# COAL AGE

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

SYDNEY A. HALE, *Editor*

New York, February, 1933

## "Watchman, What of the Night?"

RECAPITULATION of industrial developments during the third year of the most severe depression in the experience of the present generation of business men is not a cheerful task—if the examination is confined to the superficial and the obvious. Declining production, falling prices, beggared capital and labor in many sections denied the opportunity of regular employment at meager wages make up a pattern all too familiar for peace of mind. In the case of coal, the pattern is in no sense one of its own design, but has been imposed upon it by conditions in other industries to which it must sell its product.

Yet, even in these common woes, coal has suffered much less in recent years than many other basic industries. Production 58.3 per cent of the boom 1929 figures was a record not a few industries have reason to envy. Although bituminous price levels were unsatisfactory, here too, largely because drastic liquidation began long before the 1929 débâcle, the decline, precipitous as it was, nevertheless was less marked than in many other lines of commercial activity.

When the survey goes beyond these common ills and probes into what coal is doing to meet changing conditions, however, the study becomes a record of solid achievement and substantial promise for the future. Wearied warriors may falter or halt, but progressive management is attacking on all fronts. Courageous leadership knows that tomorrow's battles are won by today's planning—and is acting on that knowledge.

Just what does the record show? It shows accident-prevention work, despite the tragedies of last December, establishing a new low level for comparison; the anthracite industry making real headway in cost reductions through greater underground mechanization; a bituminous research program directed and controlled by the industry itself on the rim of reality; fresh and searching exploration of old and new roads to modernization; intensified merchandising activities reflected in interest in greater refinements in preparation; an increasing percentage of the output of the country loaded mechanically. These achievements and others set out in more detail in the pages which follow give real evidence that leadership in coal is not on the retreat.

## A New Philosophy

FORMAL ATTACK on the reasonableness of the general level of transportation charges on basic commodities, made in the joint petition filed last month with the Interstate Commerce Commission by the National Coal Association and allied agricultural and lumber interests, marks a striking departure from traditional attitudes. In the past, group action on freight rates by coal operators has been directed primarily against rate relationships—a form of attack in which patently an organization representing all producing districts could not participate. Now individual group differences temporarily are submerged to meet a common peril.

The present plight of the carriers is one to

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evoke the sympathetic concern of all who recognize the part railroad transportation plays in the economic life of the nation. But, can the railroads be saved by permitting the maintenance of rate levels which destroy sources of traffic? That, bluntly, is the question which these joint petitioners have asked the Commission to decide.

## Chasing Its Tail

WITH AIR at atmospheric pressure everywhere over the top of the mines, why take air back two, three, four or even five miles, almost to the point from which it was taken, with risks of leakage and possibilities of a recirculation when discharged from the mine?

In thin seams, the long room headings, even though driven full height at great expense, have needed booster fans to carry air to the face. In such mines, if the cover is not thick, or if topography favors, shafts and fan drifts should be used to cut out the resistance of carrying air back to a shaft near the mine entry. Thus the travel of the air would be halved by the elimination of the return and the resistance much reduced by using both headings of the main entry as intakes. Overcasts would have to be eliminated, so the method might be undesirable where gas is present.

Our ventilation systems need revision now that, with mechanical aids, we can drive tunnels more rapidly and concentrate our coal-getting facilities at a few points.

## Where the Furnace Heat Goes

NO EFFORT has been made to find how much of the heat of anthracite travels from it as radiance and how much as the heat of warmed gas, or how much of this latter heat the water of the furnace actually receives. Observation, however, shows somewhat conclusively that with a well-covered fire nearly all the heat is radiant heat and little is convective, and that of that little, the fire receives a mere modicum. But actual measurements would be so much more convincing! In fact, such data might make furnace makers anxious to capture more of the convective heat or to relinquish all attempt to get any of it and to spend the money thus saved in enlargement of the furnace capacity, where the coal could be burned so slowly as to give nothing but radiance of an effective kind.

The study might show that the use of larger sizes of anthracite and a deep fire conserves heat, if it does not reduce operating costs. It might suggest other arrangements of the stoker and gravity-feed furnaces that would make a better use of radiant heat. It might show that with a standard furnace less economy of heat is obtained with a firepot of large horizontal dimensions than with one that is small, or that the firepot walls of empirical thickness are too thick for economical operation. The studies are all well worth while and are needed for a clear understanding of the mechanism of combustion of the domestic furnace.

## Recognizing Competition

RECENT DECISIONS of the Interstate Commerce Commission involving Illinois intrastate coal rates and charges from Illinois, Indiana and western Kentucky to trans-Mississippi destinations emphasize the inroads of new forms of competition. In the Illinois case, 188 I.C.C. 342 and 683, it is the growth of motor-truck haulage of industrial coal which moves the Commission to reconsider earlier findings, 182 I.C.C. 537 and 603, and grant the railroads permission to lower their rates. In the second case, 186 I.C.C. 697, natural-gas competition hitting both the railroads and the coal operators gives rise to an appeal for permission to meet this competition without observing the long-and-short haul provisions of the interstate commerce act at intermediate points.

The railroads asked for the right to reduce rates on fine coal both to points at which natural gas was available and to points at which such fuel was being contracted for or to which pipe lines had been planned: the Commission granted relief, involving reductions of 31 to 53c. per ton, only to points actually served by pipe lines. This limitation seriously jeopardizes the business of carriers and coal mines. As Commissioner Tate remarked in dissenting from this phase of his colleagues' decision: "The time to act, if the rail carriers are to be benefited, is before the traffic has been lost by reason of contracts [for gas] possibly to run over a long period of time, rather than to wait until the traffic is lost."

# +COAL INDUSTRY

## Widens Battle Front in War Against Competition

WITH declining demand and the increased pressure of substitute fuels forcing still further liquidation of capacity, both the anthracite and bituminous divisions of the coal industry intensified efforts to secure some measure of profit from available business and strengthen defenses against other fuels. The drive for lowered production costs continued unabated, as indicated in other articles in this issue, and was paralleled by heightened interest in measures for relief from internal and external competition, the extension of old markets and the development of new outlets.

Bituminous coal production dropped from 382,089,000 net tons in 1931 to 305,677,000 tons in 1932, according to preliminary estimates by the U. S. Bureau of Mines. Although the 1932 production was the lowest since 1904, when 278,660,000 tons was produced, the percentage of decline from the 1929 output —42.9 per cent—was materially less than that recorded for most other major industries. Anthracite tonnage, too, on this basis held up remarkably well.

As in other depression years, the major part of the bituminous decline, according to available figures, was due to decreased industrial consumption. Railroads, which normally consume about 24 per cent of the country's output as locomotive fuel, used only 66,200,000 tons of soft coal in road-train and yard-switching service in 1932 (estimated), a decline of 18.5 per cent from the 1931 total of 81,232,000 tons. Public utilities, normally taking about 11 per cent of the annual output, consumed 30,328,000 tons last year, against 38,734,000 tons in 1931, a decrease of 21.7 per cent.

Production of pig iron and ferroalloys, which ordinarily absorbs about 10 per cent of the normal output, required only 17,000,000 tons (estimated) in 1932, a drop of 38.8 per cent from the 1931 figure of 27,800,000 tons. Total consumption of these three industries, representing about 45 per cent of the production and 60 per cent of the industrial consumption in normal times, was only 113,341,000 tons in 1932, a drop of 23.3 per cent from the 147,766,000 tons in 1931 and 49.3 per cent from the 222,939,000 tons in 1929, indicating clearly that the industry may expect to regain a substantial block of tonnage with any increase in industrial activity.

While no data are available for the purpose of making comparisons, it appears that domestic consumption of bituminous coal also suffered in 1932, due to the decreased income of the householder and warmer-than-usual weather. This is borne out by widespread reports of reduced buying, doubling up of families, and the use of wood and corn in many districts.

Although the anthracite division, as usual, fared somewhat better than bituminous, due to the stabilizing effect of the normally large percentage of shipments that goes into the domestic trade, warm weather, decreased buying power and the competition of substitute fuels and foreign coal nevertheless took an added toll in the past year. Production dropped to 49,350,000 net tons in 1932, a decline of 17.3 per cent from the 1931 total of 59,646,000 tons. From 1929 to 1932, production dropped from 73,828,000 to 49,350,000 tons, a decline of 33.1 per cent.

Spot price movements in the bituminous markets of the country indicate a further material drop (probably 10 to 15 per cent) in the average realization per ton in 1932. Anthracite prices also were revised downward $1 per ton on domestic sizes in February, 1932, and widespread complaints indicated that even these lower quotations were being shaded.

Intensification of inter- and intra-district competition in the bituminous industry in 1932, growing out of the further decline in consumption, resulted in additional wage reductions in practically all of the non-union fields, and these were paralleled by concessions in the remaining union districts. This liquidation, however, was not accomplished without widespread labor difficulties growing out of the effect of decreased wage rates and curtailed working time on the miner's pay envelope.

Of the non-union fields, Ohio probably was hit hardest by a seven-months' strike ending Sept. 18, which covered the majority of the producing districts. Union recognition and wage reductions were the principal causes. The miners, however, were unable to obtain union recognition, though they received a stabilized wage and other concessions. Other non-union districts affected by strikes and attendant disorders in 1932 included parts of western and central Pennsylvania; eastern and western Kentucky. After prolonged campaigns accompanied by considerable violence, the United Mine Workers was able to reestablish itself in Arkansas and parts of Oklahoma and Missouri in 1932.

In the union fields in 1932, interest centered on the efforts of Illinois and Indiana producers to secure wage concessions from the United Mine Workers. As a result of preliminary disagreements, all union operations in these states closed down on April 1, except for a few which continued to run on temporary agreements. The union capitulated in Illinois on Aug. 10, and agreed to a new scale carrying basic rates of 68c. per ton for pick mining (Danville district) and $5 per day for tracklayers and timbermen. The old rates were: pick mining, 91c.; tracklayers and timbermen, $6.10. The Indiana union agreed to a 25 per cent reduction on Sept. 10, bringing the pick mining rate down from 91c. to 68c. per ton and the inside day rate down to $4.57½, against $6.10.

Dissatisfaction with the action of union officials in signing the Illinois scale after referendum difficulties led to the formation of the Progressive Miners of America. The success of this organization in stopping work in several Illinois districts finally resulted in its acceptance by a number of operators, southern Illinois excepted, with the result that it controlled about 25 per cent of the Illinois tonnage at the end of the year. Reduced scales also were accepted by the United Mine Workers in southern and northern Wyoming, Washington and Montana in 1932.

While yielding in the bituminous fields, the United Mine Workers refused any concessions to anthracite operators, who applied for relief late in 1932. The joint meeting got under way on Sept. 6 and ended Oct. 4. No definite reduction was proposed by the operators, and the question finally went to a board of arbitration chosen on Nov. 3. No decision had been announced up to the beginning of this month.

The bituminous industry in 1932 intensified its search for relief from wage, market and price disorders growing out of unrestricted competition, and at the same time turned its attention to warding off legislative proposals designed to place control of the industry in the hands of the federal government. The sales agency plan adopted by representatives of the bituminous industry in December, 1931, was the focal point of the majority of these efforts, with Appalachian Coals, Inc., as leader in the fight.

Organization of Appalachian Coals was completed in March 1, with 70 per cent of the commercial tonnage in the eight high-volatile fields of southern West Virginia, Virginia, Kentucky and Tennessee signed up and 10 to 12 per cent more promised. No attempt was made to operate, however, in view of notice by the Department of Justice of intention to start suit under the provisions of the Sherman Act. As a result of this notice, organization of similar agencies was held in abeyance in western Kentucky, the low-volatile fields of southern West Virginia, northern West Virginia, central Pennsylvania, western Pennsylvania, Ohio, southern Wyoming, and Colorado and New Mexico.

Trial of the Appalachian Coals case got under way Aug. 1, and an adverse decision was handed down on Oct. 3, though the court decided that the sales agency's control of production and markets would not be monopolistic, and suggested that the defendants seek legislative relief from the distress conditions brought out at the hearings. Hearings on the appeal to the Supreme Court ended Jan. 10, 1933.

• While holding steadfastly to its contention that the sales agency plan is legal, the bituminous industry also moved for the adoption of legislation to permit cooperative marketing. At a series of conferences which began in December and still continue, bituminous representatives proposed that the natural-resource industries (anthracite and bituminous coal, oil, copper and lumber) press for the adoption of legislation modeled after the Capper-Volstead Act, which exempts agriculture from the provisions of the Sherman Act to permit cooperative marketing.

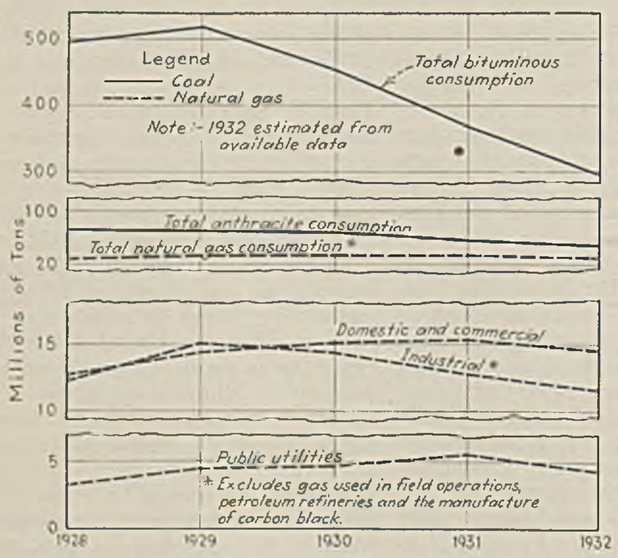
The bituminous industry was again called upon to fight federal control in 1932 as the result of the introduction of identical bills in Congress by Representative Kelly and Senator Davis, Pennsylvania. Both bills, among other things, provided for the appointment of a Bituminous Coal Commission and the legalization of marketing pools, but restricted the right of coal companies to operate non-union by refusing licenses to these companies to ship in interstate commerce. Hearings on the Davis bill, which began before a Senate subcommittee on March 14 and ended June 2, showed that some operators were in favor of some form of federal control, though not necessarily the Davis-Kelly coal bill. The majority, however, opposed the bill unqualifiedly, and as a result of their criticisms, the sponsors amended their measures to meet some of the outstanding objections, though the labor features were retained. No action was taken on either bill, in the session of Congress which adjourned last summer, but the sponsors announced that they would be introduced in future sessions.

Still another coal control bill, modeled on the British Coal Mines Act of 1930, was offered by Representative Lewis, Maryland, to apply to both the anthracite and bituminous industries. The bill, however, never came to a vote, though an explanation of its provisions by the author in December induced members of the American Mining Congress to recommend a study of the workings of the British act as a basis for action on "similar bills now under consideration" in this country.

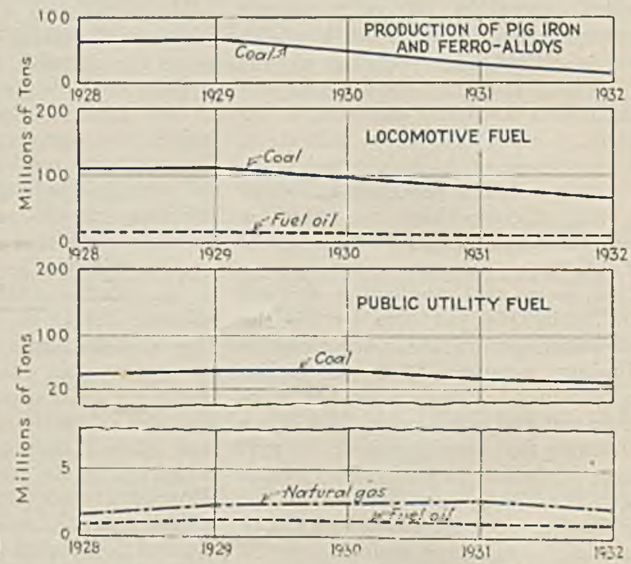
To protect the home market, both the anthracite and bituminous industries backed measures for a tariff on foreign coal and fuel oil. As a result, excise taxes of 10c. per 100 lb. on imported coal and coal products and ½c. per gallon on imported fuel oil were adopted by Congress early in the year. The anthracite industry later opened a campaign for still higher import taxes on coal to compensate for the depreciated currencies of countries exporting to the United States.

The rising tide of dissatisfaction among bituminous operators with the large percentage of delivered prices absorbed by freight rates was translated into positive action for reductions in December, 1932, and January, 1933. In a statement presented to the National Transportation Committee on Dec. 31, the National Coal Association declared that high delivered costs were responsible for large losses to competing fuels and sources of energy, and that a readjustment of transportation charges would help both the coal industry and the railroads by increasing consumption.

The National Coal Association took a still further step in this direction by joining with farmers' and lumber manufacturers' associations in a petition for a general reduction in freight rates on basic commodities, which was presented to the Interstate Commerce Commission on Jan. 25, 1933. The surcharge of 6c. per ton, an outgrowth of the gen-




Consumption of Coal and the Coal Equivalent of Natural Gas for the Five Years 1928-32




Consumption of Coal and the Coal Equivalent of Other Fuels in Certain Industries eral increase of 15 per cent in freight rates granted by the commission early in 1932, also came under the fire of a number of operators' associations and individual producers.

While the anthracite industry has for some time been considering a request for a general reduction in rates on hard coal, no group action was taken last year. The Delaware, Lackawanna & Western Coal Co., however, filed a petition with the Interstate Commerce Commission on Jan. 28, 1933, requesting a general reduction in anthracite freights to combat bituminous coal and substitute fuels.

Trucking of anthracite and bituminous coal showed a further major increase in tonnage handled and length of haul in 1932. In addition, trucking, formerly largely confined to domestic sizes, was extended to steam coal last year. While the major bituminous movement still is confined to areas within 50 miles of the mines, according to a survey by the National Coal Association, hauls of 100 miles are frequent, and in some cases extend up to 200 to 300 miles. Even the latter distances may be increased, due to the interest in return loads of coal manifested by certain trucking firms specializing in long-distance hauling. Character and responsibility of the firms engaged in trucking is steadily improving, the association finds, and in some instances mining companies are re-equipping tipples solely for trucking business.

Areas in which trucking of bituminous coal showed a major increase in 1932 included: New England, Alabama, central and western Pennsylvania, Ohio, Indiana, Illinois, North Dakota, Missouri, Arkansas, Oklahoma, Colorado, New Mexico, Utah, Wyoming and Washington. Trucking of anthracite was most active in eastern Pennsylvania, though southern New York and parts of New Jersey, Delaware and Maryland also were affected. Some rate reductions were made in New England, Illinois and Colorado in 1932 to meet the situation, and retailers continued their drive for the passage of city ordinances to curb trucking.

Fuel oil continued its gains in the domestic and commercial markets in 1932, though at a lower rate. Sales of domestic oil burners are estimated at 86,000 in 1932, against 110,000 in 1931. Installations of commercial burners increased from 42,400 on Jan. 1, 1932, to 44,800 on Jan. 1, 1933. One feature of the past year was the increased activity in the installation of distillate burners on ranges, water heaters and similar equipment. An estimated total of 220,000 range-burner units was sold in 1932, against 140,000 in 1931. Total sales of all distillate burners was 280,000 in 1932.

Consumption of fuel oil by railroads and public utilities showed declines in 1932, but not to the same extent as coal. Steam railroads used 1,750,000,000 gal. (estimated) in road-train and yard-switching service last year, a decline of 12.2 per cent from the 1931 total of 1,992,000,000 gal. Coal consumption declined 18.5 per cent. Public utilities burned 8,123,000 bbl. of fuel oil in 1931 and 7,775,000 bbl. in 1932, a drop of 4.3 per cent. This compares with a decrease of 21.7 per cent in coal consumption. Fuel oil used by both the railroads and utilities dropped 10.9 per cent in 1932, against a decline of 19.5 per cent in coal consumption.

Natural gas also increased its participation in the fuel market of the country in 1932, though the actual volume declined, according to available figures. Domestic and commercial consumption dropped from 380,897,000,000 cu.ft. in 1931 to 364,000,000,000 cu.ft. in 1932 (estimated), or 4.4 per cent, while consumption by industry (excluding field operations, petroleum refineries, manufacture of carbon black and public utilities) declined to an estimated total of 290,000,000,000 cu.ft. in 1932, a drop of 10.1 per cent from 322,700,000,000 cu.ft. in 1931. The most severe decline in natural gas use (23.4 per cent) occurred in the public utility industry, where consumption decreased from 139,328,000,000 cu.ft. to 106,566,000,000 cu.ft.

Total consumption of natural gas (domestic and commercial, industrial and public utility) dropped from 842,925,000,000 cu.ft. in 1931 to 760,566,000,000 cu.ft. in 1932 (estimated), or 9.8 per cent. Relative consumption of coal and the coal equivalent of fuel oil and natural gas for five years is shown graphically on p. 36.

Natural-gas activities in 1932 were confined largely to the development of new markets. Major construction in 1932 included a pipe line from the Tioga field of Pennsylvania to Syracuse, N. Y., and an 80-mile 12¾-in. line in California. Elsewhere, work was confined largely to connecting in new communities, especially in the Middle West, South, Southwest, Rocky Mountain states and California.

Both the anthracite and bituminous industries met the added pressure of competitive fuels by intensifying merchandising and research work. The attention of both industries turned more and more to those parts of their merchandising programs dealing with substitutes, and the advantages of coal appeared more frequently in sales talks and advertising.

Research work by the Anthracite Institute in 1932 covered merchandising, extension of anthracite utilization, and combustion, and included the following problems: analytical studies of retail selling, costs and profits, including distribution from the operator to the dealer and the dealer to the consumer; combustion and heating; possible new market territories; and new uses for anthracite. Among the results of the institute's work, which includes the testing, approval and development of heating equipment and controls at its Primos (Pa.) laboratory, was the development of a new anthracite gas machine.

The work of the institute was supplemented by the efforts of individual producers. Several companies continued the development of heating equipment, controls, and combustion methods in 1932, and the Jeddo-Highland Coal Co. brought out a new anthracite-burning range, designed not only for cooking but also for heating a six-room house, humidifying the air and supplying hot water.

The increased interest of bituminous operators in the formation of centralized research facilities for extending the use of soft coal culminated in the adoption of plans for a research laboratory by the research committee of the National Coal Association in December. A charter for Bituminous Coal Research, Inc., will be secured in February of this year, according to plans, and this organization will be in charge of a program of research, national in scope, for fostering the utilization of both domestic and industrial coal.

One cheering item in the 1932 market situation was the comparative stability of domestic stoker sales,. Total sales of domestic stokers were 6,783, against 6,915 in the same period in 1931, according to the reports of 55 manufacturers to the Bureau of the Census. Sales of other classes of stokers, however, dropped off in 1932 in response to decreased building and industrial activity. Comparative sales for the four principal classes of stokers in the first eleven months of 1931 and 1932 are shown in the accompanying table.

The year 1932 also was characterized by increased interest of coal companies and equipment manufacturers in the development of puverized-coal burners for household use. So far, however, the work has been confined largely to development, though a few installations are in actual operation.

**Comparative Stoker Sales**

| | Number Sold 1931 | Number Sold 1932 |
|---|---|---|
| Class 1[1] | 6,915 | 6,783 |
| Class 2[2] | 1,520 | 916 |
| Class 3[3] | 1,223 | 585 |
| Class 4[4] | 2,463 | 1,287 |

[1]Residential (capacity, less than 100 lb. of coal per hour). [2]Apartment house and small commercial heating jobs (capacity, 100 to 200 lb. of coal per hour). [3]General commercial heating and small high-pressure steam plants (capacity, 200 to 300 lb. of coal per hour). [4]Large commercial and high-pressure steam plants (capacity, over 300 lb. of coal per hour).

# + SKILLFUL PLANNING

## Opens Way to More Profitable Anthracite Operation

By JAMES H. PIERCE
*James H. Pierce & Co.*
*Scranton, Pa.*

THE ABILITY of the anthracite industry as a whole to operate on a profitable basis is closely linked with the general economic outlook for the future. Basically, all industries are suffering from the diversion of capital credit from industry to the support of local, state and federal administration. Industry cannot continue to compete with government for available funds, and as long as this competition continues, there can be no progress. Money has taken flight from industry and is piling up in large city banks and is not available to industry for long-time credits, consequently capital improvements are practically at a standstill.

