing tonnage output per total employee. This in turn has given the impetus to all modern mechanization movements. Mechanical loading equipment today, however, has a capacity per minute, per hour and per shift far in advance of present ability to utilize more than one-third to one-half of it. It seems inevitable, therefore, that the theory of roof control, technically proved by formula and model experiment, will soon resolve into practical long-face operations where loading machines can function continuously throughout the shift with tonnages per total employee far greater than history or precedent could ever project.

YESTERDAY AND TODAY

+ United Electric Mirrors Progress

Won by Continuous Modernization

WHEN THE FIRST LAND DREDGE started the age of mechanical stripping in Illinois, handling 40 cu.yd. of overburden per hour was excellent performance; today the shovel at Buckheart strips 1,600 cu.yd. Back in the '90s the Danville pioneers boasted of a daily output of 1,000 tons of coal; today United Electric Coal Cos., which grew out of that pioneer enterprise, can produce 16,000 tons from its four active operations. These early developments and present-day policies are epitomized in the paragraphs that follow; operating phases are treated in detail in the five succeeding articles.

I . . . YESTERDAY

THE HISTORY of the United Electric Coal Cos. very closely parallels the progress in development of large excavating equipment and its application to coal mining. Although not incorporated until 1918, United Electric had its inception as far back as 1885, when the first mechanical stripping operation in Illinois was opened near Danville on properties controlled by individuals who were later to organize the present company. By developing strip mining, great reserves of comparatively low-grade coal lying near the surface were added to the commercially available fuel resources of the State. And, as shovel capacity grew and made the stripping of still heavier overburden practicable, the reserves adaptable to this method of exploitation were further enlarged both quantitatively and qualitatively.

The first mechanical excavating machine used in 1885 for removing the overburden from the coal seam was in reality a dredge minus the hull. This "dry-land" dredge, purchased from the Marion Steam

Shovel Co., had a 50-ft. boom and was built entirely of wood. Power to hoist its $\frac{3}{4}$ -yd. dipper and swing the wooden boom was furnished by a single-cylinder vertical steam engine. Under favorable digging conditions the removal of 40 cu.yd. of overburden in an hour was considered excellent; today 1,600 cu.yd. per hour is handled by the Bucyrus-Erie 950-B 30-cu.yd. shovel at the new Buckheart mine opened by the United Electric company near Canton, Ill., late last year.

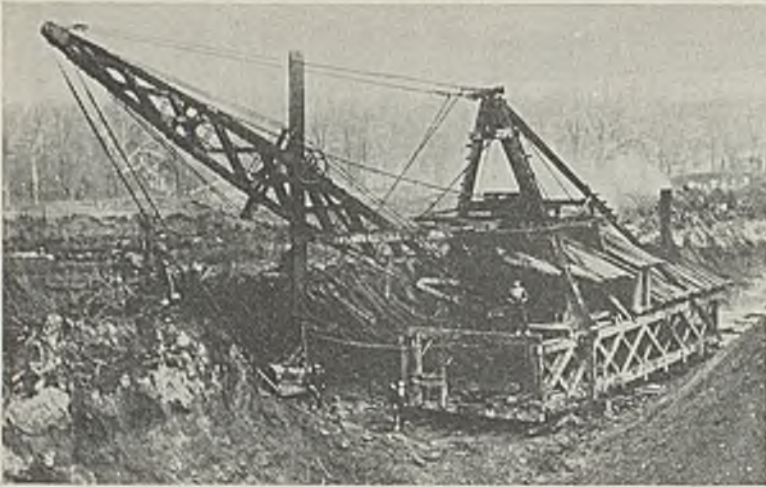
After a period of comparatively successful operation of the first machine, a second and larger shovel was required to handle the thicker overburden encountered. This shovel followed the same engineering lines as the original dredge but had a $1\frac{1}{4}$ -yd. dipper. Still later a third machine with a $1\frac{1}{2}$ -yd. dipper on a 65-ft. boom and powered by two vertical steam engines was purchased. Difficulties due to intermittent floods and fruitless efforts to satisfactorily repair the machines, however, led to their abandonment in 1890.

At that time the company acquired three draglines with $\frac{1}{2}$ -, $\frac{3}{4}$ - and 1-yd. buckets, respectively, all equipped with 80-ft. horizontal booms. These machines operated with such efficiency that the company soon was enjoying an output of approximately 1,000 tons of coal per day. But the occurrence later of shale, soapstone and increasing overburden began to slow up the progress of the machines to a marked degree and it became necessary to drill and blast this harder material. Subsequently, because of labor troubles and other difficulties, the operation became unprofitable and was closed down.

In 1903 the Hartshorn Bros., of Danville, organized the Electric Coal Co. and six years later acquired the old abandoned strip pits and one of the non-revolving draglines. When digging was resumed, however, the dragline was found to be in operable condition only about 30 per cent of the time. Unwilling to continue operations with equipment which was out of commission for repairs 70 per cent of the time, the new organization ordered a Model 250 Marion stripping shovel weighing 150 tons and equipped with a 3-cu.yd. dipper. This shovel—then the world's largest—was put to work in 1911. Up to this time Illinois stripping had been attended with more grief than profit. But the foundations of present practices had been established. The new shovel was a success from the start and the profitable operation of coal mines by the stripping method may be said to date from that time.

Bigger Equipment Marches In

The next year the Hartshorns installed a Model 270 shovel; this was larger in all dimensions and had greater capacity and range than the Model 250. Later two additional



1885 — Mechanical stripping starts with dry-land dredge and ¾-cu.yd. dipper



1911 — "World's largest" shovel digs in with its 3-cu.yd. dipper at Danville pit



1937 — Overburden at the new Buckheart mine is removed by 30-cu.yd. dipper

Model 270s with 80-ft. booms and 6-cu.yd. buckets were purchased. A Model 300 shovel with 90-ft. boom, 56-ft. dipper handle and 6-cu.yd. bucket followed. This machine, weighing 300 tons and again the largest shovel in existence, was put into operation at the Danville property. Still later other larger and more improved machines were installed.

With the success of stripping demonstrated, the United Electric Coal Cos., which succeeded the Electric Coal Co. in 1918, inaugurated a program of expansion. In 1922 a new property was acquired near Cuba, Fulton County, Illinois. This mine was developed and brought into production the following year. In 1925, acreage in Farmersburg, Sullivan County, Indiana, was bought, developed and put on a production basis before the year was out. The Chicago Collieries Co., with properties in the Danville area, was taken over in 1926. In 1927 a property then operated by the Solar Coal Co. at Freeburg, St. Clair County, Illinois, was purchased.

Table 1—United Electric Coal Cos. Operations

Name	Location	Daily Capacity (Tons)
Cuba No. 9	Cuba	3,000
Fidelity No. 11	Duquoin	7,000
Red Ray No. 13	Freeburg	2,000
Buckheart No. 17	Dunfermline	4,000
Combined daily capacity....		16,000

Fidelity mine was added to the list in 1929 by purchase of the coal acreage from the Mississippi Coal Co. Although operations at Fidelity were started nearly ten years ago (see *Coal Age*, December, 1929, pp. 729-736), it is still the world's largest strip mine, with a 1937 output of 1,200,000 tons of prepared coal. The newest member of the United Electric family is the Buckheart mine, Dunfermline, Fulton County, Illinois. Construction of this plant was started on June 1, 1937, and the first coal was loaded last November (see pp. 49 and 52).

During this period of expansion some of the older properties naturally have dropped out of the picture. The historic Mission No. 1 mine, in Vermilion County, Illinois, where the Model 250 shovel made its debut more than a quarter of a century ago, ended its noteworthy career in October, 1933, and two other operations in the same county have disappeared from the active list in recent years. Today United Electric production is concentrated at the four properties in Illinois shown in Table I.

II... TODAY

THE present management of the United Electric Coal Cos. assumed control in October, 1935. Since that time a number of administrative and operating changes have been effected. One of the most important of these was the acquisition of the outstanding minority interest in Coal Sales Corporation, its sale subsidiary, as of June 30, 1937. At that time the subsidiary was dissolved and its operations were combined with that of the parent company. The latter now fully controls its market outlet through its own sales organization. This new set-up has been reflected in a reduction in sales costs per ton.

Operating changes effected at the various properties have made it possible to reduce costs in the face of rising wages and higher prices for materials and supplies. The drilling and blasting procedure has been changed, with a substantial increase in efficiency in this phase of operation. All loading and stripping shovels have been equipped with larger capacity, light-weight steel dippers. This, together with the acceleration of haulage and tippie operation, also has contributed materially to reducing operating expenses. Details of these changes are given on p. 47.

How Tonnage Has Grown

Back in the clamorous days of 1920, when buyers were bidding feverishly against one another for tonnage and strip-pit production for the country as a whole reached a new high, Illinois strip mines (both shipping and local) had a combined total output of 589,540 tons. Last year, United Electric's premier producer—Fidelity—alone poured out more than twice that tonnage for its sales department to move in a buyers' market. And Cuba, Red Ray and, in December, Buckheart also were claiming their share of the salesmen's efforts.

United Electric finds its major outlets in Illinois, Missouri, Iowa, Nebraska, Wisconsin, Minnesota and South Dakota. Some coal from the Fidelity mine also moves into Arkansas and Tennessee. Approximately 30 per cent of the company's output last year was sold to retail coal merchants; the railroads took another 30 per cent, and general industrials, government institutions and the pub-

lic utilities absorbed the remaining 40 per cent.

To meet this sales load, the company has a sales force of seventeen headed up by M. M. Soule, vice-president in charge of sales. Headquarters are maintained at Chicago, with sales under the immediate supervision of J. M. Morris, sales manager. Two branch offices also are operated; one is at Galesburg, Ill., in charge of D. D. Klise, district sales manager, and the other is in St. Louis, Mo., in charge of L. C. Sherrill, vice-president. Five salesmen work out of the St. Louis office and four out of the Galesburg branch. In addition to Messrs. Soule and Morris there are four salesmen who work out of Chicago.

Outside Experts Employed

Instead of maintaining its own staff of combustion engineers, the United Electric Coal Cos. employs the services of the Commercial Testing & Engineering Co., which has headquarters in Chicago and branches at Toledo, Ohio, and Charleston, W. Va. "We feel," says Mr. Soule, "that an outstanding firm of this character guarantees to our customers the last word in combustion service." The cost of this consulting service, of course, is borne by the coal company.

Advertising is considered a logical and indispensable part of the sales promotion work of the company and United Electric management is backing this belief with increasing expenditures. Both publication and direct-mail copy are used. Preparation of the campaigns is handled by a Chicago agency. In addition, the company also has used talking movies to bring the story of its mining and preparation activities to interested groups.

Although two strictly industrial publications are on the present United Electric list of advertising media, publication copy, except local newspaper campaigns, is primarily directed to the retail distributors. Four retail trade journals serving the areas in which the company markets its tonnage carry the United Electric story. Mail promotional pieces hit both the retailer and the industrial consumer; a dual appeal also is the objective of some of the newspaper advertisements. Dealer

helps include both suggested advertisements for insertion in papers circulating in the individual dealer's own community and mailing pieces for distribution to his clientele. The services of the company's advertising agency also is available to retail coal merchants for help and counsel on their particular problems.

The heart of the company's promotional work with its retail outlets is the "United Electric Parade." This house organ, started last August, is an attractively printed 8½ x 11-in. eight-page monthly designed to be "a parade of selling ideas for coal merchants." In addition to carrying announcements and reproductions of the latest dealer helps and selling talks on the coals from the various operations of the company, the publication also includes practical talks on the sales problems of the retail merchant and concrete suggestions for increasing tonnage. A recent issue, for example, emphasized the opportunities open to the retailer in making a drive for steam-coal business from industrial plants not in a position to take earload deliveries.

A homely touch is given each issue by a page devoted to the philosophizing of Hank, a fictional small-town retailer. Sitting in front of his office with his pipe and his dog, Hank in his talks relating visits with Zeb Trasker, a fellow dealer with progressive ideas, succeeds each month in interlarding his drawl with shrewd comments on ways to promote better customer relations and increased business.



A MONTHLY PARADE OF SELLING IDEAS FOR COAL MERCHANTS





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JOHN V. S. NORTON
Secretary-Treasurer



M. M. SOULE
Vice-President, Sales

STRIPPING PRACTICES

+ Characterized by Continuing Improvements

At United Electric's Four Plants

By M. M. MOSER

*Vice-President in Charge of Operations
United Electric Coal Cos.*

FOUR mines, all located in Illinois, are now operated by the United Electric Coal Cos. These are: Cuba No. 9, at Cuba, with a daily capacity of 3,000 tons; Fidelity No. 11, Duquoin, with a daily capacity of 7,000 tons; Red Ray No. 13, Freeburg, with a daily capacity of 2,000 tons, and the new Buckheart No. 17 mine, at Canton, with a daily capacity of 4,000 tons.

Cuba mine is three miles south of the town of the same name, in Fulton County, on the Chicago, Burlington & Quincy R.R. Development was started in 1922 and the first coal was produced in March, 1923. The mine originally was equipped with a Jeffrey 5-track tippie, loading the usual sizes of coal. Four Model 300 electric stripping shovels with 6-cu.yd. dippers and mounted on trucks comprised the original excavators installed. Coal was loaded by four Model 36 electric shovels with 1½-cu.yd. dippers. Haulage tracks were 42 in. in gage, and coal was transported from the pits to the tippie in 7-ton cars pulled by 15-ton steam locomotives.

Shovel Changed to Dragline

Cuba started as a four-unit operation. After three years of operation, however, two units were depleted and one new unit was added to replace those retired because of obsolescence. Due to the increased thickness of overburden, it became necessary to change over one of the Model 300 shovels to a dragline equipped with a 150-ft. boom and 5-cu.yd. bucket to work in tandem with the Model 300 shovel. The newer unit was equipped with two Marion Model 350 electric stripping shovels, each with a dipper capacity of 8 cu.yd. and the first strippers of this size to be mounted on crawlers.

To increase the capacity and efficiency of these units, it became advisable to install light alloy-steel dippers in 1936 in place of the older heavy dippers. The 300 dragline bucket was changed from 6 to 8 yd. and the 8-yd. dippers on the Model 350 shovels were increased to 10 cu.yd., thereby increasing the yardage handled by these machines approximately 25 per cent.

Fidelity mine, the world's largest of its kind, is six miles west of Duquoin, Perry County, on the Illinois Central and Missouri Pacific railroads. The No. 6 seam, averaging 6½ ft. in thickness, is mined. This mine started production in 1929 as a three-pit operation. Present practice, however, is to produce coal from only two pits at a time, holding the third as a reserve.

Each pit is provided with stripping, loading, haulage and auxiliary equipment. Stripping in two of the pits is accomplished by one Marion 5480 shovel and one Marion 5480 dragline working in tandem. In this so-called tandem operation, the dragline, working in advance of the shovel, removes the clay, placing it behind the rock retaining wall which has been made by the shovel in removing the hard material down to the coal in the previous cut. The third pit is equipped with a Marion 5600 shovel, which in 1929 had the greatest capacity of any shovel built, and today, when judged by any factor other than dipper size, still is the world's largest shovel. It has a maximum dumping height of 82½ ft., which exceeds by about 25 per cent the dumping height of other large shovels. Maximum dumping radius is 146 ft., whereas the shovels carrying larger dippers are confined to a radius of 110 to 115 ft. Maximum cutting height of this machine is 97

ft., also far in excess of the cutting height of other shovels. Weight of the shovel is 1,750 tons and the motor-driven generators are rated at 1,700 kva., both greater than in any other shovel ever built.

Coal is loaded in all pits by Marion Type 490 4½-cu.yd. coal-loading shovels. All the stripping shovels and draglines have been equipped within the past year and one-half with light alloy-steel dippers and buckets, increasing their capacity by 25 per cent. The 5480 shovels were increased from 12 to 15 cu.yd. and the 5480 draglines from 10 to 14 cu.yd. The loading shovels also were increased from 3 to 4½ cu.yd. The 5600 shovel is being remodeled to carry a 26-cu.yd. dipper instead of 15-cu.yd., as at present. This is being effected by gear-ratio changes and by shortening the effective length of dipper handle.

Haulage Revision Studied

Haulage equipment at the mine consists of nine 40-ton standard-gage Heisler geared locomotives and forty 50-ton standard-gage automatic-drop-bottom steel pit cars. Each train transports 250 tons of coal per trip between the pits and the washing plant. Realizing that the efficiency of the transportation system in any coal mine is vital to its economical operation as a whole, very complete studies are being made at the present time on converting rail haulage to motorized haulage on the coal surface.

The limestone rock immediately overlying the coal at Fidelity averages approximately 18 ft. in thick-

ness. Although this is quite a bit more rock than ordinarily is handled, it is not wholly disadvantageous in that with its aid the shovel builds a wall that keeps the clay further removed from the coal and makes possible a steeper slope; thus it is possible for the shovel to dump the material nearer the point of excavation than otherwise would be desirable. By increasing the angle of repose of the stripped material, it also is possible to remove and dispose of a much greater thickness of overburden than otherwise would be possible. During the summer of 1937, two Marion 5480's working in tandem removed 87 ft. of overburden from the coal and successfully disposed of it in a section approximately 1,000 ft. long. To handle this thickness of material, it was, of course, necessary to work the strippers along faces which were convex, the stripped material being laid along curved lines of greater length than that from which it had been removed. However, the occurrence of rock made this easier to accomplish than otherwise would have been the case.

Washer Added at Fidelity

Fidelity originally was equipped with an 8-track Jeffrey tippie producing only standard screened sizes of coal. In 1934, however, the company, to keep abreast of the trend in coal-cleaning plants, installed a modern Koppers-Bleo-luxeur washery adjacent to the tippie at a cost of approximately \$300,000. Combined capacity of the tippie and washery is 1,050 tons of prepared coal per hour.

All the material encountered in the overburden at Fidelity requires blasting before the shovels can remove it. Today, two types of drilling equipment are in use, one being the Bucyrus-Armstrong standard 29-T churn drill. A new Sullivan strip borer was acquired recently, and in those parts of the pits where it is possible to drill a horizontal hole in the shale or slate and still have sufficient underlying material to protect the coal from the effect of the blast, this drill is used. However, in many places the hard limestone, through which the strip borer will not drill, occurs so near the surface of the coal that it is impossible to use this type of drill without a very heavy subsequent loss in coal.

Churn-drill holes are made on 24x27-ft. centers. Hole diameter is 9 in., which was adopted as standard after many months of experimentation. Six-inch-diameter bits form-

erly were used on these same drills and the hole spacing was 19x20 ft. Experiments on various sizes of drillholes have shown that the 9-in. hole is by far the most desirable, allowing for a greater concentration of explosive in the rock than is possible in a 6-in. hole. Cubic yards broken per foot of hole drilled has increased about 35 per cent, with only a slightly higher drilling cost. The larger-diameter holes, with a much greater concentration of explosive, give a much better blast, with greater fragmentation, displacement and heaving of the limestone overburden. This improved blasting procedure has increased materially the efficiency of the strippers.

Liquid Oxygen Breaks Rock

All blasting is done with L.O.X., manufactured on the property. The liquid-oxygen plant has a capacity of 220 lb. of liquid per hour. When the carbon cartridges, also manufactured on the property, are soaked in sufficient liquid, approximately 3,400 lb. of effective L.O.X. is produced per 24 hours.

Fidelity mine has a yearly capacity of 1,500,000 tons of prepared coal.

Red Bay mine, on the Illinois Central Ry. three miles south of Freeburg, St. Clair County, and 26 miles from St. Louis, Mo., was acquired from the Solar Coal Co. in 1927 and, with the exception of 2½ years when it was closed by labor difficulties, has been operated constantly by the United Electric Coal Cos.

Stripping at Red Bay is done with one Marion 350 electric stripping shovel with a 14-cu-yd. dipper. The overburden, averaging 37 ft. in thickness, consists of clay, shale, slate and approximately 6 ft. of hard limestone immediately over the coal. This hard rock necessitates drilling, which is done by a Sullivan side-wall machine making a 6-in. hole 40 ft. deep at right angles to the direction of shovel advance. Coal is loaded from the No. 6 seam by a Marion 37 coal-loading shovel. Transportation between the pit and the five-track Morrow tippie is effected by 50-ton standard-gage hopper-bottom pit cars pulled by 40-ton standard-gage steam locomotives.

As the mine is within trucking distance of metropolitan St. Louis, storage bins and other facilities for supplying coal direct to trucks were provided in the latter part of 1936. The storage bins have a capacity of 200 tons of each of the standard sizes—that is, lump, egg, nut and screenings. Approximately 75 per

cent of the total production is sold direct to trucks operating into St. Louis. The remaining 25 per cent, mainly screenings, is shipped to the Fidelity washery, 53 miles away, for washing and sizing.

To meet the ever-increasing demand of the truck trade for plus 2-in. sizes, a Sullivan Type S-BC shearing machine with 10-ft. cutter bar was installed in the autumn of 1937. This machine is substantially the same as the cutting machines used in underground mining except that the cutter-bar head has been turned 90 deg. to permit vertical cutting. Present practice is to cut a channel 4 in. wide along the track side of the block of coal to be loaded, which is 45 ft. in width. By employing this method of cutting, the 6-in.-lump size has been increased approximately 10 per cent, with an equivalent decrease in screenings, the percentage of egg and nut sizes remaining practically the same.

Channeling Raises Lump Yield

As an experiment, on one day's leading two channels were cut parallel to the coal block to be loaded, one along the track side and the other through the middle. By this double cutting the proportion of lump was increased approximately 50 per cent, with a resultant decrease in both the nut and screenings sizes, the percentage of egg remaining the same. Due to the fact that a large number of oversized lumps were produced by this double cutting, unloading of the hopper-bottom cars at the tippie became extremely difficult, materially reducing the tonnage produced during the shift. It is possible, however, that in seasons when higher-priced lump coal is in great demand the decreased production may be advisable to furnish the trade with the larger sizes. Experience to date with this channeling machine has proved that it affords the greatest possible flexibility in sizes produced by a strip mine.

Exemplifying the country's finest in today's design of plant and equipment is the Buckheart mine, six miles south of Canton, Fulton County, on the Chicago, Burlington & Quincy S.E. Development of this property, which had been held under option for a number of years, was started in the early summer of 1937. Coal was produced in November of the same year. This new mine, equipped with a seven-track Koppers-Bleo-luxeur tippie and washery, has a rated capacity of 650 tons per hour.

Stripping is done by a 950-B Bucyrus-Erie shovel carrying a 30-cu-

yd. all-welded steel dipper. An 85-B Bucyrus-Erie shovel, with special 5-cu.yd. dipper, loads the coal, which comes from the No. 5 seam.

Probably the most interesting feature of the equipment in the pits is the haulage units used in transporting coal between loading shovel and tipple. In selecting the proper haulage equipment for this mine, the one fundamental factor in cost of transportation taken into considera-

tion was that the larger the load hauled per trip, the lower the unit cost would be, provided, of course, that the large load could be handled with consistency.

Natural conditions at Buckheart were somewhat different from those ordinarily found on similar properties in that the elevation of the top of the dump hopper was on practically the same level as the coal seam. Therefore, no serious steep

grades were encountered. Bearing all these influencing factors in mind, three Walters 175-h.p. four-wheel-drive tractor trucks were purchased. These trucks pull two 25-ton Austin-Western bottom-dump trail cars each, or 50 tons of coal per trip. This is the largest load successfully pulled to date by one truck, and results realized so far indicate that the haulage operation is entirely satisfactory and economical.

NEW BUCKHEART MINE + Strips 5 Ft. of No. 5 Coal With 30-Cu.Yd. Shovel

ADDING a potential of 4,000 tons or more per day to its producing capacity, the United Electric Coal Cos. has again entered the Fulton County field of Illinois with a new stripping operation to recover No. 5 coal. This new operation, christened Buckheart No. 17, employs a 30-cu.yd. electric stripping unit, a 5-cu.yd. electric loading unit and 25-ton trail cars arranged for either single or tandem operation for uncovering, loading and transporting coal. Rounding out its pit and transportation equipment, United Electric also has installed a mechanical washing and screening plant with a capacity of 650 tons per hour (p. 52 of this issue of *Coal Age*).

Buckheart mine is located about six miles south of Canton, Ill., on a new spur connecting with the Chicago, Burlington & Quincy R.R. Land holdings at present consist of a tract in Buckheart and adjoining townships measuring about three miles north and south and four miles east and west at the widest point. Buckheart Creek, running about north and south, lies a little to the west of the center line of the property, with its source approximately two miles above the northern border of the tract. The preparation plant, office, garage, supply house, laboratory and other facilities are located

in the creek valley about the center of the present acreage.

The first shovel of dirt was taken out May 20, 1937, and the first coal was loaded Nov. 15. Development work was under the direction of H. A. Reid, chief engineer, and C. G. Day, superintendent, both of whom have had long experience in the stripping industry. Mr. Day started with W. G. Hartshorn in the old Danville field of Illinois in 1920 after earlier experience in shovel building.

Build Railroad and Dams

Preliminary work on the operation involved construction of a railroad grade roughly $2\frac{1}{2}$ miles long, including empty storage, tipple and load storage yards having a combined capacity of about 250 standard railroad cars; straightening Buckheart Creek and building levees, and construction of dams for water storage and flood control, in addition to excavation of building sites, etc. The railroad grade, following the creek to the preparation plant, involved the movement of about 350,000 cu.yd. of dirt. Average depth of cut was about 15 ft., running to 40 ft. on certain sections. Fills in some places were one-quarter mile or more in length, with the width

ranging from 35 ft. at the top to as much as 140 ft. at the bottom. Construction of dams and truck haulageways and excavation for building sites involved handling an additional 200,000 cu.yd. of dirt.

The major part of the grade excavation and fill work was done with scrapers and tractors, also used in dam construction. Scraper equipment consisted of four Continental wagon units with a capacity of 7 cu. yd. each (three hired) pulled by Allis-Chalmers "SO" and "L" tractors, and two $4\frac{1}{2}$ -cu.yd. Bucyrus-Erie wheeled scrapers operated by International Harvester TD40 and Caterpillar RD6 tractors. One of the latter units (RD6) since has been returned to Fidelity No. 11, while a Continental with "SO" tractor and a Bucyrus-Erie with TD40 tractor remain at Buckheart.

In constructing the grade and in most of the dam and miscellaneous work, the six scraper units worked about 120 days of 21 hours each and were assisted by a full-time Allis-Chalmers Model "K" tractor with Baker "Bullgrader" and, for about 60 days, one shift per day, by a road grader pulled by a Caterpillar 60 tractor. In making the 40-ft. grade cut mentioned above, the last 2 or 3 ft. (rock and other hard material) was taken out by the coal-



Tractor-powered scrapers working in the railroad cut made to reach the site of the preparation plant

loading shovel, then equipped with a dragline boom 75 ft. long and a 3-cu.yd. bucket. Material handled on the grading and dam-building jobs varied from good top soil to a heavy, yellow clay with a small quantity of rock and coal. Three of the dam jobs were primarily borrowing, while the fourth was built largely from material out of the railroad grade.

Upon completing the work in the one railroad cut described above, the loading shovel, with dragline equipment, was put to deepening and straightening Buckheart Creek for about two miles, supplemented by construction of channels in some of its tributaries, particularly below the preparation plant. Deepening of the main creek was carried to 3 ft. all the way down, leaving a stream channel about 15 ft. wide at the bottom. Finally, levees about 5 ft. high were thrown up on each side of the new channel.

Fresh water for the preparation plant is impounded behind an earth-fill dam (with two 48-in. overflow pipes) about one mile up the creek from the plant, material for this dam coming mainly from borrow pits. About half way between this dam and the plant a flood-control dam (earth fill with a maximum height of 15 ft.) was built of materials from the adjacent 40 ft. railroad cut. This dam is fitted with a 24-in. pipe at the bottom to accommodate the natural flow of the creek, with a 48-in. pipe set 4 ft. above. If the rainfall is more than the pipe will carry, the water rises behind the dam and spreads out over about 100 acres of land, thus providing an opportunity for any excess water in the preparation-plant

vicinity to run off, after which the collection behind the control dam drains down. The control dam takes care of anything but cloud-bursts or extremely heavy and long-continued downpours.

In addition to the main freshwater dam an auxiliary pond is provided in a hollow at the preparation plant, the fill for the truck road to

Average thickness of No. 5 coal at Buckheart is 5 ft. Beneath the seam is fireclay and immediately over it is about 1 ft. of black slate, followed by 6 to 18 in. of cap rock (lime), a variable thickness of soft shale, and clay and surface soil. Overburden thickness varies from 10 to 15 ft. at the outcrop to 60 ft. in the deepest part. However, very little 60-ft. overburden is present and the average is about 38 ft. As the coal crops along Buckheart Creek and in the hollows formed by its tributaries, much light stripping is expected. And, as the overburden can be dug without difficulty, it is expected that shooting probably never will be necessary.

Stripping operations at the time this article was prepared were designed to cut back a point near the preparation plant. Consequently, pit length was not over one-quarter mile. Eventually, however, the pit will be extended to the north and east to a total length of about two miles on the east side of Buckheart Creek. Runways will not be employed, according to present plans. Instead, entrances in both ends of the pit will be provided for the convenience of haulage equipment.

Stripping is done by a Bucyrus-



Electric shovel with 30-cu.yd. dipper at work stripping off the overburden

and across the dump hopper acting as a dam. Another dam on the opposite side of the creek forms a clarifying pond for wash water. All three dams are arranged to discharge by gravity to a pump sump at the preparation plant for make-up purposes and, in the case of creek water, boiler supply. The combined reserve of fresh water is estimated at 50,000,000 gal.

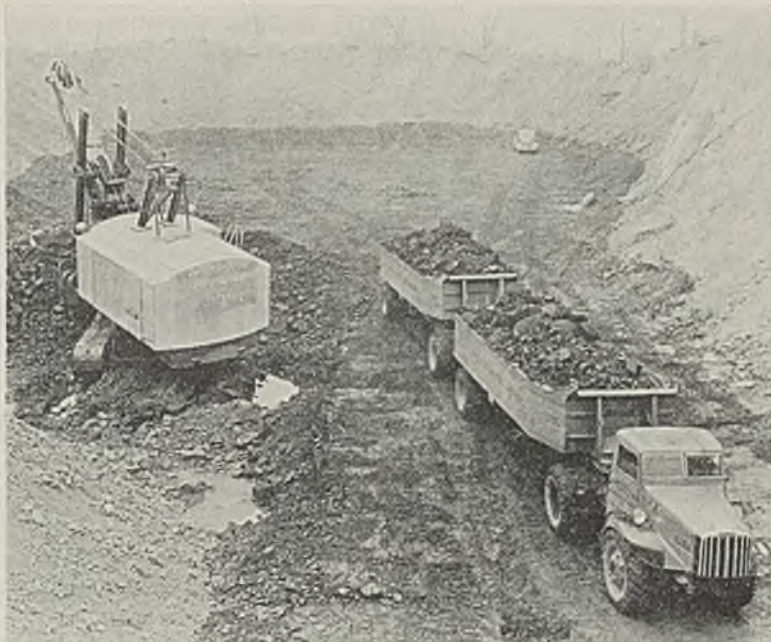
Erie 950-B electric shovel (4,000-volt General Electric electrical equipment) with a 105-ft. boom, 72-ft. dipper handle, 30-cu.yd. welded alloy-steel dipper with counter-weighted hoist and Ward Leonard control. Dumping range is 113 ft.; dumping height, 75 ft. Average width of cut taken by the shovel is 45 ft. Coal is loaded by an 85B electric shovel (4,000-volt General

Electric equipment, Ward Leonard control) equipped with a 5-cu.yd. coal-loading dipper. The loading shovel also takes a 45-ft. cut, leaving a 45-ft. berm of coal against the bank on which the haulage units operate.

Rough cleaning of the coal ahead of the loading shovel is done by an Allis-Chalmers "SO" diesel tractor with Baker "Bullgrader." The coal must be shot, and for this purpose a Chicago Pneumatic electric-motor-driven compressor mounted on White auto chassis is employed to operate two Gardner-Denver drills. Shotholes are spaced about 8 ft. apart and are loaded with 1 $\frac{3}{4}$ x8-in. King pellet powder and fired with Atlas electric squibs.

Coal is hauled from the pit to the dump hopper in 25-ton Austin-Western trail cars pulled by 175-hp. four-wheel-drive Walter tractors equipped with automatic-locking transmission for traction at all times, even though one or more wheels be in the air. Three tractors and six trail cars are on hand. This permits using the tractors and one trail car each for hauls under about $\frac{1}{2}$ mile, one way, with two trail cars in tandem on longer hauls. In tandem, these units have averaged 55 tons of coal per trip.

As natural drainage to Buckheart Creek is possible in the majority of cases by leaving openings in the spoil, dewatering of the pit is not expected to be a serious problem. Casual water, at the time this article was written, was taken care of by a 3-in. Goulds centrifugal pump mounted on a Ford chassis.



Loading shovel filling a tandem trail-car trip in the Buckheart pit

Power to operate Buckheart is received from the Central Illinois Public Service Co. at a voltage of 33,000, which is reduced to 4,000 at the mine. Three 500-kva. units constitute the power-company substation. Pit equipment is supplied by a main pole line with laterals at about 1,000-ft. intervals out to the pit. Three fused cutouts are mounted on the pole at the end of each lateral, with sockets for connecting trailing cables. Auxiliary transformers (three 25-kva. skid-mounted units) also are placed at the end

of the lateral for reducing the voltage to 440 for operating the compressor, pump and any miscellaneous electrical equipment necessary. Shovel's and other pit units are fitted with 1,000-ft. General Electric trailing cables.

Trucks and trailers, as well as other portable equipment, are stored in a garage in an 80x90-ft. building of 22-gage sheeting on a steel framework. The building contains also a repair shop, washroom and boiler plant. Heat is distributed by ILG twin-type diffusers.

Buckheart Construction Staff, Summer of 1937

Left to right, H. A. Reid, chief engineer, United Electric Coal Cos.; B. J. Berhalter, Koppers Construction Co.; E. E. Laurell, assistant mine manager; Fred Standard; T. H. Latimer; W. C. McCulloch, coal-preparation manager; "Scotty" Bane, Bucyrus-Erie Co.; C. G. Day, Sr., mine manager; Jimmy French; C. G. Day, Jr., chief electrician; Guy Shorthouse, timekeeper; and A. G. Groat, pit foreman.



MECHANICAL CLEANING

+ Heads Modern Preparation Methods

At New Buckheart Strip Mine

By IVAN A. GIVEN
Associate Editor, *Coal Age*

TO ENABLE its sales department to offer coal prepared in accordance with modern practice, the United Electric Coal Cos. has rounded out its new Buckheart strip operation, six miles south of Canton, Ill., with a mechanical cleaning and screening plant with a capacity of 650 tons of mine-run coal per hour. The new plant is equipped to ship seven sizes (6-in. lump, 6x4, 4x2, 2x1½, 1½x1, ¾x¾ and ¾-in. x 48-mesh) simultaneously after treatment to allay dust, six over either belt- or pan-type loading booms and the seventh (¾-in. x 48-mesh) through a hinged loading chute. A mixing conveyor and crushing equipment permit shipment of mixtures of any two or more of the seven primary sizes, as well as various sizes of

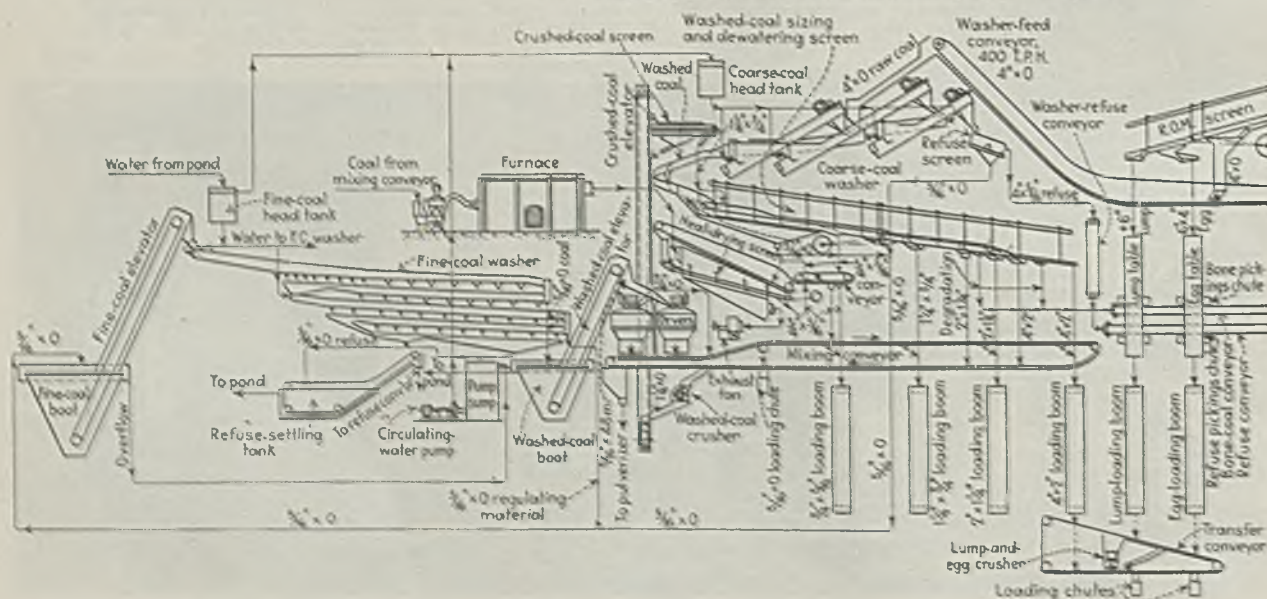
crushed coal either alone or in mixtures with the other sizes normally prepared.

All coal under 4 in. is "precision washed" in two washing units, one for 4x¾-in. and the other for ¾x0-in. material. Two picking tables are provided for 6-in. lump and 6x4-in. egg, and provision is made for breaking down chunks before sending them into the preparation plant. Two centrifugal dryers are provided for dewatering coal from the fine-coal washer and a special heat-drying screen is installed to remove moisture from the ¾x¾-in. size. Auxiliary crushing and screening equipment are provided to insure maximum recovery of all coal values from pickings and washery refuse. As the above summary indicates, maximum flexibility in the shipment of sizes and mixtures was rated equally im-

portant with ability to produce coal uniform in size consist and heat and ash content.

The new Buckheart preparation plant, designed and built by the Koppers-Rheolaveur Co., cleans and sizes coal from the Illinois No. 5 seam, which is sold under the Buckheart trade name. Impurities to be removed are primarily horseback material unavoidably loaded in pit operation, pyrites in lenses and laminations, overburden material left on the top of the coal after cleaning operations in the pit (see article beginning on p. 49), and any bottom material which may be picked up inadvertently by the loading shovel. The seam is free from bands or part-

Fig. 1—Flowsheet, Buckheart No. 17 preparation plant

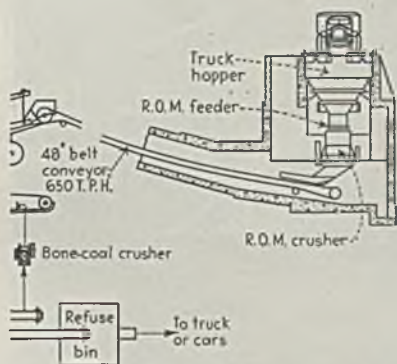


ings; the impurities constitute about 10 per cent of the material fed to the preparation plant.

Raw coal is brought to the plant in trail cars, which dump into a 200-ton steel-and-concrete hopper. Plans call for the future installation of a railroad track over the hopper to permit bringing in material to date rejected in mining out horsebacks at the Cuba operation of the company for recovery of the coal. Raw coal is fed out of the hopper by a reciprocating duplex pan feeder operated by variable-stroke eccentrics at about 60 strokes per minute. To handle any water which may be encountered, a pump sump with a float-controlled turbine pump has been built under the dump hopper.

Chunks Reduced to 12 In.

To reduce chunks loaded in the pit to a reasonable size, the feeder discharges into a 24x60-in. McLanahan & Stone crusher with manganese-steel-segment roll with hawk-bill teeth, part reduced in length to give a slugger action with the remainder; provisions for quick adjustment and automatic "Steelstrut" toggle. The crusher, in a 30-in. frame, to permit handling the chunks in the desired manner, reduces the larger material to a maximum of about 12 in. and discharges the coal onto the mine-run belt conveyor leading to the preparation plant. This conveyor, with a capacity of 650 tons per hour, is fitted with a 48-in. 7-ply 28-oz.-duck Goodyear belt running on anti-friction idlers carried on a steel frame with a steel deck plate between carrying and return strands of the belt. Inclination of the conveyor is 18 deg.



Mine-run from the main belt falls onto the upper section of the single-deck primary, or mine-run, screen of welded construction with steel hangers. The upper section is fitted with 4-in. round-hole plate, while the lower section is fitted with 6-in. round-hole plate. Thus, the two

screen sections separate the raw feed into 6-in. lump, 6x4-in. egg and a minus 4-in. resultant. The latter is conveyed to the washery.

Lump and egg go to two shaking picking tables and picking is arranged so that two products (bone coal and pure refuse) are removed. Bone goes on the bone conveyor (see flowsheet) to an 18x24-in. Jeffrey single-roll crusher, where it is reduced to 2 in. and smaller and eluted to the washer-feed conveyor. Rock drops into the refuse conveyor and is carried to a 50-ton refuse bin with undercut gate for discharging the material into either trucks or standard-gage refuse cars for disposal.

Each picking table is equipped with four 250-watt Westinghouse mercury-vapor lamps. Lump and egg, after passing over degradation screens, go onto double-beaded pantype loading booms (Table I). To permit crushing lump or egg, or both, or for making mixtures of these two sizes alone or in combination with other sizes made elsewhere in the plant, the booms are arranged to discharge, in raised position, into a transfer conveyor (maximum capacity, bottom strand, 370 tons per hour) in a separate structure beyond the boom ends.

Crusher is Reversible

Between the strands of the transfer conveyor is set a No. 60 Type F. T. American Pulverizer ring-type lump and egg crusher with a capacity of 225 tons per hour. Of a recently developed type, the crusher is arranged to operate in either of two directions, one to crush lump to minus 6 in. and the other to crush both lump and egg to minus 4 or 1½ in. The change is made by swinging a fly gate from one side to the other and reversing the crusher motor. The crusher discharges into the bottom strand of the transfer conveyor, equipped with rack-and-pinion gates to telescopic chutes over the lump and egg tracks.

With the transfer conveyor and crusher it is possible to load lump and egg separately, and also to load 4-in. lump, 6x4-in. egg plus crushed 6-in. lump or a minus 1½-in. product made by crushing lump and egg. In addition, by bringing coal over on the 4x2-in. boom, as indicated in Fig. 1, mixtures of lump and egg with the smaller sizes up to and including a reassembled mine-run, as well as mixtures of the smaller sizes with crushed lump or egg, or both, can be loaded.

Minus 4-in. raw coal from the mine-run screen, plus material from

the bone crusher, is carried to a Rheolaveur coarse-coal washing plant by a slight conveyor with a capacity of 400 tons per hour. The washer consists of a main launder 56 in. wide with two 56-in. Rheo boxes, and a re-washing launder, discharging into the primary launder, 32 in. wide with one 32-in. Rheo box. Regulating material from the lower box of the primary launder is recirculated while material from the upper box is conveyed to the rewashing launder for re-treatment. Material through the rewash box is coarse-coal refuse. This refuse is discharged onto a 4x8-ft. Tyler-Niagara single-deck vibrating screen with ½-in. cloth. Oversize goes to the washery-refuse conveyor. Undersize goes to the boot feeding the elevator to the fine-coal washer.

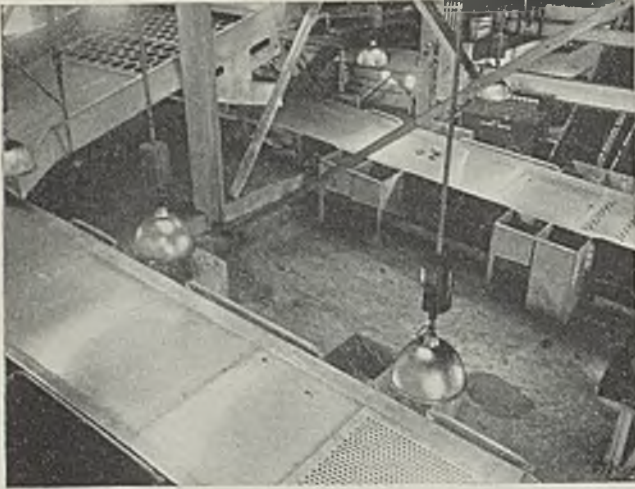
Welded Screen Dewaterers Coal

Clean 4x0-in. coal off the end of the primary launder flows with the wash water to a steel-welded washed-coal dewatering and sizing screen made in two sections and carried on flexible wooden hangers. Capacity of the screen is 360 tons per hour. The upper section consists of two decks. The top deck is fitted with ¾- and 1½-in. screen plate, while the bottom deck is fitted with Aescaloy plate with ½-in.-diameter perforations.

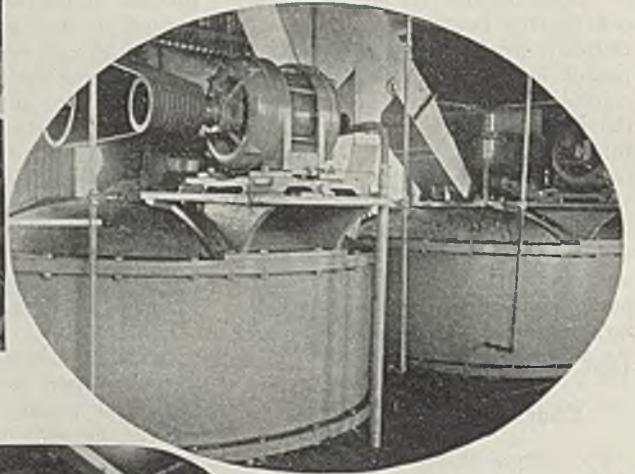
Two decks also comprise the lower section of the washed-coal screen. The top deck is fitted with 1½- and 2-in. screen. The bottom deck, equipped with four fly gates, is blank except for two degradation-screen sections. With the screen fittings noted, the two sections produce 4x2-, 2x1½-, 1½x¾-, ¾x½- and minus ½-in. sizes. Degradation goes to the bone conveyor for recirculation and resizing. While the 4x2- and 2x1½-in. sizes normally go to their respective loading booms, provision is made for discharging them into the bottom strand of the slack-mixing conveyor for transportation to a washed-coal crusher.

The washed-coal crusher, an American Pulverizer No. 30 Type S ring unit with a capacity of 200 tons per hour, reduces the feed to minus 1½ in. From the crusher the coal drops into an elevator which raises it to a 4x18-ft. double-deck (upper deck scalping) Symons horizontal vibrator. Oversize, over a ¾-in. screen, is discharged to the washed-coal sizing screen, while the undersize goes to the top strand of the slack mixing-conveyor for combination as desired.

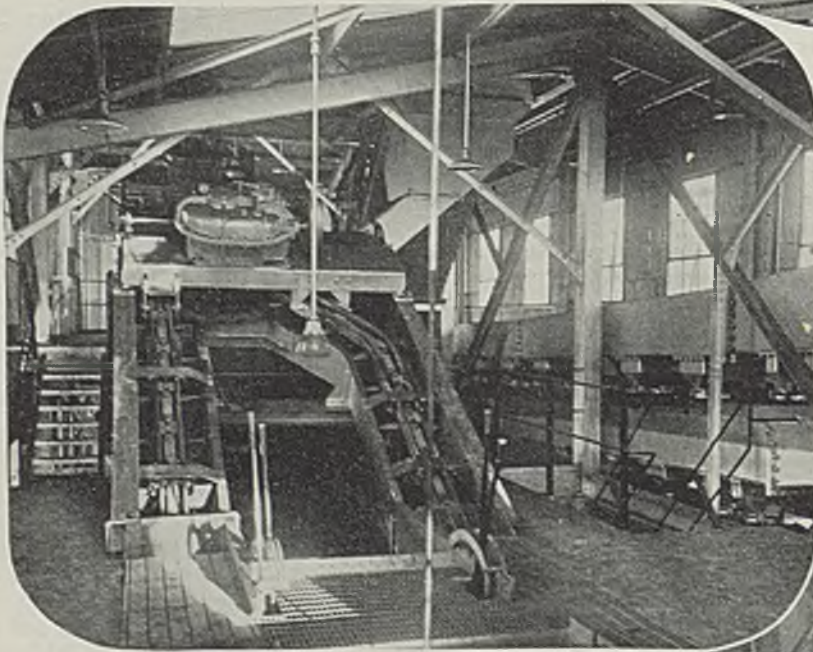
Coal ¾x½ in. in size off the bottom deck of the upper section of the washed-coal screen discharges into a flight conveyor arranged so that the



Lump and egg are cleaned on shaking picking tables. Part of the mine-run shaker appears at the upper left

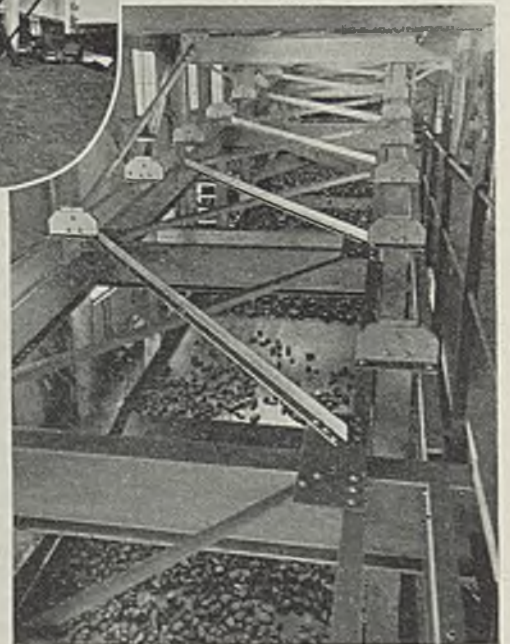
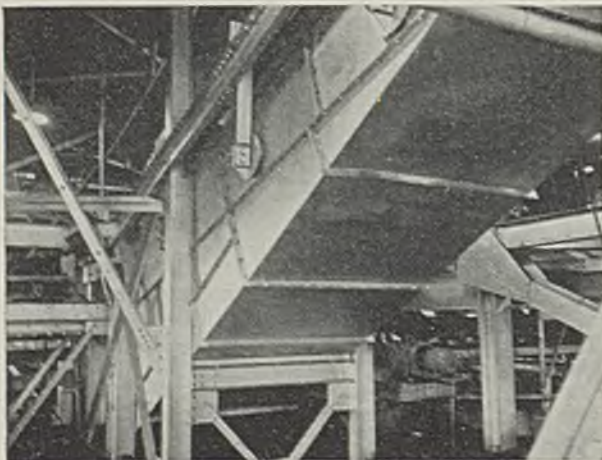


Two centrifugal dryers handle minus 5/16-in. coal



Washing floor in the Buckheart plant with the coarse-coal washer at the left and part of the launders comprising the fine-coal washer at the right

Heat-drying screen, with hot-air hood and suction casing (under screen), for drying 3/4x5, 16-in. coal



Washed-coal sizing screen, Buckheart preparation plant

coal can continue on to the loading boom or mixing conveyor, or can be discharged into a second conveyor feeding a heat-drying installation. The dryer consists of a single-deck high-speed screen driven through roller-bearing eccentrics. Hot air is used to dry the coal and is introduced into a hood over the screen at a temperature of about 900 deg. F. From the hood the air is drawn down through the coal into a suction casing below the screen by a Sturtevant exhaust fan discharging into a stack to the atmosphere.

Capacity of the heat-drying screen is 75 tons per hour. The installation is designed to eliminate all surface moisture down to the inherent moisture so that the dried coal will take up moisture from coal already thoroughly dewatered in the centrifugal dryers or other previously dewatered coal with which it may be mixed and thus insure a still lower moisture content in the mixture. After drying, the coal is discharged onto the bottom strand of the first $\frac{3}{8} \times \frac{1}{8}$ -in. conveyor for delivery to the loading boom or mixing conveyor. Heat for the dryer is supplied by a furnace fired by a B-15 Unipulvo pulverizer with a capacity of 1,700 lb. of coal per hour. Thermostatically controlled louvers on one side of the furnace, with manually controlled louvers on the opposite side for use as desired, admit outside air for tempering the hot furnace gases.

Furnace Has Relief Stack

The furnace is connected with the hood over the drying screen by a steel pipe lined with A. P. Green firebrick supplemented by Plibrico for special shapes (bends, etc.). The pipe is provided with a manually controlled damper. Back of the furnace and forming a part of the hot-air pipe is a similarly lined relief stack, also with manually controlled damper.

The final product made on the washed-coal screen is $\frac{1}{8} \times 0$ -in. coal through the bottom deck of the upper section. Together with the water, this size falls into a hopper which also receives coal and fines from a $\frac{1}{8}$ -in. screen in the flume from the coarse-coal washer. From the hopper the coal and water flow to the boot serving the elevator leading up to the Rheolaveur fine-coal washer, of the free-discharge type. This boot, as noted above, also receives minus $\frac{1}{8}$ -in. material from the coarse-coal refuse vibrating screen. Water overflowing the boot goes to a sump feeding a Frederick circulating-water pump delivering the water to a constant-head tank serving the coarse-coal washer.

Material under $\frac{1}{8}$ -in. is washed at Buckheart in a Rheolaveur fine-coal washer comprising four launders. The top launder, 20 in. wide, is divided into two 10-in. sections. All other launders are single units with the second and third 14 in. wide and the fourth 10 in. wide.

Material from the two top launders (cleaned minus $\frac{1}{8}$ -in. coal) goes to a washed-coal boot; material from the third launder goes either to the washed-coal or fine-coal (feed) boot; material from the fourth launder goes to the fine-coal boot for recirculation. Material through the Rheo boxes in the bottom launder is discharged into a fine-coal refuse tank. In passing to the fine-coal

boot, third- and fourth-launders material goes over $\frac{1}{4}$ -mm. wedge wire, the undersize also flowing to the refuse tank. This tank contains a slow-moving flight conveyor with a capacity of 15 tons per hour, which discharges the dewatered refuse into the washery-refuse conveyor.

Washed $\frac{1}{8} \times 0$ -in. coal is dewatered in two Type AR-3 Carpenter centrifugal dryers, each with a capacity of 35 tons per hour. The dryers are served by an elevator from the washed-coal boot, with provision for bypassing the coal around them, if desired. Water and minus 48-mesh coal removed in the dryers flows over a wedge-wire screen, with the underflow going to waste and the overflow

Table I—Motor and Drive Details, Buckheart Preparation Plant

Equipment	Feed, Feet or Strokes per Minute	Motors ¹		R.P.M.	Drive
		No. Type	Hp.		
Mine-run feeder, duplex pan.....	60	1 ART	20	1,160	Speed reducer ²
Mine-run crusher, 24x60 in., 650 t.p.h.....	40	1 ART ³	50	865	V-belts ⁴
Sump pump.....	...	1 ARKV	3	1,740	Direct connected
Mine-run belt, 48-in. wide, 180 ft. c.c., 18 deg., 650 t.p.h.....	350	1 ART ³	60	1,165	Reducer ²
Mine-run screen, 6-in. stroke.....	120	1 ART ³	20	860	V-belts ⁴
Lump and egg tables.....	150	1 ART ³	15	860	V-belts ⁴
Refuse conveyor, 62-ft. centers, 75 t.p.h., and bone conveyor, 98-ft. centers, 50 t.p.h.....	80	1 ART	15	1,750	Motoreducer (41.9 r.p.m.) ⁵
Bone crusher, 18x24 in., 50 t.p.h.	60	1 ART ³	25	865	V-belts ⁴
Lump boom, beaded pans, 42-in. wide, 50-ft. long, 110 t.p.h., and egg boom, same type, 150 t.p.h.	70	1 ART	15	1,750	Motoreducer (41.9 r.p.m.) ⁵ and chain
Transfer conveyor, 3 corners, 42-in. wide flights, 40-ft. centers, 275 t.p.h. top strand, 370 t.p.h. bottom.....	90	1 ART	15	1,750	Motoreducer (41.9 r.p.m.) ⁵
Lump-and-egg crusher, 225 t.p.h.	40	1 ART ⁶	75	1,165	V-belts ⁴
Washer-feed conv., 42-in. wide flights, 114-ft. centers, 400 t.p.h.	95	1 ART	50	1,160	Reducer ² and spur gears
Coarse-coal-washer conveyors.....	...	3 ART ^{3,7}	7½	870	V-belts ⁴ and reducers ⁸
Rheo boxes.....	...	1 ART ⁷	3	1,740	Motoreducers (59.4 r.p.m.) ⁹
Coarse-coal refuse screen.....	...	1 ART ^{3,7}	5	1,150	V-belts ⁴
Washed-coals screen, 4½-in. stroke, 360 t.p.h.....	160	1 ART ^{3,7}	40	865	V-belts ⁴
Belt booms, 48-in., 68-ft. centers: 4x2-in., 100-370 t.p.h.; 2x1½-in., 100-300 t.p.h.; 1½x¾-in., 80-350 t.p.h.....	110 or 220	3 ART ⁷	3¾ and 7½	1,720	Motoreducers (17.5 and 35 r.p.m.) ⁶
Belt boom, ¾x¾ in., same as others, 70-250 t.p.h.....	140	1 ART ⁷	5	1,740	Motoreducer (22.4 r.p.m.) ⁶
Slack mixing conv., 30-in. wide flights, 114-ft. centers, 230 t.p.h., both strands.....	100	1 ART ⁷	25	1,160	Reducer ² and spur gears
Fine-coal elevator, 24-in. wide buckets, 73-ft. centers.....	45	1 ART	20	1,160	Reducer ² and spur gears ⁸
Washed-coal elevator, 24-in. wide buckets, 45-ft. centers.....	33	1 ART	10	1,740	Motoreducer ⁶ (27.8 r.p.m.) and spur gears ⁸
Dryers, 35 t.p.h. each.....	...	2 ART ³	50	1,160	V-belts ⁴
Fine-coal-refuse settling-tank conv., 30-in. wide flights, 38-ft. centers, 15 t.p.h.....	20	1 ART ⁷	3	1,740	Motoreducer ⁶ (12.9 r.p.m.) and chain
Fine-coal refuse conv., 18-in. wide flights, 20-ft. centers, 60 t.p.h.....	85	1 ART	3	1,740	Motoreducer (16.8 r.p.m.) ⁶
Washed-coal crusher, 200 t.p.h.....	690	1 AR	75	1,165	V-belts ⁴
Crushed-coal elevator, 36-in. wide buckets, 61-ft. centers, 250 t.p.h.	100	1 ART	25	1,160	Reducer ² and spur gears ⁸
Crushed-coal screen, 125 t.p.h.....	...	1 ART ^{3,7}	10	1,160	V-belts ⁴
¾x¾-in. conveyors, 18-in. wide flights, 36- and 34-ft. centers, 75 t.p.h.....	80	2 ART ⁷	5	1,740	Motoreducers (41.9 r.p.m.) ⁶ and chains
Heat-drying screen.....	...	1 ART ^{3,7}	15	1,150	V-belts ⁴
Pulverizer, heat-drying plant.....	...	1 ARX	20	1,750	V-belts ⁴
Heat-drying exhaust fan.....	690	1 ART ⁷	30	1,160	V-belts ⁴
Circulating-water pump.....	865	1 ARX ⁷	60	895	Direct-connected
Make-up water pump.....	...	1 CS ¹⁰	40	1,760	Direct-connected
Stoker and fan, heating plant.....	...	1	5	.....	.....
Unit heaters.....	13	P ¹¹	1½	1,140	Direct-connected
Oil pump.....	1	.....	1½	.....	.....
Boom hoists, 5-ton.....	6	C35 ¹²	7½	1,610	.....

¹All motors are Allis-Chalmers, with exceptions as noted. ²Jones. ³Includes slide rails. ⁴Texrope. ⁵Equipped with solenoid brake. ⁶Falk. ⁷Splashproof motor. ⁸Equipped with roller holdback and a special take-up adjustable from the top of the boot. ⁹Equipped with roller holdback. ¹⁰Westinghouse. ¹¹Emerson. ¹²Shepherd-Niles.

returning to the washed-coal boot. The dryers reduce the surface moisture of the coal to about 7 or 8 per cent and discharge it into the slack mixing-conveyor for transportation to a telescopic loading chute or to any of the belt booms for mixing.

Four belt-type loading booms supplement the two beaded-pan booms previously noted, and the six booms take care of all but one of the seven sizes shipped, as well as handling mixtures as required. All belt booms are equipped with pantographic chutes to facilitate changing cars.

Circulating water consists of the overflow from the fine-coal and washed boots, which is collected in a steel sump. From this sump the water (carrying approximately minus 48-mesh slurry) is pumped to a constant-head tank feeding the coarse-coal washer. Overflow from the head tank goes back into the sump. Make-up water is added in the constant-head tank supplying the fine-coal washer, with a branch line to three rows of sprays over the washed-coal screen.

In line with the desires of the United Electric Coal Cos., the Buckheart plant was designed to conform with the latest standards for safety, light, ventilation, convenient access to equipment and fireproof construction. Steel-and-concrete construction throughout, including galvanized corrugated roofing and siding, makes the plant fireproof. Floors and walkways, with a few exceptions, consist of 3 in. of reinforced concrete, with toe cleats where necessary. All floors are reached by at least two stairways of steel channels with subway-

grating treads, and all floors, walkways and stairways are provided with substantial steel railings.

Corrugated wire-glass skylights over the picking tables and washing plants plus numerous steel-sashed windows with clear-glass lights provide the maximum of natural illumination during the day, with an equally effective lighting system for night operation or maintenance. Plenty of space around equipment was provided to give a good light distribution and make operation and maintenance more convenient and safer. Lift beams are provided over all heavy equipment units. Inclosed speed reducers and heavy steel machinery guards add to safety.

The building is heated by a stoker-fired boiler operated at a maximum pressure of 15 lb. per square inch gage to supply steam to thirteen Grinnell unit heaters.

Sixty Motors Operate Plant

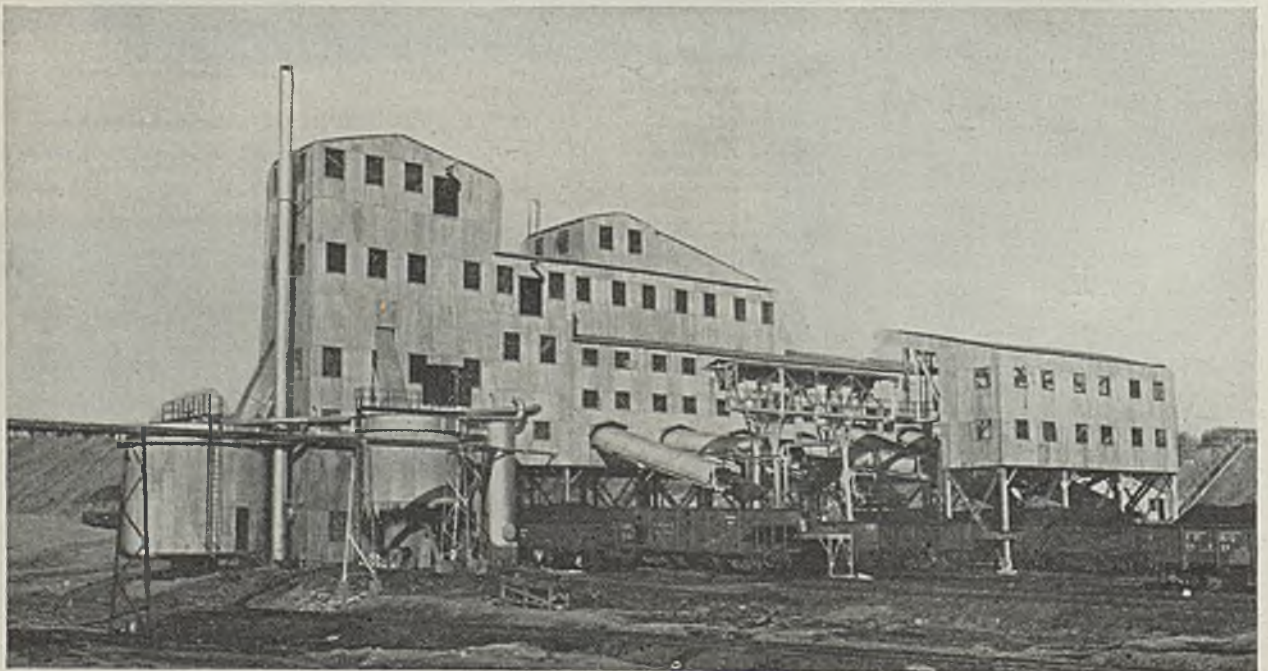
Sixty motors, ranging from $\frac{1}{2}$ to 75 hp., operate the equipment. Type, speed and other details are summarized in Table I, along with drive details. Allis-Chalmers motors predominate, with splashproof types on certain equipment, as indicated in the table. With one or two exceptions, the drives employ Tex-ropo V-belts, Jones speed reducers or Falk "Motoreducers." Motor couplings are of the Bartlett-Hayward "Fast" type. All eccentrics (spheri-

cal faced with high-grade babbitt lining, except for the roller-bearing units on the heat-drying screen) are lubricated by an oiling system consisting of pans under the eccentrics, oil reservoir, Bowser filter and pump, and header line with flexible connections to the eccentrics. Other bearings and parts, except inclosed speed reducer (splash systems), are grease lubricated through pressure fittings. All vibrating screens are carried on shock absorbers.

Motors operate on 440 volts, with 110 volts for lights using either Benjamin reflectors with shock absorbers or glass inclosures with wire guards. The preparation plant is supplied by its own 4,000/440-volt transformers, with auxiliary 4,000/220/110-volt transformers for lights and certain 220-volt loads. All building wiring is placed in galvanized or sherardized conduit, while all outside circuits consist of Trenchlay to eliminate pole lines in the yard.

Motors rated 2 hp. or less are standard NEMA normal-torque normal-starting-current squirrel-cage units. In ratings of 3 hp. and over NEMA high-torque low-starting-current squirrel-cage motors are employed, except for normal-torque pump motors. Westinghouse De-ion starters are used, and on motors up to and including 50 hp. the inclosed combination magnetic-switch type with fused knife switches and overload relays are employed. For motors of 60 hp. and over, reduced-voltage magnetic-type starters are installed. All power circuits are protected by Colt "Noark" safety switches, and safety switches also

This washing, screening, drying and crushing plant prepares Buckheart coal for the market



are employed in all other circuits.

Motors are controlled from General Electric pushbutton stations mounted on console-type panels with indicating lights. Start and stop buttons also are located at each motor for emergency use and testing. Three control panels are provided and interlocks are not employed. The main control panel is located on the washing floor, with a second panel on the picking floor. A third panel,

for controlling loading booms and auxiliary equipment, is installed in the boom operator's booth overlooking the loading tracks, from which the car retarders also are controlled.

Buckheart facilities also include a laboratory, staffed with a chemist, for making simple routine and control tests, primarily moistures, ashes and floats-and-sinks. For proximate analyses and sulphur and B.t.u. determinations, composite sam-

ples are made up and forwarded to the company's Fidelity No. 11 laboratory, Duquoin, Ill. (see below).

Coal is weighed as it goes into the storage yard on a Winslow scale with Streeter-Amet recorder. About 20 to 25 men (exclusive of weigher, chemist and certain other company men) operate the Buckheart plant. Other than gravity car shifting is performed by a 25-ton Plymouth gasoline-powered locomotive.

SPEED AND ACCURACY + Feature System of Quality Control Provided by Fidelity Laboratory

NUMEROUS papers have been prepared on the subject and standards have been established for obtaining performance data through the medium of analyses in which every effort is devoted to obtaining the average results of any specific operation. This principle has been advanced in coal preparation in particular and results of plant operation based on daily or weekly averages are quoted to show the efficiency and uniformity of production. From a broad point of view this idea has merit, but when applied to plant control the averaging of samples or the mixing of two or more increments to obtain a composite conceals the very thing for which the sample was taken: namely, the results at the particular instant when the single increment was obtained. This information is desirable for two reasons: first, to show the extreme possible variations in the washed products from the plant; and second, to permit plant adjustments to be made to minimize the variation and more nearly obtain a product which is continuously within the range of quality established for the coal.

Coal in place often is not uniform over the entire area of the mine and successive trips or cars may fluctuate widely in quality. One of the principal advantages of washed over raw coal is the uniformity of product and the unvarying quality of each car from a washery having an adequate control system. The small user of

coal who may buy a ton or 50 tons is not interested in the average of a daily production of 5,000 tons or more. He is interested in the quality of his particular small purchase and in the fact that the quality may be duplicated in any subsequent purchase from the same source.

To maintain this uniformity in the Fidelity washery of the United Electric Coal Cos., Duquoin, Ill., a new practice in sampling and analyzing has been developed. This practice consists of the accelerated burning of coal ashes on samples prepared from single instantaneous increments of the various washed products. Heretofore, plant control has been based almost entirely on float-and-sink methods or, in some cases, on the ash percentages in average samples analyzed the following day or at best after a lapse of several hours.

Ashes Ready in 30 Minutes

In accelerated-burning practice, actual ash percentages in washed sizes are available for the plant operator approximately 30 minutes after the sample is taken. No additional equipment is necessary, as these results are attained by adapting existing equipment to the purpose. A multiple-unit combustion-tube electric furnace is connected to a tank of oxygen and by proper control of temperature and oxygen flow the coal is burned to ash in less than

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*Coal-Preparation Manager
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ten minutes' actual exposure in the tube. The hook-up consists of a few feet of rubber tubing, with rubber stoppers attached, arranged to permit the oxygen to bubble through a wash bottle so that the rate of flow may be observed. The volatile matter is driven off in the lower-temperature unit to prevent mechanical losses, and the crucible, which is of the combustion-boat type, then is advanced to the higher-temperature unit for complete combustion. Accurate temperature control is possible by means of built-in rheostats and the results check muffle burning within the permissible differences allowed by A.S.T.M. standards.