There seems to be two outlets: (*a*) Either we must reduce municipal, state and federal expenditures or (*b*) have government borrow more than ever and loan it to industry to revitalize it.

The first is undoubtedly sound and will preserve our traditional methods of transacting business; the second is the road to socialism with its unproved theories and lack of a practical background of success. Not only must government economize but those industries which expect to survive must put their house in order.

The anthracite wage structure is out of balance with wages paid in other industries, and anthracite operators must face this courageously or their markets will continue to shrink. They owe it to themselves, their employees, to local communities and indeed all their customers, to adjust wages to present conditions. If they fail, the miner, who is now the aristocrat of wage earners, will go the way of stone masons, who maintained high wages only to be replaced by common laborers and a concrete mixer.

There is a happy medium where mine owners and workers both may prosper, and intelligent labor leadership should cooperate to determine where the equitable wage level should be stabilized. In the meantime, the mining industry, seeking to preserve itself, attempts to solve the problem by economizing on the use of labor, and pours badly needed capital into improvements to further replace labor. Until a general policy is decided upon, each company will attempt to work out its own salvation, and those who obtain lowest costs will have the best chance to survive.

The writer approaches this task of outlining the principles of profit-planning work with the full knowledge that practically all methods sketched herein are known and used by progressive mining companies in whole or in part, in one form or another, but it is believed that most companies do not attempt to carry out the various studies in the degree of detail which we have found essential to the develpoment of all pertinent facts.

In times of prosperity, management is not hard pressed to show results, and the incentive is not sufficiently urgent to explore every avenue of expense thoroughly to see where economies may be effected. In times of adversity, management is prone to prune down quickly that part of the operating, technical and clerical staff which is regarded as dispensable, and to cut heavily into the salary schedules of those who, with a depleted force, must carry a heavier burden of work than when profits were flowing freely. Thus the incentive provided the administrative staff to economize springs largely from their fear of losing their jobs or having salaries reduced if results are not satisfactory.

This process should be reversed, and intensive operating studies should be made of every element entering into production cost at a time when the companies can afford to maintain an organization for this purpose. This organization, if of proper caliber, can easily justify its expense, not only in prosperous times but in periods of depression as well.

I. ORGANIZATION STRUCTURE AND POLICIES—Since the human element is of profound importance, the first step in analyzing any business is to see how its organization structure is built up to capitalize human values and to take advantage of the constructive, creative and united efforts of employees and officials. A study of the organization charts of many coal companies reveals a faulty structure which causes mistakes in transmitting and interpreting orders, and prevents the proper upward flow of accumulative information and ideas which under-officials and workmen would like to bring to the attention of the higher management. Departmentalizing is frequently carried to extremes, resulting in an improper sense of proportion and balance to the objective to be obtained.

Certain organizations are what may be termed the "military type," where decisions are made at the top and passed down to the organization without comment or explanation. Little authority is granted under-officials in the exercise of reasonable judgment. This type of organization does not stimulate the officials or employees to make suggestions. The organization chart must be designed to allocate responsibility and authority properly and define the latitude of various officials.

Having established a proper organization structure and methods, and assuming the personnel is satisfactory, the question of the proper training of the organization is the next logical move. An important step is to take the mystery out of management by furnishing subordinate officials with all the necessary information to run their part of the job well, and to see that they understand its importance in relation to the operation as a whole. Whenever possible, officials should be made acquainted with the aims and purposes of the management, and the reasons for various lines of effort, so that they are not compelled to work blindly.

Knowing the purpose, they can and will work with a better understanding and spirit, and instill that spirit in all connected with the work. The creation of a friendly as well as respectful relationship in any organization from top to bottom, should and will produce better results.

It is particularly important to recognize that the sectional foreman is the key-man in any program. He has direct daily contact with the workmen. To them he represents the company, and if he does not understand the company's plans and policies, he cannot interpret them for the employees. He should be supplied with certain cost data, information on car yield, topping, prepared sizes, production per man-hour, material costs, accident records, etc., in a form he can readily understand. Efforts should be made to give this information by "units of work performed" rather than on a per-ton basis, as it is difficult for a sectional foreman to relate "per-ton" costs to his particular work. At the monthly staff meeting, the records of sectional foremen should be set forth in comparative form, thus creating a healthy spirit of rivalry.

II. Methods of Recording and Interpreting Results—The function of management is to plan the result in advance rather than explain the result afterward. There is a great tendency to gather statistics rather than essential facts. This results in a multitude of meaningless time-wasting reports which make clerks out of high-priced officials.

To determine what data should be secured and how to interpret them, one must know how to allocate the proper weight to individual items that make up a cost statement. Anthracite cost statements differ greatly, due to the various depths of mines, the quantity of water to be pumped, the thickness of veins, quantity of timber required, and for many other reasons. In general, however, one may consider that costs will come roughly within the following general limits, each item being expressed as a percentage of the total cost of production:

| | Per Cent |
|---|---|
| (1) Mining, loading, timbering | 38 |
| (2) Transportation and hoisting | 9 |
| (3) General inside force | 8 |
| (4) General outside force | 9 |
| Total labor | 64 |
| (5) Power | 5 |
| (6) Supplies | 11 |
| (7) Royalties | 6 |
| (8) Administrative salaries, taxes, accident and general insurance, depreciation and depletion | 14 |
| | 100 |

III. Detailed Face Studies—From the foregoing percentage table, it may be seen that most attention should be devoted to Item No. 1, "Mining, Loading and Timbering." This cost is roughly divided into (*a*) face cost and (*b*) development cost. Development cost may be normally expected to vary from 20 to 25 per cent of the total mining cost, so that the major opportunity for economies in Item No. 1 rests with the face cost.

To secure a proper face cost requires a concentrated mining plan and a careful study to determine whether maximum performance is being secured from men and equipment. Among the studies necessary to bring out all of the vital facts are the following:

(*a*) *Production per man-hour.*

(*b*) *Refuse cleaning at the face.*

(*c*) *Timbering methods.*

(*d*) *Safety methods* (to reduce cost, lessen labor turnover, and yield uniform production).

(*e*) *Shooting methods* (to determine their effect on yield, prepared sizes and refuse cleaning).

(*f*) *Time Studies* (to determine the degree of service which the company organization is rendering to the coal producer. This will include time studies of mining machines, mine cars, and of the face producer, to determine the avoidable delays; also such additional information as will show whether the electric power, compressed air service, etc., is functioning to best advantage).

(*g*) *A study of mechanical vs. hand loading* (to reduce the expense of blasting bottom, to speed up and cheapen extraction, and to permit concentration of workings).

(*a*) *Production Per Man-Hour*—This figure should be compared to results being attained by competitive companies operating under similar conditions; then a detailed study should be made of the factors affecting the production performance. This study, as it progresses, always develops interesting opportunities for increasing the miners' output, while at the same time decreasing the face cost.

(*b*) *Refuse Cleaning at the Face*—As piece rates are based upon a "car-basis," it is important that coal rather than refuse be loaded. Deserving first consideration is the method of blasting. Unnecessary breakage of rock is objectionable, as large pieces of refuse can be more easily separated than smaller pieces. Visual inspection of the refuse discarded, reference to courthouse records and unceasing vigilance and discipline are necessary to keep the car yield under control. A 10 per cent gain or loss in car yield may increase or decrease costs from 30c. to 40c. per ton.

Two fundamental concepts underlie our work:

1. That coal-mining companies exist not for the purpose of mining and preparing coal but for the purpose of ***mining, preparing and selling coal at a profit.*** Thus, every element which enters into the cost of operation and sales is of primary importance.

2. The conviction that probably in excess of 90 per cent of officials and workmen are honest, have an inherent pride in their daily accomplishment, and a desire to justify their existence in the scheme of life, whether it be at work, in the home or in their social contacts. This being so, officials and workmen have a natural desire to know and understand why they are asked to perform certain tasks; management, to get proper results, must capitalize this desire by patiently and persistently conveying to the organization the essential things which they should know. The intelligence and integrity of employees must not be underrated, as men normally strive to live up to the ideals we create for them.

(*c*) *Timbering Methods*—As timbering constitutes one of the major items in anthracite coal mines, it may be well to state in some detail what may be accomplished through a careful study of timbering methods. Proper framing, and bracing and proper material are extremely important. Certain classes of timber, such as beech and birch, should never be used where any length of life is required and especially not as collars. As the labor cost of handling and setting timber is a large item, it is important to be selective as to the kind and size of material used.

To give a concrete example of the enormous savings which may be effected by a careful study, accurate records have been taken at an anthracite mine over a two-year period, after certain economies, which will be enumerated later, were put into effect progressively. For the period July, 1929, to June, 1930, inclusive, the total timber cost, labor and material, amounted to $92,909.11, with a total tonnage production of 197,272, giving a cost of 47.1c. per ton, of which 19.7c. per ton was for labor and 27.4c. per ton for material. For the period July, 1930, to June, 1931, inclusive, the total timbering cost was $66,039.35, with a total tonnage production of 291,589, giving a total cost of 22.6c. per ton, of which 9.7c. per ton was labor cost and 12.9c. per ton material.

For the above comparable periods, this gave a cost reduction of 24.5c. per ton divided between 10c. per ton labor and 14.5c. per ton material. Stated in another way, $26,869.76 was saved, although output increased 94,317 tons. Assuming that the conditions continued in the second half of 1930 and the first half of 1931 as they had during the second half of 1929 and the first half of 1930, the saving for a produced tonnage of 291,589.11 would have been $71,439.30, divided between labor saving of $29,158.90 and a material saving of $42,280.40.

A question may arise as to why, with the increased tonnage of the second half of 1930 and first half of 1931, the main road, slope and plane timbering would not have been reduced by the increased divisor. It must be borne in mind, however, that to increase the production 94,317 tons during the second period referred to necessitated practically doubling the feet of development driven, which class of work at this colliery involves the largest timber consumption, so that this factor would offset any argument as against the reduction gained by the tonnage divisor.

*Saving by Reduction in Size of Props*—Props varying in diameter from 8 to 12 in. were used in robbing areas, advancing chambers, development roads, and elsewhere, with little regard to varying conditions. Our study developed that, where the roof was fairly good, more successful robbing was attained by using 6- and 7-in. diameter props, which served the same purpose in robbing; namely, a warning and a steadying of any loose slabs, but gave a better roof break following pillar extraction. Where large props were used, the roof did not collapse, but carried over some distance, rapidly breaking the props where the miner was working, thereby requiring excessive relief props.

*Saving by Reduction in Size of Collars*—Collars used were 10- or 12-in. diameter timber, largely regardless of roof conditions. In 50 per cent of the cases, the collars were used only as a warning against any danger arising from the continually moving strata, and 6-in. timber was found adequate for this type of protection.

*Elimination of Standard Method of Timbering*—A standard method of timbering had been used, as follows: All chambers carried a line of props 5 ft. apart, 8- to 12-in. diameter, and all gangways carried collars of 10- to 12-in. diameter timber set on 5-ft. centers. In many cases, gangways and chambers were driven under hard sandstone roof and needed very little timbering. In chambers, by staggering props or placing them only under bad pieces, the quantity and size used were reduced 50 per cent.

*Purchasing Props Cut-to-Length vs. Purchasing Props in Railroad Cars*—Props had been shipped in random lengths in railroad cars, which necessitated considerable overtime and labor in unloading and conveying to the sawmill for cutting. Under the new system, props were purchased cut to length, delivered in trucks and many of them unloaded directly into the mine cars. This change reduced the price of props approximately $1.75 per ton, and eliminated three men and all of the overtime in the prop yard.

*Cushioning Props to Avoid Breakage*—Due to the squeezed condition of the property in certain robbing areas, especially along the barrier pillars or faults, the roof rode over the pillars for some distance in the robbing area, with the result that this slow settling broke an enormous number of props, and necessitated additional relief propping.

This breakage of props was reduced 75 per cent by placing a 4-in. block of soft wood either on the top or bottom of the prop, which acted as a cushion and compressed without breaking the props.

*Utilizing Broken Props*—A considerable saving was effected by reclaiming broken props, which were sent to the sawmill, cut to shorter lengths, and used in the thin veins, and the remainder cut into cushion pieces, turned into wood rollers, or made into wedges.

*Skipping System of Robbing Pillars*—The practice of robbing pillars was to clean up alongside the pillars in order to reach the back end of them before retreating. We found that, due to the squeezed condition of the pillar areas, a 6-ft. skip could be made along the pillar without moving any bottom or gob rock, thus reducing the size of the legs from 8 ft. to 5 ft. and the collar from 11 ft. to 6 ft., and the diameter from 10 in. to 6 in. This was made possible through the shaker-chute system of mining.

*Increasing Efficiency in Timbering*—Through adopting a standard practice of framing the timber, aligning the collars and legs, with the proper pitch to the leg, proper spragging, forepoling and lagging, a large amount of development road timber breakage and the necessity for relief timbering was eliminated through having the weight distributed over a number of timbers rather than having the high timber carry the load.

*Reducing Size of Cogs*—The standard practice was to use an 8- or 10-ft. square cog. Our study developed the fact that the condition of the roof, which was badly broken, could be better controlled by the use of 5-ft. square cogs.

*Elimination of Unnecessary Cogging*—A large quantity of timber was used in cogging along gangways, especially at old chamber branches and gangway junctions. It was also noted that a large quantity of rock was sent out of the mines to be dumped, while the timber was sent in to be put in cogs. By reversing this practice, the rock was gobbed at the chamber branches and gangway junctions, and eliminated the timber.

*Increased Producer Performance Due to Less Timber Labor* — Through elimination of excessive timbering, and reduction in the size of the timber, it was found that the miners and laborers could give one-quarter more of their time to blasting and loading of coal, with the result that this item was a big factor in the greatly improved producer performance.

*Reduction of Timbering Aids Transportation*—The reduction in timber consumption greatly relieved the transportation system and eliminated considerable work of the supply shaft crew and the outside transportation.

*(d) Safety Methods*—Despite the reduction in timber size and quantity mentioned above, by close supervision of the working face and rigid discipline among the workmen, accidents in the mines have been reduced approximately 50 per cent. Men have been equipped with safety shoes, protective hats, battery lamps, safety goggles, and are now experimenting to determine a proper type of safety glove. In addition to this, all shots are fired with electric battery. Production is more uniform and labor absenteeism has decreased.

*(e) Shooting Methods* — A careful study should be made of each vein to determine the location of the opening cut, the best location depth and spacing of the holes, the burden on the front and back of the holes, the quantity and kind of powder to be used, and the proper tamping of the charge, keeping a record of the percentage of prepared coal and the cost of powder per ton of coal produced.

*(f) Time Studies* — Time studies always bring to light very interesting facts. In general, we find that the average lost time of the face workman, over which he has no control, is 31 per cent, or, stated another way, he is doing effective work only 69 per cent of the time. The same low efficiency is true of equipment such as motors, mine cars, cutting machines and loading units.

A typical time study of mining-machine and scraper-loader performance is shown below and indicates the possibility for getting more effective work out of equipment by determining just what items are causing delays.

Motor studies indicate that approximately 30 per cent of the effective capacity of locomotives is not used, due to various delays. The time study, therefore, brings out the important element of *coordination of men and equipment* so as to render the greatest service to the producer, so that his productive capacity and earnings may be increased. As the result of time studies, the investigation leads into the transportation system, compressed-air system, power supply, hoisting cycle, and frequently to the preparation plant, to find out where valuable time is being lost which can be put to productive use.

Time Study of Mining-Machine Performance

| | Per Cent |
|---|---|
| Average cutting time | 27.5 |
| Loading and unloading | 24.9 |
| Total effective time | 52.4 |
| Moving | 20.6 |
| Repairs | 7.5 |
| Transportation delays | 14.2 |
| Changing bits | 5.3 |
| Total ineffective time | 47.6 |

Time Study of Scraper-Loader Performance

| | |
|---|---|
| Loading time | 55.3 |
| Changing scraper location | 4.1 |
| Total effective time | 59.4 |
| Waiting for cars | 27.5 |
| Repairs | 4.9 |
| Lunch | 4.3 |
| Idle | 3.9 |
| Total ineffective time | 40.6 |

*(Turn to page 62)*

# ✦ ANTHRACITE INDUSTRY

## Intensifies Efforts to Reduce Production Costs in 1932



WITH the rising tide of competitive fuels, unseasonable temperatures over most of the coal-burning months, declining exports to other countries due to the adoption of protective measures against outside products, and increasing competition from foreign fuels all working to force still further curtailments in production, the anthracite industry intensified the cost-reduction and market extension programs adopted a few years ago. Research to discover new markets and increase the utility of anthracite as fuel took on added force, and the industry worked vigorously to curb imports of foreign coal. Paralleling these activities, discussed more fully on p. 35 of this issue, individual producing companies concentrated on the shipment of a better product at a lower cost.

Two general methods of reducing cost —closing down high-cost workings and the installation of mechanical-loading equipment—were continued in 1932. In addition, a few companies sought relief in the negotiation of special working agreements with local unions. Installation of machines, however, was the major plank in the cost-reduction programs of practically all companies mining coal with a dip gentle enough to make their use feasible. As the northern field more generally meets this specification, the majority of the machines were installed in this region in 1932.

The possibility of mining thin coal or coal in sections previously mined and flushed or closed by crushes is the chief advantage of anthracite loading equipment. As virgin areas are few, and much of the remaining work is in thin beds or in beds already mined once or twice, avoidance of rock cost is a vital problem. The pressure for reductions in mining cost, in fact, made the elimination of rock work, in several cases, the deciding factor between continued operation and a shutdown.

The extent to which anthracite companies, particularly in the northern field, are turning to mechanization is indicated by the fact that more than 200 shaker conveyors alone were sold to operating companies or contractors in 1932. The number of shaker units installed in the last few years, according to an independent survey made late in 1932, totaled more than 600. In addition, several chain-and-flight and belt conveyors, a few pit-car loaders and mobile loading machines, and a relatively large total of scraper units were being used underground. For shaker conveyors, reports from various sources indicate that direct and indirect savings, after fixed charges and increased cost of power and maintenance, aggregate 50 to 75c. per ton.

With machines accounting for nearly 90 per cent of the output, the Price-Pancoast Coal Co. operation, described in the preceding issue (*Coal Age*, Vol. 38, p. 3), is one of the outstanding examples of shaker-conveyor mining in the anthracite region. At this mine, conveyors are used in mining both solid coal and pillars in crushed sections, and are given credit for continued operation of the mine.

In general, anthracite companies adhered to the standard chamber and pillar system in developing virgin coal with machines, though at least one company is using shaker conveyors in longwall work. The several plans used in solid work, therefore, differ only in the number of chambers operated as a unit. In most cases, the standard plan is based on the use of one machine per chamber. This also applies to work in caved areas.

The Scranton Coal Co., which has added materially to its equipment in the past year to bring mechanized tonnage up to 60 per cent of the total, is recovering both solid and crushed coal with shaker conveyors, chain-and-flight conveyors, scraper units and pit-car loaders. The latter, however, are used solely as transfer conveyors. This company employs one-, two- and three-chamber units. The two- and three-chamber systems are based on the installation of one conveyor in each chamber, with one cutting machine to serve all the places. The coal is drilled with pneumatic drills. Chambers average 275 ft. in depth, and conveyors may discharge into cars or a transfer conveyor. The third system is based on the use of one conveyor per chamber, which is worked two shifts.

Cutting machines, naturally, are not employed in the crushed areas. In these sections, pillars are recovered by skipping up the sides just wide enough for the conveyor and three or four rows of props and then recovering the remainder by open-ending. With this method, the rock work is avoided, and only a minimum of caved material is handled. Advantages of skipping are: decreased robbing time; increased production per man per day, which means lower cost per ton; smaller openings, with decreased timbering and gob-moving costs; smaller company force and transportation facilities.

At the Harry E. colliery, Wyoming Valley Collieries Co., Forty Fort, Pa., shakers and scraper units are used for recovering wide pillars in good condition, and for solid work in thin veins. The pitch varies from 8 to 10 deg. in favor of the shakers, and the average production per man per day is 5 to 5½ tons. No cutting is done, and electric drills are used. Avoidance of track work and increased production per place are features of the Harry E. work. Plans call for the eventual mechanization of 65 per cent of the output.

While plans are based on favoring grades where possible, many shaker conveyors are being used successfully on adverse grades up to 5 deg., though where adverse grades are unavoidable,

belt and chain-and-flight conveyors frequently are employed. Where scrapers are used, the small 7½-hp. units introduced a few years ago are practically standard, due to their flexibility, decreased crew and suitability for use in isolated places. Self-loading equipment for use on shaker conveyors is in the minority, though the Lehigh Valley Coal Co. has installed a number of duckbills on shakers driving gangways.

In addition to the companies mentioned above, major additions to mechanical loading equipment have been made at the collieries of the following, either by the companies themselves or by contractors: Susquehanna Collieries Co., Pittston Co., West End Coal Co., Penn Anthracite Mining Co., and others.

While the pneumatic drill is still in the majority, one-man portable electric drills are coming into increasing use, chiefly in connection with mechanical loading. Elimination of costly compressed-air equipment and transmission systems is the basis for the adoption of electric drills. Costs as low as one-fifth of the air-drilling costs are cited by some authorities.

A second major development in drilling in the anthracite region is in the use of detachable bits for pneumatic drills. These bits sell at 35 to 40c. each, and are used for drilling both coal and rock, though in rock work the maximum advantages are not secured unless a sufficiently large number are in use to make the question of transporting steels to the sharpening plant a major one. Quite a number have been sold to miners for use in coal, largely because their use eliminates the lost time and danger of bringing the drills out to be sharpened.

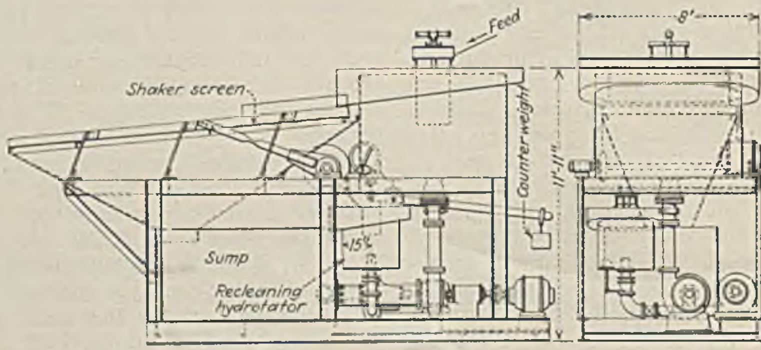
Stripping offers another means of reducing mining costs and increasing recovery, and for that reason showed a major increase in 1932, the work extending to outcrops, anticlines and basins in all regions where conditions make it feasible. Two-, three- and four-yard draglines are favored over shovels. Spoil disposal is accomplished by casting or by hauling it away in side-dump cars or trucks. In a few instances, stripping is supplemented by driving slopes down from the pits to recover pillars previously abandoned as unminable.

One of the major 1932 projects is the Forest City stripping of the Hudson Coal Co., which is being worked under contract by Carey, Baxter & Kennedy. A 6-cu.yd. dragline is used for removing the overburden down to a maximum depth of 100 ft. This dragline is equipped with a 160-ft. boom, diesel-electric drive and Ward-Leonard control, and is similar in size and equipment to the machine installed some time ago by the same company at the Dunmore stripping of the Pittston Co.

Several anthracite companies carried on experiments with backfilling in 1932, though in the majority of cases the work was not extensive. At the Richmond No. 3 colliery, however, the Scranton Coal Co. started the use of hydraulic backfilling in the Clark and Fourteen-Foot (Big) veins five months ago to complete the recovery of 200,000 tons, or 85 per cent, of pillar coal that ordinarily would have been left in place to support the surface. Sand and gravel from a near-by pit is mixed with breaker refuse to make the backfilling material. It is estimated that 330,000 cu.yd. of minus 1½-in. material will be used during the life of the project.

The surface plant consists of a scalping screen, crusher for oversize material, storage hopper, feeder disk and mixing cone, together with the necessary excavating, conveying and pumping equipment. The flush line consists of a 6-in. vertical pipe and two horizontal lines (one in each bed). The latter are made of 8-in. cast-iron pipe in 6-ft. sections, with bolted hub-and-spigot joints. Each horizontal line ends in a number of branches to the various chambers. Retaining walls for holding the flushing material are built of mine rock or brattice lumber. It is expected that the ultimate subsidence will be about 3 in. in the Fourteen-Foot and 2 in. in the Clark vein.

Compressed air is a large item of expense at anthracite collieries, due largely to waste at the face. To reduce the losses growing out of wrongful use of compressed air, Carroll Garner, mining engineer, Jeddo-Highland Coal Co., designed an automatic air control for use at gangway connections. This valve (see *Coal Age*, Vol. 37, p. 399) is credited with large air savings at Jeddo-Highland mines.



Hydrotator Equipped With Recleaning Unit

Developments in pumping practices and equipment at anthracite collieries in 1932 were largely confined to the installation of automatic control equipment for the elimination of operating labor. Savings growing out of the use of this type of control are variously reported to be from $5,500 to $50,000 per year, depending upon the number of stations so equipped. The Pittston Co. completed in 1932 a new underground pump station at the No. 9 colliery, Duryea, Pa. Like many others, this station (see *Coal Age*, Vol. 37, p. 325) is equipped for full-automatic operation. To guard against stoppages, dual electrical equipment was installed, and two column lines were provided.

With installation of new preparation equipment somewhat lower in 1932, anthracite companies concentrated their efforts on shipping an even better product than in the past. Slate and bone percentages in domestic sizes and ash in steam sizes were subject to close scrutiny and downward revision. As a result, an increasing number of companies have brought the standard ash for buckwheat (No. 1) shipments down to 10 per cent. Sizing equipment was overhauled with an eye to reducing still further oversize and undersize, and few plants are left that are not equipped with degradation screens at the loading stations.

The year 1932 was marked by the completion of the second of the Philadelphia & Reading Coal & Iron Co.'s central breakers at St. Nicholas, Pa. This breaker, with a rated capacity of 12,500 gross tons per day, prepares all the coal from the company's Mahanoy division. Coal from distant mines in the Mahanoy division is brought to the breaker in railroad cars, and from two adjacent collieries by a belt conveyor. Heavy refuse is removed in preliminary cleaners at the various collieries.

Cleaning equipment at St. Nicholas

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# ✦ FUTURE OF RESEARCH

## In Rehabilitation of the Bituminous Coal Industry

By JOHN C. COSGROVE
*Chairman, Research Division*
*National Coal Association*

THE present cycle in the bituminous coal industry, and it is only bituminous coal that I intend to deal with in this article, dates back to the beginning of the World War, and it is necessary to review briefly some of this history in order to get a clear perspective of what is necessary and what to aim for in the future. For many years, there was a general rule in the coal industry that the consumption doubled each ten years. While this is not exactly accurate, it is sufficiently so and, as it was a generally accepted fact, explains the activities and viewpoint of the industry. The problems were chiefly those of developing satisfactory supplies and the making of satisfactory sales connections; the industry was concerned only in a very minor way with an improved product or improved means of utilizing it.

The War came along and coal, like all commodities, took a tremendous jump in price. Anything that looked like coal commanded an immediate market at a high price. This condition continued after the War and, due to disturbances in the industry, coal did not suffer in the immediate post-War crash. Therefore, the continuation of high prices for coal while other industries were suffering in what we then called a "depression," but which now looks like a very mild one, stimulated the interest of the consumer in the cost of his power and, therefore, in the efficient use of his fuel. Great strides were made and are continuing to be made in the efficiency of the use of coal in industry.

As competition grew keener, the operator joined in this effort by shutting down the mines producing the poorer qualities, concentrating production on better quality in the installation of cleaning plants, and in many ways improving the quality of his product. This entailed a tremendous amount of experimentation and research work, which is mostly lost sight of because it was not concentrated in any one place or in any one organization, but the record for increased efficiency is a remarkable one.

However, due to excess supplies, increased efficiency and the improvements of methods of transportation, oil and gas began to look around for increased markets, with the result that their encroachment on the bituminous markets has accelerated the drop in fuel requirements brought about by the improved efficiency, and we have today a very much larger productive capacity in the bituminous mines of this country than is necessary to meet the country's requirements. This leaves the coal industry with a marketing problem which is ripe for the help of an intensive research program and one which should be pushed by the industry as vigorously as possible.

Do not get the impression that there has not been a great deal of research

John C. Cosgrove

going on in the coal industry. A few months ago A. C. Fieldner and Aldon H. Emery, of the U. S. Bureau of Mines, compiled a record of the "Research Activities in the Mineral Industries of the United States." The section on coal covers 47 pages and it lists over 500 problems in research being worked upon, covering all kinds and manner of subjects. Many of these subjects are purely scientific, but a large portion of them are taking up very practical problems. A great many of them are studying power problems, but out of all this mass of work we have every reason to expect future developments of great importance to the industry.

I divide the reasearch problem facing the industry at the present time into two general heads. The first problem is the protection of and the retaking of our domestic coal markets by means of the development of better and more convenient methods of burning coal. The second problem is the development of new uses for coal.

I place the problem of keeping and regaining the domestic market first, because it seems to me that that is the place where our research can secure the earliest results. To obtain these results we need apply ourselves to the problem only after the coal leaves the mine, because the work of preparing the coal at the mine is going forward at a rapid rate. Every encouragement should be given to the continuation of improved preparation, but we can, to a considerable extent, depend on our inventive geniuses and the manufacturers of equipment to carry forward this work. This brings us down, therefore, to the problems of delivery, burning and ash removal as it pertains to the household, the apartment house, office building, etc. What these consumers want is automatic heat, or at least an improvement over the present method. When it comes to more uses for coal, the second problem, I am not one of those who believe that we will find means of making it into a "breakfast food," or some exaggerated use, but undoubtedly there are many possibilities of new uses in the heat and power field if we can find ways to convert it into a more flexible form.

The Research Division of the National Coal Association has been working very diligently to lay plans which will start the industry on a comprehensive research program. We believe that it is of the utmost importance to have this work centralized and placed under the control of the representatives of the industry. The best thought of the industry is being assembled, all suggestions are carefully weighed, and it is hoped to have a complete plan ready to present at an early date, so that the work may be started without undue delay.

It is interesting to look into the future and see what we might hope for. If one is to build up his hopes from research, he needs only look around at some of the remarkable developments of the last few years in other industries. Look at Cellophane.

On the utilization of coal for domestic purposes, there are two lines being given some consideration at the present time. One is the small stoker, which has developed to a practical stage and a large number of which have been installed. The other is the work being done with powdered coal for the small heating plant. There are many people in the industry who think that powdered coal is the solution; that the coal dealer of the future will deliver to the household powdered fuel put up in paper sacks; that the householder will simply place the paper sack in the burner, which will draw the coal out of the sack into the fire. The empty paper sacks will be used to hold the resultant ashes and will be taken away by the coal dealer when he brings his next supply. Certainly a bright outlook for the home burning bituminous coal and yet a highly probable one.

Others believe that the coal will be dropped in a bin on the outside of the building, will be taken into the mechanical stoker by a conveyor, which conveyor on its return will bring back the ashes — purely automatic. Another bright picture for the consumer and not at all impossible.

But either of these problems, before it becomes practical, will require a lot of research, a lot of testing and trying. Probably we need a complete new design of boiler, firebox and all the appurtenances. All of this simply illustrates that the bituminous coal industry needs a laboratory for this work.

There is another idea of great importance and that is that we need to develop coal into some kind of a liquid fuel. Some work has been carried on on a colloidal fuel by the combination of either petroleum or byproduct oils with coal, and, of course, we cannot overlook our old friend "low-temperature distillation." Perhaps we will ultimately make coke by "low-temperature distillation" and use the resulting oils to combine with coal to make a colloidal fuel; the coke to be used as a domestic fuel and the colloid to be used in place of, or in combination with, fuel oil.

Personally, I am impressed with the possibilities of obtaining a liquid fuel by the hydrogenation process. This process has been successfully used in laboratory work and we know that we can, by the addition of hydrogen, turn coal into liquid fuel, but the cost, by any known process, is too great—a wonderful opportunity for research. Because the mechanical process is too costly is no reason for us to give up the idea.

The best example that I know of as to what can be done is what has taken place in the production of nitrogen. The chemists of the world have known since about 1795 that nitrogen of the air could be converted into useful nitrogen compounds. The cost of obtaining the nitrogen compounds from the air was so expensive up to about 1900 that these processes had no practical value. Since that time at least half a dozen practical commercial processes have been developed by which the useful nitrogen compounds so necessary for fertilizers, for explosives, for dyes and for drugs can be prepared from the air. At the present time several commercial plants of this type are operating in this country. They are working so efficiently that we are threatened with a surplus of the nitrogen compounds.

I recently read an article which stated that the Japanese have found that by the hydrogenation process they can make out of two tons of Manchurian coal one ton of heavy oil. The article did not give any information as to cost nor the process used, but with the low prices that have prevailed during the past year for slack in the United States, it is easily conceivable that a process might be developed which would permit the turning of this cheap slack into liquid in a commercial way.

The problems and possibilities are very many but we are only at the beginning. The future for bituminous coal research is very bright—the immediate problem seems to be one of organization and finance.

▼

# Anthracite Industry Intensifies Efforts To Reduce Production Costs in 1932

*(Continued from page 42)*

consists of Chance cones for domestic and steam sizes down to No. 4 buckwheat, which is prepared in Hydrotators. Sizes down to pea first pass through primary cones operating at a specific gravity of 1.90. Here, the heavy refuse is removed. Final separation at a specific gravity of 1.70 takes place in secondary cones. Pea, buckwheat, rice and barley are cleaned in rectangular top cones at a specific gravity of 1.70. The breaker is divided into two identical halves, each of which can be operated independently.

The West End Coal Co. also completed a new breaker equipped with Chance cones at Mocanaqua, Pa., in 1932. One purpose was reduced operating costs through location nearer the center of the property. This cut transportation 800 car-miles per day. Bull shakers and rolls are located in a separate structure at the ground level to reduce the weight of the breaker structure proper and eliminate refuse hoisting. Foreseeing the eventual obsolescence of egg, the Haddock Mining Co. erected a new breaker at Port Carbon, Pa., in which provisions for making this size were omitted. To compensate in part for this loss, the oversize in crushing was raised to increase the output of the other domestic sizes 5 to 7 per cent.

Another development in anthracite preparation in 1932 was the initiation of a program of improvement and addition at the Loomis Rheolaveur plant of the Glen Alden Coal Co. Two additional launders for egg to buckwheat inclusive are being installed, and the inclination of the existing primary and rewash launders is being changed for more efficient cleaning. This work supplements the installation of a free-discharge silt plant for $\frac{3}{64}$-in. x 65-mesh coal in 1931. Upon completion of the reconstruction program early this year, the Loomis plant will consist of the following units: sealed-discharge plant, egg to buckwheat, inclusive; free-discharge plant, rice, barley No. 1 and barley No. 2; free-discharge silt plant, barley No. 3 ($\frac{3}{64}$-in. x 65-mesh). Total capacity will be 750 gross tons per hour, an increase of 150 tons. The maximum ash limit for the silt plant has been set at 10 per cent.

As a result of experimental work at the William Penn colliery of the Susquehanna Collieries Co., the Hydrotator Co. has added a recleaning Hydrotator to its equipment for washing the fine sizes. The recleaner replaces the "recleaning cone" and small concentrating tables used on previous models to reduce the loss of good coal in the refuse. Where the recleaning Hydrotator is installed, the underflow from the main

Table I—Savings Due to Installation of Capacitors at Madeira, Hill & Co. Collieries

| Colliery | Capacitor | Manufacturer | Location | Power-Factor Before, Per Cent | Power-Factor After, Per Cent | Cost of Capacitor | Monthly Saving |
|---|---|---|---|---|---|---|---|
| Lawrence...... | 360 kva. 2,300 volts | General Electric | Near 66,000-2,300-volt substation | 60 | 75 | $4,095 | $250–$300 |
| Morea......... | 240 kva. 2,300 volts | Westinghouse | Near 66,000-2,300-volt substation | 74 | 88 | 2,880 | 180– 225 |
| Colonial*...... | 600 kva. 2,300 volts | General Electric | Near 66,000-2,300-volt substation | 70 | 85 | 5,067 | 450– 500 |

*Proposed.

tank is subjected to a secondary cleaning to secure a good refuse. The recleaning Hydrotator is equipped with a separate pump and acts as a separate washing unit. To make operation automatic, the recleaner is suspended from a counterweighted lever, and is equipped with a discharge port closed by a rubber ball. An accumulation of refuse causes the recleaner to fall, thus opening the port and discharging the refuse. When the weight is reduced, the tank rises, closing the port.

On a rice machine at the Wanamie (Pa.) colliery, Glen Alden Coal Co., a test with the recleaning Hydrotator showed the following results: feed—impurities, 12.8 per cent; ash, 16.2 per cent; clean coal—impurities, 1.4 per cent; ash, 9.3 per cent; refuse—coal, 2.6 per cent; ash, 73.0 per cent. Several tests with the recleaner have shown, it is asserted, that recoverable coal in the refuse is consistently below 5 per cent.

Table II—Purchases of Treated and Untreated Timber, Switch Sets and Ties by an Anthracite Company

| Material | Preservative | Lineal Feet: Treated | Lineal Feet: Untreated | Lineal Feet: Total | Per Cent Treated |
|---|---|---|---|---|---|
| **1931** | | | | | |
| Props | Zinc chloride / Wolman salts | 96,773 / 3,004 | 9,545,199 | 9.644,976 | 1.03 |
| Lagging | Zinc chloride | 113,624 | 4,822,412 | 4,936,036 | 2.30 |
| Total | ..................... | 213,401 | 14,367,611 | 14,181,012 | 1.46 |
| Switch sets* | Creosote | 15 sets | 12 sets | 27 sets | 55.50 |
| Ties† | Creosote | ....... | 4,385 | 4,385 | 0.00 |
| **1932 (11 months)** | | | | | |
| Props | ..................... | ....... | 6,009,464 | 6,009,464 | 0.00 |
| Lagging | ..................... | ....... | 1,917,655 | 1,917,655 | 0.00 |
| Total | ..................... | ....... | 7,927,119 | 7,927,119 | 0.00 |
| Switch sets* | Creosote | 7 sets | 9 sets | 16 sets | 43.80 |
| Ties† | Creosote | 1,400 | 2,525 | 3,925 | 35.70 |

*One switch set consists of about 43 ties of different length for standard-gage track.
†Standard gage.

A barley machine at Wanamie is being equipped with the recleaner, as well as a new installation at the Pennsylvania colliery, Susquehanna Collieries Co.

Twenty-one Menzies hydroseparators were installed at anthracite collieries in 1932 (see p. 57). These machines were divided as follows: grate, 2; stove, 4; chestnut, 3; pea, 4; buckwheat, 5; rice, 2; barley, 1. Ten machines were installed at the Stanton colliery, Glen Alden Coal Co., Wilkes-Barre, Pa., later destroyed by fire. Of this total, two machines especially designed for handling flat coal were installed on stove and chestnut. Glen Alden also put in two flat-coal machines at the Nottingham colliery for stove and chestnut. The Pittston Co. installed five hydroseparators at its No. 1 colliery, Dunmore, Pa., two of which are used for washing grate coal, the first instance of their employment on this size.

Installations of concentrating tables in 1932 included eighteen Deister-Overstrom Diagonal-Deck coal-washing tables. Fourteen of these tables were installed by the Lehigh Navigation Coal Co. at its Coaldale, Lansford and Nesquehoning breakers. The total included two tables at the Coaldale plant for re-treating No. 1 buckwheat from jigs, and one table at the same plant for washing flat pea. The other eleven machines were installed for No. 1 and No. 2 buckwheat. Haddock Mining Co. installed a table at its Candlemas colliery, Silver Brook, Pa., for reclaiming coal from refuse at the rate of 3 tons per hour. Other installations were made by the following: Wolf Collieries Co., Inc., Drifton, Pa., one table on barley; Hoover & Abrams, Beach Haven, Pa., one table on 1x½-in. river coal; Jonathan Coal Mining Co., Shamrock, Pa., one table on No. 4 buckwheat.

A complete list of 1932 anthracite preparation contracts appears on p. 57.

Anthracite electrification progress was characterized by increased interest in the installation of synchronous motors, capacitors and condensers for power-factor correction. That the resultant savings constitute a worth-while item is indicated by results at the properties of Madeira, Hill & Co. (Table I). Additional capacity is being considered for the Lawrence colliery, and a 600-kva. installation is proposed for the Colonial colliery to save $450-$500 per month. In addition to the savings, experience has shown that motors operate more efficiently due to decreased variations in voltage.

## *Anthracite Merchandising*

**While the operating division of the anthracite industry is laboring mightily to reduce costs and turn out a product which will win a wider market acceptance, the sales division has been equally busy seeking to build a stronger bridge between the mines and the consumer. Because anthracite finds its principal outlet in the domestic trade, merchandising efforts naturally have centered around the retail distributor. A composite picture of what a number of the leading producers and wholesalers are doing in that direction, therefore, will be presented in a series of articles beginning in the next issue of *Coal Age*.**

Table III—Purchases of Treated Gangway Timber by an Anthracite Company in 1931 and 1932

| Preservative | Lineal Feet | Per Cent of Total Gangway Timber Treated |
|---|---|---|
| **1931** | | |
| Zinc meta-arsenite | 18,035 | ... |
| Zinc Chloride | 3,864 | ... |
| Total | 21,949 | 4.6 |
| **1932** | | |
| Zinc Chloride | 22,450 | 5.7 |

One of the major 1932 developments was the completion of the electrification program of the Pine Hill Coal Co., Minersville, Pa., the final changes involving hoisting, the main fan and portions of the haulage system (*Coal Age*, Vol. 37, p. 442). This resulted in a saving of 30c. per ton in addition to the economies growing out of previous work covering other mine operations. The main ventilating fan was equipped with a 200-hp., 80-per cent power-factor, automatic-starting synchronous motor, and a 420-kva. capacitor was installed to bring the plant power factor up to 91 per cent.

In addition to other safety measures, anthracite companies continued extensions in the use of electric lamps and safety headgear in 1932. At the collieries of one company, the use of safety hats raised the tons mined per head injury up to 182,723 in the first eight months of 1932, against 55,130 in the year 1928. Comparative records compiled by another anthracite company showed that compensation and medical costs due to head injuries were reduced from $7,964.70 in 1929 to $68.68 in the first six months of 1932 by the installation of safety headgear.

Activity in the installation of treated timber and ties made slow but definite progress in the anthracite region in 1932. Comparative purchases by one large company in 1931 and 1932 are given in Table II. Due to stocks on hand, this company made no purchases of props and lagging in the past year. Late in 1932, this company had installed 8,000 sets of treated timbers on permanent and semi-permanent roads. This covers all installations back to 1927, when the program really got under way. Out of the total, 7,000 sets still are in service. Rot accounted for 53 sets destroyed; crushes and caves for the rest.

The comparative records for 1931 and 1932 for still another anthracite company are given in Table III. This table shows that the total percentage of treated timbers installed in gangways increased from 4.6 per cent in 1931 to 5.7 per cent in 1932.

# + RESEARCH IN COAL

## Broadens and Deepens Year by Year

LARGEST of the developments in research during 1932 was the decision of the Research Section of the National Coal Association, under the chairmanship of John C. Cosgrove, to open a laboratory for the study of coal problems. This new organization, to be known as Bituminous Coal Research, Inc., will center its initial efforts on development of equipment and methods to hold and broaden the market for coal as a fuel. This phase of the research program is outlined in the article by Mr. Cosgrove on pp. 43-44 of this issue.

In the matter of chemical tests of coal, the U. S. Bureau of Mines has shown that all the water of hydration as well as half the carbon dioxide in carbonates are removed in the process of distillation by which, in standard proximate analyses, the quantity of volatile matter is determined—that is, all the volatile matter is distilled rather than simply the strictly vegetal matter, though the volatile matter of coal usually has been regarded as being wholly organic.

The Bureau of Mines has adopted a method of ascertaining the percentage of chlorine with the aid of a bomb calorimeter—a method both accurate and rapid. Dr. R. Thiessen has determined that fusain, or mineral charcoal, in some cases is not so objectionable as has been freely asserted. In fact, fusain may improve the coking qualities of coal; nevertheless, if it is present in segregated lumps in the seam, it tends to make the coke from such coal break into small pieces.

Studies have been made by the Bureau of Mines into the value of soot-remover compounds for cleaning flues and chimneys. In this investigation, it was found that certain chemical compounds cause soot to burn at temperatures lower than normal, but whether such compounds are of any practical value to the householder is open to question, it is said. The best of the compounds was found to be cupric chloride with chlorides of the elements lead, tin, zinc, calcium and sodium in the order named. The relation of clinker formation to the softening temperatures of the ash proved quite elusive. In general, ashes with large quantities of alumina and silica as compared to bases have high softening temperatures, but no close relation between these ratios can be determined. The iron content of very refractory ashes is relatively low, but, in general, the relation of ferric-oxide content to softening temperatures is indefinite.

Both the U. S. Bureau of Mines and the Anthracite Institute have been studying secondary air or overfire air. The results of the first of these studies have not been reported. The institute finds the maximum possible savings do not justify a large investment, that three factors—the difficulty in mixing air, the necessity for high temperatures and the varying quantity of air needed—make the design of an efficient device difficult and that four types tested failed completely to prove their effectiveness.

With the judicious use of firedoor slide dampers the escape up the chimney of the unburned carbon monoxide from the burning of Pennsylvania anthracite will be reduced to a minimum.

Experiments at the Chester plant of the Philadelphia Electric Co. have shown that, with the air-control device under test, hot spots in the fuel bed could be avoided, thus permitting the use of cheap coals, burned at rates over 70 lb. per square foot of grate area and using air heated to 520 deg.

It has been found that when coke is impregnated with sodium carbonate, the gas formed in a gas producer has a lower percentage of carbon dioxide and therefore is more effective than ordinary producer gas. It also has been ascertained that satisfactory gas is obtained from such impregnated coke at a grate temperature 400 deg. lower than is necessary with untreated coke. For this reason, the University of Michigan is testing further the effect of thus impregnating the product of the byproduct oven.

Tests are being made by the Battelle Memorial Institute on behalf of the Ohio State University into the ash-fusion characteristics of the various benches and partings of the seams of Ohio so as to suggest a selective method of operation that will afford coals which will clinker only at a high temperature.

Tests have been made in a large gas furnace at the U. S. Bureau of Mines, Pittsburgh Station, into the removal of ash as molten slag, using ash with iron, with iron ore, with limestone and iron ore, and with limestone and salt cake respectively as fluxes. The fluxing effects of silica, magnesium oxide and calcium chloride also were studied.

At the Mellon Institute, to determine the percentage of solids in city atmospheres, measured volumes of air are passed through filter paper and the resultant darkness of the medium is compared with that of paper of various standardized shades. The apparatus used is the Owens automatic filter. Particle counts also are being made, using the Owens jet dust counter, the solids being precipitated on a cover glass, mounted on a glass slide and counted at a magnification of 1,000.

Studies have been made at the University of Illinois into the quantity of sulphur that will pass off as volatile sulphur compound when coal is carbonized in streams of gases. When the gases of carbonization at 1,000 deg. C. were nitrogen, carbon dioxide, carbon monoxide, methane or ethylene, 50 to 60 per cent of the sulphur was removed in four hours. Where the stream was of water gas, 76 per cent of the sulphur passed away as gas, with anhydrous ammonia 82 and with hydrogen 87 per cent. At 800 deg. C., a stream of steam removed 84 per cent, and water gas with hydrochloric acid 72.5 per cent of the sulphur. The study developed that oxidation and leaching, followed by carbonization in hydrogen, gave a sulphur elimination of 93 per cent; and instantaneous carbonization in hydrogen, 59 per cent. If 20 to 25 per cent of the sulphur in the coal is removed as removable pyrite, and 84 per cent is removed by steam, only 12.8 to 12 per cent of the sulphur will remain.