The entire routine of control sampling consists of intercepting by the swing-box method the stream of washed coal entering the railroad car to obtain the individual increment for that time period. This increment is taken to the sample-grinding room and is crushed without drying in an automatic sampler and grinder of the coffee-mill type to about $\frac{1}{4}$ -in. maximum size of particle. A 5-lb. portion is obtained for drying and further preparation. This portion is air-dried by spreading it, not over one layer deep, in large pans in a low-temperature electric

drying oven. When dry, the sample is pulverized in a rotary-disk mill to pass 10-mesh, riffled to 100 grams and further pulverized to 60-mesh, after which it is transferred to a 6-oz. rubber-stoppered bottle and taken to the adjoining analytical room. The time of sampling, crushing, drying and pulverizing takes not over twenty minutes, and by the proper coordination of sampler and analyst the ash percentages are posted for the inspection of the washery operators within a half hour after the sample is taken. Residual-moisture percentages run uniformly and are estimated for control work but are actually analyzed on all samples before the end of the day.

Half-Hour Sampling Sufficient

The results thus obtained show definitely the quality in regard to ash percentage at any particular time and the routine may be repeated as often as necessary to show the results desired. Observations have shown that 30-minute sampling periods are sufficient to maintain uniformity at Fidelity and one sample man easily can take the samples and prepare them for the analyst.

The total sample for the individual increment varies in quantity with the size of the particles but is taken sufficiently large so that the chance inclusion of a refuse particle will not vitiate the final results. For 1½-in. screenings, the size most frequently loaded, a 50-lb. increment has proved satisfactory. Larger sizes require proportionately larger increments.

An additional feature which really is confined to bituminous results is the elimination of duplicate work to obtain plant-control data and also

analyses suitable for sales representation. The buyer of bituminous coal wants to know the ash content primarily, and where the float ash varies, a misrepresentation may easily result from relying exclusively on the percentage of sink to compute the ash in washed coal. With the ash-control samples the figure is obtained definitely and is available directly from an actual analysis without taking a second set of samples.

If average results are desired it is easy to average numerically the individual increments and to make up a composite sample by mixing equal quantities of the powder from each increment. This method is used in obtaining a sample for complete proximate analysis, including B.t.u., sulphur and ash-fusion for the day. Unit coal values for the coal are uniform, so that check determinations daily are all that are required. A separate portion of the wet crushed coal is reserved for total-moisture determination.

The permanent record of each day's operation is reported in graphical form from which the ash percentage in the washed coal at any specified time may be obtained by inspection. In addition the proximate analyses are tabulated along with the percentages of float in the refuse from both the fine- and coarse-coal washers. Operating data from the washing plant are recorded on the same sheet, so that the files on tonnages and recoveries are kept intact and complete in juxtaposition to the analyses.

The Fidelity laboratory, which is operated as a central laboratory for the various mines of the company, is located at the Fidelity washery and serves as control laboratory for

this operation also. It is completely equipped for all ordinary coal investigation, including byproduct tests and ultimate analyses. Gas-analyzing sets and a complete supply of chemical glassware and reagents permit a wide range of analytical determinations to be conducted aside from the immediate needs of the washery itself.

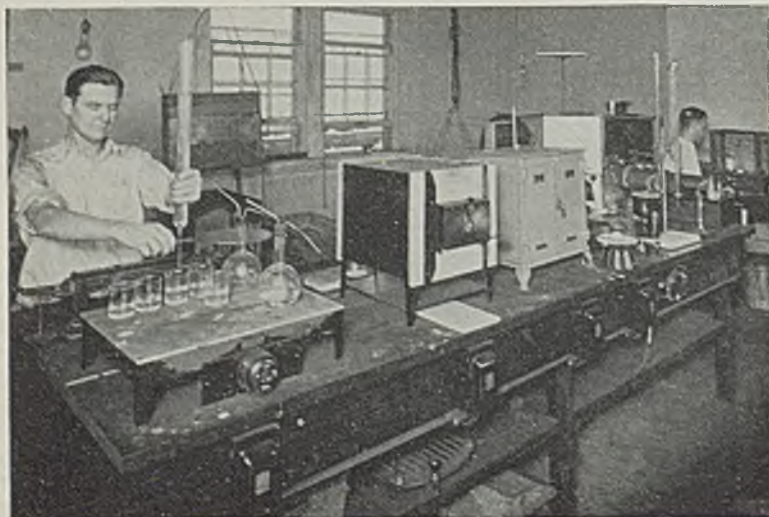
In arranging the laboratory, the paramount idea was maximum speed and efficiency with a minimum of manual labor. Without sacrificing accuracy this has been aided by auxiliary equipment suitable for the work to be done. A motor-driven reciprocating screen of an inverted Parrish type, mounted with a series of punched plates with openings of the standard sizes for this region, eliminates hand testing of sizes. The speed and length of stroke with the proper pitch duplicates the hand-sieving motion and all screen sizes are delivered to their receptacles by hopper chutes attached to the shaker. For fine screen sizing a "Ro-Tap" machine with a nest of 8-in.-diameter brass sieves down to 200-mesh is used.

Convenient Layout Stressed

Float-and-sink tanks are conveniently located on one side of the analytical room and on the opposite side of the drying oven from the sample-grinding room. Overhead supports permit lifting the inner screen basket by means of rope blocks and the washing platform and floor drain facilitate the washing of float-and-sink fractions to remove the zinc-chloride solution. The drying oven, which is built in the partition between the two rooms, has doors opening from both sides and the pans of wet coal placed in the dryer from one side may be removed from the other side to be weighed and prepared for analysis. Float-and-sink testing is at present limited to tests on daily-average washery-refuse samples and to monthly raw-coal washability studies. The raw-coal sample, however, is accumulated by daily increments taken over the entire month.

The metric system of weights is used throughout to eliminate conversion of ounces to decimal equivalents of a pound and to establish a uniform system from the delicate analytical balance to the large platform scales equipped with a kilogram beam. The intermediate-size solution balance with sliding-tare weight adjustment completes the range of accurate weighing instruments from one-twentieth of a milligram to five hundred kilograms.

Part of the Fidelity laboratory facilities



With the exception of the ash-fusion furnace, the equipment is entirely electrical and includes a 2-g.p.h. water still, hot plate, muffle furnace, Fieldner-type volatile furnace and constant-temperature moisture oven in addition to the multiple-unit furnace previously mentioned. The furnaces are all on a central table and have individual control switches and rheostats mounted close to each unit. This table is near the analytical balance to eliminate extra steps for the analyst.

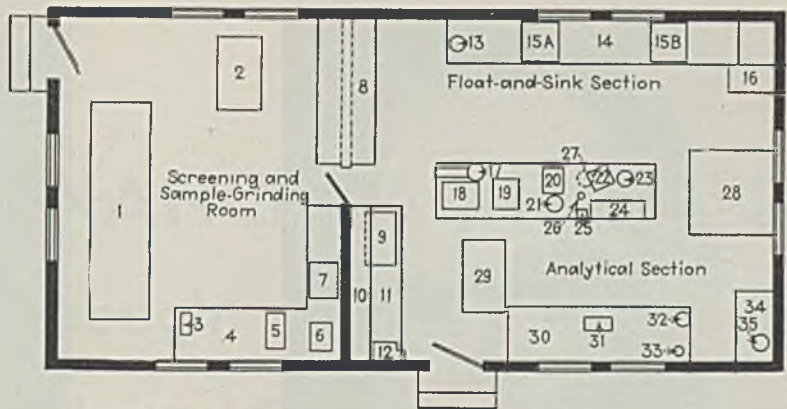
Adoption of the new-type Barrett ash-fusion furnace was influenced by the necessity of using cylinder gas as a source of fuel, since commercial city gas is not available. It has proved to be very economical and has been otherwise very satisfactory, particularly from the standpoints of operator comfort and the rapidity with which it cools sufficiently for subsequent determinations. Temperature observations are made with a portable optical pyrometer mounted on a tripod and calibrated directly in degrees Fahrenheit.

A Parr oxygen-bomb calorimeter is used for B.t.u. determinations and special attention was given to the establishment of a unit-coal value for coal produced at this mine. It has been gratifying to observe how closely these values check from day to day over a period of months. In order to calibrate the new equipment, check determinations on duplicate samples have been obtained from the U. S. Bureau of Mines, the Illinois Geological Survey and other laboratories.

Charts Preserve Results

The use of graphical means of representation has been promoted in the daily routine and charts which are helpful in maintaining the uniform quality of products have been constructed for ready reference. These charts show the B.t.u.-ash relationship on a moisture-free basis, moisture-free B.t.u. conversions to as-received values for various moisture percentages, the progressive daily record of the individual items of operating and analytical data and the relationship between percentage of sink in the washed coal and the corresponding ash.

In connection with the latter item it is interesting to note that the float-and-sink method of plant control is in reality only a means to the end of learning the ash percentage of the finished product and is nearly always used in conjunction with an established chart to show that value. The converse also is applicable and the amount of sink



General arrangement of equipment, Fidelity laboratory

- 1—Reciprocating sizing screen; 2—rotary crusher and automatic sampler; 3—coarse pulverizer; 4—riffing bench; 5—fine pulverizer; 6—fine-pulverizer motor; 7—Ro-Tap sieve shaker; 8—low-temperature drying oven; 9—sink; 10—shelves; 11—work bench; 12—distilling apparatus; 13—pressure filter; 14—float-and-sink drain rack; 15A and 15B—float-and-sink tanks; 16—file cabinet; 17—solution balance; 18—hot plate; 19—muffle furnace; 20—moisture oven; 21—desiccator (recessed in bench); 22—ash-fusion furnace; 23—oxygen tank (recessed in bench); 24—combustion-tube ash-burning furnace; 25—thermocouple pyrometer; 26—volatile furnace; 27—liquid-gas tank (recessed in bench); 28—desk; 29—typewriter desk; 30—work bench; 31—analytical balance; 32—calorimeter; 33—calorimeter motor; 34—calorimeter-bomb bench; 35—oxygen tank (recessed in bench).

in the washed coal can be estimated from the ash analysis obtained by accelerated burning and a similar reference to the chart. Efficiency figures based on the Drakeley formula, or modifications of it, can therefore be obtained by substituting the values from the chart and the float-and-sink test need be used only to establish the chart.

At the Buckheart laboratory (p. 52) the testing is confined merely to routine control work. Analytical equipment therefore is restricted to a minimum, although the sample-preparation equipment is as fully complete as at the central laboratory. The sample-preparation room is incorporated in the boiler room for easy disposal of sampled rejects and the analytical room is unique in being located in the housing under one of the settling cones near by. Sample-preparation equipment consists of a laboratory ring-type pulverizer built by the American Pulverizer Co. for coarse grinding and a Braun disk pulverizer for fine grinding. A riffle and containers for samples complete the equipment.

The analytical room, with analytical balance, moisture oven, desiccator and combustion tube, is complete for moisture and ash determinations. All other analyses are conducted at the Fidelity laboratory on composite samples prepared by combining the pulverized portions of each sample increment.

Float-and-sink tests are carried out in the boiler room, where water-hose connections and floor drains permit washing the solution off the products.

The washing problems at the different United Electric mines vary

widely. At Fidelity, the principal impurity is the blue band characteristic of the No. 6 seam throughout the State. There also are numerous small partings and lenses of pyrite which break free in the mining and crushing processes. The blue band extending horizontally over the entire area constitutes a uniform percentage of refuse removed continuously in the washery.

Refuse Fluctuates Widely

At Buckheart, on the contrary, the so-called "horseback" material in the Fulton County No. 5 seam consists of clay partings extending vertically through the seam in irregular thicknesses and divergent directions so that at certain locations the surface of the coal will be marked like a spider web. Immediately beyond and extending in some instances for several hundred feet, there will be a complete absence of these partings and the seam is entirely free of visible impurities. Because of this the washery may operate for a period of time with no refuse except the casual top clay or inadvertent bottom material lifted by the shovel and within a minute's time will be discharging as high as 30 per cent of refuse. The ability to adapt itself to conditions such as these marks the flexibility of the Rheolaveur launder. Whereas raw coal from the Fulton County No. 5 seam particularly may be extremely irregular in quality, it has been shown by the above control methods that these variations can be eliminated and a washed product consistently uniform can be produced.



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Chief Engineer



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Sales Manager

≧
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the Staff
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United
Electric
Coal
Companies*
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WILLIAM C. MCCULLOCH
Coal Preparation Manager



L. C. SHERRILL
District Vice-President, St. Louis

MAINTENANCE FACILITATED

+ By Forethought and New Materials

At United Electric Strip Mines

By C. N. STRONG
Engineer

FRED A. HUFF
Mine Manager, Fidelity Mine

and CARL G. DAY
*Mine Manager, Buckheart Mine
United Electric Coal Cos.*

IN THE operation of large strip mines, such as those of the United Electric Coal Cos., where the bulk of the work is done by a few machines of very large capacity, it is essential that the output of the machines be not seriously restricted by delays for repair which cut into what should be useful operating time. The occurrence of a major breakdown in one of the larger units can be of far more serious consequence than the mere cost of the labor and the spare parts needed for repairs, as the entire operating routine may be seriously disrupted and the mine output adversely affected for an extended length of time.

Preventing Breakdowns Important

Keeping all equipment in such shape as to diminish the likelihood of a serious breakdown at an inopportune time, therefore, is of prime importance. While it is impossible to foresee all the "hard luck" that may occur, reasonable precautions can be taken in the form of regular inspection and frequent overhauling of equipment and by providing a handy supply of spare parts sufficient to take care of such failures as are likely to occur as a result of ordinary wear and tear. A well-equipped machine shop and an experienced repair crew also are of major importance in preventing costly delays.

Fidelity mine is equipped with two Marion 5480 15-cu.yd. stripping shovels, two Marion 5480 14-cu.yd. draglines, one Marion 5600 26-cu.yd. shovel, and three Marion 390 4½-cu.yd. loading shovels. In addition to excavating machinery, facilities include transportation units, and a tippie, washery and L.O.X. plant, all of which require mechanical maintenance.

All major overhauling jobs on the large excavators are done in the summertime, so far as possible, in order to take advantage of the better working conditions and increased daylight and to avoid long delays in mining operations, which normally are more intensive in the fall and winter months. This practice has proved to be safer and more efficient and economical.

Within reasonable limits, sufficient spare parts are kept on hand to insure against any prolonged interruption in stripping and loading operations. As soon as a part breaks, it immediately is replaced with a spare. The broken part then is taken to the shop to be welded and reinforced as soon as possible, or another part is ordered immediately through the purchasing department in case the broken item is no longer serviceable. This gives an automatic check upon the inventory of spare parts on hand and insures against long operating delays due to awaiting shipments from the factory.

Gear assemblies are gone over thoroughly after their removal from a machine, broken parts are replaced, bearings checked, etc., and all parts are reassembled ready for reuse. As many items are interchangeable as between the 5480 shovels and draglines, one spare part or gear assembly often will be sufficient as a reserve against breakdowns in any of several machines. All parts subject to rapid wearing out are carried in stock and the following items always are kept on hand: one spare dipper handle for each machine, complete crawler castings, several caterpillar treads, shafts of all types and gears and pinions sufficient for any ordinary breakage, point sheaves for boom, complete padlock sheaves, dipper

teeth and a complete set of steel cables. The smaller dippers and buckets which were replaced last year by larger light-weight units can be substituted for the new in case of emergency.

When a machine breaks down, a new or repaired part or assembly can be substituted immediately for the broken items without interrupting operations any longer than is necessary to make the substitution. Then the damaged parts can be repaired at a convenient time in the shop without the additional expense which would be entailed by upsetting the normal shop routine to make emergency repairs.

Salvage Accompanies Repairs

When the broken parts are gone over in the shop, all items suitable for reuse are salvaged, cracks welded and reinforced, broken rivets replaced, bolts tightened, new shafts made up, if necessary, and the whole reassembled ready for use again in the same or in a similar machine. As there is no foundry in the shop, no castings can be made. However, considerable success has been attained in welding and repairing broken castings.

The Fidelity machine shop is equipped to make all repair parts for the big shovels except castings, pinions and gears. This includes such large items as dipper handles for the 5480 shovels. The tendency in recent years has been to use a lighter-weight steel in order to se-

cure longer life with less weight, and the company constantly takes advantage of the latest developments in the production of improved high-grade steel.

The shop is well supplied with all kinds of welding equipment and makes much more use of welding in repair jobs than was the practice ten years ago. Aside from roller bearings, about 95 per cent of the bearings on the mine equipment are brasses. All brass bearings are purchased in the rough and machined in the shop.

The Fidelity shop also makes spare parts for the Freeburg mine, where stripping is done by a Marion 350 shovel. Dipper handles also have been made for the Cuba mine. Shop personnel consists of a foreman, four machinists, six boilermakers and welders, two blacksmiths, one of whom is assigned to sharpening bits for the Bucyrus-Armstrong 29-T churn drills; one blacksmith's helper, one carpenter, one carpenter's helper and two laborers for general repair work. One of the boilermakers is kept busy on locomotive repairs. Altogether, there are six men qualified to do electrical welding.

Operators Watch for Breaks

Men operating the various mining units are required to keep a constant watch for mechanical breaks. This is supplemented by a regular inspection of all machinery at regular intervals by the master mechanic. As far as possible, ordinary repairs on stripping and loading machines are handled by the regular operating crews under the supervision of the master mechanic, who consults with the mine manager on major repair jobs. If additional men are needed, they are recruited from the shop force, and while in the pit these men work under the direction of the master mechanic.

While many parts of the large shovels, such as wire cable and dipper teeth, are subject to constant wear and frequent renewal, most of the larger items require repairs much less frequently and may go for several years without renewal or major repairs. Close attention to minor cracks, loose bolts and broken rivets will avoid major breakdowns, and an effort is made to keep equipment in running shape by catching needed repairs in time. A considerable saving in time and expense also is effected by replacing such items as hoist cables before they break.

It is customary to lower the booms of the big machines and over-

haul them completely every second year. Loose rivets are replaced, bolts tightened, small plates renewed or reinforced and cracks in larger plates welded and patched. All machinery attached to the boom then is gone over thoroughly, as it is much easier to replace such items as point sheaves while the boom is down. On a machine such as the Marion 5480 it requires about one eight-hour shift to make ready and about three or four hours to actually lower the boom.

From past experience it is possible to predict the probable life of many parts of the shovels. The point sheave, for example, usually lasts about three years. Then it becomes worn in the groove and begins to pinch and wear the hoist cable, at which time the sheave must be renewed. Occasionally the spokes will break and require welding, but the old-type sheaves are being replaced gradually with new manganese-steel sheaves which are expected to have several times longer life. The sheave bearings sometimes require renewal. The dragline fairlead sheaves must be watched closely for alignment and wear in order to prevent undue wear on the drag cable. These also, as they wear out are being replaced with new manganese-steel sheaves, which are expected to give about three times the life.

Handles Overhauled Yearly

The dipper handle is taken off each shovel once a year and gone over thoroughly for loose rivets and bolts and cracked plates. As a result of this frequent tightening-up, the life of a single handle can be extended to about three years. Certain parts, such as the manganese-steel rack, which has an ultimate life of six to eight years, can be used again in building a new handle in the shop. A handle can be removed and replaced with a new one in one eight-hour shift. Shipper shafts, pinions and bearings usually last about two years. As in the case of all gears on the machines, many small parts can be salvaged for reuse in making up new gear assemblies in the shop.

Circle rails and rollers usually last about eight years. They were renewed last year on two of the 5480 machines for the first time and the other two shovels will require the same attention this summer. In a job such as this it usually is necessary to renew all the rollers (of which there are 84) at the same time as the circle rails so that they may wear evenly. Instead, the 12-in. rollers were machined down to an

11-in. diameter and heat-treated again. Then 4-in. forged, heat-treated circle rails were installed in place of the original 3-in. rails. Thus the purchase of new rollers was avoided. The whole job took about ten days with the regular shovel crews making the change in the field.

In doing a job of this nature it must be remembered that unusually heavy weights are involved. It is necessary to support the entire upper portion of the shovel (including boom, counterweights, etc.) free from the lower structure by temporary timber cribbing.

The 30-in.-diameter center pin about which the upper portion of the shovel revolves has been replaced in two of the large machines after about eight years' service. The center-pin bushing requires replacing at the same time. It usually takes eight hours to burn out the old bushing, the electrician having already dismantled the electrical equipment. The complete job of installing a new center pin and bushing requires about 36 hours.

About once a year the lower frame of each shovel is overhauled thoroughly and loose rivets and bolts are tightened. Any weakness in the plates is reinforced by riveted patches which later are welded all around to provide double strength. Caterpillar traction units now require occasional attention after seven or eight years' service and the rollers are now being replaced, as needed, with rollers of higher-grade steel. The bearings of the rollers have to be renewed frequently. It takes about one eight-hour shift to change a broken sprocket wheel or roller on a 5480 machine. The original caterpillar treads have not yet been replaced.

Crawler Castings Welded

Fractures of three of the crawler castings of the 5600 shovel provided an opportunity for a unique welding job performed in each case without removing the unit. The castings, which had broken just behind the sprocket wheel, were welded and then reinforced with heavy steel plates and bands. The units now are stronger than originally and are expected to last indefinitely. After repairing the three broken castings, the mechanics proceeded to reinforce the five remaining tractor units in a similar manner. Each unit required about four days' work, and the job was done during idle periods so that no time was lost except for the three castings which actually had broken.

Another even more unusual job

was the repair of the main hoist drum on the 5600 shovel, which had become worn so that a replacement appeared necessary. Without removing the drum, a portable lathe was set up inside the shovel and the worn rope grooves on the casting were machined down to a smooth surface. A special high-grade steel lagging about 2 in. thick and grooved for 2½-in.-diameter hoist rope already had been made up in the Marion factory. This lagging was placed on the newly machined surface of the drum and fastened on with countersunk bolts through the drum, making a perfect machined fit. It is believed that this new lagging will last at least three times as long as the original drum surface.

Machining the drum (about 1½ in. cut off in places) and installing the lagging took about four days of 24 hours each. A saving of several thousand dollars was made by doing the job without removing the drum from the shovel, as the weight of the drum with attached shaft, gears, brakes and housing amounted to approximately 25 tons. At least one week's delay in operations was saved by machining the drum in place, which, along with the saving in the cost of a new drum, made the method most economical.

Special Lagging on Drums

Hoist drums on the 5480 shovels have been replaced with new ones provided with special lagging attached in a similar manner. Drums on the 5480 draglines have not required any repairs, as their load is comparatively small. However, one drag drum has been machined and covered with steel lagging and its useful life considerably lengthened. In this case, the drum was first removed from the machine, as it was a much smaller task than removing a shovel hoist drum. Other drag drums will be reinforced in the same way when necessary.

The hydraulic leveling jacks have supply tanks which have to be pumped up about once a month in order to maintain the required pressure to level the machine. In the spring the light winter oil is drained off and replaced with heavier oil suitable for hot summer operations.

One of the largest items of maintenance expense, of course, is wire rope. This is to be expected at Fidelity, where 75 per cent of the material handled by the shovels is hard rock. The company, however, has noticeably reduced the amount of wire wear, as well as the maintenance cost of the shovel proper, as a result of the new drilling and blast-

ing methods adopted a year or so ago (see p. 47 of this issue), which resulted in a much better displacement of the limestone, with consequent easier digging.

Table I summarizes the life and cost of wire rope used on the large shovels and draglines at Fidelity and other company mines during 1937. An individual record is kept of each rope to show the date placed in service, yardage moved and the date retired from service, so that comparative costs per yard can be determined as between ropes of different manufacture. In comparing individual ropes, however, a number of factors must be taken into consideration in addition to the diameter, stranding and type of core. The diameter and condition of the drums and sheaves over which the cables operate, of course, are important, but the factor having the greatest bearing on the useful life of a rope is the actual digging conditions encountered, as noted in the preceding paragraph. Improved digging resulting from changes in blasting practices lengthened the average life of stripping-shovel hoist cables ap-

problems are encountered in maintaining the 490 loading shovels as in the larger stripping machines. However, similar jobs are more easily handled and involve much less time and expense.

Electrical maintenance is under the charge of the chief electrician, who is responsible for all electrical equipment throughout the mine. He is assisted by one electrician in each pit, a shop electrician who is available at all times for work at the tippie, and another electrician on the second shift available for work whenever needed. There also is an apprentice electrician.

Electrical equipment on the shovels and draglines is constantly under surveillance, as the motors operate under maximum load almost continually. Controls are inspected and lubricated every 24 hours, and contactors are renewed as needed. Commutators are stoned about four times a year to avoid flashing over and eliminate brush trouble.

Armatures are gone over thoroughly every year and revarnished and rebanded if necessary. So far, there has not been sufficient arma-

Table I—Yardage and Rope Life, Large Stripping Equipment, 1937

Mine	Machine	Ropes Used	Diameter, Inches	Avg. Yardage Moved per Rope	Rope Cost per 1,000 Cu. Yd.
Cuba No. 9.....	350 shovel.....	1 hoist rope....	1¾	657,674	\$0.53
		2 hoist ropes....	1½	829,463	0.50
		3 hoist ropes....	1½	569,273	0.76
		4 hoist ropes....	1¾	346,333	0.93
Fidelity No. 11..	360 dragline.....	9 drag cables....	1¾	137,042	1.88
	5480 shovel.....	5 hoist ropes....	2	572,548	1.28
	5480 shovel.....	6 hoist ropes....	2	469,627	1.53
	5480 dragline.....	4 hoist ropes....	1½	508,863	0.96
Red Ray No. 13..		7 drag cables....	2½	330,708	1.47
	5480 dragline.....	4 hoist ropes....	1½	753,987	0.68
		6 drag cables....	2½	355,843	1.42
	5600 shovel.....	5 hoist ropes....	2½	565,964	2.06
	350 shovel.....	4 hoist ropes....	1¾	510,185	0.79

proximately 20 per cent at Fidelity. Considerably easier digging is the rule at the other mines, especially Cuba No. 9.

Boom support cables (1½-in.) are replaced, for safety, every three years, as it is difficult to detect wear due to fatigue when portions of the cable are not easily visible. The 4-in. safety cables also are replaced frequently.

Another large item of expense is dipper teeth. On the large stripping shovels a set of teeth lasts a month to six weeks, after which time the points are renewed, using the same bases. Points usually are changed by sets to keep them evenly lined up for digging.

Dippers and buckets are watched constantly for cracks and unusual wear. Small cracks are repaired immediately by welding to prevent their development into major breaks.

Generally speaking, the same

ture rewinding to justify the installation of rewinding equipment in the electrical shop; armatures are sent out to a local armature concern whenever such work is required. The generators in the Ward Leonard sets on the shovels are so heavy that they are not taken out of their bearings, any necessary rewinding being done in place. About twice a year all motors are cleaned thoroughly by blowing with air and cleaning solution. Spare armatures for all shovel motors are carried in stock, and there are miscellaneous small motors available for replacements on pumps, etc.

Life of individual trailing cables is six to seven years. They are subject to severe usage and all kinds of weather. The hot sun constantly beating down upon them during the summer is especially injurious to the insulation. Pit electricians watch for cuts and bruises caused by such things as falling rocks, and apply

temporary insulation with heavy rubber tape. Cables regularly are taken out of service once a year—oftener if necessary—and are gone over thoroughly in the shop, where the bad places are reinsulated and vulcanized. Special care is taken in the case of these 5,000-volt 700-ft. cables in order to safeguard the workmen in the pit and also to insure against operating delays due to short circuits.

Aside from the stripping and loading machines, the other items of equipment which must be looked after and kept in shape include the Heisler locomotives and other haulage equipment, drainage pumps, and drills. A geared locomotive requires more attention than the ordinary rod locomotive, although in other respects it is admirably suited to the haulage problem at Fidelity. The Heislars are overhauled thoroughly in the shop about once every three years, but certain things require more frequent attention. It is customary to renew the flues every 18 months; that is, remove the flues, clean out scale, weld on new tips and replace. The fireboxes must be replaced every six to eight years, and the tires are machined and replaced as needed. Repairs to the coal haulage cars are avoided by keeping the brakes in shape and by proper lubrication of the journal boxes.

Impellers Renewed Annually

Pit drainage pumps require new impellers about once a year, due to the action of the sulphur in the pit water. Drills occasionally develop a cracked frame which is easily repaired in the field. The 9-in. bits are sent to the shop for resharpening.

Maintenance and repair work in the tippie and washing plant is handled by the operating crew under the direction of the top washer foreman. The day operators are all qualified to make minor repairs and there are two repairmen on the second shift to handle jobs that cannot be done while running. So far as possible, delays for repairs are avoided during the day shift to prevent interference with the output of the plant, and an effort is made to forestall operating delays by catching them ahead of time on the repair shift.

The Freeburg mine of the company is a much smaller operation and considerably less heavy equipment is necessary than at Fidelity. There is a much smaller maintenance crew and a smaller shop. However, the problems and their solution are essentially the same. Stripping is done by means of a 350 shovel with a 10-yd. dipper, assisted by a 37

dragline. A 37 shovel is used for loading. Many of the spare parts for the Freeburg equipment are made in the Fidelity shop, including dipper handles.

A major boom-repair job was performed on the 350 stripping shovel last summer. Two big castings—the boom-socket and foot units—were replaced. It was necessary to lower the boom, which was completely overhauled for the first time in several years. The job required about one month's time.

United Electric's Cuba mine is equipped with two Marion 350 10-cu.yd. shovels, one Marion 360 8-cu.yd. dragline and three loading shovels. The Marion 350 shovel in the Cuba No. 4 pit was erected in 1925 and was the first large shovel to be built with caterpillar traction. The 350 shovel and 360 dragline in Pit No. 1 were transferred to Cuba from another mine at a later date. The older Model 300 shovels have been retired from service. In general, the maintenance work on these machines is similar to that at the Fidelity and Freeburg mines. Every summer they are given a month's general overhauling and put in shape for another year's operations.

Larger Dippers Installed

In 1936 the dipper capacity of the strippers was increased by installing light-weight dippers. The discarded units are held in reserve as spares. Dipper teeth are a big item of expense. New teeth are built up by welding in the shop before use. This practice lengthens their service and results in an appreciable saving. It has been found that welding dragline teeth does not pay, as the points usually break before wearing down.

After the three stripping shovels were about two years old it became necessary to renew the circle rails on all, as insufficient bearing surface was provided. Instead of the original 110-lb. rail, the machines now have a steel bar with a 6-in. cross-section bent to a circle, with a new type of rollers to fit. This arrangement provides about twice as much bearing surface and no trouble has occurred since its installation.

The center pin was changed on the oldest machine last year after twelve years' service. None of the hoist drums has been replaced, although two drums have been removed for rebushing. The friction housing on the dragline fails, due to the heat, and has to be changed every few years. The friction blocks for the brakes form a continual source of expense on all the shovels.

Sprocket wheels and rollers on the caterpillar-traction units are now of

much better design and can stand rougher treatment than in former years, so that changes are not so frequent now. All of the caterpillar frames have been reinforced by welding a 2x5-in. steel bar around the sprocket end and along the underside to the guide roller in the rear. This became necessary after several had failed either just behind the sprocket wheel or across the middle of the frame. There have been no failures since this means of reinforcement was adopted. The original treads on the 1925 machine have been replaced with high-grade manganese steel.

Shipper shafts, main rotating shafts, pinions, gears and similar parts, sheaves and dipper handles are renewed every two years on the average, and the armatures of the crowd and swing motors are rewound at similar intervals. Brushes are short-lived, two to three being required each month. Commutators are trued up every six months. The cylinders for the hydraulic leveling jacks have all had to be replaced, due to breakage of the flange at the bottom of the casing.

The Model 37 and 36 loaders are much older machines and also are subject to rougher going than the larger machines, in comparison with their size and design. They therefore require frequent attention. The repair jobs themselves, however, are relatively small. The mine shop is equipped to handle all ordinary repairs and can do such machine work and welding as usually is required. There also is a separate shop where the Vulcan locomotives are serviced and overhauled.

Crews Repair Shovels

The master mechanic looks after all mechanical repairs and is also in charge of the shops. His force consists of one blacksmith, one blacksmith's helper, one machinist, one welder and two boilermakers. The shovel crews usually do all the repair work on their shovels. There also is an electrician with a helper.

The Buckheart mine of the company (see pp. 49 and 52) began operations in November, 1937, and, as all the equipment is new, very little repair work is anticipated aside from such things as dipper teeth and wire rope. By observing wear on various parts it will be possible to build a supply of items sufficiently in advance of their need. A small shop is located at the mine, but advantage will be taken of the facilities of the near-by Cuba mine whenever the work requires. As yet, there has been no need to build up a large mechanical organization.

MERCURY-ARC RECTIFIERS

+ Meet Substation-Relocation Problems

Growing Out of Rapid Face Advance

By A. LEE BARRETT

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CHANGES in the nature of the mining operation, in the working day, in machinery and in mine concentration have introduced new problems in the conversion of power from alternating to direct current and in the distribution of that power to the point of use. In 1930, most mines operated one shift per day. With the advent of the 35-hour week, many mines adopted double- or triple-shift schedules, thus maintaining or increasing tonnage and at the same time securing greater utility of plant equipment. The trend toward mechanization has tended to concentrate mining activities and concentration is being used on its own merits to improve the efficiency of mine operation.

Load Factor Has Increased

All of these factors necessarily have had an effect on conversion equipment, on load factor and on the d.c. distribution system. Tons mined per kilovolt-ampere of demand and kilowatt-hours per ton mined today stand at figures not greatly different from those of 1930, but the daily load factor has increased materially. In the case of a rather large group of Pittsburgh Coal Co. mines, tons mined per kilovolt-ampere have decreased 4 per cent, along with kilowatt-hours per ton, but the daily load factor has increased about 15 per cent. The small change in these monthly factors, in spite of the shorter working day and week, has been made possible by a more efficient use of machinery and equipment.

At any mine there are certain pieces of equipment for which the power consumption is more or less definitely fixed, such as the fan and pumps. These classes of equipment

of the power consumption. Increased production made possible by double-shifting and mechanization, together with concentration, has allowed for an increase in power consumption at the face without an increase in these fixed power charges. The load factor, based on a day's operation, has materially improved, so that the general changes in mine operation have not, in most cases, required the purchase of additional conversion equipment.

Mechanization has, however, made marked changes in load distribution. usually represent 30 to 35 per cent



Fig. 1—Rectifier substation,
Crescent No. 2 mine

In 1930, in the usual case, 75 per cent of the load grew out of haulage, while 25 per cent was the result of face operations. Under these conditions, the a.c.-d.c. haulage substation could be economically located along the haulageway at a point which would remain more or less fixed throughout the life of the mine. The mine face, in 1930, advanced slowly and covered a wide area, so that a face substation, which

handled about 25 per cent of the load, could remain at one location for a long time—usually ten to fifteen years.

Mechanization and concentration have greatly changed this picture. We now find that 50 to 60 per cent of the mine's d.c. load is concentrated at the operating face and that the area covered by this working section is greatly reduced. For example, one mine which in 1930 had approximately 900 working rooms for a production of 6,400 tons per day, now has 36 rooms for a production of 5,500 tons. The face substation, however, is larger and must be moved much more often in the future than was necessary in 1930.

Face Advances 1,560 Ft. Yearly

Considering the case of a 6,000-ton mechanical mine operating three shifts, we find that the working area is approximately 5,000 ft. long. On the basis of usual operating schedules and 5-ft. coal, this face advances 1,560 ft. each year, or 7,800 ft. in five years. In other words, at the end of five years, the substation will be 7,800 ft. from the face if it was at the face at the beginning. The d.c. voltage at this mine is 550 and the maximum instantaneous d.c. demand is approximately 1,400 kw., half used at the face and half by mine haulage. The face substation thus will have a maximum d.c. load of 1,270 amp. If the instantaneous allowable voltage drop is set at 20 per cent, or 110 volts, the resistance of the circuit must be not more than 0.078 ohm.

At the end of the five-year period,

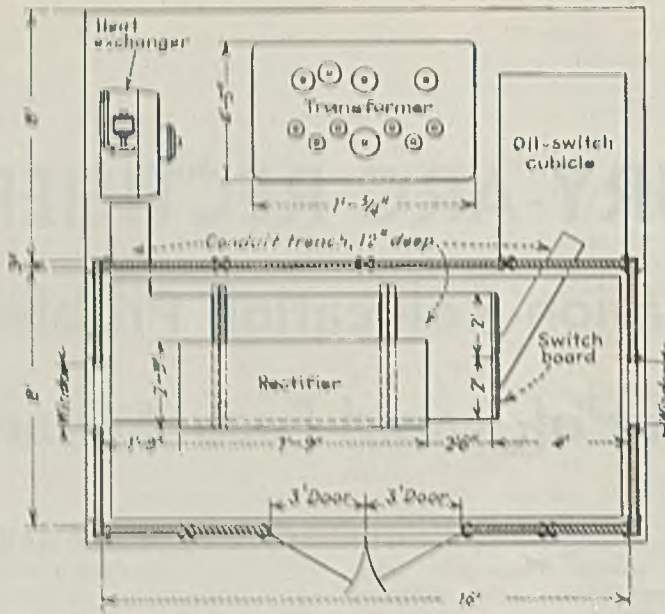


Fig. 2—Floor and foundation plan for ignition-rectifier substation

two 1,000,000-circuit cables will be required for the trolley circuit, and, if 60-lb. rail is used, a 1,000,000-circuit cable will be required in the ground circuit. Under the best of conditions, this would require 72,000 lb. of copper, worth approximately \$10,800, without the cost of wires or installation labor and material. Since the distribution copper cost varies as the square of the distance from the load center for a given per cent voltage drop, distribution copper costs will mount even more rapidly for distances greater than 7,800 ft. Good performance of equipment requires that maximum voltage drops shall not exceed 20 per cent, so that it is impractical to reduce the quantity of copper. The obvious solution to the problem is to keep the face sub-

station near the face. A distance of 7,800 ft. seems to be the logical maximum. Mines with 250-volt distribution are even less fortunate, since, with the same total copper and allowable percentage voltage drop, the substation can be one-half as far from the face and, hence, must be moved approximately twice as often. A substation which must be moved every five to eight years, instead of every fifteen years, should be designed to facilitate relocation. In the past, motor-generator sets or rotary converters have been used for all a.c.-d.c. conversion. Installation and relocation of these stations is, in general, expensive, due to the foundations and size of building required. Usually these stations have been non-automatic. The substation operator

usually also had charge of the lamp house and the mine fan, frequently located near by. The present frequency of substation relocation makes automatic stations a necessity if d.c. distribution efficiency is to be kept high and operating costs low.

Two rectifier substations have been installed by the Pittsburgh Coal Co. in the past year as a better means of meeting the new condition. They have provided high efficiency and reliable automatic control. The installation cost has been greatly reduced, since the size of the building is small—approximately 15x16 ft., inside dimensions—for a 600-kw. substation (Fig. 1).

Rectifier substations now under consideration are of the igniter, or multiple-tank, type. A 600-kw. station of this type will be housed in a building with inside dimensions of 8x16 ft. with dimensions of approximately 3x8 ft. and 3 ft. high, will be located immediately behind the automatic-switching equipment, which will be mounted on two panels 24 in. wide and 90 in. high. The building will house only these two units. The heat exchanger, control transformer and main transformer will be outdoor equipment and, though located on the same foundation, will be outside the substation building. The oil switch will be housed in a small weatherproof cubicle and will also be located outside the substation building. Fig. 2 shows apparatus arrangement.

The substation building will have insulated, fabricated steel walls and roof and will knock down in five pieces: four walls and the roof. All piping and conduit will be located in covered ducts in the foundation. Terminal boards on each piece of apparatus will provide for easy dis-

Fig. 3—Comparison of conversion efficiencies

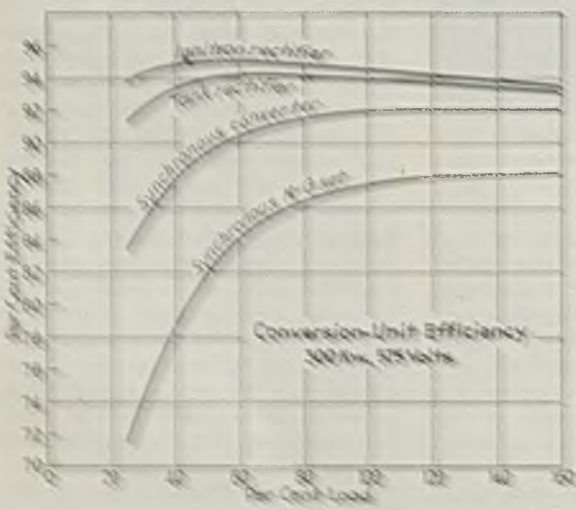
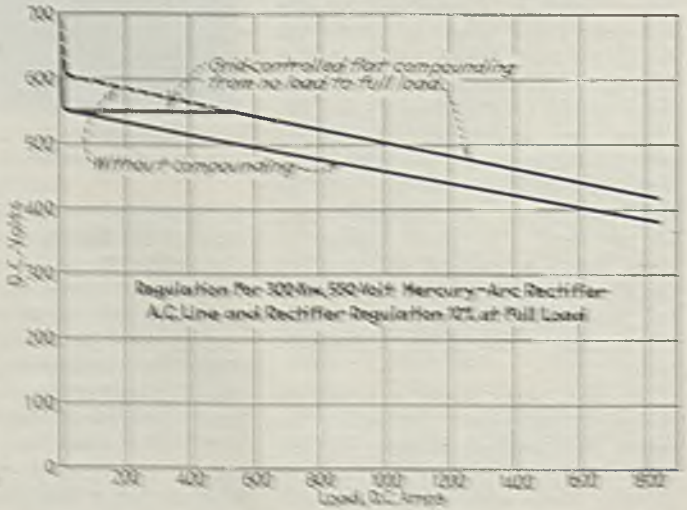


Fig. 4—Ignition-rectifier regulation curve



connection of wiring, which will run in conduit between the units. When the substation is dismantled, these connections may be opened and the conduit clamps released. Then the conduit, together with all the wiring, may be moved and reinstalled intact, eliminating the necessity of rewiring the relocated substation. Further, there will be no more than four conduits. The oil-switch housing will contain the oil switch, lightning arresters and instrument transformers, making a small and readily portable unit. The heat exchanger, together with circulating pump and motor, will be self-contained and portable.

Fourteen Parts in Station

Practically speaking, such a station will consist of one building in five parts; one heat exchanger, one rectifier complete with excitation apparatus, one main transformer, one oil-switch unit, one switchboard and four conduits, complete with wiring, or a total of fourteen parts.

After the foundation at the new location has been completed, actual dismantling, moving and erection will require no more than two days. Obviously, foundation cost will represent most of the expense of relocation. This total cost should be less than 2 per cent of the station cost. The trolley of the system will be at negative potential, so that the rectifier tanks can be grounded.

Outdoor location of the auxiliary equipment has many advantages. Outside location of the high-voltage circuit breaker allows the equipment inside the substation to be operated at about d.c. output voltage; in this case, 550 volts. Removal of high potentials from the inside of the substation should contribute substantially to safety. Outside heat-exchanger installation reduces considerably the size and cost of the substation building. The necessity for complicated air ducts and passages through the wall of the building is eliminated and a greater quantity of air may be moved through the heat exchanger for the simple reason that there is no resistance to air flow other than that in the unit itself. A water-to-air heat exchanger is used because a water supply frequently is not available at the mine substation location. Use of Prestone in the rectifier makes it definitely an all-weather unit. Furthermore, Prestone contains a rust inhibitor which successfully prevents corrosion of the rectifier water jacket and piping, eliminating dismantling to clean the water jacket.

The efficiency of the igniter-type

rectifier is somewhat higher than that of the single-tank rectifier, which, in turn, is definitely higher than either the rotary converter or synchronous motor generator when operated at 550 volts (Fig. 3). The high light-load efficiency of rectifiers is particularly desirable in mine service because of the low load factor usually found. The best load factor usually is under 60 per cent, while 40 per cent is considered above standard.

At one large Pittsburgh Coal mine a 600-kw. rectifier is saving, due to increased efficiency, 26.5 per cent of the rectifier cost each year when compared to a synchronous motor generator. Savings in the 250-volt field are not quite so attractive, but are, nevertheless, very worth while.

The overload characteristic of rectifiers makes them quite suitable as mine conversion units, since high instantaneous loads are the rule rather than the exception. Most conversion apparatus for mine service is selected on the basis of its instantaneous capacity, so that, generally, the rectifier may be smaller in capacity than rotating equipment for the same job. Ease with which voltage regulation may be obtained with the

igniter-type rectifier is an advantage, being achieved simply by shifting the phase of the voltage to the grid of the ignition tubes. Fig. 4 is a regulation curve for an ignition rectifier as used for mine service. Parallel operation presents no problem in that the face substation usually is a mile or more from the haulage substation. Maintenance and reliability of the igniter-type rectifier, as well as the conventional rectifier, have proved superior to that of rotating apparatus.

The first igniter-type-rectifier installation for industrial power conversion was made in February, 1937, in the No. 6 mine of the Union Collieries Co., near Pittsburgh, Pa. The equipment was specified and installed under the supervision of A. L. Lee. It consists of a 6-phase, 300-kw. 2,300-volt a.c. to 275-volt d.c. ignitron rectifier (Fig. 5), installed underground. Three portable stations of the same size were installed recently by the Weirton Coal Co. near Uniontown, Pa. These stations are completely portable in that all equipment is mounted on three trucks. Maximum over-all height is 55 in.; width, 62 in. The rectifier truck is 84 in. over

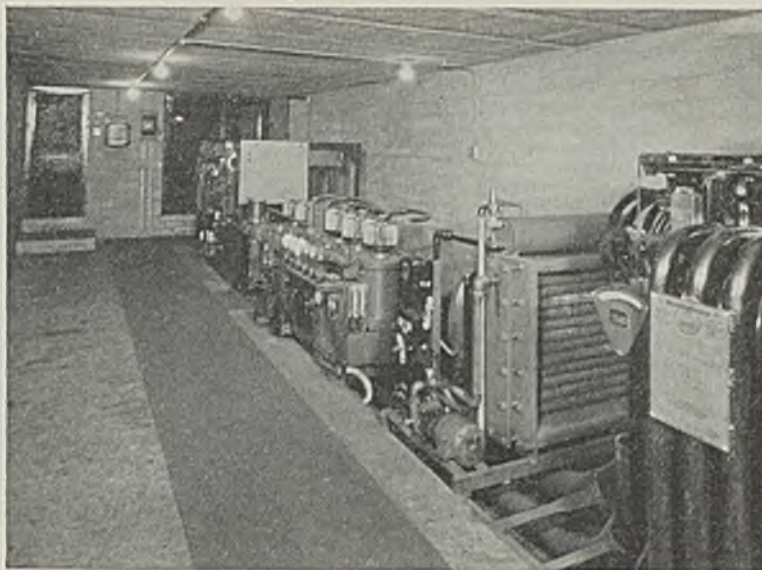


Fig. 5—First igniter-type-rectifier installation for industrial power conversion—underground station at No. 6 mine, Union Collieries Co.



Fig. 6—Shop view of portable rectifier station for the Weirton Coal Co.

the bumpers; the switch gear truck is 81 in. long, and the transformer truck is 146 in. long. These trucks may be moved about the mine without breaking the electrical connections between them, so that at a new location it is necessary only to connect the high-voltage a.c. and d.c. lines before placing the station (Fig. 6) in operation.

Research on the ignition-type rectifier is constantly going forward in both the Westinghouse and General Electric laboratories. At the present time, 250-volt, sealed-off, 6-phase rectifiers rated at 100 kw. are available. These steel tubes are water-cooled, are 6 in. high and 7 in. in diameter. Steel air-cooled sealed-off tubes are in experimental service and considerable possibilities are indicated. New

methods of ignition seem just around the corner.

In summary, the ignition-type rectifier is at a disadvantage in comparison to the single-tank rectifier in that the life of the igniter tube, an auxiliary, is limited, and such a 6-phase rectifier has approximately two times as many vacuum seals as the single-tank rectifier. The advantages of the ignition type are: smaller size than the same capacity single-tank rectifier, hence lighter and more portable; easier voltage regulation through phase shift of the voltage to the grids of the firing tubes; easier inspection and maintenance, due to the smaller size of the parts involved. Three tanks of a 6-phase unit may be shut off, in case of a failure in one tank, and emer-

gency power supplied for pumps and fans at reduced voltage as a 3-phase rectifier. Due to its shorter arc path, its efficiency is higher than that of a single-tank rectifier.

The ignition-type rectifier would seem to provide the mining industry with a substation no more expensive than contemporary substations. Such a substation, however, is much more portable than any other present-day installation. It may be kept at the face, thus reducing distribution losses; it requires little attention, since there are no bearings to replace and few moving parts to wear out; it is unusually resistant to damage by lightning; it provides highly reliable automatic control; and its efficiency is substantially better than anything heretofore available.

FANS IN PARALLEL

+ And Core-Drill Gas Bleeding

Feature Pocahontas Fuel Improvements

WITH a saving of \$1,600 per month, twin propeller fans operating in parallel at the top of a new air shaft have been included in the ventilation-improvement program carried out in the last few months at mines of the Pocahontas Fuel Co., Inc. These fans replaced a 10-ft. propeller unit of a different type installed at a crop opening five years ago. In addition, a centrifugal fan at another operation has been replaced by a 111-in. propeller unit to reduce the power cost to 45 per cent of the former figure. And finally, core drillholes only 80 ft. deep have been made to drain gas from coal workings 170 ft. below the surface at a third mine of the company.

Sinking of the shaft and installation of the double fan cost in the neighborhood of \$65,000. Replacement of the centrifugal fan required an outlay of about \$11,000, while the gas-relief holes cost only the usual footage charge for 3-in. prospect holes. Planning and careful engineering, together with company rather than contract work, speeded the shaft sinking and held the cost to a low figure.

No. 31 mine, Amonate, Va., is the one now being ventilated by the twin fans—two 96-in. Jeffrey Aerodyne units which went into service Nov. 21. This mine, operated by the Pocahontas Corporation, a totally owned subsidiary of the Pocahontas Fuel Co., Inc., is in a 30,000-acre coal tract purchased in 1923 from the H. C. Frick estate (*Coal Age*, January 1937, p. 3). The mine was opened in 1924, and to speed the work the development was carried on from a number of outcrop openings. Disk fans and small motors supplied the ventilation until the spring of 1932, when a 10-ft. two-stage Jeffrey Aerovane fan operating exhausting was installed at the crop on Beech Fork.

This fan was installed as a low-cost temporary substitute for the air shaft, which already had been planned and had been prospected by an 8-in. drillhole. Early in 1937 immediate need for more air and the promise of a considerable saving in purchased-power cost by reason of shorter air travel led to a decision to sink the shaft at the location formerly planned and to install an Aerodyne fan.

Greater assurance against complete interruptions to ventilation was paramount in a later decision to purchase two smaller fans instead of one large unit. One fan could continue to circulate approximately three-quarters of full current if the other should be taken out of service due to a mechanical or electrical difficulty. The greater cost of the two fans compared to one larger fan was not enough to offset the advantages.

The fans, designated as "8-96," are installed for exhaust operation on opposite sides of the 18-ft. circular shaft, but their axes, which intersect the center line of the shaft, are 17 deg. off a straight line. Brick adits 12 ft. wide by 11 ft. 8½ in. high leading to the fan adapters are made with the bottom corners (shaft coping) flared or rounded to 6-ft. radii.

Each fan is driven by a 20-hp. 220-volt S70-r.p.m. General Electric squirrel-cage motor which, with Trumbull safety switch and General Electric magnetic starter, is mounted in an 8-ft.x8-ft. 3-in. separate building adjacent to the fan proper,

which is driven by V-belts. Pitch diameters of motor and fan pulleys are 13.03 and 25.63 in. respectively, giving fan speeds of 442 r.p.m. at rated full-load motor speeds.

Steel casings, or adapters, between the brick adits and fans contain doors which can be closed if one fan is shut down temporarily. These doors are not latched and are held open by the normal air current. At the higher output ratings of which the fans are capable the doors to a fan would close automatically if that fan stopped and the other continued in operation, thus assuring continuous ventilation. That one fan will deliver approximately three-fourths as much air as the two fans in parallel is due to the drop in water gage with decreased flow (pressure required to force air through a mine varies with the square of the volume). The exact ratio depends on the fan and motor characteristics.

Fan operation is supervised by an attendant who lives within 150 ft. of the shaft. At present, the volume up the shaft is approximately 160,000 c.f.m. and the water gage is 1 in. As indicated in Table I, the power cost per month for this volume is calculated at \$404.10, compared to \$2,042.59 if the same volume were pumped through the mine by the old Aerovane fan and without benefit of the short cuts provided by the new shaft.

Sinking and concreting the 18-ft. shaft, which is 257 ft. deep, was completed in 61 working days, mostly three-shift work. Diameter of the excavation was about 20 ft. 6 in.; thus the concrete lining, which extends all the way to the bottom, is 12 in. or more thick. The 8-in.



Two propeller fans operate in parallel at the top of the new air shaft

prospect hole drilled in 1932 to the coal at the center of the present shaft revealed considerable water. Therefore, pressure grouting was done in 1937 before sinking was begun. One of the reasons for the 8-in. hole was that the 1932 plans favored raising the shaft from the bottom.

Pressure grouting of the 8-in. hole took 1,200 bags of portland cement and at various times during the work a special "aqua-gel" totaling

twelve bags was pumped into the hole. The maximum pressure attained was 900 lb. per square inch, but that maximum pressure could be held only a short time and the grouting did not show in the rock strata in the creek near by. The next step was to put in at opposite points across the shaft two 3-in. core drill-holes to a depth of 200 ft. Into these two holes was pumped a total of 2,000 bags of cement. Two more 3-in. peripheral holes 200 ft. deep were drilled, and into these 1,500 bags of cement was pumped. In this case the grouting finally did appear at a rock outcrop in the creek 80 ft. away.

The peripheral holes were drilled only to a coal seam 40 ft. above the seam being mined (No. 5) because from observation of caves up to that height it was known that the strata in the 40-ft. interval made no water.

Air shaft and new parallel-operated fans result in a combined saving of \$1,600 per month in ventilating No. 31 mine. At the left is the section at the 18-ft. air shaft at No. 31 mine. Sinking, lining with concrete and finishing bottom flares and coping was completed in 61 days using company labor. Pressure grouting cut water influx to a "convenient" quantity.

Material	Section	Thickness	Depth	Elev.
Surface			0'-00"	7728.00
		38'		
Gray sandy shale		12'-0"		
Sandstone		28'-0"		
Coal		0'-7"	78-7	749.47
Fireclay		7'-0"		
Sandstone		21'-0"		
Gray shale		5'-0"	115-7	2114.64
Coal		0'-7"		
Shale & fireclay		4'-0"		
Shale & soapstone		15'-0"	130-0	2091.00
Coal		3'-0"		
Sandy fireclay		21'-0"		
8 soapstone		28'-0"		
Sandstone		9'-8"		
Hard sandstone		7'-11"	195-7	2032.42
Coal		4'-6"		
Dark shale		4'-6"		
Fireclay		45'-8"		
Sandstone				
Coal		5'-2"	246-8"	1981.30
Shaft bottom				





Gas estimated at 150 c.f.m. is burning at the top of this core drillhole, one of four which have reduced the gas content in an underlying mine section from 1.5 to 0.3 per cent.

The pressure grouting was done by the Oil Well Cementing Co., Charleston, W. Va. As a result, just a convenient quantity of water entered the shaft and only a few times was it necessary to pump or bail. The sinking and immediate application of the concrete lining was done in 30- to 31-ft. steps. Six 5-ft. wooden-ring forms were used, each ring consisting of four sections. The finishing, or joining to the completed concrete section above, was done with a 16-in. ring section. A mix pro-

portion of 1-2-3 was used and the "3" consisted of crushed limestone.

After applying the last concrete in a finishing ring there was no delay to await setting of the concrete because mucking of a 6-ft. depth of loose rock previously shot provided practically continuous working. As soon as that rock was loaded the forms were removed and drilling was begun for the next shot. At the bottom the shaft is flared with 18-ft. radii to two 10x12-ft. adits extending in opposite directions and connecting with the mine airways. Reinforcing is placed in the flat top of the adits and in the flares up to the straight wall about 28 ft. from the floor.

Drill Holes Bleed Off Gas

No. 34, also a Pocahontas Corporation operation, at Bishop, W. Va., is the mine in which the quantity of gas in a certain section has been reduced by shallow bleed holes drilled from the surface. Here the mine workings are in the Pocahontas No. 5 seam, which lies fairly level under 170 ft. of cover in the floor of the narrow valley where the bleed holes are located. These holes are in West Virginia on Horsepan Creek and one of them is within 40 ft. of the State line. Increase of methane content to a maximum of 1.5 per cent in the return in that section led to the gas-bleeding experiment which reduced the content to 0.3 per cent.

History of the project is as follows: A 3-in. coal-prospecting core drill-hole made several years ago produced

a flowing-water well and there existed at a point $\frac{1}{4}$ mile down the creek another well drilled as a private enterprise. A few bubbles of gas came up with the water in both wells, but not in sufficient quantity to maintain a flame. Water flow from the prospect hole stopped apparently because children had dropped rocks into it. Some time later, when mining had progressed to that locality, the water in the private well disappeared and a moderate and continuous flow of gas appeared. This well is 80 to 100 ft. deep.

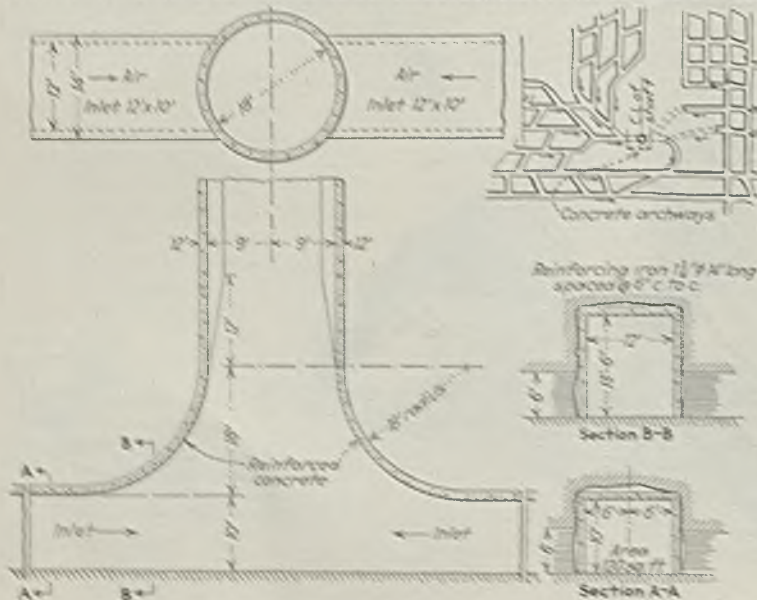
These observations, made at the time an excessive quantity of gas was struck in the mine workings 170 ft. below the valley floor, led to the drilling of a 3-in. core hole to a depth of 85 ft. During drilling the water was lost at 80 ft. and the gas began to flow at 70 ft. In the first 30 ft., a 15-ft. stratum of dense, unbroken sandstone was pierced. Gas flow at this hole was estimated at 150 c.f.m. and has not changed perceptibly since the start.

A second 3-in. hole was drilled

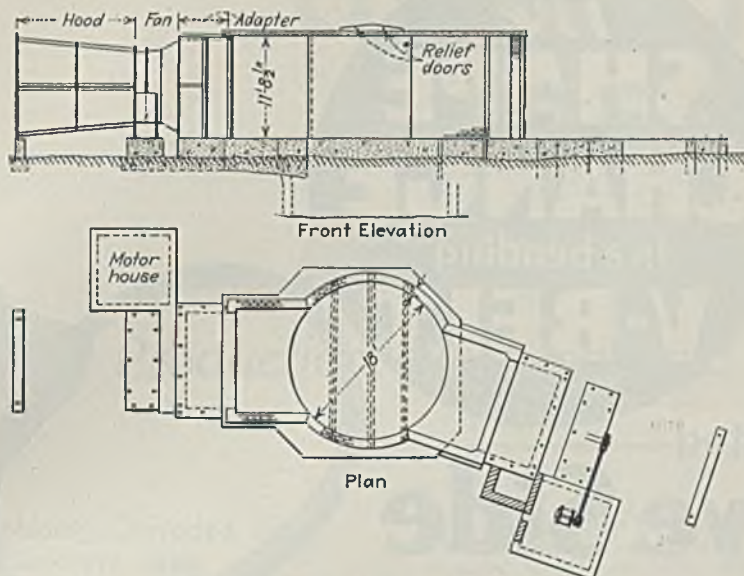


Steel doors folded to the open position in the adapter of the Jenkinjones fan

Corners are rounded to an 18-ft. radius at the bottom of No. 31 mine air shaft



300 ft. away. Depth was the same and the result was identical except that the gas pressure was somewhat less. At the first hole the pressure was barely perceptible when the pipe was covered with the hand. Next, the original prospect hole was cleaned out and its flow also duplicated that from the first 85-ft. hole. This original prospect hole extends down through the solid coal in the No. 5 seam (the one being worked) and into a No. 3 seam 125 ft. below. The No. 4 seam is missing in this locality. At a distance of 2,000 ft. from that group of three holes a fourth was drilled and now the four are discharging a total of about 600 c.f.m., which is being burned at the tops of



Parallel-operating fans at the top of No. 31 air shaft are placed slightly "out of opposite," which plan saved considerable excavation of a rock cliff at the rear

pipes 12 ft. from the ground level.

When, on account of a maintenance job on power equipment, the exhaust fan which ventilates the workings was shut down for two hours the air in the section showed considerably less methane than the 0.3 per cent when the fan was running. In this section of the mine the rock for some distance above the coal is broken, this indicating a disturbance, although the No. 5 coal is somewhat thicker in that vicinity. It was observed that the extra gas originally encountered did not come out of the No. 5 coal itself but from surrounding rock. Of interest is the conclusion that, had the present group of three new holes been drilled before the mining was begun in the

coal beneath, only an insignificant quantity of gas would have appeared. As indicated by the action of the hole drilled as a private water well, gas would not have appeared until after water was drained out of the strata by the mining.

No. 5 mine, Jenkinjones, W. Va., one of the original holdings of the Poahontas Fuel Co., Inc., is now ventilated to the extent of 109,462 c.f.m. with a motor input of 30.8 kw., as compared to 109,175 c.f.m. with a motor input of 67.7 kw. before the new "8-111" Aerodyne fan was put into service, Dec. 6, to replace a centrifugal fan of the backward-curved blade type. No changes were made in the mine and conse-

quently the water gage remains at 1.5 in. The new fan, as did the old, operates exhausting. Besides the No. 5 workings the fan also ventilated an 11-mile section of the 18.6-mile drainway completed in September, 1936 (*Coal Age*, January, 1937, p. 3).

The old fan, 7 ft. in diameter and 4 ft. wide, is still in excellent condition after twenty years of reliable service. Replacement at this particular time was due principally to the prospect of saving 259,000 kw.-hr. per year of purchased power. Actual operation, however, indicates an annual saving of 319,000 kw.-hr., assuming continuous fan operation. Other advantages are: availability of spare fan (the old centrifugal was left in place) and ability to increase air volume at any time by applying a different pulley and larger motor to change the new-fan speed.

Adapter Has Steel Door

The motor now in use is a General Electric Type KT two-speed 870/470-r.p.m. 50/25-hp. 220-volt unit that has seen prior service. The drive is a V-belt. As in the case with the twin Aerodyne installation at Mine No. 31, the adapter of the Jenkinjones fan is equipped with steel doors which can be closed in event the old fan is called into service temporarily. A curved-brick adit leading from the drift opening of the mine to the adapter of the new fan has an opening in the side connecting with the old fan and steel doors are installed which when closed, as is the normal position, present a smooth surface.

Table I—Comparison of Operating Costs for Ventilating No. 31 Mine

Quantity, C.f.m.	Water Gage, In.		Cost per month	
	Old*	New*	Old*	New*
120,000	2.2	.56	\$816.72	\$170.47
135,000	2.8	.71	1,226.95	242.73
150,000	3.4	.88	1,683.04	332.96
160,000	3.7	1.00	2,032.59	404.10
175,000	4.7	1.20	2,672.62	528.74
200,000	6.1	1.56	3,989.44	789.25
250,000	9.5	2.44	7,791.88	1,541.51

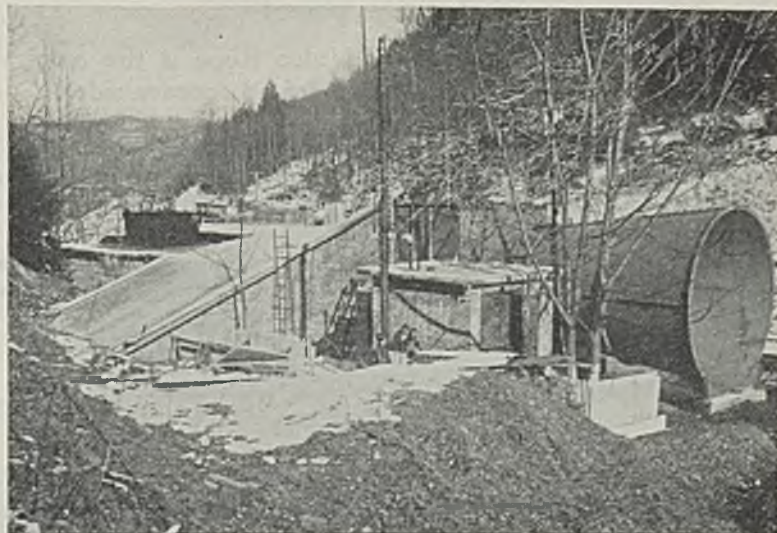
* Old method, one 10-ft. Aerovane fan at outcrop opening; new method, two 8-ft. Aerodyne fans at air shaft; italic figures in table are results for the quantity of air now being circulated.

Table II—Comparison of Performance, Old and New Fans, No. 5 Mine, Jenkinjones.

	Quantity, C.f.m.	Gage, In.	Motor Input, Kw.
Old fan*..	109,175	1.5	67.7
New fan†..	109,462	1.5	30.8

* 7x4-ft. centrifugal.
† "8-111" Aerodyne.

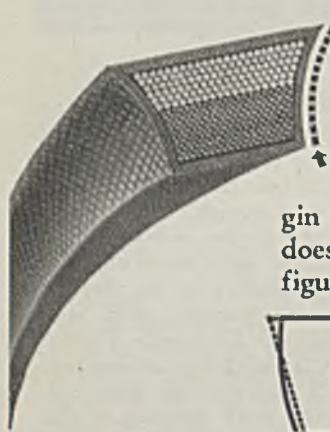
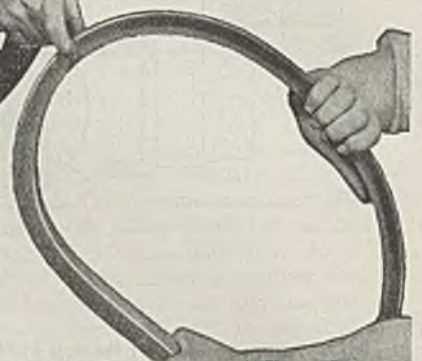
At No. 5 mine, Jenkinjones, ventilation power was reduced from 67.7 to 30.8 kw. by replacing the centrifugal fan (left) with a propeller fan (right)



This Simple Fact...

The SHAPE CHANGE in a bending V-BELT

Shows Why You Want V-Belts With the Patented Concave Side



When *any* V-belt bends around its pulley, the top of the belt is under tension and grows *narrower*. The bottom, under compression, *widens*. A result of these two changes, the sides of the belt *bulge out*. If the sides were *straight* to begin with, they are now forced into a shape that does not fit the sheave groove—as shown in figure 1, below.



WHAT HAPPENS
WHEN A V-BELT
BENDS



Figure 2 shows how this shape change is corrected by the patented *concave side*. The top narrows, the bottom widens—but there is no side-bulge. This insures uniform side-wall wear which means *longer life*. Moreover, the full side-width grip on the pulley carries heavier loads without slippage; which saves belt wear and also saves power!

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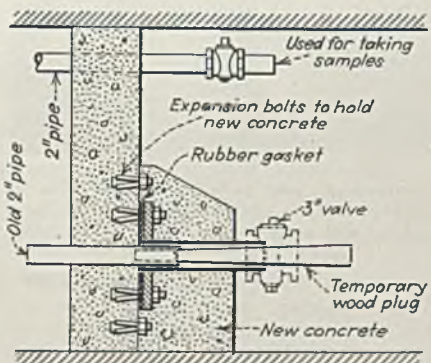
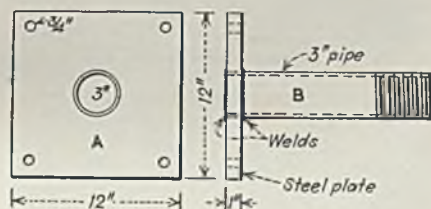
OPERATING IDEAS

From

Production, Electrical and Mechanical Men

Replacing Corroded Pipes In Concrete Seals

When old workings are sealed it is customary, writes Thomas James, mine manager, American No. 2 mine, Knox Consolidated Coal Corporation, Bicknell, Ind., to place a pipe in the top of the seal for sampling gas, etc., with an additional pipe at the bottom which can be used either for draining the area behind the seal or for pumping water back in behind it. At American, seal water is used for



Showing how new pipe was installed in bottom of concrete seal

washing coal. It often happens that one or both the pipes will corrode out, and also it frequently is the case that the area behind the seal is full of water or gas or both. As the pipes are embedded in 3 or 4 ft. of concrete, which is the usual thickness of the seals, replacing a pipe is quite a job, especially if there is gas or water pressure.

How the replacement problem was handled when it came up recently at American mine is shown in the sketch. When the pipe corroded through it was broken off at the seal and stopped temporarily

with a long tapered wooden plug. Then Plate A was cut out and a 3-in. pipe threaded on one end was welded into it as shown. Four holes then were drilled in the seal to correspond with the holes in the plate and common trolley-type expansion bolts were placed in these holes. Then the face of the seal was smoothed off around the location of the pipe and, using a rubber gasket between seal and plate, the plate was bolted in place. Next, the wood plug was pulled and a 3-in. valve was screwed on the pipe. To make the job stronger and safer, the installation was concreted from the valve back to the seal. Results were perfect, Mr. James states.