As regards the conflict between gas and coal, the heating of two identical school buildings in Fayetteville, Ark., one burning natural gas controlled automatically and one heated by hand-fired coal, was investigated by L. C. Price, research associate professor of mechanical engineering, University of Arkansas. He found that 21,000 cu.ft. of gas was equivalent to a ton of coal, which would show that, under the conditions of burning, the gas furnace gave a higher efficiency per unit of heat supplied than the coal furnace. But neither of the furnaces is described nor is the heat equivalent of the coal used specified.

Burning bituminous coal in a typical hand-fired hot-water heating plant, the State College of Washington found 27.1 per cent of the heat lost was due to the sensible heat of the furnace gases; with a typical stoker-fired hot-water heating plant, 28 per cent of the heat was lost in that manner; with a specially designed stoker-fired hot-water heater, with a clean heat exchanger and a slow rate of feed, it was only 10.84 per cent, though with medium rate of feed it was 16.35 per cent, and with the same rate of feed and a dirty heat exchanger it was 23.60 per cent.

Summarizing, the college declares that with hand-firing and poorly designed heating plants only, 30 to 40 per cent of the heat in coal ordinarily finds its way into the house. Automatic stoking raises this efficiency approximately 15 per cent, and with an economizer 16 per cent more was saved, so that under normal operation a 78 per cent efficiency is attained. With oil at 8½c. a gallon and coal at $8.50 a ton, the extra cost of heating a residence with oil as compared with stoker-fired coal in a typical heating plant is 88½ per cent.

In its studies of the relative value of coal and byproduct coke, the Anthracite Institute found that, as compared with coke, anthracite burned more evenly and gave a more even heat output, needed half as much manual attention, absorbed only 28 per cent as much water, demanded half as much storage and furnace space, produced more heat with a given draft, was more efficient at mid-season demands, though less economical at lower ratings, could be banked twice as long and, with identical drafts, required only three more minutes to reach maximum output from a cold start.

That flames may be extinguished by electric fields has been discovered by the U. S. Bureau of Mines, but also it is found that charged ions lower considerably the ignition temperature of flammable gases. By Schlieren photography, the Bureau has been able to show that the pressure wave produced by an ex-

## Coal Researches in Progress or Completed in 1932 or Planned for 1933

*Air Pollution; Smoke Abatement*

Coke Plant Smoke, 1932. Pittsburgh Testing Lab.
Conditions in Pittsburgh, Pa., long-time study, to continue, 1933. Mellon Inst.
Conditions in New York Metropolitan Area, begun in 1930, to continue 1933. Stevens Inst.
Measurement of Solids in Gas Streams, begun in 1930, to continue 1933. Stevens Inst.
Stack Gases and Removal of Sulphur From Same, continued from 1930. Univ. of Ill. with Utilities Research Corp.

*Briquetting of Coal*

Binder for Briquet, 1932. F. D. Snell, Inc.
Binders for Briquets, begun in 1931, to continue 1933. Battelle Mem. Inst.
Briquetting Especially of Mixtures of Anthracite and Bituminous Coal, to continue. H. C. Porter.
Use of Briquets, 1933. Battelle Mem. Inst.

*Carbonization of Coal*

Effect of Inorganic Salts on Carbonization of Lignite, 1931-1932. Univ. of N. D.
Effect of Space Relationships and Gas Velocity on Yield and Quality of Byproducts, to continue. H. C. Porter.
Low-Temperature Distillation, to continue. Detroit Testing Lab.
Pretreatment of Pulverized Coal by Low-Temperature Carbonization Prior to Central Station Use, to continue. Nat. El. Heating Co.
White Process of Carbonization, report published 1932. Battelle Mem. Inst. with Ohio State Univ.

*Chemical Tests of Coal*

Alcohols as Solvents for Coal, 1933. Ohio Wesleyan Univ.
Analysis and Composition of U. S. Coals, long-time study, to continue. B. of M.
Ash-Forming Constituents in Coal, 1933. Ohio Wesleyan Univ.
Chemistry of Decay in Relation to Peat and Coal Formation, to continue. B. of M.
Electrolytic Oxidation of Coal, 1932. W. Va. Univ.
Elimination of Sulphur From Coal, 1932. Univ. of Ill.
Extraction of Solvents, to continue. Carnegie Tech.
Extraction of Solvents, to continue. B. of M.
Halogenation of Coal, to continue. Carnegie Tech.
High-Vacuum Distillation of Coal, to continue. Carnegie Tech.
Influence of Rate of Heating and Maximum Temperature on Properties of Products Obtained From Coke, to continue. Carnegie Tech.
Influence of Water of Hydration and Carbonates in Coal on Standard Method of Determining Volatile Matter, to continue. B. of M.
Low-Temperature Oxidation, to continue. Carnegie Tech.
Moisture in Coal, 1933. Ohio State Univ.
New Method of Determination of Chlorine in Coal, to continue. B. of M.
Permanganate vs. Chlorate Methods to Determine Reactivity of Coal, to continue. B. of M.
Regeneration of Humic Acids From Coal, to continue. Carnegie Tech.
Regeneration of Humic Acids From Coal by Nitric-Acid Oxidation, 1932. W. Va. Univ.
Separation of Ulmins From Resistant Plant Residues, to continue. Carnegie Tech.
Softening of Bituminous Coal During Combustion, 1932. H. C. Porter.
Standardization of Agglutination Tests of Coal, 1932. B. of M. with A.S.T.M. and A.S.A.
Standardization of Distillation Assay for Determining Yield for 20-G. Sample of Coal, to continue. B. of M.

Sulphur in Iowa Coal, Amount and Nature of, 1933. State Univ. of Iowa.
Theory of Fractional Distillation at Extremely Low Pressures, to continue. Carnegie Tech.

*Combustion of Coal and Coal Products*
*(See Economics of Coal and Other Fuels)*

Absorption of Radiant Heat in Boiler Furnace, to continue. A.S.M.E.
Adaptation of Household Stoker to Lignite, 1932-1933. Univ. of N. D.
Admission of Overfire Air to Anthracite-Burning Domestic Furnaces, 1932. Anth. Inst.
Automatic Stokers and Economy With N. & W. Ry. Coals, begun 1929, to continue. N. & W. Ry.
Combustion of Coal, 1932. Northern States Power Co.
Combustion of Iowa Coals in Various Stokers, 1932, to continue. Iowa State Col. of Agr.
Determination of Fusibility of Coal Ash and Interpretation of Results in Terms of Furnace Operation, 1932. Northern States Power Co.
Development of More Convenient Way of Burning Anthracite, to continue. Anth. Inst.
Effect of Air Flow on Stoker Structure and Fuel-Bed Temperatures, 1932, to continue. Am. Eng. Co.
Effect of Mixing Coals on Ash-Fusion Temperature of Mixture, to continue. Carnegie Tech.
Flow of Air in Stoker Plenum Chambers, to continue. Am. Eng. Co.
Fuel Cell, to continue. Carnegie Tech.
Fuel Economy in Domestic Heating, 1932. Univ. of Wash.
Fuels in Brickkilns, 1932. B. of M.
Heat Losses Reported as Due to Unconsumed Hydrogen and Hydrocarbons, 1933. Ohio State Univ.
Mechanism of Combustion of Solid Fuels, to continue. Carnegie Tech.
Pipettes and Reagents for the Analysis of Flue Gases, 1933. Ohio State Univ.
Preheated Air on Fuel-Bed Characteristics, to continue. B. of M.
Relative Availability of Cokes for Domestic Furnaces, to continue. B. of M.
Removal of Ash as Molten Slag from Powdered-Coal Furnace, 1932. B. of M. with A.S.M.E.
Secondary-Air Mixing Devices for Domestic Furnaces, to continue. B. of M.
Smokeless Combustion of Coal Domestically and Commercially, 1932. Univ. of Wash.
Soot-Remover Compounds, 1932. B. of M.
Testing and Development of Equipment for Burning Pennsylvania Anthracite, Stokers, Thermostats, etc., 1932. Anth. Inst.
Tests of Bituminous Gravity Feed Stoker Furnaces, 1933. Univ. of Utah.
Tests of Underfeed-Stoker Boilers, 1932, on Cambridge Coal, to continue with other coals. Ohio State Univ.
Value of Iowa Coals in Domestic Heating, to continue. Iowa State Col. of Agr.

*Economics of Coal and Other Fuels*

Byproducts of Coke and Gas Manufacture, to continue, A.G.A.
Anthracite vs. Byproduct Fuels, 1932. Anth. Inst.
Coal for Metallurgical Purposes, 1932. Battelle Mem. Inst.
How to Choose a Household Fuel, 1932. Battelle Mem. Inst.
New Uses for Anthracite, 1932. Anth. Inst.
Pennsylvania Anthracite vs. Competitive Fuels, to continue. Anth. Inst.
Power-Plant Survey on Coal Performance, State of Ohio. Begun 1931; to continue. Ohio State Univ.

plosive is a contributing factor in the ignition of firedamp.

In his study of mine roofs, P. B. Bucky, at Columbia University, has found that models can be used at low cost when stress is imposed by centrifugal force. Investigations are being made into the effect of cracks in mine roofs, the behavior of strata overlying mine excavations, the weakening of the mine roof by arched openings and the effect of block caving.

Humic acids are formed by the decay of vegetal materials probably for the most part of lignins. They are found in soil (humus) peat, lignite and brown coals. Humins in coal probably were formed from humic acids in the peat by some form of reduction by which the latter lost their oxygen. The reconversion of such humins into humic acids is called the "regeneration of humic acids." Studies of such oxidation and regeneration have been made by West Virginia University.

One study related to the degree of oxidation under electrolysis as determined by the regeneration of humic acids. It was found that oxidation was most effective with alkaline electrolytes. The course and extent of oxidation depended largely on the electrolyte used. With a copper electrode, oxidation apparently stopped at the humic-acid stage. With a platinum electrode, humic acids are oxidized even in acid solution. It was found that the maximum absorption of oxygen occurred early in the action, but that the greatest evolution of carbon dioxide and the maximum formation of humic acids occurred later, which fact suggests that the humins have to be oxidized in a degree before humic acids are formed.

Other tests were made on regeneration of humic acids by nitric-acid oxidation, and on the effect of particle size, time of operation and rank of coal on the action of the nitric acid. In all the coals, including anthracite, humic acids were obtained by the oxidation, but none was obtained from coke, suggesting that the carbon in coal is not free but in chemical combination with the oxygen and hydrogen of the humins. With two coals, one from the Pocahontas No. 4 and one from the Pittsburgh bed in the Scotts Run field, it was found that there was no direct correlation between the evolution of carbon dioxide and the regeneration of humic acids.

## Coal Researches in Progress or Completed in 1932 or Planned for 1933—*Continued*

Production and Disposal of Byproducts in Coke and Gas Manufacturing, to continue. A.G.A.
Use of Terms "Net and Gross Calorific Values" of Fuels, to continue. H. C. Porter with A.G.A.

*Equipment and Material for Mines*

Field Investigation of Safety of Electrical Equipment, 1932, to continue. B. of M.
Gas Detecting Devices, to continue. B. of M.
Gas Masks and Respirators for Mineral Industry, 1932. B. of M.
Heating of Trailing Cables, 1932. B. of M.
Mining Explosives, to continue. B. of M.
Safeguarding Electrical Equipment for Drainage, Preparation and Haulage, to continue. B. of M.
Safety of Blasting Equipment, 1932, to continue. B. of M.
Safety of Trailing Cable, 1932. B. of M.
Study and Classification of Electric Safety Codes, 1932, to continue. B. of M.
Wire Rope, to continue. B. of S. with A.S.M.E.

*Gas; Use, Manufacture, Purification and Treatment*

Available Hydrogen in Fuel as Measure of Value for Gas Making, to continue. Univ. of Mich.
Development of Anthracite Gas Machine for Industrial Uses, to continue. Anth. Inst.
Effect of Sodium Carbonate on Operation of Gas Producers, to continue. Univ. of Mich.
Efficiency of Conversion Gas Burners as Affected by Different Control Methods, to continue. Univ. of Ark.
Enrichment of Coke-Oven Gas by Thermochemical Catalytic Action, to continue. Carnegie Tech.
Formation of Gum in Coal Gas and Its Elimination, to continue. Mellon Inst.
Liquid Purification of Coal Gas With Recovery of Sulphur, to continue. Mellon Inst.
Synthesis of Hydrocarbons From Water Gas, to continue. B. of M.

*Physical Tests of Coal*

Absorption of Gases by Coal, to continue. B. of M.
Accelerated Slacking Test for Coal, to continue. B. of M.
Agglutinating Values for Coal, 1932. B. of M. with Minn. By-Product Coke Co.
Effect of Agglutinating Value and Plasticity on Resistance to Passage of Air Through Thin Ignited Fuel Beds, to continue. Univ. of Mich.
Friability of Coals, to continue. B. of M. with Univ. of Wash., A.G.A. and A.S.T.M.
Grindability of Coal, to continue. Carnegie Inst.
Grindability of Coal, long-time research, 1932. Babcock & Wilcox Co.
Grindability of Coal, to continue. Battelle Mem. Inst.
Grindability of Coal With Reference to Development of Suitable Standard and Correlation to Seam Location, to continue. Univ. of Mich.
Plasticity of Coal in Relation to Physical Properties of Coke Produced, to continue. B. of M.
True Density of Coal, to continue. Carnegie Tech.

*Preparation of Coal*

Economy of Cleaning Processes. Battelle Mem. Inst.
Froth Flotation, to continue. B. of M. with Univ. of Wash.
Improvement of Launder Processes, to continue. Battelle Mem. Inst.
Jigging of Anthracite and Bituminous Coal, to continue. Battelle Mem. Inst.
Performance of Alabama Washers, 1932. B. of M. with Univ. of Ala.
Pneumatic Tables, to continue. B. of M. with Univ. of Wash.
Selective Mining to Improve Coal Quality, 1932. Battelle Mem. Inst. with Ohio State Univ.
Washability of Alabama Coals, 1933. Univ. of Ala.
Washability of Fine Coal, to continue. B. of M. with Univ. of Wash.
Washability of Illinois Coals, to continue. Univ. of Ill.
Washing of Iowa Coals, to continue. State Univ. of Iowa.

*Pulverized Coal*

Combustion of Pulverized Coal, to continue. Battelle Mem. Inst.
Mechanism of Burning Individual Particles, to continue. B. of M.
Sampling Pulverized Coal, 1932. Univ. of Wash.

*Tar and Tar Products*

Alcoholic Constituents of Low-Temperature Tar, to continue. B. of M.
Composition of Low-Temperature Tar, to continue. B. of M.
Effect of Addition Agents on Tar Constituents From Coking Belleville Coal by Kernite Process. Molding Characteristics of Resins. Washington Univ.
Methods of Analyzing Low-Temperature Tar, to continue. B. of M.

*Miscellaneous Hazards (See Equipment and Material for Mines)*

Carbon Monoxide Pathology, to continue. B. of M.
Compressibility and Crushing Strength of Pittsburgh Coal Bed, to continue. B. of M.
Effect of Quantity of Dust and Source of Ignition on Explosibility of Coal Dust, to continue. B. of M.
Efficiency of Rock-Dust Barriers, 1932. B. of M.
Electrostatic Phenomena in Mines, 1932. B. of M.
Explosibility of Mine and Industrial Gases, to continue. B. of M.
Explosive Properties of Acetone-Air Mixtures, 1932. B. of M.
Falls of Roof and Coal, to continue. B. of M.
Laboratory Study of Inflammability of Coal and Other Mineral Dusts, to continue. B. of M.
Mine Fires, to continue. B. of M.
Safe Handling and Use of Liquid-Oxygen Explosives, 1932. B. of M.
Strength of Mine Roof, to continue. Columbia Univ.

*Miscellaneous*

Binder for Coal Coloring, 1932. F. D. Snell, Inc.
Cinders or Boiler Ashes as Aggregate for Concrete, to continue. B. of S.
Classification of American Coals, to continue. B. of M. with A.S.A.
Coal Characteristics—Fusain in Ohio Coals, 1933. Ohio State Univ.
Coal Mining Methods and Costs, to continue. B. of M.
Hydrogenation of Coal, to continue. Univ. of Wash.
Methods for Analyzing Light Oils, to continue. B. of M.
North Dakota Lignite for Activated Carbon, 1932-1933. Univ. of N. D.
Oil-Steam in Dehydration of Lignite, 1931-1932. Univ. of N. D.
Origin and Constitution of Coal, to continue. B. of M.
Phenol Identification, to continue. Carnegie Inst.
Precision Calorimetry in Relation to Coal Processing, to continue. Carnegie Tech.
Reactivity of Lignite Char, 1931-1932. Univ. of N. D.
Smokeless Combustion of Coal Domestically and Commercially, 1932. Univ. of Wash.
Surface Subsidence at Experimental Mine, to continue. B. of M.
Ventilation, Shaft Bottom Vanes and Improvements in Aircourses, 1932. Univ. of Ill.
Waste Water from Mines, to continue. B. of M.

# + ACCIDENT PREVENTION

## Gives Further Evidence of Progress in 1932

By SCOTT TURNER
*Director, U. S. Bureau of Mines*

FOR eleven months, the prospect was bright that 1932 would be the banner year for safety in coal mines in the United States, surpassing 1931, when the accident rate of 3.31 per million tons of coal produced set a new mark for low cost of coal in human life. Although there were three major explosions of gas and dust during the first half of 1932, the influence of these explosions in raising the death rate was overcome by reductions in the number of accidents from other causes later in the year. Three more major explosions costing 91 lives in December, however, immediately changed the picture. The present outlook, therefore, based on figures covering eleven months and incomplete figures for December, is that 1932 will show little, if any, change when compared with the previous year.

The number of men who lost their lives in coal-mine accidents was not as large in 1932 as it was in the preceding year. This was because many mines were closed and many other mines were in operation only a short time. Production for the year fell off 20 per cent. Hence it was to have been expected that the number of deaths from accidents would also be reduced. Such was the fact, but the decline in the number of fatal accidents merely paralleled the loss of tonnage, with the result that the relationship between production and fatalities was not affected materially, if at all.

It is estimated that final reports for 1932 will show 1,180 fatalities, from all causes of accidents, at coal mines in the United States. Output for the year, which was approximately 355,000,000 tons, will therefore represent a fatality rate of 3.32 per million tons, as compared with a rate of 3.31 for the previous year. The rate for bituminous mines alone was 3.09, and that for anthracite mines was 4.76, while the corresponding rates for the preceding year were 2.83 for bituminous and 6.42 for anthracite.

These figures show that substantial progress in safety was made in anthracite mines, but that some ground was lost in the fight against accidents at bituminous mines. It should be remembered, however, that these figures reflect the net result of coal-mining operations throughout the country as a whole. We must not forget that positive gains in safety were made by large portions of the industry, and that the losses were confined to relatively few instances; being heavy, such losses were reflected vividly in the net rate for the industry.

Six major explosions of gas or dust occurred in 1932. Three of these explosions were in Virginia, one occurring in January and resulting in 6 deaths, one in February with 38 deaths, and one in June with 10 deaths. No other major explosion occurred until December, when New Mexico reported one that killed 14 men, Kentucky reported one with 23 lives lost, and Illinois reported the largest explosion of the year with a loss of 54 lives. These six explosions in 1932 resulted in 145 deaths, as compared with the same number of explosions in the previous year and 56 deaths.

Deaths from falls of roof and coal, which always outnumber those from any other single cause of accidents in coal mines, resulted in 601 fatalities, as far as we can judge from reports available at present. In arriving at this number, we have attempted to allow for the usual revision that must be made in preliminary figures when final reports for the year are received. The fatality rate for this class of accidents, after allowing for expected revisions, stands at 1.693 per million tons of coal produced.

**The low accident rates in 1931-1932 have recorded new high marks in safety from which the industry will be judged hereafter. With the return of normal business conditions and the re-employment of many employees who presumably will often be less inclined to safety than the men who have been retained on company rolls during the depression, the operating companies will be faced by a more difficult problem in the prevention of accidents. If this fact is universally recognized and accident-prevention efforts are directed in the light of the new conditions, there is little doubt that coal mining will never again be associated with the high accident rates that formerly prevailed, but that the years 1931 and 1932 will prove to have been the beginning of a new period as far as lowering of the human-life cost of coal is concerned.**

The corresponding figure for the previous year was 1.942. It is fortunate that the rate for accidents of this kind was materially reduced (the reduction amounting to 13 per cent), because as falls of roof and coal usually account for nearly half of all accidental deaths in coal mines, any reduction in the fatality rate from this class of accidents signifies a larger number of lives saved than would be the case with an equal percentage reduction in the death rate from any other cause of accidents. This saving in the loss of life from falls of roof and coal was the chief factor that prevented the fatality rate for the industry in 1932 from rising above the 1931 level, as it otherwise would have done because of the increase in the death rate from explosions of gas and dust.

The fatality rate from accidents caused by underground-haulage equipment in 1932 remained almost stationary at the 1931 level. Possibly about one per cent reduction was effected in the rate for the year just closed. At present, the figure stands at 0.518 per million tons, as compared with 0.523 for the previous year. Should this small betterment be shown by final reports for the year, the improvement probably will be found to have been made in anthracite rather than bituminous mines. The number of men killed in haulage accidents was 184, as compared with 231 in the year before. Thirty-three of these fatalities were reported in the anthracite mines of Pennsylvania, and the remainder in bituminous mines in various states. In nearly one-half of the cases in the industry as a whole, the victims were run over by the cars, and in about one-third of the cases the employees were squeezed between car and rib or post or roof.

More than a hundred million pounds

of explosives was used in coal-mining operations last year. In handling and using this quantity of blasting material, 34 men were killed directly by the blasts, and 61 others lost their lives in two explosions that resulted when blasting ignited the gas or dust. As the 61 fatalities were due directly to the explosions, they are included in the number of fatalities shown under explosions.

The 34 deaths from handling or using explosives resulted in a fatality rate of 0.096 per million tons of coal produced during the year, the rate for the previous year being 0.091. This rate was the net result of an increase in the explosives-accident rate at bituminous mines and a reduction in the corresponding rate at anthracite mines. Only about 2 per cent of all fatalities in the mining of bituminous coal were directly chargeable to explosives, whereas about 6 per cent of all fatalities at anthracite mines were caused by explosives. For the industry as a whole, the principal class of explosives accidents was premature shots.

Electricity caused 52 deaths at coal mines last year. These were due to shocks or burns. At least 14 other men lost their lives in an explosion that is believed to have been due to ignition of gas or dust by an electric arc. The 52 deaths were about 4½ per cent of the total number of fatalities from all causes at coal mines during the year. When related to the year's output of coal, the 52 fatal accidents directly chargeable to electricity indicated a fatality rate of 0.147 per million tons, exactly the same as in the preceding year. Direct contact with trolley wires was the principal cause of accidents from electricity.

Accidents from falls of roof and coal, haulage, gas-and-dust explosions, explosives, and electricity accounted for 89 per cent of the total number of coal-mine fatalities from all causes. There remain but 11 per cent of the fatalities to be grouped under miscellaneous causes. In this miscellaneous group, accidents due to machinery form the principal class. One hundred and thirty-eight fatalities were classed as due to miscellaneous causes in 1932. Of this number, 64 occurred on the surface from various causes, 10 in shafts, and 64 underground. Of the number occurring underground, 21 were due to machinery, chiefly coal-cutting machines. The fatality rate for accidents from all miscellaneous causes, including accidents in shafts and on the surface, was 0.388 per million tons, as compared with 0.410 in the previous year, a difference of five per cent in favor of 1932.

As is well known, the United States normally produces from five hundred to more than six hundred million tons of coal each year. Production fell off sharply in 1931, and still more sharply in 1932. Indeed, last year's output was smaller than the production in any previous year since 1904, when the coal mines of the country produced 351,816,398 tons.

Taking 1904 as a starting point, we find that some states did not keep accident records as early as that year. We have accident records for states that produced 339,164,812 tons in 1904, and we know that, in connection with this production, 1,995 miners were killed.

Scott Turner

These figures show that 588 lives were lost for each hundred million tons of coal produced. We may consider these 588 fatalities as representing the price in human life that was paid for each hundred million tons of coal mined in the United States in 1904.