Ropes Cleaned and Oiled In Special Box Device

Lubrication of hoisting ropes is an important factor in tonnage hoisted. Applying new lubricant should be preceded by scraping or brushing off the old lubricant and accumulated dirt. A combination cleaning and lubricating device used at Zeigler No. 2 mine, Bell & Zoller Coal & Mining Co., Zeigler, Ill., is shown in the accompanying illustration.

When a rope is to be lubricated, this box, which is split vertically, is clamped around the rope and supported on temporary timbers set in the shaft. The

stopper in the bottom of the box is a piece of used conveyor belt having a hole with a slit over to one side to fit tightly over the rope. The rope dressing or lubricant is poured into the box and the cage is raised slowly to pull the rope through. The piece of belting scrapes off the old lubricant and dirt and the new adheres as the cleaned rope passes up through the box. The belting piece is renewed as often as it wears to a loose fit.

The box is 20 in. high, 10x12 in. inside at the top and 3x4 in. inside at the bottom. Wedge pins pull the clamps which hold the two halves tightly together. To lubricate that part of the rope from the ground landing to the drum when the cage is at the bottom, the box is moved to the hoist house, where it is used in the same way but necessarily in a slanting position.



Screen Jackets Blanked Off By Hinged Door Plates

Arranged with screen jackets with various-sized perforations for making a number of different sizes, the main shaker screens at the Centralia No. 5 mine, Centralia Coal Co., Centralia, Ill., also are equipped with hinged blanking plates for cutting out one section of the upper shaker when desired. As shown in the accompanying illustration, one blanking

Box which cleans and lubricates the ropes at Zeigler No. 2 mine.





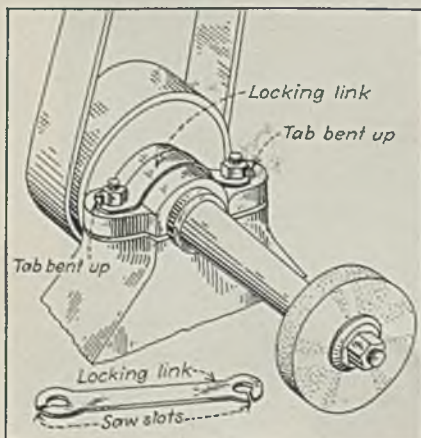
When not in use, the blanking plates are raised against the screen sides

plate, which is hinged in the middle as well as to the shaker side plate, extends two-thirds of the way across the screen. The other plate, hinged to the opposite screen side plate, takes up the remainder of the screen width. In blanking position, the plates are locked together as shown so that they will lie flat. When not in use, the plates are raised out of the way at the sides of the screen, and are fastened in that position by means of the vertical straps shown in the illustration. Blanking off or opening the section of the screen in question is a matter of only a minute or two under the arrangement here described.

Bearing Nuts Locked By Strap and Tab

Termining it a simple and effective means of locking two nuts of any bearing cap, Charles H. Willey, Penacook, N. H., submits the idea sketched in the accompanying illustration. The locking piece is made with saw slots as shown. It then is placed on the bolts and, after the nuts are adjusted, the tabs are bent up with a chisel to provide a sure lock which is especially useful where check nuts are

Locking piece holds nuts securely



not available. The locking piece may go over the top of a bearing or across from one to the other of two bolts on one side. The only requirement is that it go from bolt to bolt.

Care in Applying Packing Prevents Trouble

One of the chief causes of trouble in the application of packings by those with little or no experience is a tendency to tighten a gland too much at the first, writes John E. Hyler, Peoria, Ill. When a gland is tightened so that there is no leakage whatever it is impossible to determine what the friction may be, with the result that heat may build up quickly and score the rod. Pulling up a gland only moderately tight so that a certain amount of leakage occurs at the start is a good habit to form. This insures that

Horseshoe Nails

THE HORSESHOE NAIL for want of which a battle was lost forms the theme of a widely known poem. This poem forcefully reminds us of the importance little things sometimes have. This applies to operating coal mines as well as to all other activities in life. This department, it might be said, exists to supply the missing "horseshoe nails" in mine operation. To do this, it seeks the aid of operating, electrical, mechanical and safety men who have developed methods of saving time or money or reducing working hazards. Send in yours, along with a sketch or photograph if it will help to make it clearer to the reader. For each acceptable idea, Coal Age will reward the author with \$5 or more.

there will not be enough friction when the rod first goes into operation to cause sudden heating, shortening the life of the packing, on one hand, and possibly damaging the rod, on the other.

Much has been done in late years to make the packing of reciprocating rods more scientific and at the same time more practical. Packings for every type of service are carefully engineered. An example is the V-type ring used by many on reciprocating rods. These rings have a flexible lip on their inner surfaces in many cases which is forced to close down on the rod on the work stroke but at the same time releases sufficiently on the return stroke to eliminate a greater part of the friction. Less friction means a lower power consumption and fewer packing replacements, with a consequent reduction in number of shutdowns to re-new packing.

Lining Prolongs Roller Life In Severe Service

Cast-steel cage rollers with "bronzed-up" linings last at least twice as long as rollers of the same material without bronze linings at Zeigler No. 2 hoisting shaft, Bell & Zoller Coal & Mining Co., Zeigler, Ill., where the duty is unusually severe. The illustration shows two rollers which have been lined with Oxweld No. 25 manganese-bronze rod by gas welding. In the one at the right, welding has just



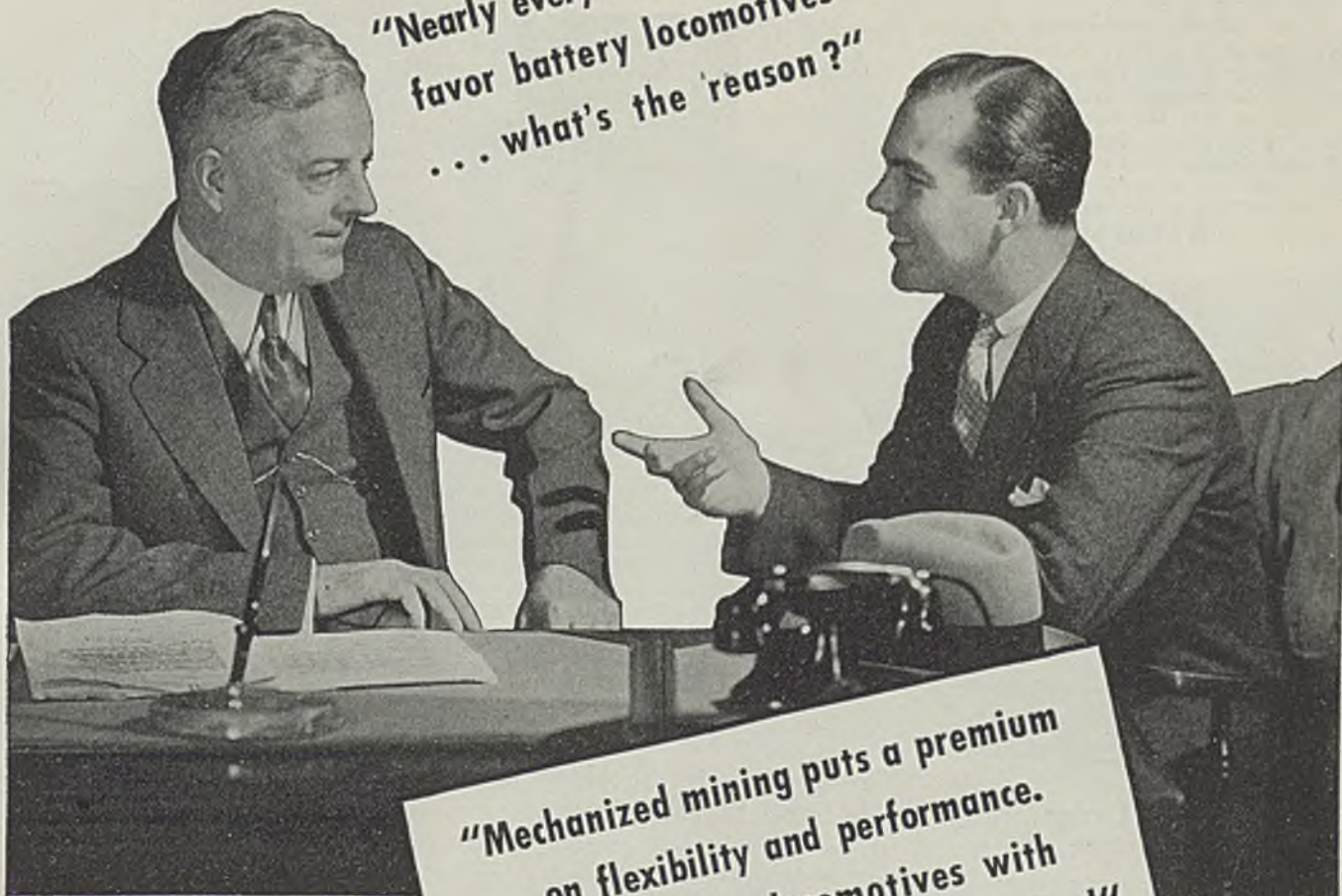
"Bronzed-up" new cage rollers last twice as long as solid cast-steel rollers. Here is a welded and a finished roller on the welding bench, Zeigler No. 2 mine.

been completed, while that at the left has been bored to the required 4-in. diameter. This bronze liner stands both abrasive action and "beating" better than steel. A pressed-in or shrunk-in liner would not last well because of the microscopic voids which would exist even with ground fits. Many other wearing parts of the 11½-ton cages are "bronzed-up" on the wearing surfaces.

Shortest Possible Turnout Without Frog

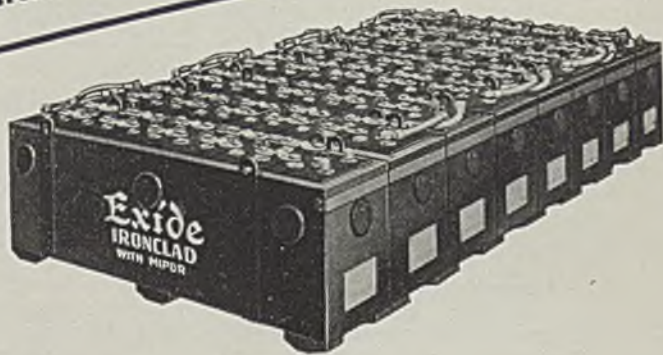
For use on the outside of a motor parting for gathering-locomotive or mule haulage where the character of the top is such that space to lay a standard turnout is not available except at an excessive cost,

"Nearly everybody seems to favor battery locomotives ... what's the reason?"



"Mechanized mining puts a premium on flexibility and performance. ... Battery locomotives with Exide-Ironclad Batteries are ideal"

THE whole object of mechanization is to deliver more coal to the tipples at lower cost. That puts it up to the haulage system. You have to get loaded cars away from the loading machine in a hurry and replace them with empty ones. Battery locomotives are ideal when equipped with Exide-Ironclad Batteries, for they have the necessary speed and power, and respond instantly to the controls."



THE Exide-Ironclad Battery has won a foremost place in underground haulage by its performance in actual service. Its high power ability enables it to handle the heaviest loads with ease. Its sustained voltage assures good speeds from the start to the end of the day. It is a battery

that almost takes care of itself. Its uniformly long life is a matter of record. That is why you can depend on Exide-Ironclads to improve your haulage service and cut costs. Write for free booklet, "The Storage Battery Locomotive for Underground Haulage."

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STANDARD OIL COMPANY'S STANOCYL STEAM CYLINDER OIL

cures cylinder scoring at this plant

THE superintendent of a central state industrial power plant was having difficulty with his Corliss engine. It simply would not pull its rated load. An inspection disclosed that the cylinder was dry and scored.

The following excerpt from his letter describes how StanoCyl and Standard Lubrication Engineering Service came to the rescue.

"We were advised by a business acquaintance to call the Standard Oil Company, which we did at once. As a result, your engineer came to our plant and made a complete inspection of the entire unit and made some minor repairs of damages that had been caused by the previous use of improper lubricants. He also gave us the brand name of products sold by your Company that would be suitable for the engine demands. These products were StanoCyl W and Polar 200 Oil.

"A stock of each product was ordered and placed in service. Our troubles have been completely disposed of. The engine pulls our full load without a tremor.

"We can, without any hesitation, recommend this product to steam engine owners who are having difficulties with cylinder lubrication."

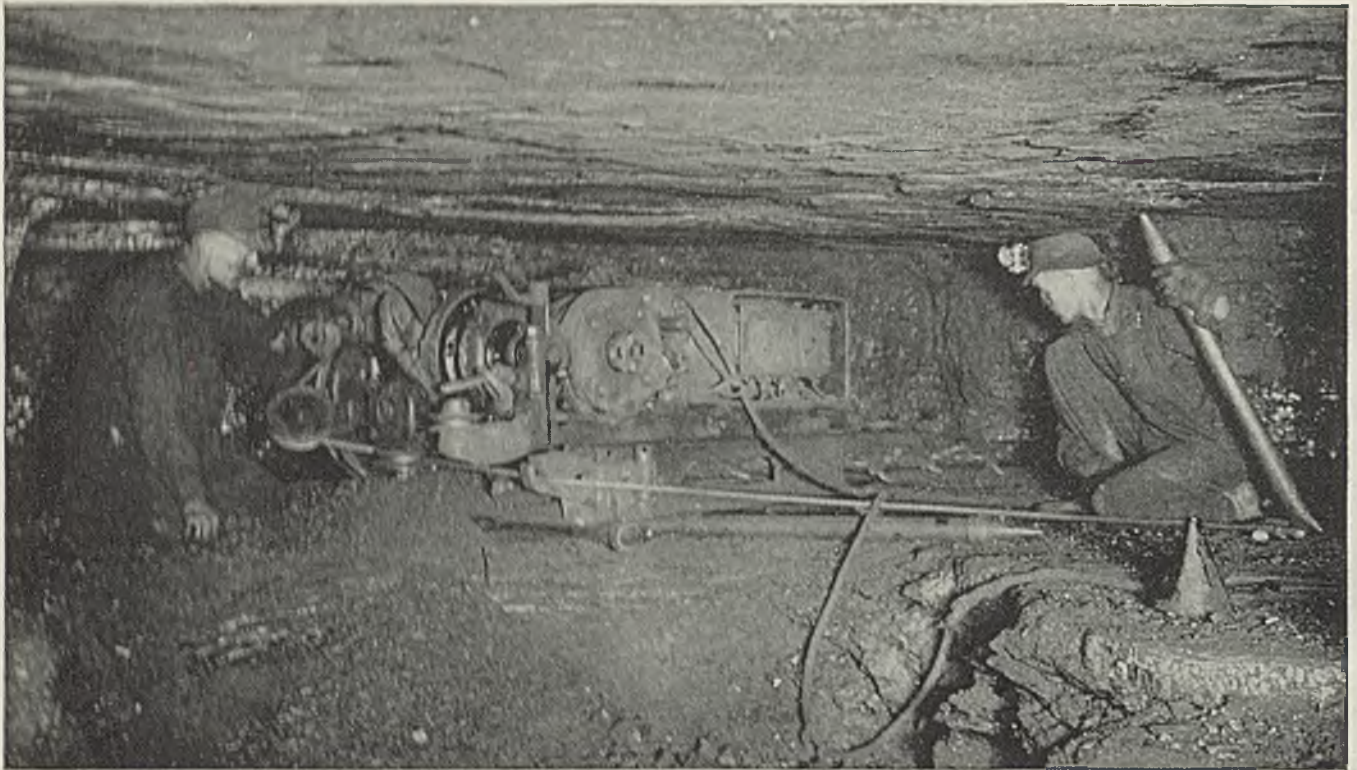
There are three grades of StanoCyl to meet all operating conditions. A Standard Lubrication Engineer will gladly recommend the grade you need. Call him at your local Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Illinois.

Copy. 1938, Standard Oil Co.

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Feed ropes seldom wear out. They may be crushed or cut to pieces, but nine times out of ten, unless preformed, they'll be thrown away before they are really worn out, because sharp broken wires sticking out make them dangerous to handle.

Form-Set, Bethlehem's preformed rope, eliminates this need for discarding feed ropes that are otherwise still good. For this rope can never become spiky.

Even though individual wires may break, the ends hug the rope; the sharp points lie snugly in place—because the wire was formed that way as the rope was made. Since no workman minds handling a Form-Set feed rope, even when several of the 96

outside wires are broken, the rope will not be discarded prematurely.

Bethlehem's "know how" brings you other improvements that lengthen rope life. Purple-strand feed ropes resist crushing—the steel has characteristics entirely different from, for example, that in hoist rope. It is harder, without being brittle—it is made to stand up under sharp bends over small sheaves.

Bethlehem (formerly Williamsport) Wire Rope has behind it half a century of experience in meeting the wire-rope requirements of industry. This background is now reinforced by the metallurgical knowledge of an organization making practically all kinds of steel for all industries. You can depend on it.



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BETHLEHEM STEEL COMPANY

WORD FROM THE FIELD

Open-Price Pact Is Launched By Hard-Coal Producers

The open-price-filing agreement recently adopted by Pennsylvania anthracite producers as a stabilization measure began to operate on Jan. 31 under the direction of a coordinating committee composed of A. E. Sloat, chairman, who is vice-president of the Lehigh Valley Coal Sales Co.; Clyde H. Stephens, district sales manager, Philadelphia & Reading Coal & Iron Co., and F. W. Pfaff, president, Hartwell & Lester. They were designated as administrators under an agreement representing more than 82 per cent of total hard-coal production, according to the Anthracite Institute.

This arrangement, contemplated in June, 1935, when Charles F. Huber was appointed administrator (*Coal Age*, July 5, 1935, p. 313), provides that every signatory producer shall file the prices, terms of sale, and sales policies which have been applied by the producer in connection with all sales. These shall control all transactions until the producer shall file information as to changed arrangements applied in connection with any sale of anthracite. When any changes are so filed, they become applicable to all of the producer's customers similarly situated, until he shall inform the committee of actual sales or offers at different prices or on different terms.

Oppose Freight-Rate Advance

Asking prompt and unqualified denial of increases in rates on bituminous coal, John Carson, Consumers' Counsel under the Bituminous Coal Act of 1937, filed a brief on Feb. 7 with the Interstate Commerce Commission in Ex Parte 123, wherein the railroads seek a 15 per cent advance in freight rates. Bituminous-coal consumers are now paying shocking and unconscionable charges to the railroads for carrying coal, said Mr. Carson, and any increases would cause many consumers to shift to substitute fuels, with the result that thousands of miners would be thrown out of work.

A memorandum stating the position of the National Coal Association on the proposed increase was filed on Feb. 9. Reiterating its opposition to advances in coal and coke rates, the association says "it appears not only that many of the bituminous-coal-carrying roads are not in need of additional revenue but also that the more bituminous coal traffic a railroad has, the greater its rate of return and the better its financial position. . . . In the face of these established facts, general revenue needs of carriers as a whole cannot justify further increases in the already high level of coal rates."

Pocahontas producers also urged denial of the proposed boost on bituminous coal, pointing out in a brief filed on Feb. 4



that "rich carriers" would be enriched further by increased rates. Most of the needy roads, it was argued, would actually suffer damage through having to pay higher costs for coal fuel. In its final brief, filed Feb. 10 in behalf of 329 railroads, the Association of American Railroads alleged that the only "practical solution" of the financial problem of the roads was an immediate increase in rates, denied that such action would drive traffic to competing carriers, and asserted that any hope for a restoration of railroad credit through reorganization on the basis of the present level of earnings is vain.

Law Curbing Armed Guards Passed in Kentucky

Two new laws which prohibit the deputizing of privately employed guards as deputy sheriffs were passed by the Kentucky Legislature late in January and were signed by Governor Chandler. Under one of the laws, the wages of such officers are paid by the employer through the State. The other law sets up qualifications for non-elective peace officers—primarily those employed as guards by industrial concerns—and provides for their appointment by the Governor upon recommendation of the prospective employer. In order to obtain a commission as a non-elective peace officer any private guard is required to be an American citizen, must be a resident of the State and county for at least two years, and must not have a criminal record.

Court Rules TVA Act Valid

Competition of the Tennessee Valley Authority with private electric utility companies was upheld as legal on Jan. 21 by the U. S. Court for the Eastern District of Tennessee at Chattanooga, Tenn. The court, composed of Presiding Circuit Judge Florence Allen and District Judges John J. Gore and John D. Martin, dismissed an injunction sought by eighteen power companies which challenged the constitutionality of the TVA Act on grounds that the Authority's rates would destroy them, rendering property worthless without just compensation. "These complainants have no immunity from lawful competition," said the ruling, "even if their business be curtailed or destroyed. "TVA contracts with cities and cooperatives in Tennessee, Alabama and Mississippi are authorized by express legislation. All municipalities in these three States have the statutory power to own and operate electric distribution systems." In these States, "non-profit membership corporations such as rural cooperatives may operate electric systems, purchase from TVA, and make contracts as to resale rates. This is also true in Georgia.

"Since the United States has acquired the dam sites legally, the water power, the right to convert it into electric energy, and the energy produced constitute property belonging to the United States. This electric energy may be rightfully disposed of by the United States through the action of the Congress, under Sec. 3, Art. IV, of the Constitution. Since floods frequently recur, and the needs of navigation are continuous, hydro-electric power generated at dams which control floods and improve navigation is continuously created, and the Government may adopt any appropriate constitutional means of disposing of the property. It is not limited in such disposition to a few or to infrequent transactions."

Within less than two weeks after this

Keeping Step With Coal Demand

Bituminous Production

Week Ended	1938 (1,000 Tons)	1937* (1,000 Tons)
January 8	6,507	10,679
January 15	7,400	10,388
January 22	7,200	9,632
January 29	7,620	8,797
February 5	7,530	9,903
Total to Feb. 5	36,257	49,399
Month of January	30,173	40,940

Anthracite Production

January 8	815	1,157
January 15	1,253	965
January 22	1,318	836
January 29	1,189	992
February 5	1,118	972
Total to Feb. 5	5,693	4,922
Month of January	4,790	4,025

* Outputs of these two columns are for the weeks corresponding to those in 1938, although these weeks do not necessarily end on the same dates.

Bituminous Coal Stocks

	(Thousands of Net Tons)		
	Jan. 1 1938	Dec. 1 1937	Jan. 1 1937
Electric power utilities	9,090	8,956	7,162
Byproduct coke ovens	7,273	8,115	8,535
Steel and rolling mills	1,109	1,256	1,264
Railroads (Class 1)	7,605	6,820	6,847
Other industrials*	14,144	14,863	11,218
Total	39,221	40,010	35,026

Bituminous Coal Consumption

	(Thousands of Net Tons)		
	Dec. 1937	Nov. 1937	Dec. 1936
Electric power utilities	3,580	3,433	3,759
Byproduct coke ovens	4,014	4,573	6,242
Steel and rolling mills	783	839	1,283
Railroads (Class 1)	7,359	7,103	8,229
Other industrials*	10,597	10,935	12,482
Total	26,433	26,883	31,995

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

decision the Authority announced it had received new applications for power from the following eight municipalities: Ellisville, Miss.; Madisonville, Ky.; Norton, Big Stone Gap, Appalachia and Pennington Gap, Va.; and Bradford and Newbern, Tenn.

Operators Form Power Company

The Sebastian County Mutual Power Co., Fort Smith, Ark., has been organized by major coal operators in the Hackett, Jenny Lind, Excelsior and Bonanza fields of Arkansas with these officers: president, George Reeves, president, Excelsior Coal Co.; vice-president, Degen Boyd, president, Excelsior Coal Corporation; secretary-treasurer, R. K. Rodgers, president, Western Arkansas Coal Co. The new organization proposes building an electrical generating and distribution system to supply coal mines in those fields, the cost being estimated at more than \$150,000. The system is expected to be in operation by next September.

Coal operators in the territory served by the Southwestern Gas & Electric Co. sought lower rates for more than two years, and the State Utility Commission recently ordered a new rate schedule. The company, however, appealed from the order, and the case is now pending in the Pulaski Circuit Court.

P. & R. Files 5-Year Plan

A plan of reorganization of the Philadelphia & Reading Coal & Iron Co. providing for retention for five years of the company's present capital structure, with the rights of security holders modified only to the extent necessary to meet the financial necessities initially for this period was presented on Feb. 17 to Judge Oliver B. Dickinson in the U. S. District Court at Philadelphia, Pa. The plan was proposed, the court was informed, with the thought that the fixed obligations of the company for interest and sinking-fund charges on its outstanding indebtedness should be placed on an income basis for a reasonable period, during which the plan proposes that the relative positions of both creditors and stockholders should be substantially preserved, but that the creditors should be given adequate representation in the management of the company.

If by Jan. 30, 1943, all accrued interest is not paid on both classes of bonds, commencing with that date all net income of the company after prior charges is to be applied in payment of this accrued unpaid interest. If necessary, the voting trust agreement might be extended for another five years and no interest would be paid on the common stock except out of net earnings, and then after previous payment of interest on the bonds and sinking-fund charges. Creditors' claims are not affected by the plan, which provides that the company shall be authorized to borrow up to \$5,000,000 for working capital, such loans to have priority to its present funded debt. Consummation of the plan is contingent upon acceptance by not less than two-thirds in amount of the bondholders. The plan was signed by Ralph E. Taggart, president, and M. P. McDermott, secretary, of the company.

A.I.M.E. Ponders Most of Coal Industry's Unsettled and Vexing Questions

MINING methods, roof behavior, combustion, preparation, safety, education and the history of the Pittsburgh Bed all had their place in the sun at the 148th meeting of the American Institute of Mining and Metallurgical Engineers, held in the Engineering Societies Building, New York, Feb. 14-18. Much interest was shown in the possibilities and advantages of speeding the advance of the coal face and in the means of obtaining for the industry the full benefits of technical education.

To support drawslate in the Warden mine, where this slate is fairly uniform and is to be gobbled, places are driven 21 ft. wide, undercut 8 ft. deep and three 2½-in. holes are drilled immediately under the drawslate for a depth of 9 ft., at 5- to 6-ft. centers, depending on slate slips, stated L. E. Young, vice-president, Pittsburgh Coal Co. On completion, 2-in. triple-strength pipe, 10 ft. long, are set in the holes as forepoles and a 4-in. aluminum H-beam, 20 ft. long, is placed across the face immediately below their exposed ends. One end of the beam rests in a hitch in the rib and the other on a heavy jack. To extend the support, in rooms wider than 21 ft., a 4-in. square steel box about 4 ft. long is slidden over the beam on the end upheld by the jack.

Two men can erect the beam, as it weighs only 4.85 lb. per foot. After shooting, the slate is posted, and pipes and beam are removed. If the roof requires it, another 4-in. beam is set across the room 6 ft. from the face, permitting the loading machine to maneuver.

Aluminum Beam on Gob Side

With abnormally thick slate, that over the gob is held. To permit the rear conveyor of the loading machine to swing under the supported slate, an aluminum beam 22 ft. long is set parallel to the track, and advanced as the face advances.

In places, cuts have been made in the

drawslate, but, with this system, dust, disposal of slate fines and their exclusion from the coal are problems. Where the slate is thick, 5-in. aluminum H-beams, 28 ft. long, 6.63 lb. per foot, are installed parallel to the face and moved up as soon as the face conveyor has cleared the beam next to the face. Sometimes three beams at 7-ft. centers are used at one time.

At Montour No. 10, pairs of rooms, 18 ft. wide on 32-ft. centers, are driven, leaving a 30-ft. rid between pairs to be cut on both sides simultaneously by two machines with 15-ft. bars which undercut it completely, so that only the 14-ft. fender is left. Thus far, the roof does not appear to have broken. An average advance of 13 ft. has been made per three-shift day and Dr. Young hoped to raise this to 35 ft. The problem, he said, is: Will the roof break with timbers drawn and only fenders to hold it and can this method be continued indefinitely?

Laminations Aid Breakege

The roof over the Pittsburgh coal is not a massive sandstone but laminated with sandy-shale partings, predicated H. P. Greenwald, supervising engineer, Pittsburgh Experiment Station, U. S. Bureau of Mines. Fallen sandstone and fenders give some support. Perhaps the roof will never break. Scanning the goaf 150 ft. back from the face, no breaks, other than of "immediate roof," can be seen. Subsidence is 40 per cent as great as coal thickness. Because of laminations in the sandstone and shallow cover, no bumps occur, declared G. S. Rice, consulting engineer, Washington, D. C., adding that great depth would introduce arch stresses.

A room roof tends to break along the ribs and along the center line with diagonal breaks at 45 deg. from corners toward center, asserted P. B. Bucky, Columbia University. With a long face, where the advance is five times the width, the breaks parallel the face, and there are also diagonal breaks. In drilling a prospect, engineers should study structural content of roof and floor as intently as mineral content. Work at Montour No. 10, asserted H. F. McCullough, engineering manager, Philadelphia & Reading Coal & Iron Co., is subsidence rather than breakege mining. Breaks seemed to be unlikely.

Douglas fir 3x12-in. springboards are used by the Northwestern Improvement Co. in the State of Washington to help shaking chutes up steep pitches when their lengths exceed 300 ft., said Cadwallader Evans, vice-president, Hudson Coal Co., presenting the paper of G. W. Evans, consulting engineer, Seattle, Wash. Sometimes they have to be 600 ft. long and without springboards, so they would buckle.

No shaking chutes longer than 325 ft. are being used by the Union Pacific Coal Co., offered Eugene McAuliffe, president, Union Pacific Coal Co. In earlier years, pan lines were extended much further, but maintenance was excessive. Coiled springs

Coming Meetings

- Canadian Institute of Mining and Metallurgy: annual meeting, March 14-16, Royal York Hotel, Toronto, Ont., Canada.
- Appanoose County Coal Operators' Association: annual meeting, March 18, Centerville, Iowa.
- Utah Coal Operators' Association: annual meeting, April 6, Ezra Thompson Building, Salt Lake City, Utah.
- Virginia Coal Operators' Association: annual meeting, April 14, Norton, Va.
- American Mining Congress: 15th annual coal mining convention and exposition, May 2-6, Music Hall, Cincinnati, Ohio.
- Mine Inspectors' Institute of America: 29th annual convention, St. Nicholas Hotel, Springfield, Ill., June 6, 7 and 8.

were used to lift long pan lines, but duckbills caused impact, and results were unfavorable.

From a questionnaire addressed to colleges regarding the relation between coal mining and employment of graduates, not a single cheerful reply was received, asserted N. G. Alford, of Eavenson, Alford & Auchmuty. In 26 replies, objections covered: Few, if any, opportunities for advancement, low pay, no program, little respect for technical training, no glamour, better prospects in petroleum and metallurgy, unattractive environment, few facilities for low-paid married men, scorn for college graduates as result of bad publicity, too many radical foreigners, long waits for foremen's papers, "put you in a hole and forget you," "engineer just a surveyor," industry backsliding, union rules retard advancement, danger makes parents object, coal-mine students want new environment, employment unsteady, work dirty and labor troubles frequent, staff afraid of trained engineers, no appreciation of brains, vision or training, and inability under labor contract in slack times to use young engineers on hourly-rate jobs.

Starting salaries, said 81 per cent of those replying, were 30 per cent higher in other mining and 33 per cent higher in other fuel industries. Metallurgy graduates get salaries well over \$200 per month. H. E. Nold, Ohio State University, declared that industry should seek its graduates in February and March, as do other industries, and not wait until students have been offered positions in other lines. Men are easy to place in aviation and other pursuits more hazardous than coal mining. Danger doesn't prevent enrollment.

Richmond and Pittsburgh Lead

"Until after 1804, bituminous coal was mined at only two places in the United States, one east of the mountains and available to the Atlantic coast cities, near Richmond, Va., and the other at Pittsburgh, west of the mountains and available only there and along the Ohio River," declared H. N. Eavenson, of Eavenson, Alford & Auchmuty, in presenting a detailed account of the early history and development of the Pittsburgh coal bed and its present commercial status. In 1699 some Huguenots settled on the James River at a place now called Manakin, about fourteen miles above Richmond. They early discovered coal, as Col. William Byrd reported its presence to the Colonial Council of Virginia, May 10 and 11, 1701.

Coal was found on Coal River, then in Virginia, in 1742, but the earliest reference to it in the Northern Appalachian fields is on the Fry and Jefferson map, dated 1751 but prepared in 1749, placing "Coal" in the Cumberland region, on the north side of the Potomac, near the Savage River.

On April 25, 1758, a young Quaker trader reported finding a piece of "stone coal that burns well" in Redstone Creek. This is the first known reference to the Pittsburgh bed in Pennsylvania. A year later, April 24, 1759, Col. Hugh Mercer, then in command at Pittsburgh, reported to Col. Bouquet that "excellent coal and limestone . . . have been lately discovered within a mile of the Monongahela, almost opposite Pittsburgh."

"Marked and even extraordinary betterment can be brought about when employer and employee work together with due sincerity" in the promotion of safety, declared Mr. McAuliffe. In some form or other, safety work had been carried on at Union Pacific mines since 1868, and in 1923 a vigorous effort to educate supervisors and mine workers was started. From 1923 to 1927, inclusive, \$596,763.78, or 4.15c. per ton, was spent on safety payrolls and material, supplemented in the next five years by \$422,412.57, or 3.15c. per ton. Meantime, operation changed from a mixed hand-and-mechanical to an almost complete mechanical-loading basis, while all then-known methods of implanting the safety idea were employed.

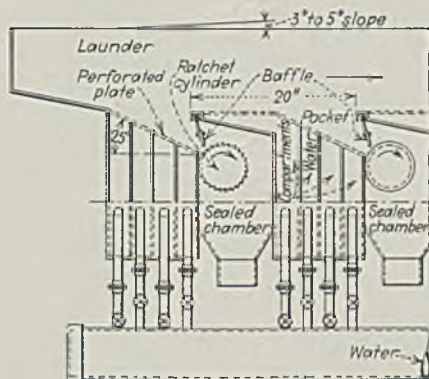


Fig. 1—Upstream half of launder

Not until the period 1933-37, however, could real progress be said to have been made, as indicated in Table I. Within this period, "we concluded definitely that a stereotyped form of safety campaign plus a heavy expenditure of money did not affect the souls of the greater number of our employees." Instead, "we undertook to make capital" of the natural inclination toward chance taking by offering a new field of hazard: i. e., drawing for prizes to be awarded for safety records and thus making chance taking in the new field dependent upon not taking chances in the old.

Fifteen years of safety work, Mr. McAuliffe contended, have shown that the mental attitude and habits of men cannot be changed except by long-continued effort. Attempts to accomplish this by heavy pressure in a short time are unwise. Also, men "are responsive to patient educational effort and a continuing appeal to their better side, rather than to wholesale disciplinary measures, and some novelty that will engage and hold their attention must be employed if results are to be obtained in any effort as intangible as

mine safety." Finally, management must do its full share.