The question naturally arises: What was the human-life cost of an equal quantity of coal produced in 1932? The answer to that question is that, even after allowing for the lives lost in the December explosions, the cost of one hundred million tons of coal in that year was only 332 lives. In 1931, a hundred million tons of coal cost 331 lives and in 1930 it was 384 lives. From these figures, it is apparent that the human-life cost of coal has been definitely and, let us hope, permanently reduced. Nor is this conclusion dependent upon the choice of 1904 as the starting point for comparison. The cost of a hundred million tons of coal was 547 lives in 1905, 578 lives in 1906, and more than 500 lives in every year but two (the cost in 1898 was 497 lives and in 1897 was 486 lives) from 1911 back to 1870, when definite records of fatal accidents began.

With the replacement of hand labor by machinery, and the consequent increase in productivity per man-hour, the number of accidents has been reduced greatly but not always sufficiently to keep pace with the rapid displacement of men. The introduction of machine methods of mining has, however, so greatly increased the average production per man-hour of labor that, even though accidents have not been eliminated as rapidly as human labor has been displaced, the American consumer is now purchasing his yearly supply of coal at a smaller cost per ton in human life than ever before. As previously stated, the lowest human-life cost of coal was reached in 1931, and the year just closed gave promise of surpassing 1931 in safety until the last month, which brought 91 deaths in three explosions, although, even so, there is still a possibility that 1932 will equal 1931 in safety.

If we may assume an average of $5,000 as representing the total cost of a fatality to a mining company and to the miner's dependents, the 355,000,000 tons of coal mined in 1932 represents a fatality cost of $5,900,000. This assumed cost, which includes expenses for medical and hospital service, and payment of compensation to the dependents of deceased employees, indicates an average of 1.66c. a ton for fatalities alone, without taking into consideration the probable cost of non-fatal injuries. On the same basis of calculation, the cost of fatalities in coal mines in 1904 was 2.94c. a ton. Had the 1904 cost prevailed in 1932, the total quantity of coal produced in the latter year would have cost $10,400,000 in compensation, hospitalization, medical and other expenses for fatal accidents instead of $5,900,000.

In other words, approximately $4,500,000 was saved because methods have been devised whereby coal mines may now produce coal at a smaller cost in human life. This progress reflects the hard work done by mining companies and state and federal mining officials to discover ways of surrounding the miner with safer conditions in his daily work.

Whether final reports for 1932 will show that the fatality rate for the year was slightly above or below the exceptionally favorable rate for 1931 is of little consequence when compared with the fact that both years were marked by better safety records than at any previous time in the history of coal mining in the United States. It is this fact that we should all keep in mind, and recall that the coal-mining companies as a class have performed this feat in the face of conditions that make the achievement all the more creditable.

# ✦ LOWER POWER COSTS—

## New Factors Enter Picture of Power Generation

By HUGH R. CARR
*New York City*

CHANGING CONDITIONS in the coal-mining industry are challenging progressive management to reexamine the question of power generation in the light of present-day developments. The swing to central-station service for mine power was fostered by several factors, including: obsolescence of power-plant equipment at the older mines; public utility power rates so attractive that they discouraged the investment of capital in new private generating plants or expenditures for the modernization of existing older private plants; and favorable reciprocal relations between coal producers and power companies. With these advantages, it is not surprising that the public utilities became the dominant source of electric power for the coal mines.

Two major developments since the ascendancy of the central station in the supply of mine power, however, are forcing reconsideration of the problem: (1) the steady increase in connected load at the mines, due largely to the mechanization of underground loading, additions to screening facilities and the installation of mechanical preparation plants; and (2) the increasing quantity of combustible material left at the mine because of greater refinements in cleaning and more selective buying by the coal consumer. For the time being, at least, intermittent operation at many mines also enters the picture, because the low load factor this introduces has a disastrous effect upon power costs per ton of coal produced.

The big increase in connected load has come in the last fifteen years. In 1909, the horsepower rating of power equipment in the bituminous field averaged 204 per mine; ten years later it was 260 hp. In the next decade, it more than doubled, climbing to 556 hp. During that same period, the total rating of power equipment in the bituminous mines increased from 2,155,065 to 3,124,187 hp.—an increase of 44.9 per cent. Expenditures for purchased power rose from $11,258,509 to $30,739,321, while the quantity of coal consumed at the mines for heat and power dropped from 11,895,955 tons to 4,602,209 tons.

Market demands have forced the coal industry to refine preparation methods still further in order to meet prevailing requirements for lower ash and sizing more closely fitted to the duty the coal is called upon to perform. Consequently, more and more material of doubtful quality is being sent to the refuse bank, and in many cases the residues left after screening fail to command a ready or stable market. Freight rates to consuming centers also play an important part in the final disposition of poorer grades of coal. Inability to use poor coal in reciprocal arrangements with power companies quite frequently is still another stumbling block.

In slack times, such as prevail at present, the load factor at mining operations is necessarily low. This results in a corresponding increase in overhead charges arising out of the effect of the demand charge on the total power bill. In many cases, the operation of the demand clause in power schedules results in a sizable addition to the per ton cost of electrical energy. While true to some degree in the anthracite industry, the effect of the factors outlined above on power cost is considerably less. For that reason, only the case of bituminous coal will be discussed in this article.

Although the conditions outlined above, reinforced by the necessity of exploring every avenue which may lead to lower production costs, put the power question well up on the agenda of management, it should be pointed out at the outset that not every mining operation is so situated that a switch to private generation of power would be either feasible or desirable. Isolated power plants can be justified only where fuel supply and the rates on purchased power give definite promise of private generation at rates less than that for which power can be purchased. This principle of the economics of power generation is fundamental.

Assuming, however, that a possible fuel supply is available and that power costs offer an opportunity for reduction, final installation is dependent upon a number of further factors, each of which will be discussed in the following paragraphs. Presentation, however, will be confined to the statement of general principles, inasmuch as the details of individual plants are properly a problem for the engineer in charge of the project.

Analysis of the fuel question leads to the grouping of individual mines into several classes. Foremost among these are the plants cleaning coal mechanically, with consequent increase in the quantity of refuse which might serve as a fuel. Hand-picking operations at other plants also may result in the production of considerable material that might serve as a boiler fuel after crushing. In these cases, the primary question might be the consumption of such waste only as fast as it could be produced though a third factor, the existence of large banks of refuse from past operations, might influence the final decision.

A comparatively large number of mines are afflicted with the perennial question of disposing of residual sizes (slack, nut-and-slack, pea-and-slack, etc.) in unstable or difficult markets. This problem is aggravated where the fines run higher than usual in impurities. Where these sizes constitute an appreciable percentage of the output, the installation of a power plant, other conditions being favorable, may be the solution to the problem of profitable disposal.

The actual mine power load usually can be ascertained quite easily as a basis for power-plant consideration. To the figure obtained from past operating records must be added the power requirements of future additions to mining and preparation equipment. Preliminary study of the question also may reveal possibilities of revenue from the sale of lighting current and central heat to the mine community or other consumers. No analysis of a mine power project is complete unless these factors are taken into consideration, as the possibilities of profitable expansion into fields other than mine operation may exert a marked influence on profit possibilities. At one operation, a 2,800-kw. turbo-generator and boilers capable of developing 3,000 boiler horsepower have been installed with future requirements in mind, though the present load is far less.

The type and quantity of water available will affect the size of the boilers and also control the installation of condensing equipment. On the whole, however, it is surprising what can be done with a small flow of water. At one mine in Tennessee, where the only source was a small rivulet, installation of a small spray pond and a jet condenser doubled the capacity of the relatively small power plant. In this case, use of the small condenser accounted for the addition of 300 kw. to the plant capacity. Unsalable coal was used as fuel, and, as the supply was limited condensing operation raised the production of power per pound sufficiently to avoid the use of a considerable tonnage of salable product.

A further factor influencing the choice of mine power is the cost of disposing of unsalable material. Where this material must be wasted, storage is an item of expense which would be obviated by the installation of a power plant. This expense should be determined and credited to the power project which eliminates the necessity for such storage.

Available operating talent will affect the extent to which refinements in plant design can be carried. It is evident that a personnel experienced in power-plant operation can get more out of the equipment installed, and it follows, therefore, that the management can afford to increase investment in plant facilities in the expectation of a proportionally greater return.

Assuming that fuel is available in the form of refuse or fine sizes which are nominally unsalable due to low prices or lack of stable markets, the economic desirability of a mine plant may be determined in two ways: (1) by the return on the investment when no value is allowed for the unsalable material used as a fuel, and (2) by the definite value assigned to the unsalable fuel when allowing only nominal fixed charges against the investment. For accounting reasons, the latter method probably is the better, as the separate mine operations can be charged for current at the utility rates, and the profits (above normal fixed charges) can be credited to the waste-coal account.

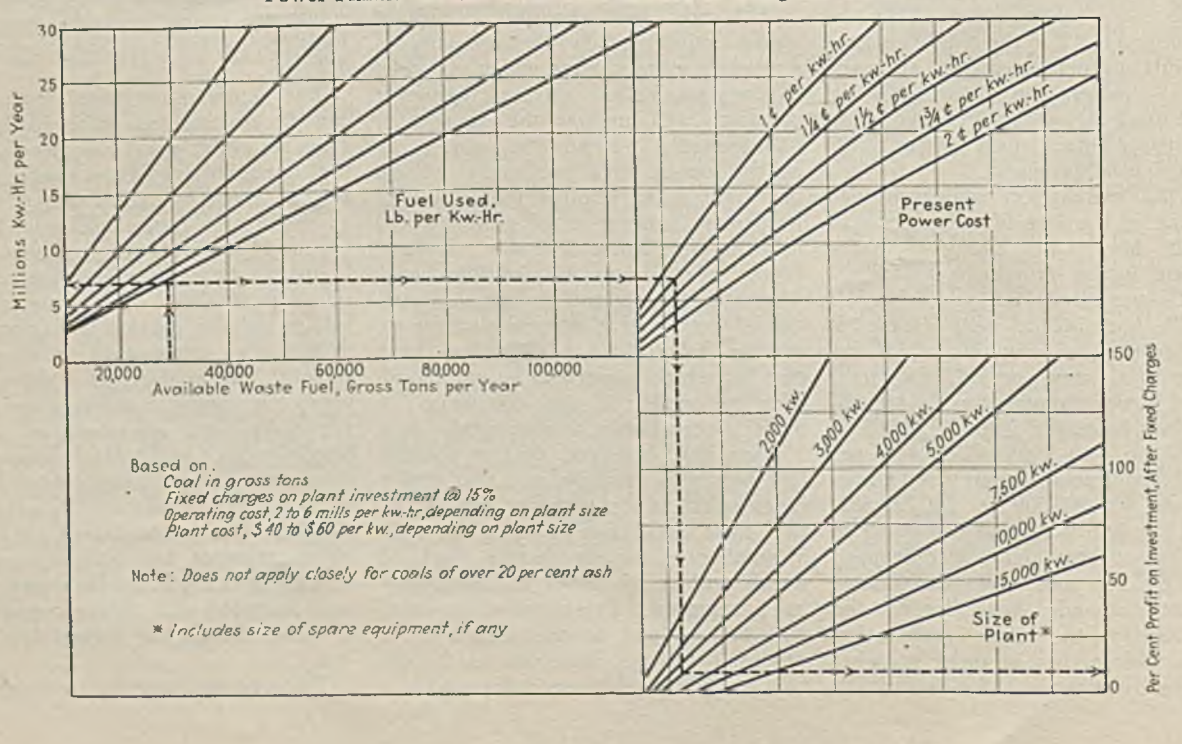
An analysis of the operating results at a hypothetical plant where hoisting and mechanical cleaning is practiced appears in Table I. The figures given, in the opinion of the author, are representative of average conditions in the eastern coal fields of the country. At some plants, however, the savings will not be so attractive, while at others the results may be even more favorable. The curves plotted in Fig. 1 show approximate results under a variety of conditions.

Mines paying relatively high power rates to utilities or operating continuously (with consequent high load factor) will show comparatively high savings from the installation of power plants. In general, high load factor shows a greater proportional gain for an isolated power plant than does the lowered demand charge offered by the power company. In many cases, the utilities have been far-seeing enough to keep their rates down to a competitive figure, but at the present time many mines operate a relatively short time each week, with the result that they pay a relatively higher average rate on account of the large proportion of rate absorbed by the demand charge. However, shortage of water in many cases prevents the installation of a mine power plant unless a condenser and spray pond are added, which eat up a large proportion of the profit that might be expected. Consideration of the factors outlined above makes it evident that the isolated plant is not a panacea for the power troubles of the coal-mining industry.

If it is decided to install a power plant, selection of equipment should turn on dependability rather than efficiency, though the latter is, of course, a major consideration. The present tendency in equipment seems to favor bent-tube boilers, open feed water heaters, uniflow engines for the smaller and turbines for the larger plants, motor-driven auxiliaries (pumps excepted) and alternating-current generators. Stokers are generally used for fuel-burning. Chain-grate types are favored for mid-western slack and cleaning-plant refuse up to 30 per cent ash. Underfeed stokers are suitable for low-ash eastern coals, and some mines have adopted pulverized-coal plants, particularly where "bone coal" is used for fuel.

Pulverizing equipment, however, should be chosen with care, and in general will be more expensive than stokers, as pulverizers, burners and furnaces require more careful design to insure reliability and decrease maintenance cost. Pulverizers for mine plants are more or less confined to roller or ball types, and a large furnace volume is necessary (3 cu.ft. per maximum developed horsepower is a safe limit to use).

**Fig. 1—Graphic Determination of Probable Profit on Investment for Various Sizes of Mine Power Plants. Dotted Lines Show Method of Using the Curves**



Elaborate buildings are not a necessity for a mine power plant, especially where the investment must be watched carefully. Boiler settings, if necessary, may be covered with "dum-dum" and left out in the open, with the firing aisle covered by a coal bunker running the full length of the installation. The engine and generator, if the plant is small, may be set in a "dog-house" opening into the firing aisle, so that attendants will have access to both the prime movers and the boiler fronts.

As fuel is either free or represents only a minor item of cost, economizers and air heaters can be omitted, the plant operating on natural draft; a fairly high stack is cheaper than a short one supplemented by induced draft fans, as the value of the additional generating capacity which must be purchased to operate the fans may run to a respectable figure. Coal- and ash-handling equipment is a necessity, of course, and the type will be governed by plant layout and topography. In general, emphasis should be put on high-grade steam-raising and generating equipment and not on refinements which do not add materially to the operating efficiency. In other words, the investment should be put into reliability, rather than buildings and accessories, though operating instruments should be included.

Exhaust pressures, boiler pressures and superheat depend entirely upon the waste fuel available for use as fuel, the necessary kilowatt capacity and the water supply. Fig. 2 shows graphically the approximate results that may be expected from variations in these factors. Consideration of the curves makes it evident that the plant which consumes the most fuel and water is the simplest. Boiler pressures are low, superheaters are not employed, and practically all of the exhaust steam is blown into the atmosphere. The least simple installation embodies high-pressure boilers and superheaters, and discharges very little water vapor into the air.

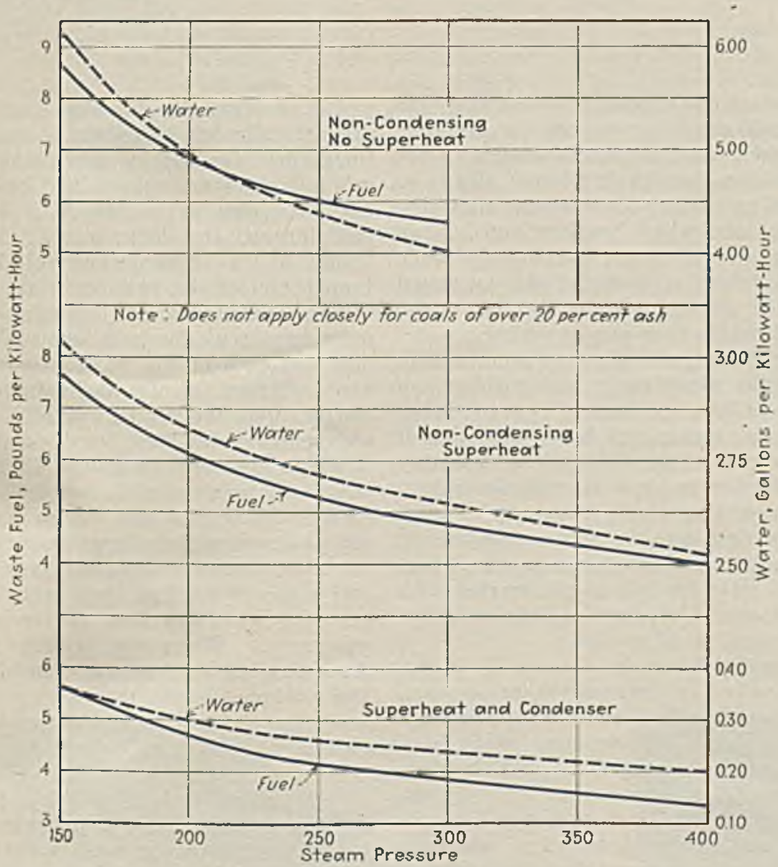



**Fig. 2—Fuel and Water Requirements for Different Types of Power Plants**

The magnitude of the steam pressure has little effect on the ease of operation or reliability of a plant. Superheaters and condensers, with their attendant auxiliaries, are not delicate power-plant refinements, but they do constitute additional equipment to install and care for. Where the waste coal supply is sufficient to make them unnecessary, they should be eliminated, unless limited water supply makes them necessary.

In considering the question of future plant requirements, either of two methods of procedure can be adopted: i.e., investment in facilities for future requirements when the plant is built, or the deferment of the investment until necessary. Investment for the future has little justification at present, unless the attitude of the plant contractor is considered, though the contractor has had many supporters among the operating fraternity in the past.

If investments are deferred until the future, however, provision should be made in the plant design for installation and operation of the added equipment. Boilers and generating units may be selected so that the future purchase of one unit of the same size will take care of the expansion program, or the equipment may be of such a type that the addition of a condenser and low-pressure prime mover will take care of future requirements without the installation of more boilers. In many cases, condensers result in an addition of one-third to the kilowatt capacity of the original plant.

**Table I—Analysis of Design Factors and Operating Results at a Mine Power Plant**

| | |
|---|---|
| **General Considerations** | |
| Kilowatt-hours per gross ton of coal handled, including screening and mechanical cleaning | 10 |
| Kilowatt-hours per ton without mechanical cleaning | 6 |
| Gross tons mechanically cleaned, daily | 2,400 |
| Gross tons not mechanically cleaned, daily | 1,280 |
| Yearly non-operating load, kw.-hr. | 20,000 |
| Daily community light load, kw.-hr. | 200 |
| Days operated per year | 200 |
| Water supply, approximate gallons per minute, summer | 400 |
| Heat value of fuel, as fired, B.t.u. | 11,500 |
| Expected peak load, present, kw | 4,200 |
| Expected peak load after future expansion by adding day and night shifts, kw | 4,300 |
| Present utility rates: | |
| Power, including demand charge, average cents per kw.-hr. | 1.2 |
| Light, cents per kw.-hr. | 10.0 |
| **Yearly Power Consumption** | |
| Coal mechanically cleaned (2,400 tons per day @ 10 kw.-hr. per ton) | 4,800,000 |
| Coal not mechanically cleaned (1,200 tons per day @ 6 kw.-hr. per ton) | 1,440,000 |
| Community lighting (200 kw.-hr. per day for 365 days) | 73,000 |
| Annual non-operating load | 20,000 |
| Total annual power consumption, kw.-hr. | 6,333,000 |
| **Fuel Supply and Plant Capacity** | |
| Coal mechanically cleaned, gross tons per year | 480,000 |
| Refuse coal production, 6 per cent of total, gross tons per year | 28,800 |
| Available refuse coal, lb. per kw.-hr. | 10.2 |
| Approximate steam pressure required, lb. per sq.in. | *175 |
| Design size of plant, kw. | 5,000 |
| **Plant Cost** | |
| First cost of plant @ $50 per kw. | $250,000 |
| Annual operating cost | †25,000 |
| **Operating Profit** | |
| Value of yearly power production @ 1.2c. per kw.-hr. | $75,000 |
| Value of community lighting per year @ 10c. per kw.-hr. | 7,300 |
| Total | $82,300 |
| Fixed charges, @ 15 per cent per year | $37,500 |
| Value remaining for profit or fuel | $19,800 |
| Profit on investment after fixed charges, per cent | 8 |
| Value recovered per ton of waste fuel, cents | 69 |

*Plant to operate non-condensing and without superheat.

†Exclusive of fuel at 4 mills per kilowatt-hour and inclusive of credit for elimination of disposal charges.

# + DEDUSTING COAL

## Offers Advantages in Both Cleaning and Marketing

By KENELM C. APPLEYARD
*Managing Director,*
*The Birtley Co., Ltd.*
*and Associated Companies*
*Birtley, England*

IT IS surprising that in most coal-producing countries so little attention has been paid to the advantages to be obtained by removing the dust from coal, whether as a preliminary to mechanical treatment for the removal of incombustible material or for the purpose of producing grades of coal which make an appeal in certain markets by virtue of being dust-free.

As is the case with so many improvements in the art of preparing coal, dedusting was originally practiced on the Continent of Europe, but it does not appear to have been the subject of any very thorough investigation or research, since even modern Continental apparatus is comparatively inefficient and would appear to have been developed for the sole purpose of removing a moderate percentage of fine dust from the raw coal, in order to relieve the load on wet washeries, or else to provide a source of supply of fuel for pulverized-coal-fired boilers.

Until three or four years ago, dedusting was hardly practiced at all in England and then only in a comparatively crude way. These last three or four years, however, has produced in all coal-producing countries a steadily increasing interest in the subject and a more active realization of the advantages accruing from the use of the process. That this interest has spread to America is evident in the development of one or two types of apparatus which have been well described, in company with European types, by H. F. Hebley, in a paper read at Hazleton before the Coal Division of the A.I.M.E. last year (*Coal Age*, Vol. 37, p. 398).

Dedusting (or aspiration, as it was then usually called) was used in the United States in the early days of pneumatic dry cleaning, but was then abandoned. In Europe, however, it has been continuously used in dry cleaning fine coals, and most of the advanced aspiration work done in England in recent years has been called forth by the demands for higher efficiency in pneumatic separation.

It is rare to come across any complete tabulation of the advantages of dedusting coal. Not all of these are general; some apply only to particular branches of the fuel-consuming industries and others to particular cleaning processes or conditions. Among the general advantages, both to producer and consumer, is the elimination of the dark cloud which is blown about so often at points of shipment and discharge and which involves not only an unpleasant nuisance, particularly when discharging in cities, but also an actual loss of tonnage which is often more considerable than people realize.

Practiced as a separate process with naturally clean coals, and without any form of later mechanical cleaning being involved, experience has shown that it is sometimes possible for a dedusting installation to show an adequate return by providing the producer with sufficient dust for his own steam-raising purposes and releasing tonnage of prepared sizes for sale to the market with a valuable "dust-free" selling point for slacks and small grades.

Even for power stations it is occasionally an attractive proposition. Most modern stations burn slack coals below about ½ in. in size, which have certain disadvantages, particularly when mechanical stokers are in use. By dedusting such a slack coal, two separate fuels are produced, each of which is better for its purpose than the original:

1. A dust-free coal which is much better suited to mechanical stokers, since it contains practically no dust to go through the grate or up the stack, and does not require the addition of moisture to hold the bed together; the latter is more open, combustion is better, and draught regulation is simplified.

2. A powdered coal which (though a proportion does require further pulverizing) is almost entirely free from pyrites and any other extraneous hard materials. A considerable reduction is thus offered to wear and tear on pulverizers, cost of pulverization, and the discharge of incombustible grit from the chimneys.

In one installation for which figures are available in England, the elimination of 3 per cent by weight of pyrites alone reduced the replacement cost of just mill parts from 6.4d. to 1.8d. per ton. Such a suggestion naturally involves the turning over of one or more boilers in a station from chain grates to powdered-fuel burners, but it is interesting to note a trend in England toward the use of both types together in large stations.

The principal benefits from dedusting are naturally felt by operators washing their coals for use by the coking and gas industries and whose hold on their customers can be increased if better metallurgical and domestic coke can be made as a consequence of better preparation of the raw materials.

The advantages of dedusting coal prior to wet washing are unmistakable. The bugbears of the washery operator are variation in his wash water, its clarification, the formation of slurry, and last, but not least, its disposal; all of which are much simplified if there is practically no dust in the raw feed. The dust should not go into the washery in any case, since in the large majority of washery operations no improvement is ever made in the fine sizes below 1/25 in., even when the fines are rewashed separately. When no rewash takes place, the limiting figure is even higher. The washing process, therefore, is being unnecessarily overloaded by just the materials which are bound to cause trouble.

If the refuse consists of soft shale or any clayey material, the fine particles dissolve easily in the wash water. In addition, the finest coal accumulates in the system, and this, coupled with the fine dirt particles, creates a surplus of slurry which has to be got rid of by running to waste a considerable quantity of irrecoverable solids, or else the wash water continues to thicken until it has to be run off and replaced. Further than this, fine, inefficiently cleaned material going forward with the cleaned coal undoubtedly retards the draining of washed fines, while the difficulties of mixing back wet slurry (very often dirtier than the original slurry-forming materials) is too well known to require further comment.

A further point is that spraying just before loading prepared sizes is often a necessity in order to remove from the coals the gray film left by a clayey wash water, so that the customer may receive the nice, bright, black lumps so dear to his heart.

All these difficulties are practically

eliminated by the removal of the slurry-forming materials in a dry condition, and at the same time certain substantial economies and other advantages can be obtained. Wash water, for example, is much economized, since it is possible to maintain the quantity of solids at round about 5 per cent, and there is no need to run water and slurry continuously to waste. The efficiency of the washing operation is improved, since a major source of trouble has been removed and there is restored that degree of regularity in the washing medium which is so essential to good results. Finally, the moisture content of the washed fines is reduced, since the water-retaining element is no longer present and drainage is so much easier whether by dewatering screens or in bunkers.

In planning new washery installations it is possible to reduce substantially the amount of settling equipment installed. The coal producer, however, has the dust on his hands. It is always a little less in ash content than the dust in the original raw coal, since the selective action of any air-operated dedusting process leaves behind it the particles which are just greater in specific gravity than those of the coal particles at the point of separation. It is almost certainly cleaner than the slurry which would be formed out of the same materials, and it is in a form that is easily handled and conveyed, and also easy to mix with either wet or dry coals. It is also easy to burn, as suggested above.

The dust can be mixed back into the washed and dewatered fines, if necessary, thus showing a rather better yield of coal, a lower ash content, and lower moisture content than can usually be shown by returning slurry to dewatered fines. It can be sold separately in occasional circumstances for use as powdered fuel; it can be burned at site in the form of powdered fuel; or it can be moistened sufficiently to enable it to be burned under Lancashire type boilers with ordinary methods of firing. The latter method is now quite common in England, and the problem of adding sufficient moisture to the finest coals for this purpose is by no means so difficult as is sometimes imagined.

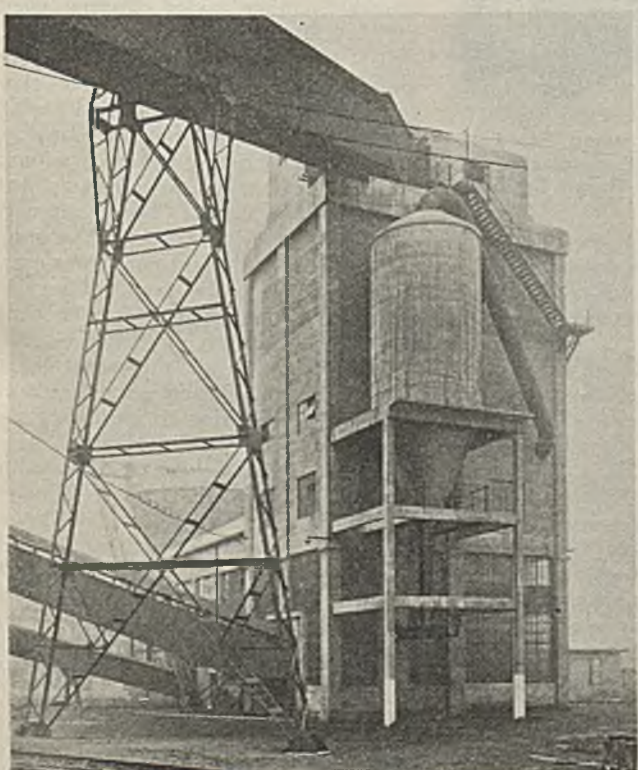
A further alternative, used much on the Continent of Europe and just beginning to gain favor in England in certain restricted circumstances, is to take the dust, where it is very dirty but suitable for making metallurgical or domestic coke, and treat it by flotation with a subsequent drying operation to reduce the moisture content just to the point where the dust will not blow about after admixture with washed or dry-cleaned fines.

For the coking coal producer, the removal of fusain is often a good talking point. It is generally held that much of the fusain in coal lies in the dust, and its removal sometimes results in an improved and stronger coke. This can be done where the producer has an alternative avenue for disposal of the dust. In many cases it has been determined that with coals running high in salts, wet washing results in a substantial reduction in the salt content of the washed product. This no doubt is the case, but the necessity of counteracting such an argument when advanced against the dry-cleaning process led to a good deal of research in the matter, which showed clearly that with many coals the salts, like the fusain, also lay with the dust, and that the elimination of the latter resulted in a substantial reduction of the salt content in the dedusted coal. Thus a further duty of the washer can sometimes be materially lightened.

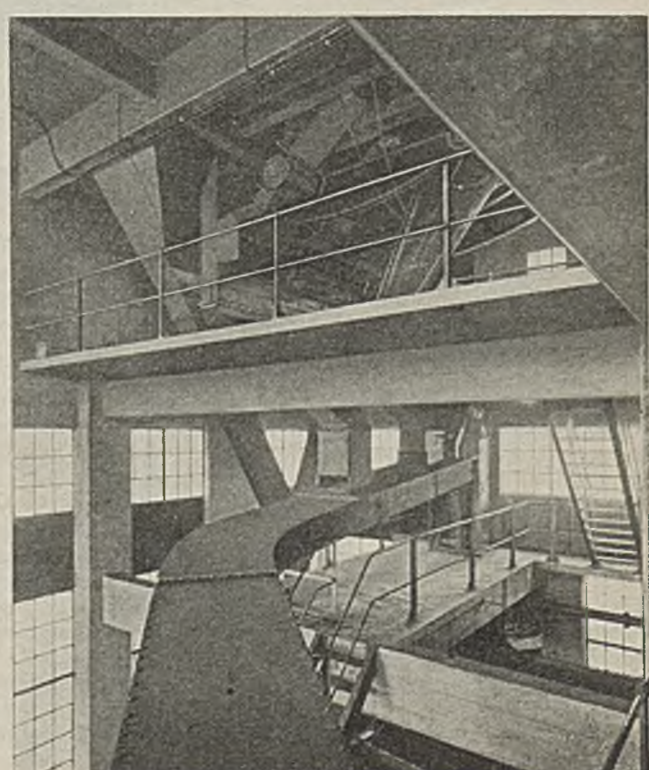
Where dedusting is used in association with the dry-cleaning process, the primary advantages are those outlined above; i.e., the elimination from the raw coal of troublesome material which cannot be cleaned as a commercial proposition and which interferes with the operation of the cleaning equipment. Many of the advantages outlined above are common to both wet and dry processes, but the experience of the marketing advantages already detailed has been quite largely obtained from dusts obtained from dry plants. The advantages of selling "dedusted" coal to great markets like that of London, where coal is discharged from colliers into barges and grabbed from the latter, has been almost as marked as selling "dry-cleaned" coal to them.

*(Specific problems in dedusting and results obtained by aspiration will be discussed in the second installment of Mr. Appleyard's article, to be published next month.)*

Reinforced Concrete Birtley-Waring Filter



Interior of Dedusting Plant at British Coke Ovens



# + PREPARATION

## Keeps Pace With New Market Demands

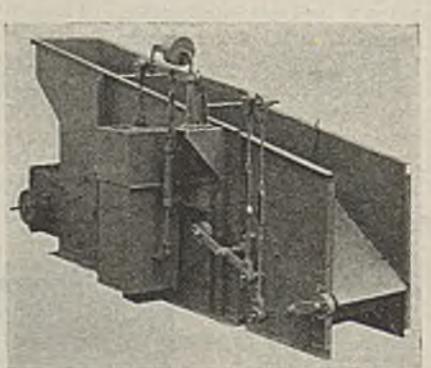
BITUMINOUS-COAL preparation again was called on to meet the still higher standards of the buyers' market that prevailed in 1932. With production down and fewer plants operating, technical developments were devoted largely to the production of coal meeting the stricter requirements of all classes of consumers. The year, therefore, was characterized by refinements in cleaning, sizing and handling to reduce still further removable impurities and allowable limits of oversize and undersize, particularly in the smaller sizes.

West Virginia, as in past years, retained its leadership in the capacity of new preparation facilities, though Pennsylvania stepped into the forefront in the capacity of mechanical cleaning plants contracted for (developments in Pennsylvania anthracite preparation are discussed in a separate article in this issue, p. 42). Of the three mechanical plants contracted for in Pennsylvania last year, two were of the dry type and one included wet-washing equipment.

Barnes Coal Co., Barnesboro, Pa., selected the new Stump "Air-Flow" coal cleaners, brought out by Roberts & Schaefer last year, for cleaning 3x0-in. coal from the Lower Kittanning seam at the rate of 360 tons per hour. The "Air-Flow" cleaner consists of a stationary metal box approximately 7 ft. long, 48 in. high and either 12, 18 or 24 in. wide. In operation, air is forced up through a resistance element installed between two pervious plates, which form the deck on which the coal is carried. The resistance element insures an even distribution of the air, which is supplied by a fan and regulated by a pulsator, or revolving shutter. The clean coal is carried down to the discharge end on a cushion of air, while the refuse settles to the bottom and travels forward to an automatic disposal gate. A middlings discharge opening is located just above the refuse discharge, and also is automatically controlled. An "Air-Flow" cleaner (50 tons per hour) also went into a Northern Illinois Coal Corporation plant in 1932 for cleaning pickings from a picking table.

Washing of all coal under 8 in. in one operation, with subsequent drying of the finer sizes, are features of the new West Mineral (Kan.) plant of the Pittsburg & Midway Coal Mining Co., which was completed in 1932. Maximum capacity of the plant is 350 tons per hour. The Wuensch differential density process was installed for the 8x0-in. coal, and after washing the minus 1¼-in. slack is screened out and dried in a D-L-O dryer (brought out last year by the Oliver United Filters, Inc.) to 4½ per cent moisture.

The D-L-O dryer was developed at the Friar Tuck plant of the Sherwood-Templeton Coal Co., Linton, Ind., as a simple and economical answer to the problem of dehydrating washed minus ¾-in. coal to prevent freezing. The coal is carried through the dryer on a conveyor made up of perforated pans, and is dried in a current of heated air. Air is supplied by a suitable stoker-fired hot-air furnace, and is drawn down through the material by an exhaust fan. Both the quantity and temperature of the air and the speed of the conveyor are adjustable to meet varying conditions.



Factory View of the Stump "Air-Flow" Coal Cleaner, Showing Automatic Controls for Middlings and Refuse Discharges

Cherry Tree Coal Co., Emeigh, Pa., let a contract for the second Pennsylvania air-cleaning plant late in 1932. Cleaning equipment will consist of Peale-Davis pneumo-gravity separators; capacity, 160 tons per hour. Total plant capacity is 250 tons per hour. Union Collieries Co., Renton, Pa., also let a contract late in the year for a steel tipple and coal washery equipped with Link-Belt-Simon-Carves coal washers; capacity is 375 tons of coal per hour.

Virginia also got a mechanical cleaning plant in 1932, when the Pocahontas Corporation contracted for a washery at its Bishop operations employing the Link-Belt-Simon-Carves equipment for cleaning 3x¼-in. coal at 165 tons per hour. This company also contracted for one of the several rescreening plants installed in 1932, which includes special equipment, with a capacity of 180 tons per hour, for making several different grades, including the smaller sizes.

In West Virginia, the new No. 4 plant of the Pond Creek Pocahontas Co., equipped with Link-Belt-Simon-Carves washers for stove and large and small nut, got into stride last year. Among the features of this plant is the use of rescreening-type loading booms, developed by the Link-Belt Co., and also installed at several other plants, for screening out degradation as the coal is loaded, and a slack storage plant with a capacity of 150,000 tons.

Initial operation in January, 1932, brought another major cleaning plant, the C. C. B. Smokeless Coal Co. operation at Glen White, into the West Virginia picture. The Glen White plant employs the new self-contained sealed-discharge Rheolaveur units designed for installation in existing structures without material rearrangement of equipment. This equipment has been improved in the past year by the substitution of chain-and-flight conveyors operating parallel to the launders for the elevators formerly used for handling refuse and transferring materials. Advantages claimed for this construction are: increased compactness and reduced first cost, in addition to increasing the flexibility of the washing units.

One of the few mechanical cleaning plants in Illinois, that of the Midland Electric Coal Corporation, Atkinson, added a Rheolaveur washer and a specially constructed high-speed dewatering screen to its jig facilities for recovering material passing a 1½-mm. wedge-wire screen. Capacity of the Rheolaveur equipment is 35 tons per hour.

The Mead (W. Va.) Smokeless Coal Co. installed a Norton automatic coal washer at its plant in 1932 for preparing egg coal at the rate of 65 tons per hour. The feed to the washer passes over 3½-in. bar screens, with the result that the equipment frequently is called upon to handle pieces as long as 18 to 20 in. In Indiana, the Linton-Summit Coal Co., of Terre Haute, completed a new preparation plant employing Norton washers on 3x0-in. coal. Capacity of the plant is 250 tons per hour, of which the washing equipment accounts for 150 tons. Included in the preparations facilities are a mixing conveyor and crushing equipment, a characteristic of an increasing number of new plants, and facilities for reclaiming coal adhering to the picking-table refuse. In dewatering the washed product, a long series of experiments was carried out with the wedge-wire screens installed, with the result that free moisture in the 1¼-in. x ½-mm. product does not exceed 6 per cent, thus preventing freezing in cold weather.

Evidence that the increased interest in the smaller sizes is having its effect on preparation methods is afforded in the number of contracts for special equipment for making these sizes. During 1932, for example, in addition to other instances cited above, the Continental Coal Co., Cassville, Pa., and the Heisley Coal Co., Nanty-Glo, Pa., installed special pea-coal screening plants, while the New River Co., Macdonald, W. Va., let a contract for a screening plant for nut, stoker and slack with a capacity of 300 tons per hour. Guyan Eagle Coal Co., Amherstdale, W. Va., installed a nut-coal plant, and facilities for making 2x1¼- and 1¼x⅜-in. nut and ⅜-in. slack were contracted for by the Glendora Coal Co., Sullivan, Ind. The Glendora project also included a loading boom for the large nut, making it one of a growing list of companies which are using loading booms for this and corresponding sizes to reduce degradation. Most of the plants listed above employ vibrating screens for separation and, in addition, a number of the vibrating screens installed by other companies in 1932 are used for fine-coal screening.

While the majority of the vibrating screens were installed primarily for use on the smaller sizes, this type of equipment is receiving more attention as a means of primary sizing, a field formerly ceded to the shaker screen. Advocates of the vibrating screen for this work point to high capacity per square foot, with consequent simplification of plant layout and decreased space requirements, and also cite lowered power costs. Two new plants employing vibrating screens for the entire range of separation were installed by the Beaver Run Coal Co., Beaverdale, Pa., and the Hastings Fuel Co., Hastings, Pa., in 1932. Both plants, built by the Robins Conveying Belt Co., are equipped with "Gyrex" vibrating

## COAL'S 1932 CONSTRUCTION RECORD

THE 1932 RECORD of installation of new coal preparation facilities is given by companies in the table below. This record covers both the bituminous and anthracite industries, and includes plants rebuilt and major preparation facilities installed in existing structures.

This summary of new construction in 1932 was made possible through the cooperation of the following manufacturers of equipment (abbreviations used in the table follow the names in parentheses): Koppers-Rheolaveur Co. (Rheolaveur); Link-Belt Co. (Link-Belt); McNally-Pittsburg Mfg. Corporation (McNally-Pittsburg); Roberts & Schaefer Co. (Roberts & Schaefer); Robins Conveying Belt Co. (Robins); United Iron Works Co. (United); Pittsburgh Coal Washer Co. (Pittsburgh); Morrow Mfg. Co. (Morrow); Fairmont Mining Machinery Co. (Fairmont); Kanawha Mfg. Co. (Kanawha); Deister Concentrator Co. (Deister-Overstrom); H. M. Chance & Co. and the Chance Coal Cleaner (Chance); Wilmot Engineering Co. (Wilmot); Dorr Co.; Hydrotator Co.; Deister Machine Co.; American Coal Cleaning Corporation; Cumberland Coal Cleaning Corporation; and the Montgomery Coal Washing & Mfg. Co.

### New Topworks Construction in 1932*

| Coal Company | Plant Location | Capacity, Net Tons per Hour | Preparation Equipment |
|---|---|---|---|
| Barnes Coal Co. | Barnesboro, Pa. | 360 | Roberts & Schaefer[1] |
| Beaver Run Coal Co. | Beaverdale, Pa. | 200 | Robins[2] |
| Blackwood Coal & Coke Co. | Blackwood, Va. | 300 | Fairmont |
| Blue Bell Coal Co. | Harrisburg, Ill. | 50 | McNally-Pittsburg |
| Broad Mountain Coal Co. | Frackville, Pa. | 80 | Chance |
| C.C.B. Smokeless Coal Co. | Princewick, W. Va. | 150 | Fairmont |
| Cherry Tree Coal Co. | Emeigh, Pa. | 250 | Fairmont[3] |
| Clemens Coal Co. | Pittsburg, Kan. | 300 | McNally-Pittsburg |
| Continental Coal Co. | Cassville, W. Va. | 300 | Fairmont[2] |
| Elkhorn Collieries Corporation | Farraday, Ky. | 100 | Morrow |
| Elk River Coal & Lumber Co. | Widen, W. Va. | 80 | Link-Belt |
| Enos Coal Mining Co. | Princeton, Ind. | 50 | Link-Belt |
| Everett-Saxton Co. | Dudley, Pa. | 100 | ................ |
| Glen Alden Coal Co. | Loomis, Pa. | 170[4] | Rheolaveur |
| | Wilkes-Barre, Pa. (10) | 280 | Wilmot[5] |
| | Wilkes-Barre, Pa. | 30 | Dorr Co.[6] |
| | Plymouth, Pa. (2) | 55 | Wilmot[5] |
| | Scranton, Pa. (2) | 55 | Wilmot[5] |
| Glendora Coal Co. | Sullivan, Ind. | 100 | McNally-Pittsburg |
| Guyan Eagle Coal Co. | Amherstdale, W. Va. | 75 | Link-Belt |
| Haddock Mining Co. | Port Carbon, Pa. | 90 | Chance |
| | Silver Brook, Pa. | 5 | Deister-Overstrom[7] |
| Hastings Fuel Co. | Hastings, Pa. | 200 | Robins[2] |
| Heisley Coal Co. | Nanty-Glo, Pa. | 100 | Fairmont[2] |
| Hoover & Abrams | Beach Haven, Pa. | 10 | Deister-Overstrom[7] |
| Huntsville-Sinclair Mining Co. | Huntsville, Mo. | 300 | McNally-Pittsburg |
| Jamison Coal & Coke Co. | Greensburg, Pa. | 200 | Robins[2] |
| Johnstown Coal & Coke Co. | Portage, Pa. | 200 | Robins[2] |
| Jonathan Coal Mining Co. | Shamrock, Pa. | 15 | Deister-Overstrom[7] |
| Leckie Smokeless Coal Co. | Anjean, W. Va. | 500 | Link-Belt |
| Lehigh Navigation Coal Co. | Coaldale, Pa. (3) | 50 | Deister-Overstrom[7] |
| | Lansford, Pa. (6) | 75 | Deister-Overstrom[7] |
| | Nesquehoning, Pa. (5) | 60 | Deister-Overstrom[7] |
| Lindley Coal Co. | Houston, Pa. | 200 | Morrow |
| Lorado Coal Mining Co. | Lorado, W. Va. | 325 | ................ |
| | Lorado, W. Va. | 325 | ................ |
| Lorain Coal & Dock Co. | Blaine, Ohio | 500 | ................ |
| | Blaine, Ohio | 325 | ................ |
| Mead Smokeless Coal Co. | Mead, W. Va. | 65 | McNally-Pittsburg[8] |
| Midland Electric Coal Corporation | Atkinson, Ill. | 35 | Rheolaveur |
| Montfair Gas Coal Co. | Enterprise, W. Va. | 250 | Robins[2] |
| New River Co. | Macdonald, W. Va. | 300 | Pittsburgh |
| New River & Pocahontas Consolidated Coal & Coke Co. | Layland, W. Va. | 500 | ................ |
| Norfolk & Western Ry. | Williamson, W. Va. | 300 | Kanawha |
| Northern Illinois Coal Corporation | Wilmington, Ill. | 50 | Roberts & Schaefer[1] |
| Norwood-White Coal Co. | Herrold, Iowa | 200 | Link-Belt |
| Pardee Bros & Co. | Lattimer Mines, Pa. | 370 | Rheolaveur[9] |
| Penn Coal Co. | Rector, Iowa | 125 | Link-Belt |
| Philadelphia & Reading Coal & Iron Co. | St. Nicholas, Pa. (2) | 110 | Hydrotator Co.[10] |
| | Locust Summit, Pa. (2) | 100 | Hydrotator Co.[10] |
| Pioneer Coal Co. | Pittsburg, Kan. | 400 | United |
| Pittsburg & Midway Coal Mining Co. | West Mineral, Kan. | 300 | McNally-Pittsburg[11] |
| Pittston Co. | Dunmore, Pa. (5) | 280 | Wilmot[5] |
| Pocahontas Corporation | Bishop, Va. | 180 | Link-Belt[12] |
| | Bishop, Va. | 165 | Link-Belt[13] |
| Sandy Run Miners' & Producers' Co. | Sandy Run, Pa. | 200 | Chance |
| Schick Co-operative Coal Co. | Bellaire, Ohio | 100 | Robins[2] |
| Stevens Coal Co. | Shamokin, Pa. (2) | 45 | Wilmot[5] |
| Susquehanna Collieries Co. | Mt. Carmel, Pa. | 25 | Hydrotator Co.[10] |
| Union Collieries Co. | Renton, Pa. | 375 | Link-Belt[13] |
| United States Fuel Co. | Hiawatha, Utah | 300 | ................ |
| West Virginia Coal & Coke Corporation | Omar, W. Va. | 80 | Link-Belt[2] |
| Wolf Collieries Co. | Drifton, Pa. | 10 | Deister-Overstrom[7] |
| Wyoming Valley Collieries Co. | Forty Fort, Pa. | 290 | Chance |

*Also includes rebuilt plants and major installations of preparation equipment in existing structures; installation of more than one cleaning unit is indicated after the plant address.

[1] Stump "Air-Flow" coal cleaners. [2] Vibrating screens. [3] Peale-Davis pneumo-gravity separators, 125 tons per hour. [4] Additional capacity to bring total up to 850 net tons per hour. [5] Menzies hydroseparators. [6] Dorr thickener (diameter, 85 ft.) handling water carrying $\frac{1}{16}$-in. coal at 4,000 g.p.m. [7] Deister-Overstrom Diagonal-Deck coal-washing tables; figures given under capacity represent output of washed coal, rather than feed capacity. [8] Norton automatic coal washer. [9] Capacity, Rheolaveur equipment, 140 net tons per hour. [10] Hydrotators. [11] Wuensch cone equipment and D-L-O dryers. [12] Rescreening plant. [13] Link-Belt-Simon-Carves coal washers.

screens, picking tables, mixing conveyors and belt loading booms for preparing and loading lump, nut, mine-run, slack and special fuels for pulverized-coal burners, stokers and hand-fired equipment. The capacity of each plant is 200 tons per hour.

One of the smaller sizes of bituminous attracting increased attention is domestic stoker coal. The accompanying table, based on a *Coal Age* survey, gives domestic stoker sizes produced in a number of the country's coal fields. This table shows that, in general, most of the eastern mines ship slack or nut-and-slack for this purpose, though a number are equipped to supply nut, pea and similar sizes. Where slack or nut-and-slack are shipped, it usually is produced on the regular shaker screen equipment. The majority of the eastern mines, however, have installed electro-magnets for removing tramp iron.