Ten per cent of the cost of mining and preparing coal is chargeable to injuries, stated D. Harrington, chief, health and safety branch, U. S. Bureau of Mines, on the basis of a recent study. Mechanical equipment in an industry introduces its own hazards, although it may eliminate others. About 50 per cent of all fatalities in the coal industry are due to machinery. Its growing use also is reflected in a heavy increase in deaths from explosions of electrical origin. In every case of an electrical explosion an open-type machine was responsible, declared Mr. Harrington in advocating permissible equipment. Frequently, operators reject permissible equipment because of the slightly higher cost, whereas three recent explosions with open-type equipment involved losses of \$1,000,000 or more each.

Machines Cancel Safety Hats

But while explosions are spectacular as well as important, a real problem is falls of roof and material or men, which account for 50 per cent of all fatalities. In 1937, the rate per million tons (tentative) was 1.60, compared with 1.608 in 1927-36. Therefore, progress has been practically nil, despite estimates that 100 or more lives are saved per year by safety hats. This shows that gains along some lines are cancelled by losses in others. "Temporary" removal of supports at mechanized faces, for example, causes many fatalities.

Electric cap lamps are another major safety adjunct. But here again, changing conditions may nullify a part or all of the advantages, such as increased air dustiness growing out of the use of machinery. A major need, said Mr. Harrington, is an electric lamp that also will warn against mine gases. Safety shoes, goggles and reduction in the use of black blasting powder are other accident-prevention measures of proved worth. In the field of transportation, the trolley system was held by Mr. Harrington to be the weakest link in the safety chain, accounting for about 10 per cent of all fatal and non-fatal injuries.

Studies of a Rheolaveur-type launder showed that only the small areas above the refuse draws had such mobility that coal could separate itself from impurity, stated A. C. Richardson, Battelle Memorial Institute. With a given feed and water volume, the best separation occurred when operating at a little less than "competent slope," which, for given conditions, permits neither deposition nor erosion of the refuse bed. As deposition area is small, deposition must be rapid, if large tonnages are to be cleaned, and

(Turn to page 84)

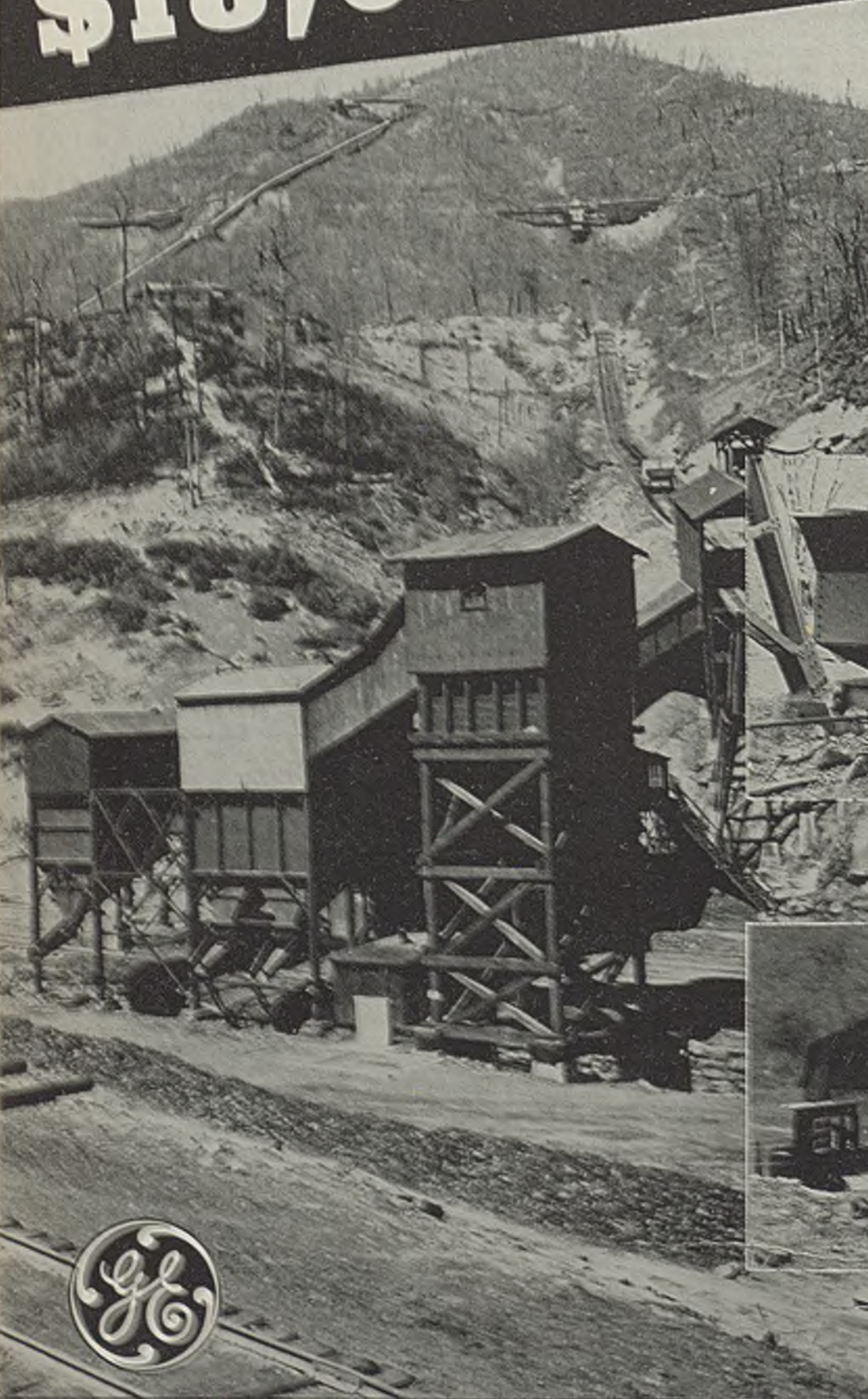
Table I—Tons Mined and Man-Hours Worked per Injury by Five-Year Periods, Union Pacific Coal Co.

	1923-27	1928-32	1933-37
Tons mined	14,368,523	13,384,472	13,989,629
Per cent mechanically loaded	15.61	63.18	97.18
Fatalities	48	35	22
Non-fatal injuries	1,319	1,045	241
Total injuries	1,367	1,080	263
Tons mined per fatality	299,344	382,413	635,892
Tons mined per non-fatal injury	10,893	12,808	58,048
Tons mined per total injury	10,511	12,393	53,192
Man-hours worked	21,249,248	17,634,900	16,086,503
Man-hours per fatality	444,776	503,854	731,205
Man-hours per non-fatal injury	16,186	16,875	66,749
Man-hours per total injury	15,617	16,329	61,165


\$18,000 SAVED

IN

Looking up the mountain from the tippie at Bonny Blue. Note the monitor on the track and observe the steep grade near the top that makes without trouble now



The loaded monitor ready for the descent



The empty monitor about to start back for another load



GENERAL



TWO YEARS

at BONNY BLUE with
the G-E Lowering Motor
that Hauls and Brakes

Here is the G-E Type MT, 600-hp, wound-rotor motor that has had such an important part in cutting coal-lowering costs at Bonny Blue. It not only drives, when necessary, but provides regenerative braking for smooth and economical operation

FOR years, the Blue Diamond Coal Company, Bonny Blue, Va., used the gravity principle at its Bonny Blue mine to lower coal in a drop-bottom monitor from the dump house near the top of a mountain to the tippel, 3700 feet below. It was a tough job, ruinous on the brakes and hard on the loaded monitor and the rest of the mechanical equipment. The high repair bills, frequent interruptions during bad weather, and occasional wrecks were a continual headache to everyone concerned.

Then the chief electrician at Bonny Blue and a G-E engineer figured out a way of doing this job with specially designed G-E control and a G-E 600-hp motor that, when brought to synchronous speed by the overhauling

load, would function as a generator. The speed of the downgoing load would then depend upon the amount of resistance put into the rotor circuit and could thus be safely increased to any practical limit. The "motor," furthermore, would generate considerable electrical energy for running other electric equipment at the mine—and, if necessary, could do a normal haulage job. At *all* times, operations would be under the *complete* control of the operator.

The equipment was put into operation about two years ago. Now the Blue Diamond Company finds that maintenance expense has been slashed, wrecks no longer occur, and the opera-

tion has been made smooth and uninterrupted regardless of the weather. Furthermore, the motor has poured and continues to pour—thousands of dollars' worth of power back into the line. The total estimated savings to date are approximately \$18,000—more than the original cost of the equipment.

You may not have this particular problem at *your* mine, but the chances are that you have another one—one that can be solved by G-E application of engineering and high-quality equipment. Why not bring *that* problem to our engineers? Call our nearest representative now. General Electric Company, Schenectady, New York.

E L E C T R I C

an inclination so much less than competent slope that deposition is non-selective.

Further, the coal in the refuse was much finer than the average refuse particle, both in launder and draws. If fine refuse were added to fill voids, clean refuse would result. Due to a vortex in the draw, refuse from the latter had more coal than that deposited between draws. The more refuse, the less coal deposited in it; hence, each successive launder makes a more perfect coal separation. The moving mass increases in density from top to bottom of stream.

In the Battelle washer (Fig. 1), explained Mr. Richardson, the infrequent boxes of the old design are replaced by a continuous series of pockets, bottomed by perforated plates through which regulated streams of water gently pass from four compartments in each pocket to the screen surface. The pocket bottom is 20 to 40 deg. to the horizontal and leads to an opening constricted above by an adjustable baffle. A cylindrical draw regulates passage of material. As four pockets suffice, the launder is short.

Bed to be Loose and Permeable

With the Rheolaveur, best results will be obtained if material flows down the launder so slowly that enough water can be provided to keep the mass loose and permeable, asserted C. P. Procter, foreman, Champion No. 1 preparation plant, Pittsburgh Coal Co., speaking for J. T. Crawford, assistant superintendent of docks, Pittsburgh Coal Co. of Wisconsin, himself and M. J. Williams, foreman, Champion No. 1 preparation plant, Pittsburgh Coal Co.

After its first rush down the classification section of the launder, the bed on the launder bottom should begin to form at a point far enough from the head of the first Rheobox (generally 4 to 5 ft.) for the material to even out and the heaviest pieces of slate to reach the bottom of the moving mass. If this point of first bedding is moved back merely by reducing the volume of water, the flow may become too thick and sluggish, preventing proper gravity classification and aiding size classification, in which case the finer sizes will so segregate at the bottom of the flow that the larger bone and slate will reach the launder bottom too late to enter the boxes. Material will be better cleaned either by creating a longer low-pitch section ahead of the first box or by elevating the barrages or both. However, increase in barrage height alone may so deepen the bed as to defeat that purpose.

At one plant, the primary rewash refuse from the Rheobox of the rewash launder is elevated to a ring crusher prior to rewashing in a secondary launder. At the cleaning plants of the United Electric Coal Cos., said W. C. McCulloch, coal-preparation manager, a three-box system is used for coal having partings that give trouble; a four-box system provided with a crusher prepares coal having partings that need cleaning. Experience has enabled the Pittsburgh Coal Co. to raise its tonnage per inch width of launder from 5 to 8 tons per hour, asserted Mr. Morrow, preparation manager. Lessened volumes of water are desired because of water scarcity and because too much "black water" has to be classified or run into the streams.

About 95 per cent of the 7,000 domestic stokers in the Seattle area are of overfeed type, declared H. F. Yancey, supervising engineer, Northwest Experiment Station, Seattle, Wash., for himself; K. A. Johnson, junior chemist of the station; A. A. Lewis and J. B. Cordiner, Jr., research fellows, University of Washington. About 30 different makes of overfeed stoker are made and sold locally. Price affects selection, as they can be bought for from \$50 to \$150, depending on controls, whereas an underfeed stoker sells for \$250, but a sawdust stoker for \$30.

Reduction-gear box, feed screw with threads spaced at closer intervals at the reception end so as to prevent choking, feed tube, fan intake and housing, grate and retort are embodied in the equipment. Ashes pushed forward by introduction of fuel fall from the retort end, in the eight inches or more between retort and furnace wall and drop into a can.

Moisture in coal and dewatering problems, particularly the former, were the subject of three papers and a lengthy discussion, the latter revolving around the many-sided problem of definition of terms, objectives in moisture determination (coal classification, prevention of freezing, etc.) and methods of ascertaining moisture percentages accurately, as well as accurately distinguishing between different types of moistures, on which much additional work is felt to be necessary.

Table II—Angle of Repose and Sliding Angle on Galvanized Steel of a Certain 0x $\frac{3}{4}$ -in. Coal (Bed Moisture, 2 Per cent)

Percentage of Surface Moisture	Angle of Repose Deg.	Sliding Angle Deg.
0.0	36	27
0.8	37	29½
1.3	38	31
1.6	39½	32
1.8	40	32
2.4	42	34
2.7	43	34
4.0	48	35½
4.5	46	37
6.0	50	38½
6.4	53	38½
8.0	49	46

A standard method for determining surface moisture in coal is needed, asserted T. W. Guy, consulting engineer, Charleston, W. Va., in commenting on one aspect of the problem. Percentage of surface moisture affects screening, dustiness, freezing, angle of repose, angle on which coal will slide over a smooth surface (Table II), bulk and air-cleaning-table capacity. Unfortunately, companies use different methods for sampling and determining moisture content. Thus, to make comparisons based on surface moisture, corrections usually have to be made.

Bed moistures even up to 12 to 15 per cent probably do not affect screening, but, when coal sticks on screens, a reduction of 1 per cent in surface moisture may correct the difficulty. With less than 1 to 2 per cent of surface moisture, coal will become excessively dusty unless it has been treated with a dust preventative.

When $\frac{3}{4}$ x 1-in. coal is dewatered to 2½ to 3½ per cent of surface moisture, it usually causes little or no trouble from freezing, unless subjected to heavy rain followed by extreme frost. But this size with 1 or more per cent more moisture would give serious trouble in frosty

weather. With air tables cleaning small coal, if the minus 14-mesh coal in the feed has more than 6 to 10 per cent surface moisture, operation may be difficult, even though the average surface moisture of the feed may be comparatively low.

Offering actual data on coal-drying results at the Northern Illinois Coal Corporation, E. J. Bottomley, mining engineer, made the point that variations shown were not necessarily the fault of the drying equipment but exemplified the need of a "method of air drying samples to the same point for proper determination of dryer efficiency and moisture analysis." Mr. Bottomley's paper was read by Mr. Guy. At Northern Illinois, $\frac{1}{4}$ -in. x 48-mesh coal, after first passing through a pair of Carpenter dryers, is heat-dried in a Christie drum unit, which reduces surface moisture from 8 to apparently 2 per cent. Total moisture in the dried product, however, apparently varies from 9.88 to 15.80 per cent, compared with 13.80 to 15.90 per cent in raw 2x0-in. coal. In the case of the D-L-O dryer, handling 1x½-in. coal, adherent moisture in the feed ranged from 6.20 to 11.19, compared with 4.19 to 6.89 in the product.

As the line of demarcation between "surface" and "inherent" moisture is somewhat indefinite, it seems likely that the latter is released to a considerable extent in the standard moisture determination, said Mr. McCulloch. It has been found advisable, therefore, to use a fixed figure for inherent moisture and subtract from the total to determine surface moisture. Concluding his address, Mr. McCulloch described the procedure for moisture determination at the Fidelity laboratory (see p. 57) and also for dewatering coal at the Buckheart mine (p. 52). At Buckheart, 1½ x ½-in. coal dewatered on a shaking screen showed a surface moisture of 3 per cent. In smaller sizes, reductions are: $\frac{3}{4}$ x 5/16-in. over a heat-drying screen, 6 per cent to zero; minus 5/16-in. coal through Carpenter dryers, 24 to 6 per cent.

Rosin's Size-Distribution Law

Results of an attempt to apply the equation developed by Rosin and Rammler, Germany, relating percentage retained on a test sieve to the size of the openings, later shown by J. G. Bennett, who applied the law to British mine-run, to be applicable to coarse as well as fine sizes, were detailed by M. R. Geer, junior mining engineer, and Mr. Yancey, in a paper presented by the latter on the expression and interpretation of the size composition of coal. Tests were made by the authors on both coarse coal (6- down to 3/16-in.) and fines (200- to 10-mesh).

If cumulative weight per cent is plotted against screen size on a specially ruled paper, a straight line is obtained for any material which follows the law of size distribution. The slope and intercept of this line gives the constants in the equation (one indicating directly coarseness of the material and the other the distribution factor, inasmuch as it is related to the weight distribution between the sizes) and may be used to describe the size distribution of the material.

The Rosin-Rammler equation, concluded the authors, expresses accurately the weight percentages retained on all but the coarsest screens used in any analysis. With coarse screens, the percentage re-



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This most important circuit should be carried through the most reliable cable obtainable.

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Hazard rubber jacketed and steel wire armored cable is in many cases the most efficient for deep holes. Because the rubber jacket takes the place of a lead sheet, the cable weight is light and it is low in cost.

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Convention Hears Mechanization Report, Wage Scales Left to Committee

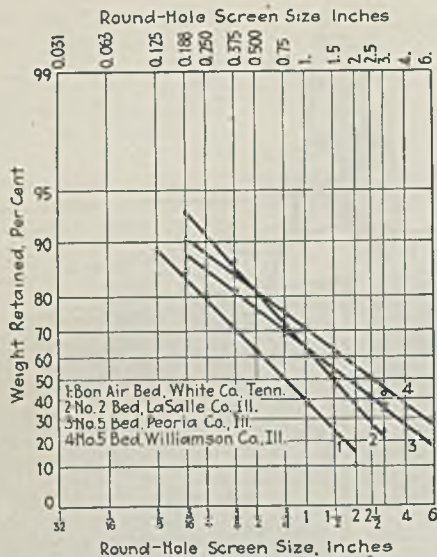


Fig. 2—Rosin and Rammler size-distribution chart

tained generally is less than that indicated by the equation. In some cases, the formula can be used to lighten the labor of making screen analyses and also as a check on their accuracy.

Pointing out that while the Rosin and Rammler formula appears to fit under the conditions to which it has been applied, Paul S. Roller, associate physical chemist, Eastern Experiment Station, U. S. Bureau of Mines, expressed the opinion that it was unsound in that it did not hold at the boundaries: i. e., in the case of very fine or very large coal. At the same time Dr. Roller stated his belief that a distribution function for material smaller than coal which he uncovered in 1937 also would apply to coal as well.

Convergence recorders, said H. Landsberg, Pennsylvania State College, have been modified to suit needs in rooms where convergence is slower and smaller than in rapidly moving longwall faces. A dial meter reading to 0.001 in. was devised and read at 24-hour intervals. The linear expansion of rocks for a 105-deg. difference in temperature—the annual range—is 0.0685 per cent, but these changes do not extend far into the mine. As shown by Table III, moisture affects roof rock more than temperature.

Table III—Linear Expansion of Rocks and Weight Increase from Moisture

Rock	Percentage Linear Expansion		Weight Increase
	With Bedding	At Right Angles to Bedding	
Limestone	0.002	0.003	0.5
Sandstone	0.010	0.020	0.7
Shale	0.070	0.100	1.5
Shale with clay	0.200	1 to 2.9	5.0

Slides showing progressive fractures in his gyroscopic machine were shown by Mr. Bucky. He asserted that, as faces advance, stresses advance also and old fractures close. Upward fractures from the mid span never extend far toward the surface. By gyroscopic methods, just what might be expected in the development of longwall faces can be shown.

CONTINUING STUDY of mechanization and its effects on wages and employment was recommended in a report presented in summary form at the convention of the United Mine Workers held at Washington, D. C., Jan. 25-Feb. 3. This summary, presented as part of the report of the international officers of the union, was based upon the results of a study made by Walter Polakov and a group of assistants engaged by the United Mine Workers to make an extensive factual survey of the question to the end that "we may be prepared at the expiration of the existing (Appalachian) agreement to discuss intelligently the various phases of the machine mining problem."

The agreement which ends next March, the union officers pointed out, set up a commission of operators and miners "to make a joint study of the problems arising from mechanization of bituminous coal production . . . including the problem of displacement of employees." Although several meetings of the commission have been held, the two groups, declared the report signed by John L. Lewis, president, Philip Murray, vice-president, and Thomas Kennedy, secretary-treasurer of the international union, have been unable to agree upon the procedure to be adopted in making a joint investigation. "The coal operators," they add, "in this instance have been non-cooperative and we contend they have not complied with the spirit of the agreement."

Given Free Hand on Wages

Local unions submitted 444 bituminous wage resolutions to the convention. These recommended changes in district and local agreements, abolition of differentials, increases in rates of pay, the 30-hour week and demands revolving about mechanization. As a substitute for this flood, the wage-scale committee proposed that international officials exert every effort to make the 1939 negotiations national in scope. In the event such a movement is successful, provision is made for representation of non-Appalachian districts on the scale committee. "Every effort," said the substitute report, "shall be put forth to establish a uniform 6-hour day and 30-hour, 5-day week."

The report of the committee, which was adopted by the convention, concluded with this proposal: "The wage-scale committee is empowered through the medium of a national, Appalachian, or other proper joint conference to negotiate the best contract obtainable." All resolutions and recommendations dealing with anthracite wages were referred to the tri-district convention to be held some time prior to May 1, 1939.

"In compliance with the provisions of the current Appalachian agreement," read the summary of the Polakov report, "a study of the problems arising from the mechanization of bituminous mines, particularly by mechanical loaders, and including the problem of displacement of employees, was started on June 8, 1937, by the U.M.W. The preliminary report submitted on Nov. 3, 1937, covered a

study of performance in 164 mines in the 11 districts of the U.M.W. Combined daily production of these mines is about 267,000, of which tonnage 145,000 tons are loaded mechanically in 154 mines. This production is handled by 46,000 men. Mechanically loaded coal in the sample studied represents over 25,000,000 tons, thus giving factual data on over 90 per cent of the mechanically mined tonnage in the Appalachian region. This study included an analysis of the performance of 306 mobile loaders with daily output of over 100,000 tons and 543 conveyors and pit-car loaders handling over 44,000 tons

Higher Productivity Cited

"Accepting the tonnage loaded by hand per man-shift as 100, the productivity of conveyor loaders is 120 and that of mobile loaders 252 per man-shift. Such a large increase in labor productivity, with a constant or even shrinking demand for coal, leads to a wholesale displacement of labor. Thus, in the sample studied, the same tonnage is loaded by 46 men with mobile loaders as was formerly loaded by 100 hand loaders; the displacement of labor by conveyors is less drastic (85 per cent of the work of 100). Actually, the 15 per cent increase in mechanical loading means a displacement of 16,000 men.

"The immediate results of such an increase in productivity are: the reduction of employment in mechanized mines and reduction of labor cost per ton of output when labor is paid on a per-diem basis. Thus, taking the cost of labor per ton in 115 hand loading mines as 100, the cost in 90 conveyor loading mines is 87 and in 75 mobile loading mines is about 50 per cent. That such a reduction in production cost coupled with advanced market prices for coal offers a margin for labor's participation in the economic benefits of mechanization is evident.

"Yet, while the wage scale under the Appalachian agreement is higher than before, the total earnings are restricted by the limited number of days of work per year, as well as by various deductions from the pay envelope, such as: scrip discounts, exorbitant prices in company stores, high rent for substandard housing, excessive charges for inadequate medical care, etc. and especially deductions for operating supplies, repairs, lighting, washing, etc.—which in other industries are a part of management expense. While mechanization tends to reduce these deductions—for the day-rate men on mechanical loading they become 13.4 per cent of total deductions, as against 30 per cent of tonnage men's deductions—all above mentioned subtractions from the gross earnings of miners vary from 17.9 for 45 per cent of the men to 22.1 for 55 per cent of the men.

"Further problems arising from mechanization of mines are those in connection with the increase of fatal accident rate and establishment of an age limit for employment. Thus, from 1906 to 1933, fatal accidents due to electric equipment steadily rose by some 50 per cent; those due to motor transportation rose by some

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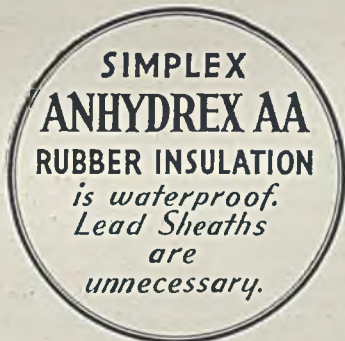
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25 per cent; whereas accidents due to explosives and mine explosions are on the decline due to various regulations.

"Preference as to age is given to men under 44 years of age in mechanized mines of the region, as is seen from the data collected at Scotts Run, W. Va., showing that in the younger group 7 out of every 9 miners are employed, while in the group of older men (45 years of age and over) only 7 out of 14 men keep their jobs. This is in contrast with the practices in Middle Western mines.

"Parallel with mechanization of mines, modifications in managerial technique, without capital expenditures on the part of the coal companies, result in a startling increase of production, lowered operating costs and greater technological unemployment. Thus, in one case, by purely managerial technique, production per loader was increased 49.2 per cent, output per machine increased 100 per cent; labor cost per ton reduced 30 per cent, and employment reduced 33.1 per cent.

"A comparison of results of mechanization in the Appalachian region with Illinois and Indiana is extremely interesting. Thirty-odd years of unionization of mines in former Central Competitive field have developed certain relations which as yet are only in the making in the unionized mines of the Appalachian region.

"For comparison's sake, we have studied mechanized mines in Illinois and Indiana with combined production about equal to the total mechanically loaded output of the Appalachian mines: namely, about 25,000,000 tons annually. To mine this tonnage, Illinois and Indiana mines under observation employ about 8,900 men, while an equal amount of coal in the Appalachian region requires 10,200 men. This is due to the higher rate of productivity in Illinois and Indiana per man-shift, thus:

	All Mines	Mech. Load.
Tons per man-day in 2 States	8.01	9.68
Tons per man-day in Appalachian mechanical mines	4.43	5.81

"The increase of labor productivity (deep mining only) from 66.6 to 70.0 per cent in Illinois-Indiana field is due largely to the three main factors: (1) higher rate of wages, (2) better relations with management, (3) higher degree of mechanization.

"1. The wage scale in effect in Illinois and Indiana is from 4 to 36 per cent higher than the rates for similar occupations in the Appalachian districts. In effect, the total payroll is from 11 to 20 per cent higher in Illinois and Indiana than in the Appalachian region.

"2. Management has learned to respect and to cooperate with the U.M.W. Instances of speed-up were discontinued upon union action. Exorbitant charges in company stores, for house rent, etc., are exceptional. Improvements in method are introduced in consultation with union, etc.

"3. Compared with the national average of 13.7 per cent of mechanically loaded tonnage, Illinois has 53.3 per cent as against the States of the Appalachian region, averaging about 8 per cent (Kentucky, 1.7 per cent; West Virginia, 7.1; Tennessee, 7.6; Pennsylvania, 8.2; Virginia, 8.9; Ohio, 13.8). Besides, Illinois and Indiana have large stripping operations; these, however, are not included in the figures given in this memo, although studied by us and reported elsewhere.

"Consequently, the outstanding characteristic of Illinois and Indiana is that with higher wage scale the cost of labor per ton is lower than in the Appalachian region and productivity per man-day is higher. Specifically, the output per man-shift in Appalachian mines is 18.6 tons and in Illinois-Indiana is 30.6 tons, or 64.5 per cent higher. Productivity per all men in the mines in the Appalachian region is 5.81 tons per shift, while in Illinois-Indiana mines it is 9.68 tons, or 66.6 per cent higher.

"At the same time, labor cost per ton loaded with mobile loaders in the Appalachian region is 34.34¢, while in Illinois-Indiana it is 23.05¢; and the total labor cost per ton in the Appalachian region is about 95.5¢, while in Illinois-Indiana it is about 48.9 per cent and 46.6 per cent cheaper, respectively. The greater saving on loading labor and the smaller saving on total mine labor are due to employment of more men for maintenance work and for general purposes contributing to better upkeep of mines and structures. In other words, it may be said that under the far-sightedness of the union, the miners have attained, in a measure, participation in the advantages derived by the owners from mine mechanization.

"From this study certain conclusions can be made which would be pertinent and helpful in the negotiation of the next wage agreement. Already, at least in one district, the facts of the study proved helpful in negotiating a local wage scale. To be specific, the available data can be used to prove:

"1. That there is a wide enough margin in cost reduction due to mechanical loading to allow participation in the benefits;

"2. That a high day-rate is inadequate without a guaranteed number of working days per year, or guaranteed annual earnings;

"3. That the displacement of labor is proceeding at a rate necessitating a definite form of protection (insurance, dismissal wage, etc.);

"4. That the problem of safety should be brought under control, as in cases of explosives and explosions;

"5. That abuses of various deductions from earnings call for wider activities in

group medical service, hospitalization, community housing, cooperative stores, undertaking establishments, bathhouses, etc.;

"6. That the problem of competing fuels, specifically of gas and petroleum, can be minimized by encouragement of coal by-product recovery, etc., etc.

"It is believed that such a study should be continued and all facts and problems arising from the extended mechanization should be continually gathered and analyzed as a guide in shaping the policies and tactics of the U.M.W."



A.M.C. Convention to Sift Wide Range of Topics

Advances in surface preparation, conveyor mining, mobile loading machines, safety, supervision and personnel training, methods of breaking down coal at the face, cutting-machine bits, underground power distribution, repair-shop practice, mine ventilation, modern haulage equipment, strip mining, and mine-roof support are subjects chosen for papers at the fifteenth annual convention of Practical Coal Operating Men and National Exposition of Coal Mining Equipment, to be held May 2-6 at the Music Hall, Cincinnati, Ohio, according to an announcement by Julian M. Conover, secretary of the American Mining Congress.

Presentation of certain of the major topics is tentatively scheduled as follows: surface preparation, May 2; conveyor mining, May 3; mobile loading machines, May 4, morning; safety, May 4, afternoon; supervision and personnel training, May 5. The morning of May 6 will be devoted to inspection of the display of mining machinery and supplies.

These topics were selected under the direction of R. L. Ireland, Jr., president, Hanna Coal Co. of Ohio, and chairman of the national program committee. Meetings of the State committees of various sections were held in Charleston, W. Va.; Pittsburgh, Pa.; Chicago; Middlesboro, Ky.; Fort Smith, Ark.; Birmingham, Ala., and Seattle, Wash. At a meeting of the national committee on Jan. 28 at Cincinnati the tentative schedule was drawn up. Participants in the last named con-



Mining Congress Program Committee Meets

Seated, left to right: A. L. Johnston, Electric Railway Equipment Co.; J. C. Wilson, Ohio Brass Co.; L. C. Campbell, Koppers Coal Co.; R. L. Ireland, Jr., Hanna Coal Co. of Ohio; Charles C. Whaler, Myers-Whaley Co.; Julian D. Conover, American Mining Congress; W. E. E. Koepfer, Pocahontas Operators' Association. Standing: Harry LaViers, South-East Coal Co.; Patrick D. McMurren, American Mining Congress; C. T. Hayden, Sahara Coal Co.; George T. Stevens, Clinchfield Coal Corporation; G. B. Southward, American Mining Congress; James Hyslop, Walter Hiesdoe & Co.; A. J. Ruffini, Wheeling Township Coal Mining Co.; Albert Gately, Republic Coal Co.; Richard J. Lund, *Mining Congress Journal*.

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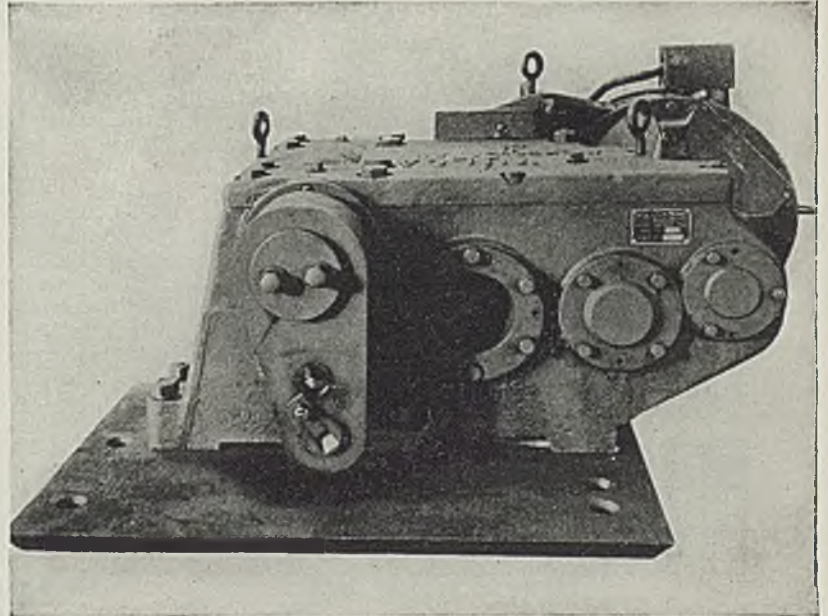
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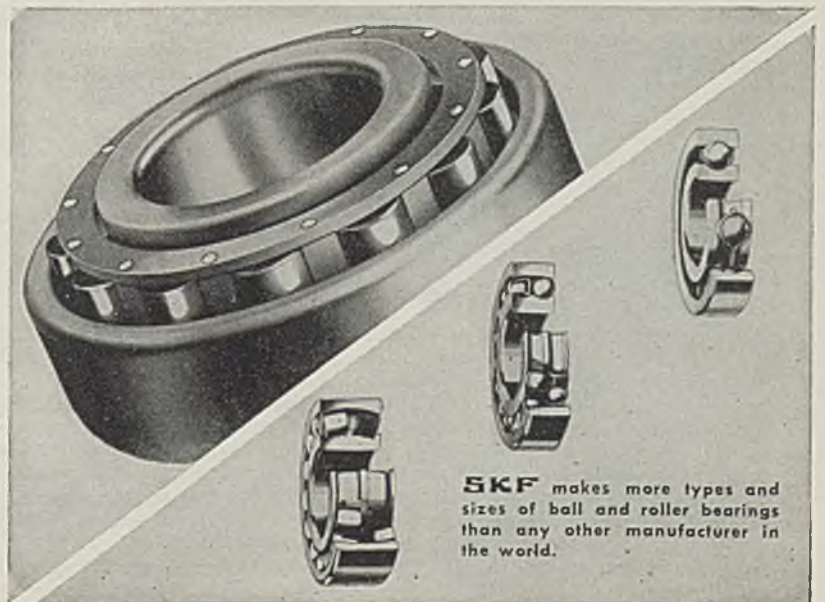
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ference with Mr. Ireland were the following State chairmen: L. C. Campbell, Koppers Coal Co. (Pennsylvania bituminous); Albert Gately, Republic Coal Co. (Montana); Carl T. Hayden, Sahara Coal Co. (Illinois); James Hyslop, Walter Bledsoe & Co. (Indiana); W. E. E. Koepler, Pocahontas Operators' Association (West Virginia); Harry LaYiers, South-East Coal Co. (Kentucky); A. J. Ruffini, Wheeling Township Coal Mining Co. (Ohio); George T. Stevens, Clinchfield Coal Corporation (Virginia).

Others in attendance included A. L. Johnston, Electric Railway Equipment Co.; Charles C. Whaley, Myers-Whaley Co.; J. C. Wilson, Ohio Brass Co.; Julian D. Conover; G. B. Southward, mechanization engineer, American Mining Congress; P. D. McMurrer, mining engineer, American Mining Congress; R. J. Lund, editor, *Mining Congress Journal*.