Dustless treatment of stoker sizes before shipment also has spread to a number of operations in addition to those using this treatment on other sizes. The Gay Coal & Coke Co., Mt. Gay, W. Va., prepares a special stoker size (1½x⅜-in.) on vibrating screens, after which it is treated with "Coalkote" and passed over an electro-magnet. Calcium chloride and other dustless preparations are used by a number of West Virginia smokeless producers on stoker coal, as well as on the other sizes shipped.

Illinois and West Kentucky report the widest range of domestic stoker sizes. In West Kentucky, rescreening plants equipped with vibrating screens or high-speed shaker screens are used by practically all shippers of stoker coal. Special inspection is the rule, and every attempt is made to remove fine material from the various nut and pea sizes before shipment.

In Illinois, as at West Kentucky mines, the most popular stoker sizes consist of slack with the fines (⅜- or 5/16-in.) removed. In addition to this standard preparation, a number of mines are equipped to ship special sizes, consisting of 2- or 1½-in. slack with partial removal of fines, as ordered. Round-hole screens are in the majority for preparing Illinois stoker coal, though a number of vibrating screens are used, particularly in rescreening. The Chicago, Wilmington & Franklin Coal Co., in addition to the usual sizes, offers two "air-washed" stoker coals: 5/16 in. x 10 mesh and 3/16 in. x 48 mesh. These are prepared over vibrating screens, and are then passed through dedusting

equipment (*Coal Age*, Vol. 37, pp. 271 and 398) for removing the 10- or 48-mesh material.

Nine companies in Logan County, West Virginia are equipped to ship eleven domestic stoker sizes from 2⅜x 1-in. down to 1x½-in., including 1¼-in. slack. Special inspection and loading is the rule at Logan County mines, and practically all companies making this size have installed provisions for removing the fine dust.

The production of briquets and other types of manufactured fuel commanded increased interest in 1932 as one means of solving the slack question. Activity in this direction included the installation of a briquetting plant at the Glen Rogers (W. Va.) plant of the Raleigh-Wyoming Mining Co., and the purchase by the Consolidation Coal Co. of briquetting machinery for installation at its Cincinnati yard. The Cincinnati plant will produce 4-in. cubes with a cement binder for domestic consumption.

In the Southwest, the "Kleen-Blox" plant of the Tahona Coal Co., Tahona, Okla., completed its second year of operation on semi-anthracite screenings. Capacity of the Tahona plant is 15 tons per hour, and the product is a 5x5x4-in. block, weighing 3½ lb., for domestic use. The product sells at a premium, and moves to Minneapolis, Minn.; North and South Dakota, Iowa, Nebraska, Kansas and Missouri in the North and to Houston, Texas; New Orleans, La.; and other southern points.

While actual installation was limited, a growing interest in dedusting raw coal before cleaning was manifested in 1932, and considerable experimental work was carried out by equipment manufacturers and preparation engineers. During the year, the Blaw-Knox Co. brought out its "Deduster" for 1x0-in. coal, and the American Air Filter Co. announced the "Turbo-Clone" exhauster and dust-separator unit for coal and similar materials. McNally-Pittsburg Mfg. Corporation acquired the American rights to the British Norton-Collins dust-extraction system, and the Koppers-Rheolaveur Co. purchased the rights to build and install the Birtley aspirator and the Waring dust filter, both developed in England.

Total capacity of mechanical cleaning plants installed or contracted for in 1932 was in excess of 4,000 net tons per hour. Based on a working day of eight hours and using the government's figures of 308 and 303.5 days as the theoretical working days in the bituminous and anthracite industries, respectively, the installed mechanical cleaning capacity in 1932 was 9,782,000 net tons. With the 1931 total, the installed mechanical cleaning capacity in the five years during which *Coal Age* has conducted its survey of construction is 107,540,000 net tons.

Total capacity of plants installed or contracted for in 1932 for handling coal by screening and hand-picking methods was in excess of 7,900 net tons per hour, according to data covering the major part of the building and reconstruction activities collected during the year by *Coal Age*. This total is exclusive of auxiliary coal-handling equipment which does not accomplish a major change in preparation facilities and is, like the mechanical cleaning capacity, under the added capacity made available.

The list of new preparation construction in both the anthracite and bituminous fields in 1932 appears on the preceding page.

**Domestic Stoker Sizes Produced in Certain Districts**

| | Sizes | |
|---|---|---|
| | Nut-and-Slack, Slack, etc. | Nut, Pea, etc. |
| Kanawha (W. Va.) | ¾* | .......... |
| Logan (W. Va.) | 1¼ | 2⅜x1, 2x1½, 2x1, 2x¾, 2x½, 1½x¾, 1¼x¾, 1¼x½, 1¼x⅜, 1x½ |
| Winding Gulf (W. Va.) | 2, 1, ½ | 1x1½, ½x¼ |
| Virginia | 2-in. down† | .......... |
| Southern Appalachian | 2, 1½ | 1½x⅜ |
| Harlan (Ky.) | 2, 1½, 1¼ | .......... |
| Hazard (Ky.) | 2, 1½, 1 | .......... |
| West Kentucky | 2, 1¼, ¾, ⅜ | 3¼x1¼, 3x2½, 3x2, 2½x2, 2x1½, 2x1¼, 1¼x¾, 1¼x⅜, ¾x⅜, ¾x¼, ⅜x⅛ |
| Illinois | 2, 1½, 1¼, ¾ | 2x⅜, 2x3/16, 1½x¾, 1½x⅜, 1½x3/16, 1¼x¼, 1¼x3/16, ¾x¼, ⅜x3/16, 5/16x10-mesh, 3/16x48-mesh |
| Southwest | 1¼ | 1¼x⅜, 1¼x½ |
| Southern Wyoming | 1⅜ | 1⅜x½, 1⅜x¼ |

*Best size found in tests by the Kanawha Coal Utilization Committee; operators equipped to ship any desired size. †Includes both slack and special sizes or combinations of sizes to fit any variations in conditions.

# ✦MECHANICAL LOADING

## Accounts for Larger Percentage of Total Output in 1932

FURTHER progress in loading mechanization was made last year, though with approaching standardization of machines and methods, the reviewer, in his search for strikingly new developments, must eventually reach a period of diminishing returns. That is true even though the percentage of coal loaded mechanically still increases, for the reduced production in 1932 probably was far greater in hand-loaded than in mechanically loaded coal.

Many new types of equipment have begun to make headway in the twelve-month period. The Ladel and the Schmidt-Kranz shaking conveyors have been introduced, the latter from Germany. With an elliptical gear, the Schmidt-Kranz drive, without any undue strain, imparts a slow forward movement to the material resting on the pans, followed by a quick return that jerks the pans from under their load, making the net advance almost equal to the gross.

The new 5-B Joy coal saws (*Coal Age,* Vol. 37, p. 243) made their appearance in the past year. These saws, though cutting equipment rather than loading, early suggested developments covering the freeing of the blocks from the face and the loading of them into cars. A single saw cuts horizontal and vertical kerfs up to 5 ft. and the blocks are dislodged by a hydraulic pad, making powder unnecessary; loading equipment is provided that lifts the blocks over the head of the operative, deftly placing them on the mine car. Three companies are using these saws.

Eickhoff Bros. have devised a short conveyor for crosscuts and room faces, jacks being provided for advancing it sidewise toward the coal face when it is used at the end of rooms and with a pan made with what might be termed a "dustpan edge" which lies down on the room floor so flat that much coal falls onto it without the use of a shovel. That firm also has devised a conveyor which, near the car to be loaded, has legs that, revolving about centers near the ground, lift the conveyor up as it is shaken and so aid the conveyor in raising the coal from floor level to car height. To avoid too large a rise near the part of the conveyor resting and operating on the floor, the legs (usually two only) are made progressively long, so that the rise is gentle but much greater than could be permitted if the legs were omitted.

In the past, locomotives have invariably spotted cars behind loading machines from the rear of the car. During the year, the Jeffrey Manufacturing Co. introduced a car spotter (*Coal Age,* Vol. 37, p. 176) that runs on its own power and, placing itself under the boom of the conveyor, spots the car from under the loading-machine boom, thus aiding in the exact positioning of the car and eliminating the use of whistles, which indicate only the direction, and not the length, of the movement desired. By its greater adjustability, it is said to make complete loading of the mine car by the boom

more feasible than with the earlier arrangement.

Test is being made in the loading of conveyors by mobile loading machines which also gob waste by the side of the road. With this arrangement, loading is practically continuous so long as a trip of cars is on hand awaiting coal.

The State of Washington has many loading devices, even though many mines have inclinations so steep that coal comes to the car by gravity. The Northwestern Improvement Co.'s mines at Roslyn have 40 conveyors; the Washington Union Coal Co. at Tono has three Cosco conveyors and two Red Devils; and the Bucoda Coal Co., two conveyors. In 1932 the Union Pacific Coal Co. in Wyoming produced 2,045,270 tons, of which 1,659,141 tons, or 81.12 per cent, was loaded mechanically.

The twelve mines of this company have been divided into 32 safety sections, each of which is in charge of a man who is held responsible for the accidents in his section. The accident records are kept on a lost-time injury basis, every injury, whether minor, major or fatal, being counted as a lost-time accident, if its occurrence prevents the underground employee from reporting for work on the next succeeding workday.

To create an incentive, two sedan automobiles, and two cash prizes—$150 and $100, respectively—paid in gold, are given as awards. The foremen and men employed in the sections passing through the year without a lost-time accident are entitled to participate in a drawing for these prizes. The automobiles go to the men and the cash prizes to the foremen of the sections in which the winners of autos are employed.

In the last six months of 1931, eight sections with 512 men had no lost-time accidents, and, in the twelve months of 1932, twelve sections with 800 men made the same record, but for the longer time—a remarkable improvement that increased the number of man-shifts per lost-time accident, for the mines as a whole, 130 per cent. The number of fatalities was reduced to one, as against an average of 9.22 per year for the previous nine years. In 1931, the Union Pacific Coal Co. had six fatal accidents, one of which occurred under the management of a contractor but was chargeable to the property.

Use of a screw-extension metal post under a crossbar, which can be moved from place to place, admits the moving of shaker conveyors and duckbills without withdrawal of roof support. Most of the tonnage is loaded with the latter equipment, and a 300-ft. room can be completed in about twenty working days and the pillar brought back in an equal time. The extraction is about 90 per cent, and about 50 per cent of the timber is recovered.

During the year, shaker conveyors with duckbills averaged 15.4 tons per man-shift; the Joy loaders, 46.0 tons; and the 3½-ton scraper loaders, 16.4

tons. The Joy loader men were working in very thick coal which was shot down for them, and, as they worked on the strike, the machines had a level bottom on which to maneuver. The men handling the duckbills and scrapers not only load the coal but undercut, drill and shoot it, the machines working uphill in pitching seams with thinner coal, a condition obtaining in the Rock Springs district.

Under the premium system installed three years ago (*Coal Age*, Vol. 37, pp. 233 and 266), 58.6 per cent of the duckbill tonnage earned a premium averaging 72.9c. per man-shift last year. Of the Joy loader men, 29.6 per cent earned a premium of 84.2c. per man-shift, and, of the scraper loader men, 26.8 per cent received 86.3c. per man-shift. This is paid in separate checks not subject to check-off for union dues, store bill, mine supplies or any other charges. It is regarded as a gratuity, not as a wage.

At the New Orient mine, in Illinois, because of short running time, the McKinlay entry-driving machines worked only 102 days last year, but drove 1,500 ft. of main aircourse, about 2,200 ft. of cross heading and about 580 ft. of panel heading per machine, cutting their way round two 90-deg. turns of 80-ft. radius before being dismantled for work in a new location. In all, 8,375 ft. of heading has been driven, or an average of slightly over 41 ft. per 8-hour shift for each machine.

At the mines of the Pruden Coal Co., the longwall workings are still operating with Myers-Whaley shovels, which also are used for heading driving (*Coal Age*, Vol. 37, p. 185). Should business justify further extension, the mine probably will develop further along these lines.

A company in Pennsylvania, which has cut its hand-pick mining from 58 per cent to zero in two years and has increased machine-mine and conveyor-loaded coal from 3 to 27 per cent, states that conveyor mining has not proved economical under heavy cover, possibly because of the necessity for leaving big pillars and the difficulty of holding the top. It is using a room-and-pillar method for its mechanical loading operations with only two rooms working in an entry at any one time. Each room is equipped with a face conveyor, a room conveyor and a mining machine with four men in each place. The room conveyors are of the Jeffrey chain-flight type, as that has been found to suit best the rolling condition of the floor.

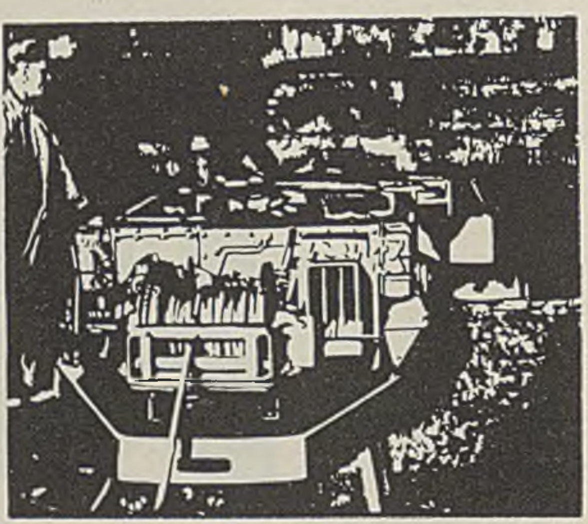
Room conveyors bring the coal down to the heading, where it falls on a cross conveyor which receives the coal from the two rooms. An elevator, or loading boom, is provided to lift the coal from the conveyor to the mine car. One man is stationed at the loading point, and he controls the situation, subject to bell signals from the face workers, for which a standard code has been prescribed. Thus there are nine men in each crew, four in each room and one at the loading point.

Rooms are driven to full length in nine working days and pillars drawn back in three days, so that a room can be started, completed and the pillars drawn in twelve days. The extraction of the inby pillar of one room is completed concurrently with the completion of its outby neighbor of two-thirds of its completed length. The management does not believe that the rapid driving of rooms and drawing of pillars has been proved to be of any definite advantage in roof support. The quality of the roof is thought to be, if not a controlling factor, at least an important one. Rapid advance and retreat in places where the roof is bad and control of the roof difficult has not improved the situation, and, of course, improvement is not necessary where the roof is all that can be desired.

Conveyor loading has practically eliminated accidents in the rooms. Safety rules require that the posts be set at 4-ft. centers with prop rows 4 ft. apart. None of these posts is withdrawn. The percentage of lump coal has been somewhat increased because of the closer supervision in blasting and because it is not necessary to break up the coal as much as when hand-loaded into cars. Men can load with conveyors about twice as much per day as hand loaders. Two of the mines produce 80 per cent of the conveyor-loaded coal. At one of these, the production per employee has increased 40 per cent over that obtained when only 8 per cent was loaded by conveyors. This includes all inside and outside employees.

At the Hanna operations in Ohio (*Coal Age*, Vol. 37, p. 95), mechanical-production sections are made up of twelve rooms, the rooms being 300 ft. long. A set of twelve rooms are driven in 40 eight-hour shifts. As all the wide units are double-shifted, a production section is finished in 20 days. Posts in the wide rooms usually are pulled and about 60 per cent of the coal is recovered from the area mined. From these and other examples, it is obvious that the life of rooms, pillared or unpillared, has been greatly reduced by mechanization.

At the mines of the Old Ben Coal Corporation, Blackor tips have been used on coal-cutting bits, increasing the cutting life of the bits 1,036 per cent, from 1.1 tons per bit used to 12.5 tons (*Coal Age*, Vol. 37, p. 259). Without the heat treatment, it is reported, the life of the bits was only 75 per cent as long. Tests are now being made with tungsten carbide, an alloy 70 per cent tungsten. The first day these bits were put on a Goodman track cutting machine, they cut thirteen places with nine bit changes—that is, only nine bits became dull enough to need replacement. Thus 845 tons of coal was cut by the nine bits, or 9.4 tons per bit, but the test is, of course, by no means determinative because of its short duration, because the other bits were dulled in the process and would eventually need replacement, and because the life of any bit depends on the hardness of the material to be cut and the technique of treatment. Thus in the harder coal the Blackor tip showed a life of 9.8 tons per bit.



Stripping progress in 1932 was largely in the direction of the use of horizontal drilling, the dehydration of the coal by heat, the further introduction of cleaning equipment and the use of counterweights to balance the weight of the bucket, thus permitting 16- and 18-cu.yd. buckets to be installed on machines that formerly carried 12-cu.yd. buckets.

# + POWER PLANTS

## Play Larger Part in New Modernization Plans

COMPARISON of the rates of growth in production and installed horsepower of motors and prime movers reveals a relatively large advance in the mechanization of bituminous coal mining in the last 25 years. Examination of the Census figures shows that the horsepower of motors and prime movers used in driving coal-mining machinery, as distinguished from the generation of electricity, increased approximately 2½ times between 1909 and 1929. During this period, the calculated capacity of the bituminous industry, using the theoretical working year of 308 days, was 560,000,000 tons in 1909, 736,000,000 tons in 1919 and 752,000,000 tons in 1929, making the 1929 capacity approximately one-third greater than the 1909 capacity.

An even more striking change has taken place in the sources of power for bituminous coal mining in the past 25 years. Again referring to the Census figures (Table I), the horsepower of motors driven by purchased electrical energy increased from 25,294 in 1909 to 2,402,500 hp. in 1929, while the horsepower of motors driven by mine-generated energy rose from 329,298 in 1909 to 707,341 in 1919, and then dropped back to 429,970 in 1929.

Anthracite operators, however, have been more firmly wedded to steam, though purchased power has been showing gains in late years. This is shown by the fact that the horsepower of motors operated by purchased electrical energy (Table I) increased from 117,693 in 1919 to 423,423 in 1929, or 259.7 per cent, while the horsepower of motors driven by mine-generated power was rising from 185,723 in 1919 to 464,164 in 1929, or 149.8 per cent.

In the bituminous industry, the rate of change over from mine-generated to central-station power varies widely among the different states. Of the five largest producing states, Pennsylvania showed a decrease of 64.1 per cent in the horsepower of motors driven by mine-generated power between 1919 and 1929, and this was paralleled by a drop in turbo-generators from 100 to 47. In West Virginia, on the other hand, while the number of turbo-generators dropped from 40 to 38, the horsepower of motors driven by mine-generated electricity rose from 87,256 to 91,839, or 5.8 per cent. Even greater percentage increases were shown in Utah and Wyoming. Further evidence of the fact that West Virginia producers are retaining their power-plant equipment is shown by replies to a *Coal Age* survey. Eighty per cent of the companies which reported operation of power plants prior to 1930 stated that these plants were still being used. Dates of original construction range from 1906 to 1929, and generating capacities range from 300 up to 10,800 kw. for the various companies.

One of the major factors in the increase in installed horsepower in the bituminous industry was the growth in volume of production and mine capacity, though another scarcely less important reason was the increased mechanization of mining activities. With central-station power easily obtainable at relatively attractive rates, and in view of the attractive reciprocal relations available, the majority of the new operations opened up in this period naturally turned to purchased power, though obsolescence of power-plant equipment at many of the existing operations was a factor in the swing to purchased power.

Within recent years, however, changing conditions have led a number of bituminous operators to consider the installation of power plants to reduce costs. Among the principal reasons for this change in viewpoint are: the effect of demand charges on the total power bill during the prevalent slack running times, and the possibility of using the increasing quantities of waste fuel available. These conditions apply particularly in the bituminous industry, and were responsible for the installation of several new plants last year.

The largest of the 1932 plants was that of the Jamison Coal & Coke Co., Hannastown, Pa. This plant, which operates on refuse from a combination wet-and-dry preparation plant installed in 1931, has a total generating capacity of 2,500 kw., and serves three mines. Equipment is as follows: three 490-hp. four-drum bent-tube boilers with a maximum rating of 37,500 lb. of steam per hour for 24 hours; three Green forced-draft traveling grate stokers; and a 2,500-kw. Westinghouse turbo-generator. Boilers and stokers were supplied by Combustion Engineering Corporation.

Another Pennsylvania installation was that of the Lincoln Coal Co., Nanty-Glo, Pa., serving one mine with a daily capacity of 1,000 tons. The plant is equipped with two 275-hp. boilers with a 250 per cent rating operating at 175 lb. per square inch; pulverized-fuel firing equipment operating on road clean-

**Table I—Changes in Power Equipment in the Bituminous and Anthracite Industries**

| | Bituminous | | | Anthracite | | |
|---|---|---|---|---|---|---|
| | 1909 | 1919 | 1929 | 1909 | 1919 | 1929 |
| Prime movers, horsepower* | 1,202,732 | 1,383,934 | 721,687 | 674,718 | 782,090 | 618,042 |
| Change from previous year, per cent | ........ | +15.0 | —47.8 | ........ | +15.9 | —21.0 |
| Steam engines: | | | | | | |
| Number* | 11,751† | 9,177 | 4,542 | 7,567† | 5,298 | 3,286 |
| Horsepower | 1,200,055† | 1,166,862 | 544,015 | 673,946† | 730,141 | 455,327 |
| Steam turbines: | | | | | | |
| Number | ........‡ | 313 | 199 | ........‡ | 45 | 282 |
| Horsepower | ........‡ | 195,779 | 145,008 | ........‡ | 50,665 | 160,424 |
| Internal combustion engines: | | | | | | |
| Number* | 349 | 1,246 | 425 | 25 | 73 | 98 |
| Horsepower | 2,329 | 21,219 | 28,004 | 772 | 1,284 | 2,291 |
| Water wheels and water turbines: | | | | | | |
| Number | 9 | 9 | 5 | ........ | ...... | ...... |
| Horsepower | 348 | 74 | 4,660 | ........ | ...... | ...... |
| Electric motors driven by purchased energy: | | | | | | |
| Number | 840 | 21,186 | 66,581 | 32 | 1,881 | 6,598 |
| Change from previous year, per cent | ........ | +2,422.1 | +214.3 | ........ | ........ | +250.8 |
| Horsepower | 25,294 | 771,131 | 2,402,500 | 1,410 | 117,693 | 423,423 |
| Change from previous year, per cent | ........ | +2,948.7 | +211.6 | ........ | +8,247.0 | +259.7 |
| Electric motors driven by mine-generated energy: | | | | | | |
| Number | 9,717 | 21,044 | 14,379 | 1,152 | 3,801 | 9,917 |
| Change from previous year, per cent | ........ | +116.6 | —31.7 | ........ | +229.9 | +160.9 |
| Horsepower | 329,298 | 707,341 | 429,970 | 46,088 | 185,723 | 464,164 |
| Change from previous year, per cent | ........ | +114.8 | —39.2 | ........ | +303.0 | +149.8 |

* Includes prime movers driving electric generators. † Includes data for steam turbines. ‡ Included with data for steam engines.

ings; and two 2,300-volt engine-driven generators. One generator, driven by a 19x18-in. high-speed side-crank engine, has a capacity of 300 kw., while the other, driven by a similar 16x16-in. engine, has a capacity of 200 kw. A feed-water heater was installed, and the plant operates non-condensing and without superheat. Firing equipment, boilers and engines were supplied by the Erie City Iron Works; the General Electric Co. supplied the generators. Total cost of the plant was $76,000.

Two new plants also were installed in southern West Virginia in 1932, one by the Scotia Coal & Coke Co. and the other by the McKell Coal & Coke Co. The Scotia plant, which was completed late in the year, is located at the Brooklyn mine of the company, near Thurmond, and serves three mines with a daily capacity of 2,000 tons. Equipment includes two 300-kw. d.c. turbo-generators and one 300-kw. a.c. turbo-generator.