Six committees have been named to expedite the work of the general committee on arrangements, which is headed by Louis Ware, president, United Electric Coal Cos. C. F. Hamilton, executive vice-president, Binkley Coal Co., is chairman of the attendance committee, with A. S. Knoizen, Joy Mfg. Co., vice-chairman. W. W. Rodgers, Westinghouse Electric & Mfg. Co., heads the committee on publicity, of which John F. Coakley, Thomas A. Edison Co., is vice-chairman; John K. McCabe, Hercules Powder Co., is chairman of the entertainment committee, assisted by L. F. Crouse, Monroe Coal Mining Co.; V. J. Nolan, National Carbon Co., directs the committee on contests, with C. B. Officer, Sullivan Machinery Co., as vice-chairman; E. B. Agee, Youngstown Mines Corporation, guides the activities of the floor committee, assisted by C. W. Gibbs, Harwick Coal & Coke Co.; and E. R. Price, Inland Steel Co., heads the welcoming committee, of which Charles C. Whaley is vice-chairman.

Harlan Men Must Stand Trial

A demurrer to a U. S. District Court indictment against 24 coal-company executives, 22 coal-producing companies and 23 present or former peace officers in Harlan County, Kentucky, was overruled on Jan. 26 by Judge H. Church Ford at Lexington, Ky. Trials of the defendants, all charged with conspiracy to violate the Wagner Labor Relations Act, were set to begin on May 16 at the London (Ky.) term of court. Judge Ford's action was the sequel to a long legal battle over the sufficiency of the indictment returned Sept. 27 by a Federal grand jury in Frankfurt (*Coal Age*, November, 1937, p. 83).

Virginia to Study Coal

A joint resolution creating a commission to study coal-mining conditions in Virginia and report to the next General Assembly has been passed by the Virginia House of Representatives. The bill, which provides an appropriation of \$500 for expenses, was sponsored by Delegate Scott Litton, of Russell. Delegate H. M. Bandy, of Wise, withdrew his mine safety bill in favor of the Litton resolution, saying the commission investigation should provide useful information.

Hampered by Flood of Court Injunctions, Coal Commission Suspends Prices

WASHINGTON, D. C., Feb. 23—Impeded by court injunctions, the National Bituminous Coal Commission decided today to revoke minimum prices for the entire bituminous coal industry and to proceed to hearings and the enactment of new schedules and marketing rules and regulations. Commissioner Tetlow announced that the order revoking the existing prices and rules and regulations would be issued tomorrow, to take effect at 12:01 a.m. Saturday.

For the third time in less than two weeks a stay against minimum prices was granted on Tuesday when the U. S. Court of Appeals here suspended schedules affecting the Associated Industries of New York State, Inc., comprising more than 1,400 members. The court held that the Commission should have held public hearings before promulgating minimum prices.

The U. S. Circuit Court of Appeals at Chicago granted a stay last Thursday to six Illinois and one Indiana coal producing companies. The companies attacked the schedules as confiscatory and discriminatory, since no allowance had been made for differentials in the grades of coals mined in southern Illinois and other Illinois and Indiana fields. The injunction was issued by Judges Evan A. Evans, Will M. Sparks and J. Earl Major to the Truax-Traer Coal Co., United Electric Coal Cos., Pyramid Coal Corporation, Southwestern Illinois Coal Corporation, Central States Collieries and Illinois Pocahontas Coal Co., all of Illinois, and the Patoka Coal Co., of Indiana.

On Feb. 11, Justices Harold M. Stephens, Justin Miller and Henry M. Edgerton, composing the District of Columbia Court of Appeals, granted a temporary injunction to 209 railroads, two coal companies and the city of Cleveland against application to them of minimum prices promulgated by the Commission. The court sustained the contention of the Association of American Railroads and the American Short Line Railroad Association that in omitting a public hearing before putting the schedules in effect the Commission violated the Guffey-Vinson Act and the Constitution. The petitioners did not question the constitutionality of the act.

Tetlow Drives Home a Point

The city of Cleveland complained that its coal bill would be increased \$250,000 annually as result of the minimums established by the Commission. When, in the course of a hearing before the Commission a few days previous, it was brought out that Cleveland paid 78¢ a ton for its coal, compared with \$1.65 called for by the Commission schedule, Commissioner Tetlow pointed out that the coal act was designed to "remedy that very thing—selling coal below the cost of production." The operator plaintiffs were the Saxon and Enos coal mining companies, of Indiana. The court set no date for a final hearing.

Following a conference at the White House Feb. 14, Chairman Charles F.

Hosford, Jr., said the Commission had no intention of suspending minimum price orders and would oppose all attempts to have its regulatory orders invalidated by the courts upon technical grounds. He also expressed the belief that the legal questions raised against the Commission should be disposed of in court as soon as possible. John Carson, Consumers' Counsel, while agreeing the Bituminous Act is workable, urged that the Commission suspend the prices under attack permanently "and proceed immediately in strict accordance with the act to establish valid prices.

Commission Makes Data Public

All the data used to determine and establish minimum prices were made public by the Commission on Feb. 8 when it began an open hearing on the general question of whether adequate public hearings were held, within the meaning of the Coal Act, prior to the establishment of such prices. After bitterly complaining theretofore because the Commission had not made such information public, a number of municipal and State governments, as well as several private corporations, fought vigorously to prevent counsel for the Commission from entering the material in the record and thus making it available for unlimited public inspection. Among these objecting petitioners were the State of New York, the cities of New York, Atlanta, Rochester and Cleveland, the Carter Coal Co. and the Indiana Gas & Chemical Co. Some of these petitioners, who brought action in Federal courts, seeking to have the established minimum prices set aside, alleged that the Commission assumed an arbitrary attitude in failing to publish the data on which the prices were based. It also was charged that the Commission acted outside of the act in failing to hold a general public hearing before making minimum prices effective.

Commission Reveals Data

The Commission maintained, however, that it did hold public hearings during the months it was working toward the determination of minimum prices and that a full hearing was afforded to all who requested it between the time that prices were announced and the date they became effective. It also was pointed out that on Jan. 19 the Commission opened to the inspection of the Consumers' Counsel all of the data used in determining prices.

Action by Judge Martin T. Manton, of the U. S. Circuit Court of Appeals at New York, on a petition by the Carter Coal Co. nearly knocked regulation under the coal act into a cocked hat as long ago as Jan. 28. In temporarily enjoining the Commission from rescinding temporary relief granted the company, Judge Manton failed at first to indicate specifically that smokeless "pea" coal shipped from District 7 into New York harbor was affected. A hurried conference of counsel for the Commission

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and for the Carter company with Judge Manton, however, soon clarified the situation. In a subsequent hearing, on Feb. 7 and 8, the stay was continued.

The Brooklyn Union Gas Co. and the Consolidated Edison Co., both of New York, and the Koppers Co. of New Jersey were granted temporary relief on Feb. 7 from minimum prices in District 7 (Southern No. 1) by a modification of the price on coal used for byproduct purposes. Pending a hearing, the order provides that such coal moving through Hampton Roads for delivery at the port of New York shall take a minimum price of \$2 a ton—instead of \$2.15.

Truck-mine prices were established by the Commission on the same day for code member producers in Districts 7 (Southern No. 1) and 15 (Southwestern), effective in the latter area on Feb. 18 and in the former on Feb. 21. In District 7 the prices for low-volatile truck coal were set at \$1.50 to \$3.35 per ton, and for high-volatile, \$1.65 to \$3.35. Several different price groups were established in District 15, but the average for mine-run was about \$3 per ton. In the case of both districts, it is provided that in any case specially prepared or treated coal take an additional charge of 10¢ a ton.

Kansas and Oklahoma operators were given the right, in a temporary order issued by the Commission on Jan. 27, to absorb the differential existing between interstate and intrastate freight rates on coal in District 15 (Southwestern). The temporary relief was allowed because of failure of the State regulatory bodies in the two States to adjust intrastate rates to conform with the increases on interstate coal shipments allowed by the Interstate Commerce Commission on Nov. 15 last. Producers informed the Coal Commission they were put at a competitive disadvantage because of the differential created by failure to adjust intrastate rates to conform with the rise in interstate railroad tariffs.

Relief Given on Machine Cuttings

The Stanley Coal Co., with its tippie in District 3 (Northern West Virginia) but most of its mine in Maryland, was allowed temporarily to sell low-grade machine cuttings at \$1.10 a ton in the Philadelphia (Pa.) market, it having contended it had been paying 20¢ per ton to have the cuttings hauled away from the mine because no price had been fixed at which they could be sold. The Wilmington Coal Mines, Inc., of northern Illinois, was granted permission to sell the five largest sizes of its coal 30¢ a ton below the price established for District 10 and 10¢ a ton under the minimum prices on its two smallest sizes. The company asserted that it produced an inferior quality compared to other Illinois coals.

Extending a previous temporary order establishing a minimum price for slack of a maximum size of $\frac{3}{8}$ in., the Commission on Jan. 25 included Districts 1 and 7 (Eastern Pennsylvania and Southern No. 1) within the scope of the order; the districts previously affected being western Pennsylvania, northern West Virginia, Ohio, and West Virginia Panhandle. Producers may sell $\frac{3}{8}$ -in. slack for not more than 10¢ a ton below the price established for their respective districts on $\frac{1}{2}$ -in. The order affects coal used for industrial pur-

poses, but no substitution may be made against orders for $\frac{3}{8}$ - or $\frac{1}{2}$ -in. slack, nor is the price on these sizes applicable to coals used for byproduct purposes.

The Commission has ruled that intrastate commerce in bituminous coal has a direct effect on interstate commerce in Virginia and Missouri and is subject to regulation under the Guffey-Vinson Act, effective Feb. 15 and 18, respectively. Wyoming operators, testifying at a hearing held in Cheyenne on Jan. 21-22, urged federal regulation in that State as a safeguard against price cutting, chiseling and labor trouble. Pleas for regulation of Utah coals also were voiced by board members and producers at a hearing held at Salt Lake City on Jan. 31.

Industry Fight on Prices Seen To Favor Cut-throat Tactics

BY PAUL WOOTON

(Coal Age Washington Correspondent)

Any shortcoming of the Bituminous Coal Commission in making public the basic data upon which it based its price calculations apparently have been made up by the calculations that have been put in the record since the point was made. It still is not clear just how the Commission can hear the representatives of 6,000 commercial mines, 9,000 truck and wagon mines, and 100,000 carload buyers of coal. As Congress set up the act on a four-year basis, it hardly could have intended to serve notice on every interested person and give each a chance to be heard, as more than the four years would be required for that purpose alone.

Lose Sight of Basic Purpose

In the controversy over procedure sight frequently is lost of the basic objectives of the Guffey Act. Congress first undertook to stabilize agriculture, which was regarded as the most disorganized part of the national economy. Then it undertook by law to improve conditions in coal mining, which provides more employment than any other single industry. It was in a state of demoralization. As steps taken under NRA had improved the situation both for operators and workers, Congress decided to try to improve the worst spot in the industrial picture. It did not go as far as it had with railroads and electric utilities. In regulating these industries provision was made for reasonable profits. The Coal Commission was directed to establish prices that would return the cost of production as a minimum. The law did not tell the Commission to make provision for a profit. The Commission went to work with this definite yardstick.

If the Commission has done a letter perfect job in arriving at price schedules the average income of the coal industry should equal the average cost. This means that well-managed mines with costs below average will be in a position to pay good wages, to modernize equipment, to undertake research and avoid the bad practices that go along with bankruptcy.

In 1928 the coal mining industry had losses aggregating \$25,000,000. In 1929 its losses totaled \$10,000,000. It lost money during every year of the depres-

sion. This is the proof that the industry was not earning the cost of production. The industry continued to lose money in 1936. It now is known that the Appalachian field group in price area No. 1, which produces 70 per cent of the country's bituminous coal, lost an average of 11¢ a ton in 1936. Were the Congressional yardstick applied with mathematical accuracy, the average price in District No. 1 would be increased by 11¢ a ton.

The Commission undertook to bring about a better relationship between the prices of domestic sizes and those of screenings and run-of-mine used by industry. It was felt that the organized buying power of large consumers had forced prices down to the point where losses on industrial coal were recouped to some extent by increasing prices on coal used for household purposes. As household consumers, the beneficiaries of the Commission's action, are not organized, more is being heard from railroads, coke plants, industrial associations and other large users that are organized and in a position to make their voices heard.

Ethiopian in Lumber?

A special right of appeal for States and municipalities from rulings of the Commission is provided in the law. It is suspected that some of the agencies have been put up to the exercise of this right by some of their industries. Consumers' Counsel, heretofore aligned with the left wing, suddenly finds that he is leading a fight in which he finds big corporations as his chief lieutenants.

Consumers seem to have forgotten that they formerly paid unreasonably low prices for coal. When they burned that coal they also burned some of the capital assets of the producer. They made the sweating of labor inevitable. The Coal Commission's position is that it is in the interest of the consumer as well as the producer to secure stabilization and remove a bad spot in the national economy. Cost of fuel for all manufacturing and power production averages less than 3 per cent of the total value of output.

If the Commission is successful in establishing its price schedules the increase in coal prices is not expected to exceed 0 per cent.

Reinhardt Thiessen Is Dead

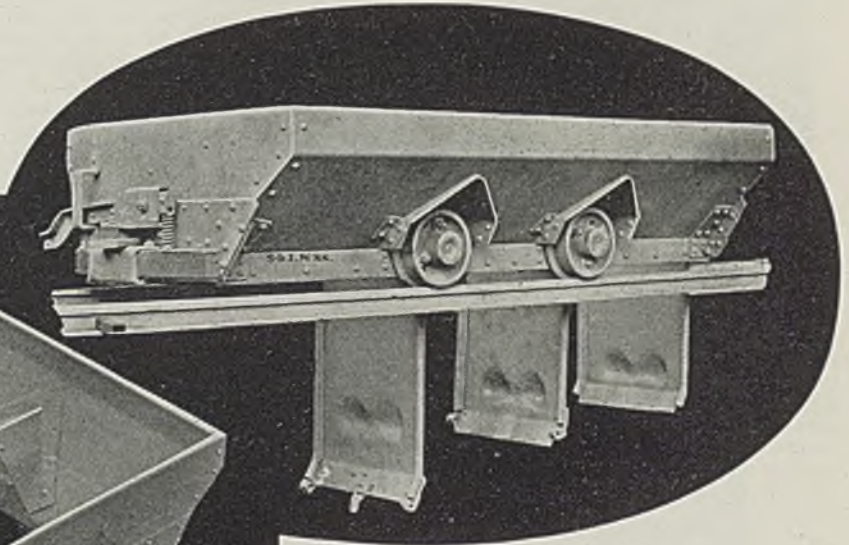
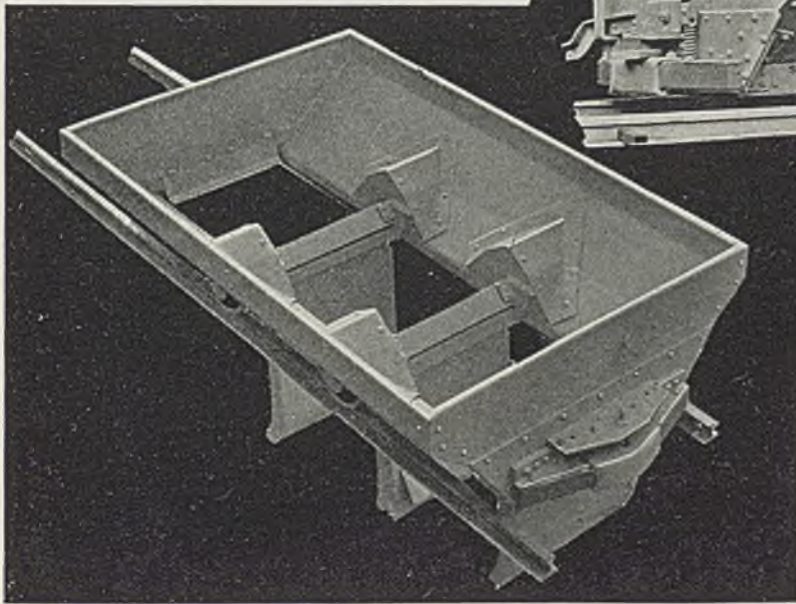
Dr. Reinhardt Thiessen, 70, research chemist for the U. S. Bureau of Mines, died suddenly Jan. 30 at his home in Pittsburgh, Pa., of a heart ailment. Born at New Holstein, Wis., he entered Lawrence College, Appleton, Wis., receiving a B.S. degree in 1895. Three years later he became an instructor in science at the Red River Valley University, in South Dakota. In 1901 he entered the University of Chicago, taught at Des Moines College, 1902-4, and at the University High School, Chicago, 1906, receiving a Ph.D. degree in 1907.

At that time, Dr. David White, of the Technologic Branch, U. S. Geological Survey, sought a man with training in botany, geology and paleobotany, and selected Dr. Thiessen for the position. He began the

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● Wise operators are paying more attention to cubic-foot-capacity-transportation. They've stopped buying — "just mine cars". This is the reason Sanford-Day is convincing so many operators that it's money saved to junk out-of-date cars and install S-D Automatics.

With this remarkable car, the doors drop in 1-2-3 order . . . forward door drops first, next the second and then the third. Coal from the car is deposited with the least possible shock. It is the most gentle method known for transfer of coal from car to bin or screen.

When you can average 4700 lbs. of coal

per car, with car only 18 inches above rail . . . "you're in the money" with cubic-foot-capacity-transportation. This average is being made with S-D 1-2-3 Automatics.

THINK OF THE SAVINGS

No tipple labor . . . no standing idle trip at tipple . . . dumped without stopping . . . no expensive dumping equipment to purchase or maintain . . . the most economical car in the world. Take advantage of these savings with S-D Automatics. And you don't even have to buy them . . . you can lease them like many other operators have done.

SANFORD-DAY IRON WORKS • Knoxville, Tennessee

MINE CARS, ALL TYPES—TRAILERS—WHEELS—SHEAVES



Dr. Reinhardt Thiessen

Personal Notes

LAYMAN COUTNEY has been appointed superintendent at Glenwood No. 2 mine of the West Virginia Smokeless Coal Co., Preston County, West Virginia.

WALTER M. DAKE, research manager, Coal Age, has been retained as part-time consulting engineer on the mineral technology and output-per man study being carried on by the WPA National Research project and the U. S. Bureau of Mines. The study is under the general supervision of Dr. O. E. Kiessling, of the Bureau of Mines, and includes surveys of the trends of technical practice and productivity in various branches of the mineral industries. The analysis trends in bituminous coal mining, on which Mr. Dake will be chiefly engaged, is under the immediate conduct of Dr. W. E. Hotchkiss, well-known economist, and the general direction of F. G. Tryon. Other collaborators include L. N. Plein, J. J. Gallagher, F. E. Berquist and Miss Warner.

H. B. DAVIES has been made superintendent at Rich Run mine of the Elk River Coal & Lumber Co., Widen, W. Va.

W. H. DONOVAN, vice-president and general superintendent of the Pryor Coal Mining Co., operating mines at Pryor and Walsenburg, Colo., has taken over the presidency of the company, vice W. H. Marshall, deceased. He will continue as superintendent. Mrs. W. H. MARSHALL is now secretary-treasurer of the company.

W. R. HANDS has been named superintendent at No. 5 mine of the Pursglove Gas Coal Corporation, Pursglove, W. Va.

JACK HENRY has been appointed superintendent at Ethel No. 2 mine of the Chilton Block Coal Co., Ethel, W. Va.

WALTER HERRIN has been made mine foreman at Caperton mine of the Premium Smokeless Coal Co., Elverton, W. Va.

CHARLES M. JOHNSON has been named superintendent at the Leckie mine of the Leckie Smokeless Coal Co., Anjean, W. Va.

L. F. JOHNSON has been appointed mine foreman at No. 3 mine of the Raleigh-Wyoming Mining Co., Hazy, W. Va.

GEORGE W. MCCAIG recently engaged in engineering work with the Pittsburgh Coal Co., has been appointed superintendent-engineer assistant at Doceua mine of the Tennessee Coal, Iron & Railroad Co., Adamsville, Ala.

H. B. MONDEY has been made assistant to the president, in charge of sales, of the Elk Horn Coal Corporation, with headquarters at the company's general offices, Carew Tower, Cincinnati, Ohio. Formerly vice-president of the Central Fuel Corporation, Chicago, Mr. Mondey succeeds J. H. BAXER, vice-president, resigned.

W. S. MILLES has been named mine foreman at Cameo mine of the Cameo Splint Coal Co., Cameo, W. Va.

LESLIE PERRY has been appointed night foreman at the new Marlfork mine of the Cabin Creek Consolidated Coal Co., Kanawha County, West Virginia.



E. J. McVann

A. J. PUGH has been appointed mine foreman at MacAlpin No. 2 mine of the MacAlpin Coal Co., McAlpin, W. Va.

COLONEL FRANK D. RASH, president of the St. Bernard Mining Co., which had operations in western Kentucky, prior to its sale to the West Kentucky Coal Co., has been elected managing director of the Louisville (Ky.) branch of the Federal Reserve Bank of St. Louis, assuming his new duties on Feb. 21. He was a coal-mining executive for 24 years, president of the Inland Waterways Co. for more than a year, manager of the Louisville office of the Reconstruction Finance Corporation for two years, and president of the Federal Land Bank of Louisville, 1934-5.

J. V. RILEY has been made mine foreman at Morrison mine of the Morrison Coal Co., Glen Morrison, W. Va.

EARL C. ROBERTSON has been elected vice-president in charge of sales of the Pittsburgh Coal Co., Pittsburgh, Pa., vice HAL E. BOOTH, resigned.

L. D. RUTLEDGE has been named mine foreman at Leckie mine of the Leckie Smokeless Coal Co., Anjean, W. Va.

O. G. SCHWANT has been appointed general superintendent by the Hutchinson Coal Co., Fairmont, W. Va.

HENRY SHAFFER has been made mine foreman at Glenwood No. 2 mine of the West Virginia Smokeless Coal Co., Preston County, West Virginia.

C. J. STEPHENS has been promoted from section foreman to general night foreman by the Chafin-Jones-Heatherman Coal Co., Peach Creek, W. Va.

DAVE SULLIVAN has been named mine foreman at Royal mine of the Royal Mining Co., Lanark, W. Va.

DR. A. C. TESTER, assistant State geologist of Iowa and associate professor of geology at the State University of Iowa, has been granted a two years' leave of absence from the latter position beginning on Feb. 1. During this period he will serve as field geologist for the Socony-

study of the origin and constitution of coal by developing a system for preparing transparent thin sections for microscopic study. The Safety in Mines Research Board of Great Britain in 1925 requested that Dr. Thiessen go to England as an exchange investigator to supervise and assist with the establishment of research on the origin and constitution of coal similar to that carried on at the Bureau of Mines, and for noteworthy accomplishment he was awarded a silver medal by the Royal Society of Arts, London.

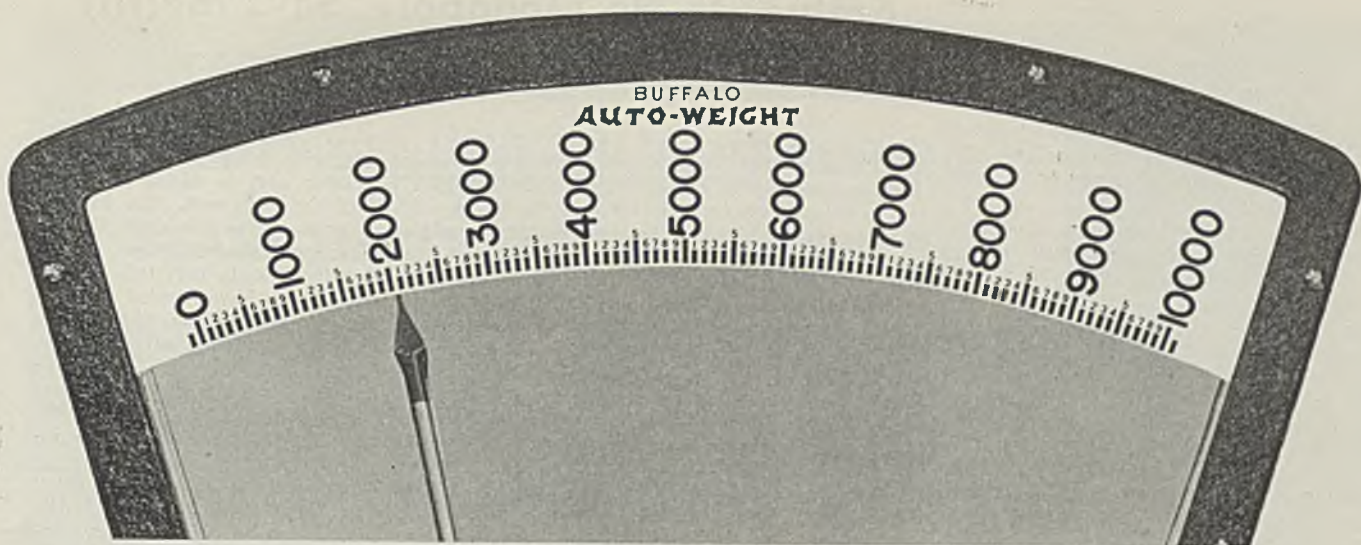
E. J. McVann Passes Away

Edward J. McVann, 69, died Jan. 30 at Emergency Hospital, Washington, D. C., following an illness of several months. At the time of his death he was executive secretary of the Property Owners' Committee, representing various coal producers in West Virginia, Virginia and Kentucky in freight-rate matters. He had had an extended career in coal and traffic circles, being at one time secretary of the Smokeless Coal Operators' Association of West Virginia and was among the earliest in the practice of law before the Interstate Commerce Commission.

Obituary

GEORGE F. GYRE, 72, of Chicago, chairman of the board of the Globe Coal Co. and director in many other enterprises, died Feb. 11 of a heart attack at Miami Fla. Moving from Mechanicsburg, Pa., to Chicago in 1880, he went into business for himself several years later, setting for himself the task of selling a car of coal each day before lunch or going without lunch.

CONSTANCE L. HERRSING, 58, vice-president, Hecksensmith Wheel & Mine Car Co., Penn, Pa., for the last 25 years, died Feb. 3. For three years after his graduation from Purdue University in 1904 he was employed by the Westinghouse Electric & Mfg. Co., whereupon he joined the Hecksensmith organization.



HOW TO SPEED UP WEIGHING Without Buying New Scales

● Weighing need no longer be the neck of the bottle in your mine, thanks to the fast, easy-to-read accuracy of the Buffalo Auto-Weight. Large, clear figures (actually three and a half times as large as those shown in the above illustration) and steady, non-vibrating pointer visible from both sides of indirectly illuminated dial,—this Buffalo Auto-Weight ends disputes between company and union weighmen.

Its accurate readings increase your profits by cutting the wide spread between Mine Weight and Shipping Weight.

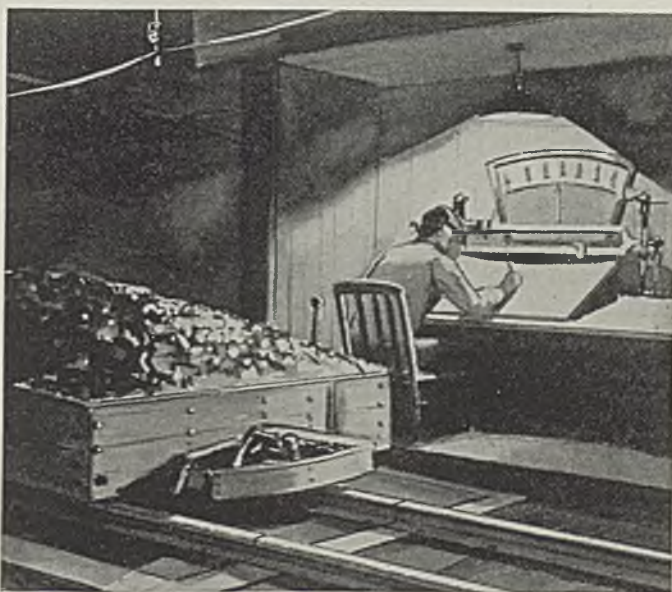
The Buffalo Auto-Weight has no springs . . . it is rugged, fully enclosed and easily attached to your present scale regardless of make. Choice of a wide variety of dial charts is available to fit your needs.

Mining men everywhere have proved and approved the Buffalo Auto-Weight during Five Years of on-the-job service. Write or mail coupon for illustrated Bulletin and low prices.

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Showing Buffalo Auto-Weight in action. Cars can be handled rapidly without slowing up production because of delays at the scale.

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Please mail Bulletins on
 Buffalo Auto-Weight.
 Buffalo Mine Track Scales.
 Nearest mine where I can see them operating.

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Mine

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CA235

Wagon Oil Co. in Columbia, South America.

RUSSELL BRANES, JR., Philadelphia, Pa., treasurer of the Westmoreland Coal Co. and Westmoreland, Inc., with operating office at Lewis, Pa., has been elected vice-president of those companies. He will retain the office of treasurer in both organizations.

D. W. WAINSWORTH has been appointed superintendent at Wyoming mine of the Fred Jackson Coal Corporation, Wyoming, W. Va.

B. J. BRONKS, general superintendent, South Side Co., Caperton, W. Va., has been elected chairman of the New River Safety Committee for 1938. Other officers named were: vice-chairman, **G. S. MASON**, West Virginia Department of Mines, and **Mr. D. NIMMER**, preparation manager, Marland New River Co.; secretary, **J. H. WINGARD**, Mining Extension Department, West Virginia University.

CLAUDE W. LIPP, general manager, Ajax Coal Co., Harland Ky., was re-elected president of the Harland Coal Operators' Association at its annual meeting. Other officers were: vice-president, **D. T. PARRINGTON**, general superintendent, Meigs, Black Coal Co.; secretary, **FRANK A. B. SLOAN**.

New Preparation Facilities

COMMERCIAL IRON, Co., Pittsburgh, Pa., contracts closed with McNally Pittsburg Mfg. Corporation for McNally-Boston assembly wash with a capacity of 250 tons per hour to supplement present 100-ton-per-hour unit and make it possible to wash all coal from the down the site. The additional equipment being installed provides for making six sizes of coal and loading them on cars or trucks.

LEHIGH NATURAL GAS, Co., Elizabeth (Pa.) Colliery, contracts closed with Hoister Consolidated Co. for Hoister-Overtown "Obigoni-Dee" coal-washing equipment to handle No. 1, bunkhouse, capacity 1,700 tons of coal per hour.

MARSHES COAL & ICE Co., Avonlea, Pa., contracts closed with Hoister Consolidated Co. for Hoister-Overtown "Obigoni-Dee" coal-washing equipment to handle No. 4 bunkhouse, capacity 120 tons of coal per hour.

SEEBLING SPARKERS, COAL Co., Whittier, W. Va., contracts closed with Primatech Machinery Co. for complete new 400-hp. equipped with shaker screens, loading bins and receiving, rescreening and conveying equipment, capacity, 260 tons per hour.

WOLF COLLIERY, Co., Mount Pleasantry, Okla., Pa., contracts closed with Winnet Engineering Co. for 30-hp. Herdwater to clean No. 4 bunkhouse for use of approximately 30 tons per hour. Equipment includes shaker machinery and is now in operation.

Key to Better Heating

As a result of legislative provisions aimed at the interest of bituminous coal, the National Coal Association has issued a new booklet entitled "The Secret Source of Better Heating." With illustrations the brochure explains three points about bituminous coal: plenty of heat, even temperatures, convenience, economy, safety, dependability and cleanliness. Brochure designed for school heating or approval.

Anthracite No Monopoly, Says Merritt, Citing Huge Losses in 1937

DENYING that there is any semblance of monopoly in the anthracite industry, as recently charged by Governor Barbe of Pennsylvania, Walter Gordon Merritt, counsel for the Anthracite Institute, asserted on Feb. 17 before the State Chamber of Commerce at Harrisburg, Pa., that estimated net losses of the producers in 1937 were between \$55,000,000 and \$80,000,000. Mr. Merritt enumerated eight moves that the Commonwealth might make to promote recovery of the industry in the interest of workers and investors and as a source of tax revenue:

- (1) Accord the industry the same degree of legal protection accorded to other persons and industries;
- (2) reduce tax barriers and influence local communities to minimize expenditures until the present crisis is past;
- (3) cease maligning the industry and ceasing it off completely when it is near ruin from competition within and without;
- (4) cease accusing the industry of trying to sell its product when it is spending millions in promotional work;
- (5) tell workers in the industry that the new assessment of the workmen's compensation law, imposing an added \$50,000,000 charge annually on the industry, will prove an enormous, resulting in a further loss of markets and income jobs; and regard this legislation;
- (6) urge the United Mine Workers to study ways and means of reducing wage rates as a means of increasing workers' earnings;
- (7) continue to add to the effort to reduce freight rates;
- (8) appeal to the Department of State for elimination of the Quincentenary Day or Pennsylvania anniversary, to improve an adequate duty on imported anthracite, and demand a Federal tax on fuel oil.

Spending Mining as 1937

Spending mining within the said was now entering its eighth year as an outlay industry, "still stands as a challenge to the Commonwealth of Pennsylvania and an indictment of its administrative ability. It has been called the desperate result of unemployed miners, but let it be said to the credit of those unfortunate miners only a small fraction—perhaps one-twelfth of the unemployed—are now engaged in this form of spending." Workers in the Spoking coal industry average \$22.60 per week and labor under substantial conditions. "All the government organized labor has gained in the last 50 years is independence within this unbridled and uncontrolled."

The well being of the anthracite industry depends upon the maintenance of the economy of the entire State of Pennsylvania, said the speaker. Being a great consumer as well as a great producer, it plays a wide variety of supplies to whole of Pennsylvania annually. The tax and the principal support of entire communities. It provides freight charges by the railroad and its financial resources are important to our banking institutions.

Wages in the industry with anthracite is less than the maintenance of high mine prices by the producers. The cost of pro-

ducing anthracite is \$4.75 per ton, off which the labor cost is \$2.05, or nearly two-thirds of the mine cost. The average realization, as shown by the U. S. Bureau of Mines, declined from \$5.98 per ton in 1928 to \$4.18 in 1935. In 1937 this realization is estimated to have reached to \$4.00 a ton. The effect of this on the balance sheets of the companies is all too clear. The working capital of the companies from Jan. 1, 1927, to Jan. 1, 1936, has shrunk from \$311,000,000 to \$26,800,000, thus leaving little fat for a survival industry to feed upon.

"Prices are devastatingly below cost. There is no allocation of markets. Labor has come into its own, if not more. Excessive royalties, if any, are so few in number that they do not affect the general picture or the general price structure. In some instances the taxes paid by the owner of the fee are greater than the royalties.

"Whether or not the freight rate structure be one of the contributing factors, the essence of the problem may be summed up in the fact that the anthracite industry needs the money and the railroads also need the money. The query which naturally suggests itself is whether a reduction in freight rates, coupled with other reductions in costs which burden the sale of anthracite, might not increase the tonnage volume and thereby improve the status of the railroads.

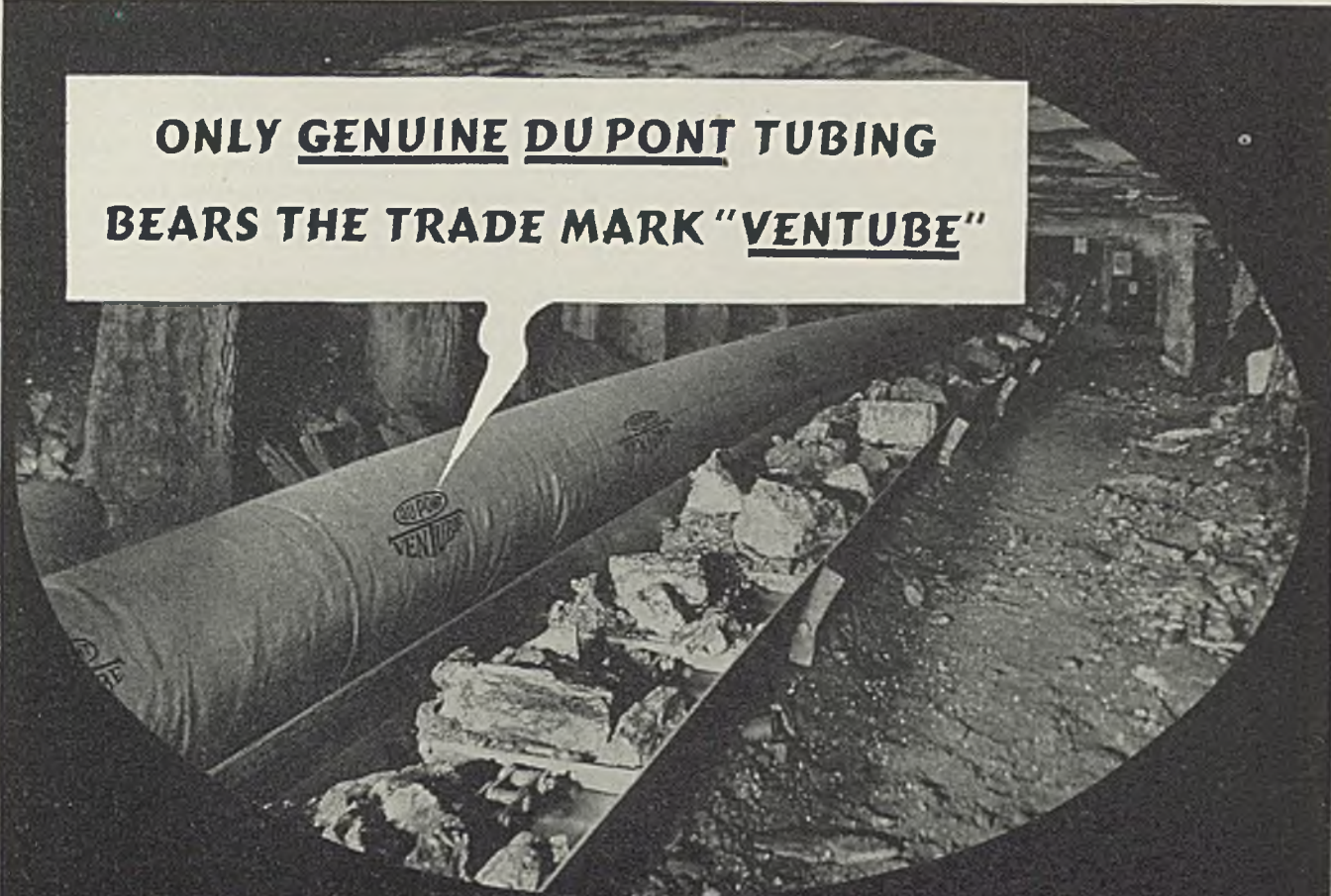
Think Operators Too Generous

"In the matter of observing the principles of collective bargaining, union recognition, conciliation and arbitration, the only criticism of the industry is that the operators have been too liberal in granting wage scales so high that the sale of the product has been retarded. Through a reform which increased wage rates have much decreased sales and decreased earnings for employees. It is altogether probable that decreased wage rates would mean greater employment with increased earnings for the wage reductions markets could be regained by lower prices.

"The matter with anthracite is partly taxes and unarranged burdens forced upon it when it was already staggering under too heavy a load. The total tax bill of nearly \$14,000,000 amounts to about 300 a ton, and \$11,000,000 of the total goes to local governments. And notwithstanding the critical condition of the industry and the dependence of the Commonwealth and municipalities on it, the legislature enacted a new workmen's compensation law, subjecting occupational disease and affecting anthracite in a way incompatible with any other industry, which will eventually impose another \$5,000,000 burden on the industry.

"To an important degree the Federal Government is not giving proper protection to the employment of the miners. In 1936 more than 337,000 tons of foreign anthracite entered the United States, 433,794 tons being from Soviet Russia. Since last August, when the State Department negotiated a trade agreement

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**"VENTUBE" blows out dust and foul air
—brings fresh air to remote working faces**

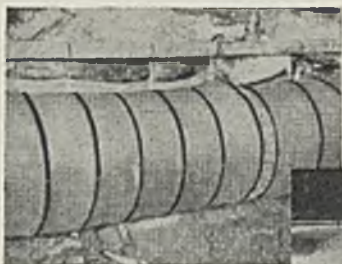
LOOK for the du Pont trade mark. It is your assurance that you're getting genuine, tested "Ventube" ventilating duct.

"Ventube" is more durable because it is made of extra-heavy, long-fibered Hessian cloth. It is resistant to fungus, damp or dry rot, moisture, acid water and gases because "Ventube" is both coated and impregnated with rubber.

"Ventube" provides low cost, efficient ventilation

for deepest workings. It's flexible. Weaves in and out of irregular passages. Eliminates costly break-throughs. Saves time by getting rid of dust and powder fumes faster. "Ventube" hangs quicker. Can be taken down easier. Therefore, "Ventube" helps you reduce man-hours.

There's an authorized "Ventube" distributor located near your mine. Test a few sections. See for yourself that "Ventube" can help cut your costs.



(Above) Non-collapsible "Ventube" can be used for suction ventilation, either to supply fresh air to the working face, or with a reverse fan, to exhaust gas and dust-laden air.

(Below) The regular type flexible "Ventube" carries fresh air to remote headings, forcing dust back away from the working face.



(Above) Du Pont's powder bag is safer, longer-lasting because it is made of "Ventube." It is coated and impregnated with rubber that won't peel off.



E. I. du Pont de Nemours & Co., Inc.
"Fabrikoid" Division
Fairfield, Conn.

with Russia, all anthracite enters this country duty free. The State Department has not yet afforded the industry the help needed to regain the important Canadian market. Since 1932 Pennsylvania anthracite entering Canada has had to pay a duty of 50¢ a ton and an excise tax of 3 per cent, making a total of about 72¢ a ton."

Reviewing the plans of the Lauck commission and others for control of one kind or another for the industry, Mr. Merritt said the only plan which has the backing of both the United Mine Workers and a substantial percentage of the industry is one to create a Federal commission, similar to the National Bituminous Coal Commission, to fix minimum mine prices—and possibly maximum ones—prescribe marketing rules and prohibit unfair methods of competition.

"The tragic part of this picture," said the speaker, "is the complete confusion and lack of direction which characterizes the situation after years of study and expenditure. The public and public officials are being misled by radicals and visionaries who wish to try out their theories of radical experimentation. The real facts they will not emphasize. The homely practical truths are unspoken. They are still feeding the public outmoded charges of monopoly and promises of lower consumer prices, when monopoly is nothing but a political phantom and lower prices are not economically practicable under any condition now in sight."

Industrial Notes

BROWN Co. announces that the executive offices of its tubular products division, which produces fiber pipe for mines, have been transferred from Portland, Me., to the Graybar Building, 420 Lexington Ave., New York City.

GOODYEAR TIRE & RUBBER Co. has created a new district for the sale of mechanical rubber goods at Cleveland, Ohio. The manager of the new district is H. D. Poster, salesman for the company in that territory since 1924; he is succeeded as sales representative by W. L. Clark, transferred from the Akron mechanical goods staff.

FOXBORO Co., Foxboro, Mass., manufacturer of precision industrial instruments and controllers, has appointed Robert V. Hamilton as resident sales engineer in charge of the Birmingham (Ala.) district.

ROCKBESTOS PRODUCTS CORPORATION, New Haven, Conn., has opened a branch at Room 612, Stephenson Building, Detroit, Mich., with Carle van de Bogart, formerly of the New Haven sales office, in charge.

MOSEBACH ELECTRIC & SUPPLY Co., Pittsburgh, Pa., has established warehouse facilities at 1315 Hansford St., Charleston, W. Va., with Thomas Angell district sales manager in charge.

SAFETY MINING Co., Chicago, announces that Howard R. Ellis, who has been its division manager in the Rocky Mountain States, is being transferred to Benton, Ill., whence he will cover the Illinois, Indiana and western Kentucky fields. The change becomes effective March 1.

WESTINGHOUSE ELECTRIC & MANUFACTURING Co. has appointed O. F. Stroman,

since 1931 manager of the industrial sales department, assistant to the vice-president in charge of sales; C. B. Stainback, formerly assistant manager, industrial sales department, becomes manager; Bernard Lester, also a former assistant manager, has been made manager of a newly created resale department.

PLYMOUTH LOCOMOTIVE WORKS, division of the Fate-Root-Heath Co., Plymouth, Ohio, has appointed George Kirtley, formerly assistant to the vice-president, as sales manager of the locomotive division. Roy J. Johnson, formerly assistant chief engineer, has been named assistant sales manager.

CHAIN BELT Co., Milwaukee, Wis., has made David B. Hill sales engineer specializing in foundry systems. His headquarters will be at the Chicago office.

TIMKEN ROLLER BEARING Co. has appointed P. T. Anvarrow, formerly head of the Atlanta (Ga.) service branch, as Atlanta division manager. B. E. Keifer has been named Cincinnati division manager.

HENDRICK MFG. Co. has a new Pittsburgh (Pa.) office, Room 744 Gulf Building.

Stoker Studies Continued

Stoker-combustion problems continue to play a major role in the projects undertaken by Battelle Memorial Institute on behalf of Bituminous Coal Research, Inc. Data accumulated during tests running over several months with different coals and varying burning conditions in small stokers were incorporated in a talk on "Automatic Residential Heating With Bituminous Coal," presented by R. A. Sherman at the Atlanta (Ga.) fuel engineering conference, Feb. 8, sponsored by Appalachian Coals, Inc. Experimental investigations into the combustion in underfeed stokers were temporarily halted to permit the preparation of a paper on results to date.

A suggested program for 1938 studies in dustless treatment of coal has been approved by Standard Oil Co. and Sun Oil Co., two of the sponsors of the work done in this field last year (*Coal Age*, May, 1937, p. 228; November, p. 90). Following this approval, plans were made for a field survey, with mines in southern West Virginia the first on the list to be visited by J. M. Pilcher, who, with Gaylord Cook, has been in charge of this particular project.

Old Har-Mar Plant Sold

Christopher Mining Co. has acquired what was formerly the Har-Mar plant at Maidsville, W. Va., and has leased 1,050 acres of Pittsburgh seam coal land adjoining. The St. Paul Coal Co. was lessor of the Har-Mar property and the acreage was leased from several estates in Monongalia County. The lessees propose starting construction immediately of railroad spurs and river tipples to the new site, which will be known as Robinson Run No. 2 mine and will be completely mechanized. It is hoped that it will be possible to ship coal by May 1. The St. Paul holdings also will be further developed.

Anthracite at Home Show

One of the largest exhibits of modern automatic anthracite heating equipment ever assembled featured the National Home Show, which opened Feb. 18 at the Commercial Museum, Philadelphia, Pa., and is to continue until the 26th. Eighteen equipment manufacturers cooperated with Anthracite Industries, Inc., in staging a demonstration of heating and air-conditioning equipment under fire. Anthracite Industries, with the cooperation of nine manufacturers, also had an interesting exhibit at the Farm Show, held during the last week of January at Harrisburg, Pa.

Neilson Breaker Burns

Fire destroyed the Neilson breaker, at Shamokin, Pa., during the night of Feb. 1, with a loss of about \$350,000. The structure, which was owned by the Merriam Coal Mining Co., had been worked regularly until the day of the fire, when it was closed for repairs.

Atlas Observes Anniversary

In observance of its 25th year in business, the Atlas Powder Co., Wilmington, Del., has issued a handsome booklet. Comprising 64 pages, printed on fine paper, the brochure describes the company's far-flung activities in the manufacture of explosives, cellulose products and industrial chemicals—"a twenty-five million dollar business with 2,500 employees." Illustrations show many of the plants and manufacturing departments as well as the products in use.

New Clinton Mine Opens

The new Clinton mine of the Electric Shovel Coal Corporation, in the Brazil-Clinton district of Indiana, was opened on Feb. 1. This operation, which produces coal from the No. 6 seam, ships from West Clinton on the Chicago, Milwaukee, St. Paul & Pacific and the Chicago & Eastern Illinois railroads. Daily capacity will be about 1,750 tons, the preparation plant being equipped to clean and load a variety of sizes for both the domestic and steam trades. F. S. Martin & Co., Chicago, are sales agents for the new mine's output.

Trade Literature

AGITATOR DRIVES—Foote Bros. Gear & Machine Corporation, Chicago (Bulletin 601, illustrated). Contains complete ratings, specifications, dimensions and description of IXL Type AD vertical agitator drives, with application views. In addition are shown IXL vertical helical powered gears, Hygrade vertical worm-gear reducers, Type WV vertical worm-gear reducers, and special reducer types.

AUXILIARY RELAYS—General Electric Co., Schenectady, N. Y. (Bulletin GEA-2711). Lists outstanding features of Type HEA multicontact auxiliary relays, describing construction, etc.

BEARINGS—New Departure, Division General Motors Corporation, Bristol, Conn.

(Booklet R. 20 pp.). Entitled "Interchangeable Bearings," this publication contains numerically and alphabetically arranged lists of competitive ball bearings, together with the corresponding numbers of interchangeable New Departure units.

BEARINGS—Shafer Bearing Corporation, Chicago (Catalog No. 14, 74 pp., illustrated). Describes Shafer radial-thrust roller bearings and self-aligning units, giving engineering data, specifications, applications and list prices.

BELTS AND OTHER INDUSTRIAL RUBBER GOODS—Cincinnati Rubber Manufacturing Co., Cincinnati, Ohio (48 pp., illustrated). Contains complete descriptions and specifications of transmission belting, conveyor belting, various types of industrial rubber hose and smaller specialties. Much valuable general information, including directions on care, is included.

COAL-MINE EQUIPMENT—Ingersoll-Rand Co., New York City (Bulletin 9047, 36 pp., illustrated). Presents briefly the many modern I-R compressors, rock drills, hoists, pumps and pneumatic tools used in coal-mining operations. Condensed tables of dimensions and performance characteristics, as well as a variety of typical installation pictures, are included.

CORDS AND CABLES—United States Rubber Products, Inc. (Wire Division), New York City. An illustrated manual, entitled "U. S. Royal Cords and Cables," gives specifications and includes charts of tests.

CORROSION-PROOF COATING—American Concrete & Steel Pipe Co., Los Angeles, Calif. (8 pp., illustrated). Describes and pictures a wide variety of applications for Amercoal, a corrosion-proof, sprayable plastic coating for use on concrete, steel and wood.

FEED WATER REGULATOR—Northern Equipment Co., Erie, Pa. (Bulletin 409-A, 8 pp., illustrated). Explains salient features of the Copes Flowmatic regulator, gives directions for installation, and includes specifications.

FLOODLIGHTS—Pyle-National Co., Chicago (Bulletins 2005, 2010 and 2015, 46 pp., illustrated). Give descriptions, specifications and dimensions of units designed to meet a variety of requirements. A price list for floodlights as well as accessories and parts is appended.

INDUSTRIAL PRODUCTS—Johns-Manville, New York City (Form GI-6A, 64 pp., illustrated). Contains information and recommendations on high- and low-temperature insulations for industrial needs, J-M bonded asbestos built-up roofs and insulated roofs, J-M corrugated Transite for roofing and siding, industrial friction materials, Transite electrical conduit and Korduct, asbestos ebony and other electrical materials, Transite pressure pipe for industrial and municipal water lines, Transite industrial vent pipes and stacks, J-M industrial flooring plank, asphalt tile flooring, Steeltex floor lath, welded wire reinforcement and materials for sound control of mechanical equipment.

LIGHTING—Westinghouse Electric & Manufacturing Co., Cleveland, Ohio (Folder F. 8408, 4 pp., illustrated). Describes the construction and application of

the Millite lighting unit for the heavy industries: includes table of mounting heights, spacing and resulting foot-candle intensities.

PYROMETER RECORDER—Brown Instrument Co., Philadelphia, Pa. (6-pp. folder). Describes the salient features of Brown Potentiometer pyrometers, which are said not only to insure precision measurement of temperatures but also to provide a legible record in both multicolor and numerals.

TRAMP-IRON MAGNETS—Electric Controller & Manufacturing Co., Cleveland, Ohio (Bulletin 910, 8 pp., illustrated). Gives information not only on E.C.&M. large-diameter circular magnets but on smaller circular units, rectangular magnets and other special types particularly suitable for removal of tramp iron from conveyor systems handling coal and other materials used in manufacturing processes. Recommendations for various sizes also are given.

VANADIUM CASTINGS—Vanadium Corporation of America, New York City (24- and 28-pp. bulletins, illustrated). The smaller brochure contains a complete description of the properties and applications of a number of vanadium alloy steels for castings where high strength is required without excessive weight or high cost. The larger publication describes the physical properties of cast irons employing varying amounts of vanadium. Numerous charts and tables list the specifications of vanadium-containing irons.

VERTICAL MOTORS—Fairbanks, Morse & Co., Chicago (Bulletin 1410, 4 pp., illus-

trated). Gives construction details, applications and special features of F-B vertical hollow and solid-shaft polyphase ball-bearing, squirrel-cage induction motors.

Coal-Mine Fatality Rate Again Recedes

Accidents at coal mines of the United States caused the deaths of 78 bituminous and 18 anthracite miners in December last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production totaling 36,226,000 tons, the death rate among bituminous miners was 2.15 per million tons, compared with 2.38 in the preceding month and 3.02 in December, 1936.

The anthracite fatality rate in December last was 3.70, based on an output of 4,752,000 tons, as against 2.81 in the preceding month and 4.65 in December, 1936.

For the two industries combined, the death rate in December last was 2.34, showing a slight decline from the preceding month, when the figure was 2.43, and an even more marked recession from the rate for December, 1936, which was 3.18.

Preliminary reports for the full year 1937 show 1,467 coal-mine fatalities, of which 1,245 were at bituminous operations and 222 at anthracite mines. In the preceding year there were 1,086 bituminous and 244 anthracite fatalities, or a total of 1,330.

Fatalities during December last, by causes and States, as well as comparative rates for the twelve months of 1936 and 1937, by causes, are shown below.

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

Cause	Bituminous			Anthracite			Total		
	Number Killed	1936	Killed per Million Tons	Number Killed	1936	Killed per Million Tons	Number Killed	1937	Killed per Million Tons
Falls of roof and coal..	619	645	1.426	120	119	2.191	739	764	1.512
Haulage.....	199	231	.459	26	31	.475	225	262	.461
Gas or dust explosions:									
Local explosions.....	18	23	.041	11	...	.201	29	23	.059
Major explosions....	23	95	.053	5	...	.091	28	95	.057
Explosives.....	31	40	.071	20	18	.365	51	56	.104
Electricity.....	44	50	.101	8	5	.146	52	55	.106
Machinery.....	35	36	.081	2	2	.037	37	38	.078
Miscellaneous underground.....	45	35	.104	24	19	.438	69	54	.141
Shaft.....	11	15	.025	6	6	.110	17	21	.035
Stripping or open-cut..	15	16	.035	8	7	.146	23	23	.047
Surface.....	46	59	.106	14	17	.256	60	76	.123
Grand total.....	1,086	1,245	2.502	244	222	4.456	1,330	1,467	2.721

* All figures subject to revision.

COAL MINE FATALITIES IN DECEMBER, 1937, BY CAUSES AND STATES

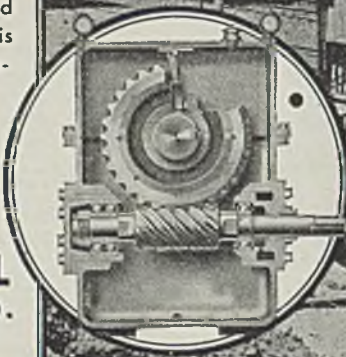
State	Underground								Open-cut and surface				Grand Total	
	Falling of Roof	Falls of Face	Haulage	Gas or Dust Explosion	Explosives	Electricity	Mining Machines	Other Machinery	Other causes	Total Underground	Persons Falling Down Shaft	Machinery		Other causes	Total Surface
Alabama.....	1	..	..	..	..	..	..	..	..	1	..	..	..	1
Colorado.....	..	..	1	..	..	..	..	..	..	1	..	..	..	1
Illinois.....	2	3	2	2	..	..	..	..	..	11	..	..	..	11
Indiana.....	..	1	..	..	..	..	..	..	..	1	..	..	..	1
Iowa.....	1	..	1	..	..	..	..	..	..	2	..	..	..	2
Kansas.....	1	..	..	..	..	..	..	..	..	1	..	..	..	1
Kentucky.....	12	..	2	..	..	1	..	1	..	16	..	..	..	16
Maryland.....	2	..	..	..	..	..	..	..	..	2	..	..	..	2
Michigan.....	1	..	..	..	..	..	..	..	..	1	..	..	..	1
Ohio.....	9	..	..	1	..	..	..	..	..	10	..	..	..	10
Oklahoma.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pennsylvania (bituminous).....	4	..	2	..	..	..	..	..	..	6	1	..	1	8
Utah.....	1	..	..	..	..	2	..	..	..	3	..	..	..	3
Virginia.....	1	..	..	..	..	..	..	..	..	1	..	..	..	1
Washington.....	..	..	1	..	..	..	..	..	..	1	..	..	..	1
West Virginia.....	10	..	4	..	2	1	..	1	..	18	..	1	..	19
Total (bituminous).....	45	4	13	2	1	3	4	1	2	75	1	1	1	78
Pennsylvania (anthracite).....	10	..	5	..	1	..	..	..	1	17	..	..	1	18
Total.....	55	4	18	2	2	3	4	1	3	92	1	1	2	96

Motor Drive Perfected with De Laval Worm Reduction Gear

BY adopting this standardized, self-contained, self-lubricated speed transformer, the designer has achieved ruggedness and minimized the upkeep of his machine, to the great satisfaction of the user.

The photograph shows a Heyl & Patterson rock larry equipped with De Laval Worm Reduction Gear, at Carolina Mine No. 86 in the West Virginia Division of the Consolidation Coal Co.

DE LAVAL
STEAM TURBINE CO.
TRENTON, N. J.



SOLD
FOR DEPENDABLE
DEWATERING
MINE SERVICE

DEPENDABLE, low cost mine dewatering service demands correctly engineered pumping equipment. Deming Turbine Pumps are built to exacting specifications. Such features as *water lubrication, cutless rubber bearings and adjustable impeller clearance* contribute to the dependable, low cost performance of Deming Turbine Pumps.

Standard pump bowls are cast iron but for acid conditions, pump bowls of bronze or other corrosion-resisting alloys are furnished. Write for Deming Turbine Pump Catalog.

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THE DEMING CO. • SALEM, O.



Economy

VENTILATION in LOW COAL

Mine-Vent Flexible Tubing assures positive, economical air supply. Couples to standard blower fan. Quickly installed or reclaimed by unskilled labor. Suspends from rib or roof. Patented airtight coupling permits use of odd lengths—saves time and material. Terminal folds back for shooting. Processed fabric resists water, powder fumes, fungus, acid.

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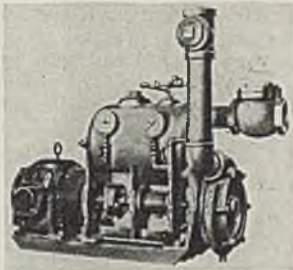
WHAT'S NEW



In Coal-Mining Equipment

SELF-PRIMING PUMP

Barrett, Haentjens & Co., Hazleton, Pa., offers the Hazleton "Auto-Pump," which it describes as providing in one compact unit a high-grade pump and a priming tank adaptable to full-automatic control. An outstanding feature is that only a portion of the air handled during the priming period passes through the pump, as the greater part is expelled from the priming tank directly



into the discharge line. The priming tank retains sufficient water to prime a short suction line. Repeated starts are necessary to prime long suction lines, the number depending upon the length of the line and the suction lift. A very high vacuum can be obtained, it is said.

Once primed, the pump will hold the prime for days, the company points out, because it is under pressure when standing idle and air cannot leak into the casing through the stuffing box. The priming cycle can be controlled manually or automatically. "Auto-Pumps" are available in six sizes, 1 to 15 hp.; 1,800 and 3,600 r.p.m. The pump end is available in any desired alloy.

GATHERING TRACTOR FOR 30-IN. COAL

A new pneumatic-tired gathering tractor for automotive haulage systems which will operate in seams as low as 30 in. is announced by the Baker Industrial Truck Division of the Baker-Raulang Co., Cleveland, Ohio. This new tractor, it is stated, is adapted to

hauling pneumatic-tired hopper cars from loading machines at the face to transfer stations and has been designed particularly for the system of mechanical mining developed by J. H. Fletcher, consulting engineer, Chicago (*Coal Age*, January, 1938, p. 47).

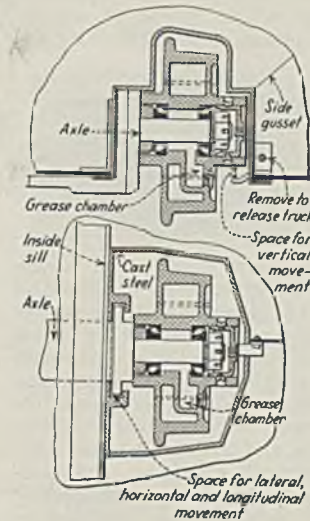
This new tractor is powered by storage batteries and operates on mine floors without tracks or other roadways. It is asserted by the manufacturer that this haulage equipment will reduce the idle time of the loading machine and will materially increase the tonnage per man-shift.

POWER SHOVEL

Bucyrus-Erie Co., South Milwaukee, Wis., announces the 33-B 1½-cu.yd. excavator, which is convertible for shovel, dragline, clamshell, crane or dragshovel service. Modern alloy steel and welded construction have been used, according to the company, to produce a machine combining smooth operation, high speed, high mobility and ample strength for steady, dependable service in the heavy digging expected of a machine of this size. Gasoline, diesel or electric power is available.

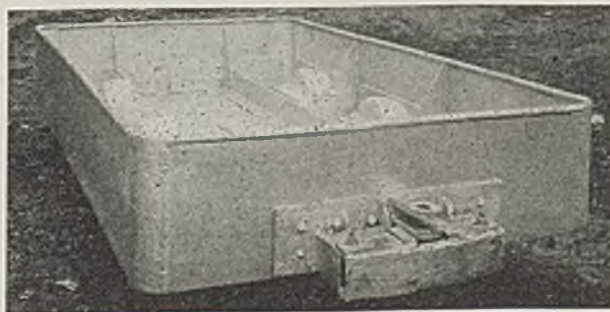
MINE-CAR KIT

Long Super Mine Car Co., Inc., Fayetteville, W. Va., now offers a "kit" of parts from which its improved drop-axle all-steel cars can be built in any mine shop with welding and cutting equipment. The use of rounded cast-steel ver-



ticals for body corners and standard pipe for the roll at the top edge of the body are declared to be the essence of the design wherein all other plates and shapes are cut square, thus making for low cost. Another advantage cited is spreading the cost of construction over a period of time by building cars "so many per month" from parts and materials carried in stock.

A rectangular-shaped body and closeness to the rail, together with a special axle construction and a minimum deduction for wheel hoods, are stated to result in maximum capacity. The manufacturer cites an instance wherein a car (shown in an accompanying illustration) with the same over-all dimensions, except that the width was 7 in. less, averaged 4.1 tons per



dump, as compared with 3.1 tons for the other cars at the mine. Design of the new wheel hoods is shown in an accompanying sketch. These, with a new axle retainer, are major improvements in the original Long drop-axle unit. The new cars have spring draft and buffing gear, and among the other advantages cited for them are safety, simplicity in construction, strength, durability and decreased draft.

INSULATORS

Two strong suspension insulators, one of petticoat design and one with a smooth disk, are offered by the Ohio Brass Co., Mansfield, Ohio. These insulators, known as "Huskitypes," are said to be made with high-impact resistance to minimize breakage from various forms of missiles and from possible rough handling during shipment and installation. The petticoat-type is intended for use on lines subject to rock throwing and which demand an insulator with standard flashover values and full leakage distance. The



other type, designed to deflect missiles from its smooth under surface without damaging the insulator, is for use on lines subject to gunfire. The elimination of the petticoats lowers the standard dry and wet flashover values only slightly, it is stated. Although these insulators are special types, they possess the same mechanical and electrical characteristics as the standard O-B suspensions. Both types have a 10-in. disk and a 15,000-lb. M. & E. rating, and are available with either a 5- or 5½-in. spacing. The 5-in. units have a socket cap and ball pin, while the 5½-in. insulators can be furnished with a socket cap and ball pin or a clevis cap and pin.

For satisfactory performance



when exposed to fog or contaminating influences such as smoke, dust, cement, salt, oil spray and chemicals, Ohio Brass has developed the "Smog-type" suspension insulator. Distinctive features are a long leakage distance, petticoating exposed to the weather, wide spacing between the outer petticoats, a deep metallized inner petticoat for flux control, a recessed cement matrix between porcelain and pin, a coupling arrangement which saves space and protects the cap from water dripping from the unit above and high-strength sections. The results are said to be high surface resistance, self cleaning of exposed parts, freedom from radio interference, high resistance to corrosion, liberal clearances between units, high string length efficiency and less breakage from mechanical impacts. The "Smogtype" has a dry flashover value of 105 kv., a wet flashover value of 55 kv., a dry arcing distance of 9.6 in., a wet arcing distance of 4.7 in. and an M. & E. rating of 15,000 lb. It is available with a socket cap and ball pin or with a clevis cap and pin.

Provided with clamps for holding the conductors in position, a line of three pin-type insulators developed by Ohio Brass is said to eliminate completely the need for tie wires.



In addition to this feature, these insulators, known as "Clamp tops," are described as free from radio interference at voltages 1.4 to 3 times normal line-to-ground voltages. "Clamptops" have approximately the same cantilever strengths, flashover values and leakage and arcing distances as the standard O-B multipart pin types. The three sizes have 10½-, 12- and 13½-in. diameters, and are for ordinary

line voltages of 34.5, 46 and 69 kv., respectively. Two sizes of clamps can be furnished which, with the reversible keeper piece, allow the insulators to accommodate any conductor from ¼ to 1 in. Both clamps fit the three insulators, permitting complete interchangeability.

Supplementing its copper-coated radio-interference-free pin-type insulators, known as "Silentypes," Ohio Brass has brought out a complete line of these insulators with aluminum-coated heads. The new design, according to the company, is intended for operators who might prefer to use an aluminum-headed insulator for



aluminum conductors. Radio-interference levels are from 1.4 to 3 times the line-to-ground voltages, providing a wide margin of protection over service voltages. The aluminum-coated "Silentypes" have the same flashover values, leakage and arcing distances, mechanical strengths, and positive adhesion of metal coating to porcelain as the copper-coated insulators. They are available in five multipart sizes, with metal or sanded pin hole, and three unipart sizes with metal pin hole. The manufacturer recommends their use only with aluminum conductors.

RAIL BENDERS

Tallman Mfg. Co., Shelbyville, Ill., offers "Talley" aluminum-alloy rail benders for rail weights of from 12 to 80 lb. per yard, both single- and double-acting types, with the exception of one Samson type for 40- to 80-lb. rail. Frames, according to the company, are adaptable to either push or pull work by equipping them with the proper number of thrust bearings and a particular type of screw. Timken bearings are used throughout, and hooks are formed on a radius at the points which contact the rail in either push or pull bending, thus tending to reduce friction and increase efficiency. The nut for operating the screw is constructed so as to permit one complete revolution with only five insertions of the bar instead of the usual six.

Models and weights are as follows: 12- to 30-lb. rail—Model 30-S, single-acting, 21½ lb.; 30-D, double-acting, 23 lb.;



20- to 40-lb. rail—40-S, single-acting, 26 lb.; 40-D, double-acting, 27½ lb.; 40- to 80-lb. rail—Model 80, Samson type, 43 lb. Any model, according to the company, can be transported and operated by one man.

AIR FILTER

Northern Blower Co., Cleveland, Ohio, offers the new "Norblo" square-type air filters for dust collection in preparation plants and other places where dust is a problem. Like the round filters of the same company, the new units are designed for continuous automatic operation. They are built up in compartments, each



furnished with an efficient shaking and air-reversing mechanism to keep the filtering cloth clean at all times.

GALVANIZED SHEET

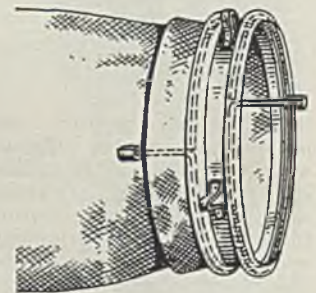
American Rolling Mill Co., Middletown, Ohio, announces the development of a galvanized sheet with a heavy coating of commercially pure zinc that will not crack or peel when subjected to relatively severe drawing or forming oper-



ations. The new material, produced both in sheets and coils, is designated as "Zincgrip" and is said to carry 50 to 75 per cent more protective zinc than tight-coat sheets generally used for fabricated products. "Zincgrip" from 16 to 28 gage, is available in any of the basic grades of galvanized iron or steel sheets and strips manufactured by Armco. According to the company, the highly protective coating and ability to withstand a heavier draw make "Zincgrip" attractive for many kinds of fabricated products where resistance to corrosion is desirable.

DUCT COUPLING

An improved coupler for flexible ventilating ducts has been brought out by the American Brattice Cloth Corporation, Warsaw, Ind. Basically, the coupling is the same as the company's "Mine-Vent" unit, with improvements, it is stated, to simplify the device, make it easier to install and remove and give a tighter seal against leakage. Size and tension of the binder ring have been increased. The grooves of the coupling ring have been enlarged and deepened to provide more gripping area for the ring and thus give the coupling greater tensile strength



when in place. Lateral projections on the binder ring serve as convenient handles and make it possible for the installer to place the ring or remove it without tools or danger of finger injuries.

EXCAVATOR

Harnischfeger Corporation, Milwaukee, Wis., offers the new P&H Model 555 excavator with a capacity of 1¼ cu.yd. Features cited by the company include: high speed, instant response to controls, snappy starting, stopping and reversing, ability to turn in a very small space, positive chain crowd, alloy-steel all-welded construction to reduce weight and increase working strength, and tractor-type crawlers. Gasoline or diesel power is available, and the unit is said to be fully convertible.