The McKell Coal & Coke Co. plant, located at the Kilsyth mine, consists of a steam generator, pulverized-fuel firing equipment, boiler setting and accessories, fans and stack, and replaced a number of horizontal-return-tube boilers that had been in service for a number of years. Fuel originally consisted of mine-run from the Kilsyth mine. Last year, the company completed the installation of a Union Iron Works steam generator, consisting of a 600-hp. boiler and accessories, and pulverized-fuel firing equipment supplied by the Riley Stoker Co. The steam generator is designed to operate at a maximum rating of 306 per cent. Fuel consists of a poor grade of bone coal screened out of refuse from the Siltex mine.

In Tennessee, the Cambria Coal Co., Briceville, began the installation of new power-plant facilities in 1932. Equipment includes two 22x24-in. horizontal uniflow engines direct-connected to 312-kva. 250-kw. 2,300-volt generators. These units were installed by the Skinner Engine Co. under the "Skinner guaranteed saving contract," which is given credit for large savings in power cost at the Rogers Bros. Coal Co. operation, Bevier, Ky., completed early in 1931 (*Coal Age*, Vol. 37, p. 523).

Construction in the anthracite region in 1932 included the installation of three boiler plants, two of which were put in by the Glen Alden Coal Co. At the Stanton colliery, near Wilkes-Barre, Pa., the Glen Alden company installed two 665-hp. and two 504-hp. bent-tube boilers, rated at 200 per cent for 24 hours, and four Coxe traveling-grate stokers to serve the Stanton and Empire collieries. Glen Alden also installed four 615-hp. Stirling boilers at South Wilkes-Barre. No. 4 buckwheat is used as fuel at both plants, and the Combustion Engineering Corporation supplied both the boilers and stokers.

In view of the economies to be expected by the construction of a plant near the load center, the Philadelphia & Reading Coal & Iron Co. erected a new boiler plant late in 1932 in connection with the construction of its new central breaker at St. Nicholas, Pa., to supply steam for certain breaker operations and the Maple Hill, St. Nicholas, and Ellangowan collieries, each of which formerly was equipped with its own boiler plant. The St. Nicholas plant consists of two C-E Coxe CD Type traveling-grate stokers, each with a two-hour rating of 20,000 lb. of No. 4 buckwheat, and two B. & W. boilers rated at 1,050 hp. each. The No. 4 buckwheat (11,000 to 13,000 B.t.u., dry basis) is pumped one-half mile from the breaker to the boiler plant by mixing it with water. Dewat[illegible]ing screens are employed to re[illegible] the excess moisture, after which [illegible]el is distributed to the boilers by [illegible]in-and-flight conveyor. The plant [illegible] built by the Stone & Webster [illegible]ring Co. Boiler working pres[illegible] is 430 lb. per square inch.

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# Skillful Planning Opens Way To More Profitable Anthracite Operation

*(Concluded from page 40)*

(*g*) *Mechanical vs. Hand-Loading*—The essence of cheap mining is concentration, and mechanical loading yields greater concentration than hand loading. Moreover, in thin veins, it eliminates blasting and loading of rock for roof clearance, eliminates the installation of tracks, shortens the length of time necessary to hold open working places and effects collateral savings in the number of company men necessary to service a given tonnage. Mechanical loading is particularly essential in caved ground workings such as are found in the Scranton and Wilkes-Barre areas.

The type of mechanical equipment to be used is dependent on the vein conditions. In clean thin veins, with good top and bottom conditions, the scraper loader gives an excellent performance, but it is useless in caved territory. The shaking conveyor yields the best results in opening up gobbed or caved territory, and our experience has been that direct and collateral savings resulting from their use, in general, may be taken at from 50c. to 75c. per ton. The chain conveyor finds little application in this work, as it will not follow the irregular pillar rib.

The second item of mining cost — namely, development—must be studied separately, to see if it can be more cheaply and more rapidly accomplished so as to give a maximum of concentration. The development must be planned by months, several years in advance, and be periodically adjusted to meet unforeseen conditions which arise.

It may be necessary periodically to accelerate or retard development at specified periods to keep all beds in proper robbing sequence, and to maintain the planned output. In squeezed or closed areas, a safety factor of 25 per cent should be used to allow for unforeseen difficulties. Development should proceed at a predetermined yearly rate irrespective of market conditions, so as to keep mining and company costs uniform and refuse disposal within reasonable limits.

To control face costs, managers, superintendents, foremen and sectional foremen should know accurately the cost per car for each working place with which they are concerned: the production per man-hour, the average topping, quantity of refuse per car, miners' and laborers' earnings, and the reasons for the departure from planned costs and output; also, the reason for make-up or consideration wages.

Mining on a daily rate basis or consideration rate should be discouraged, and careful studies should be made to determine equitable piece-work rates, even in crushed ground.

It has been our experience at numerous mines that men working on a piece-work basis perform 35 to 40 per cent more work than when working on a company work or consideration basis. Assuming, then, that piece-work rates have been or can be equitably established so that costs are satisfactory to the company and earnings are satisfactory to the miner, the contract or piece-work sysem is the ideal method of wage structure. If the essence of low mine costs lies in concentration, the greatest concentration will result where face workers are giving their maximum performance.

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*(The concluding instalment of Mr. Pierce's article, covering Inside and Outside Company Costs, Sales Strategy and the Integration of the Individual Mine With the Industry, will be published in March.)*

# + FREIGHT RATES

## Under Widespread Attack by Producers and Consumers

GROWING discontent on the part of the coal-mining industry with the percentage of delivered prices on solid fuel absorbed by transportation charges has culminated in the last few weeks in two major attacks on the coal-rate structure of the country. The first attack was directly foreshadowed early in January when the National Coal Association, in a brief opposing the emergency surcharge authorized by the Interstate Commerce Commission in 1931, declared the existing level of rates was depriving the mines and the steam railroads of 200,000,000 tons of business annually. On Jan. 25, the same organization joined with the agricultural interests and the National Lumber Manufacturers' Association in a petition for a general reduction in the freight rates on basic commodities.

Anthracite interests, which already had negotiated with the carriers for a voluntary reduction in westbound rates on hard coal reaching $1 per ton at Chicago, declined to join in this petition. The issue was promptly raised, however, by one of the largest old-line sales companies—the Delaware, Lackawanna & Western Coal Co.—in a formal complaint to the Commission attacking the rate structure from points in the Lehigh and Wyoming fields served by the Jersey Central and Lackawanna railroads to all destinations to which rates are published.

The action taken by the National Coal Association signalizes a fundamental change in policy on the part of the producing interests. Although coal always has loomed large in the annals of the Interstate Commerce Commission, heretofore, with possible rare exceptions, the bitter fights initiated by the mining interests have been directed against rate relationships between competing fields. For the most part, in the past the burden of attacking the reasonableness *per se* of rates has been left with the industrial consumer and the retail distributor.

In the petition in which the National Coal Association and its allies ask the Commission to direct the railroads to "show cause why they [the carriers] should not be required immediately to cease and desist from charging the present unreasonable and inordinately high freight rates upon basic commodities," five major arguments are set up:

1. That the severe decline in the price level of basic commodities with substantially no decline in the freight rate level has thrown the economic structure so seriously out of balance as to imperil the ability of the industries petitioning for relief to supply traffic for the railroads.

2. That the present situation is similar to that which induced the Commission to order a general reduction in 1922, except that the disparity between the level of commodity prices and freight rates is now much greater.

3. That experience has demonstrated that the increase authorized by the Commission in 1931 did not produce the results sought.

4. That a reduction in rate levels on basic commodities will tend to discourage the undue development of competitive transportation agencies and thereby preserve railroad transportation as the dominant factor in national commerce.

5. That, under conditions which prevail today, the value of railroad property and the rate of return on railroad investment must reconcile themselves to the ultimate effect of freight rates on traffic and revenues.

While this petition and the formal complaint of the Delaware, Lackawanna & Western Coal Co. respectively challenge the general rate structures on hard and soft coal, the Commission on Dec. 1, 1932, had pending before it over 100 individual complaints challenging rates to individual destinations and to whole states from every bituminous-producing state except Kansas, Maryland, Michigan, Texas and Washington. The extent of these complaints and the territories involved are indicated in the map on page 64. Because of the group system of rate making, in scores of cases any decision favorable to the interests of the complainant would mean the filing of new complaints by producing or consuming groups who felt their competitive position had been affected adversely by the relief granted.

This situation is illustrated by what happened following the decision in the *Scott Milling Co.* case, 113 I.C.C. 675, in which the Commission held that rates from southern Illinois and western Kentucky to some 20 destinations in southeastern Missouri and one station in northeastern Arkansas were unreasonable and awarded reparation approximating 50c. per ton. The same finding, with an extension further south into Arkansas, was made in the *East St. Louis Cotton Oil Co.* case, 146 I.C.C., 559. As a result of these decisions, the first one handed down in 1926, there are 19 other cases involving rates to Missouri and Arkansas via the Thebes gateway now pending before the Com-

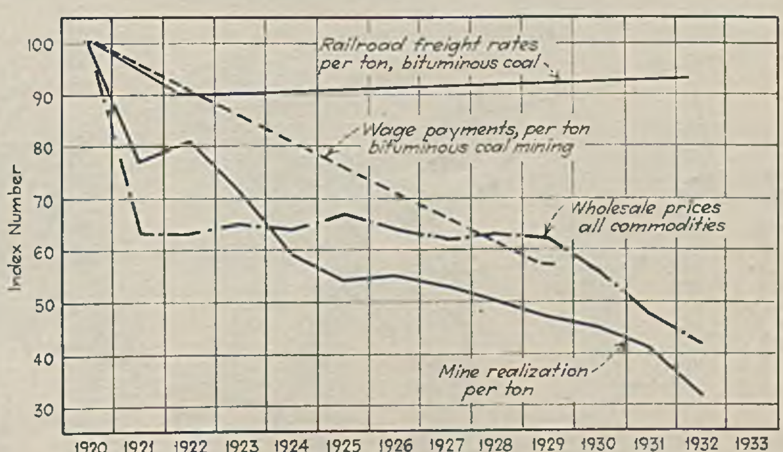



**Fig. 1—Relationship Between Freight Rates and Commodity Prices**

This chart, prepared by the National Coal Association, illustrates the trend in prices, bituminous coal sales realizations and wage payments per ton, and railroad rates on bituminous coal since 1920. The wholesale price curve is charted from monthly figures compiled by the Bureau of Labor Statistics; mine realization figures are the yearly averages reported by the U. S. Bureau of Mines from 1920 to 1931, with 1932 estimated by the National Association from the basis of returns for April to September. In the case of wage payments per ton, Census Bureau figures for 1919 and 1929 are used and, in the case of rates, only general changes in 1922 and 1932 are shown; the curves therefore do not necessarily show trends between these specific years.

mission and 11 older cases involving this same territory were reopened for further hearing with the newer complaints.

In the cases now pending are complaints involving rates from:

*Alabama* to Arkansas; Jacksonville, Fla.; Brunswick and Savannah, Ga.; Tallulah, La.; Port Gibson, Miss.; Kennett, Mo.; Wilmington and North Carolina generally; Jackson, Tenn., and points south on Mobile & Ohio; Ry.; South Carolina generally and Charleston and Spartanburg.

*Arkansas* to Lindsborg, Kan.; Aspermont, Big Spring, Coahoma, Colorado, Jaytown, Loraine, Midland, Odessa, Pecos, Sterling City, Toyah, Water Valley and Westbrook, Texas.

*Colorado* to Kansas; Nebraska generally and Atkinson and Spencer; Melrose, N. M.; South Dakota generally and Herrick and St. Charles; Dimmitt, Matador, Sierra Blanca, Roaring Springs and Texas points mentioned in preceding paragraph; southeastern Wyoming.

*Illinois* to Arkansas in general and Batesville, Calico Rock, Cherry Valley, Clarendon, Earle, Forrest City, Hoxie, Jonesboro, Limedale Spur, Marianna, Newport, Paragould, Pine Bluff, Pocahontas, Walnut Ridge, Wilson and Wynne, Ark.; Chicago Switching District. Moline, East Moline, Rock Island and Silvis, Ill.; Indiana (from Westville, Ill.); Davenport, Bettendorf and other Iowa points; Louisburg and related Kansas points; Minnesota; Missouri generally as well as Benton, Bloomfield, California, Caruthersville, Farber, Fredericktown, Hayti, Kennett, New Florence, Raymore, Rolla, Sedalia, Utica, Washington and Wellsville; Tennessee; Wisconsin.

*Indiana* to Illinois, Minnesota and Wisconsin (from Hatfield, Ind.); Marshall, Moline, East Moline, Newman, Rock Island and Silvis, Ill.; Bettendorf, Davenport and other Iowa points; Beloit, Wis.

*Iowa* (Centerville district) to Iowa, Kansas, Missouri and Nebraska.

*Kentucky* to Arkansas generally and specific destinations in Arkansas summarized under *Illinois;* Jacksonville, Fla.; Brunswick and Savannah, Ga.; Moline and related points in Illinois; Davenport, Bettendorf and other Iowa points; Kansas; Millett, Mich.; Port Gibson, Miss.; Missouri, including Benton, Bloomfield, Caruthersville, Hayti and Kennett; Wilmington and other North Carolina points; Tennessee; Charleston, Spartanburg and other South Carolina points; Beloit, Wis.

*Montana* (Roundup, Mussellshell and Geneva) to Iowa, Minnesota, Nebraska, North and South Dakota and Wisconsin.

*New Mexico* to Kansas; Nebraska; Big Spring, Coahoma, Colorado, Dimmitt, Jaytown, Matador, Midland, Odessa, Pecos, Roaring Spring, Sierra Blanca, Sterling City, Toyah, Water Valley and Westbrook, Texas; southeastern Wyoming.

*Ohio* to Mulliken and other Michigan points; Ohio intrastate.

*Oklahoma* to Kansas and Missouri points on Frisco and Missouri Pacific railroads (from Poteau, Okla., on Kansas City Southern Ry.); Lindsborg, Kan.; Aspermont, Big Spring, Coahoma, Colorado, Jaytown, Loraine, Midland, Odessa, Pecos, Sterling City, Toyah, Water Valley and Westbrook, Texas.

*Pennsylvania* (Central) to Delaware; District of Columbia; Maryland; New England States; Burnside, Hartford and East Hartford, Conn.; New Jersey generally and Kearny; New York; Pennsylvania in general and Chambersburg and Greencastle; Virginia; West Virginia; Wyoming (smithing coal from Lilly).

*Pennsylvania* (Western) to New England States, Kearny, N. J.; Harriett, N. Y.; northeastern Ohio; Chambersburg and Greencastle, Pa.; Trunk Line territory (from Westmoreland district).

*Tennessee* to Jacksonville, Fla.; Brunswick and Savanah, Ga.; Wilmington and other North Carolina points; Charleston, Spartanburg and other South Carolina points.

*Utah* to points in Idaho on Oregon Short Line and Pacific & Idaho Northern railroads; Nebraska.

*Virginia* to Jacksonville, Fla.; Brunswick and Savannah, Ga.; Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, New York, North Carolina, North Dakota, Ohio, Pennsylvania, South Dakota and Wisconsin (from points on Interstate R.R.—Stonega, Roda, Oska, Arno, Derby, Dunbar, Roaring Fork, Pardee and Dorchester); Millett, Mich.; Wilmington and other North Carolina points; northeastern Ohio; Charleston, Spartanburg and other South Carolina points; Bedford, East Radford, Danville, Harrisonburg, Hiawassa, Narrows, Pearlsburg, Roanoke, Rocky Mount, Salem, Vinton and Webster, Va.; points on Norfolk & Western in Virginia; Princeton, W. Va.; Central Freight Association and Northwestern points (from Mayflower and Benedict).

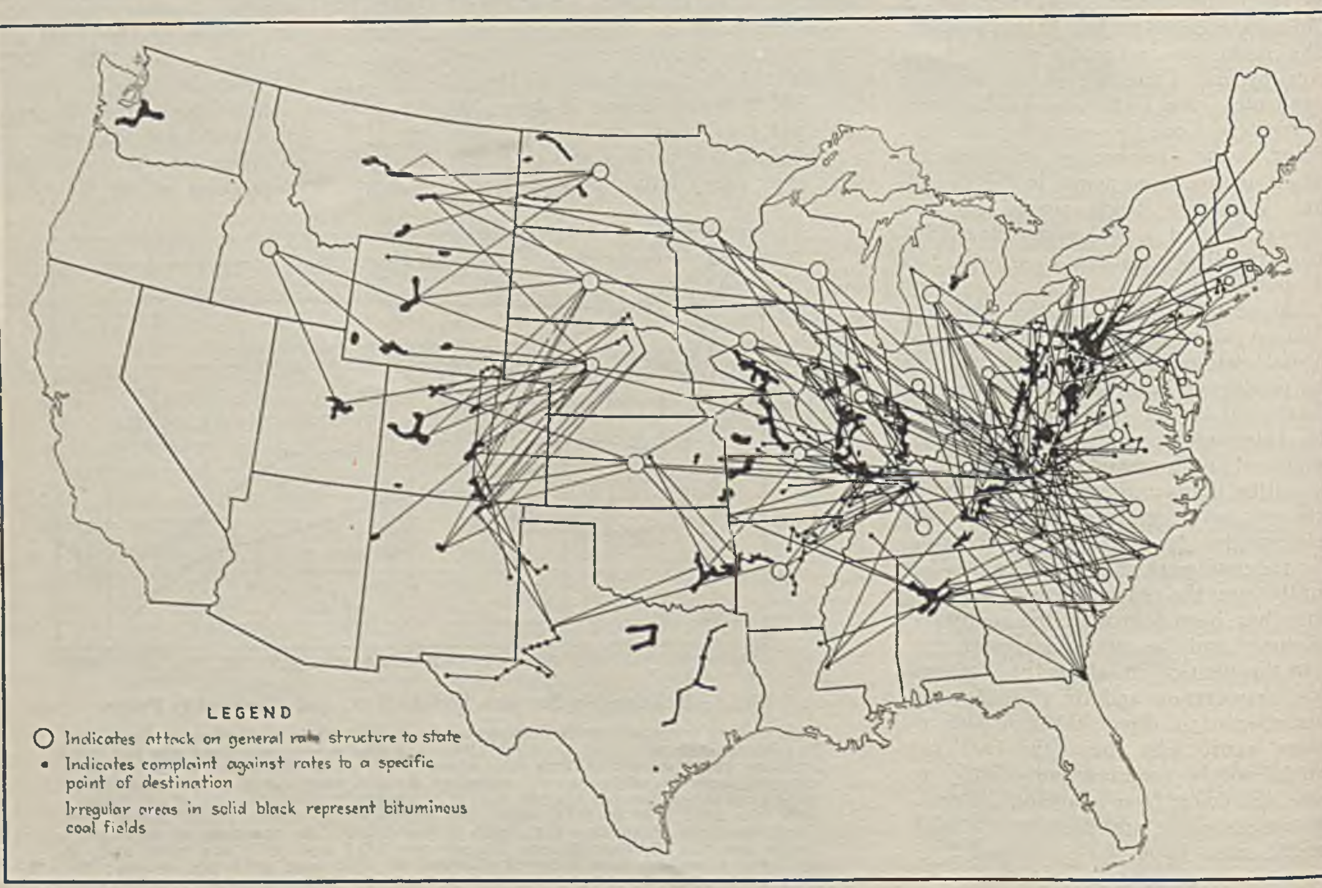
*West Virginia* to Jacksonville, Fla.; Brunswick and Savannah, Ga.; Millett, Mich.; New Hampshire; Kearny and Lehigh district, New Jersey; Wilmington and other North Carolina points; northeastern Ohio; Lehigh district in Pennsylvania; Charleston, Spartanburg and other South Carolina points; Bedford, Charlottesville, Crozet, Danville, East Radford, Fieldale, Glen Lyon, Harrisonburg, Hiawassa, Kerns, Lexington, Luray, Lynchburg, Narrows, Pearlsburg, Pig Point, Richmond, Roanoke, Rocky Mount, Salem, Staunton, Vinton, Waynesboro and Webster, Va.; Virginia from mines on Chesapeake & Ohio and Norfolk & Western railways; Lower Lake Ports (from Fairmont No. 2 district).

*Wyoming* to points in Idaho on Oregon Short Line and Pacific & Idaho Northern railroads; Nebraska; North Dakota; South Dakota.

*Inner and Outer Crescents* to Abingdon and related Illinois points; Lebanon, Saratoga and Union City, Ind.; Mulliken and related Michigan points.

Pending complaints on transportation charges for anthracite are far fewer in number and involve rates to Burnside, Hartford and East Hartford, Conn.; Wilmington and other Delaware points; District of Columbia and nearby points in Maryland and Virginia; Atlantic City, Bayonne, Camden, Newark and other New Jersey points; Pennsylvania; and Auburn Station, R. I.

Fig. 2—How Bituminous Rate Structure Is Under Attack in Individual Complaints Pending Before Interstate Commerce Commission.



# + COAL SPENDS

## $575,000,000 in 1932 Despite Industrial Depression

STILL further declines in production and more economical use caused expenditures for materials and supplies by anthracite and bituminous coal to drop to $62,700,000 in 1932, against the revised total of $91,000,000 in 1931. These figures exclude all charges to the capital account for permanent additions, improvements and betterments, as well as purchased power, explosives and wages.

Estimated total expenditures for purchased power and wages also reflected the 1932 decline in production and wage scales. Mine workers, it is estimated, received more than $405,100,000 in 1932, as against $543,100,000 in 1931, while payments for purchased power aggregated more than $32,500,000, as compared with $41,200,000 in the preceding year. Together with payments for merchandise for resale at company stores, expenditures for materials and supplies, purchased power, and wages were sufficient to bring the buying power of the anthracite and bituminous industries up to more than $575,000,000 in 1932.

Data collected by *Coal Age* indicate that the total expenditures for materials and supplies by bituminous producers were over $44,500,000 in 1932. Reduced to a per-ton basis, this averaged 14.5c., against the revised *Coal Age* figure of 16.5c. in 1931 and the average of 20.0c. determined by the U. S. Bureau of the Census in 1929. The revised *Coal Age* figure for 1929 was 20.5c. per ton.

The anthracite industry, according to the survey, spent more than $18,000,000 for materials and supplies in 1932, against $26,000,000 in 1931. These figures exclude payments for explosives.

Expenditures per net ton in 1932 were 36.5c., against 44.0c. in the preceding year. The Census figure for 1929 was 58.0c.

Returns had been received up to the time this issue of *Coal Age* went to press from all but four of the major coal-producing states of the country, and in one additional instance they were not sufficiently complete for inclusion in the table. These returns covered both captive and commercial operations, with a preponderance of reports from the latter. The bituminous estimate of 14.5c. was arrived at by weighting the totals for each state separately on the basis of actual reports from operators and the estimated output for each state during the past year. Using the preliminary figure of 305,677,000 net tons for 1932, this weighting gave $44,686,815 as the total expenditures for materials and supplies. Totals for purchased power and wages were arrived at in a similar manner.

Of the returns received which gave data with sufficient detail for inclusion in the general compilations, 7.1 per cent were from companies producing less than 10,000 tons in 1932; 18.1 per cent were from companies producing from 10,000 to 50,000 tons; 17.4 per cent were from companies producing from 50,000 to 100,000 tons; 16.8 per cent from companies producing from 100,000 to 200,000 tons; 20.0 per cent from companies producing from 200,000 to 500,000 tons; 11.6 per cent from companies producing from 500,000 to 1,000,000 tons: 7.1 per cent from companies producing from 1,000,000 to 2,500,000 tons: and 1.9 per cent from companies producing over 2,500,000 tons per year.

### Expenditures for Materials and Supplies by Coal Mines in 1932

| | 1932 Estimated Expenditures for Materials and Supplies | | | 1931 Estimated Expenditures for Materials and Supplies | | | 1929 Actual Expenditures for Materials and Supplies | | |
|---|---|---|---|---|---|---|---|---|---|
| | Production, Net Tons | Average per Ton,* Cents | Total for State** | Production, Net Tons | Average per Ton,* Cents | Total for State** | Production, Net Tons | Average per Ton, Cents | Total for State |
| Alabama | 7,850,000 | 16.5 | $1,295,250 | 11,999,000 | 14.0 | $1,679,860 | 18,189,453 | 30.0 | $5,449,568 |
| Colorado | 5,564,000 | 22.5 | 1,251,900 | 6,604,000 | 25.5 | 1,684,020 | 9,832,839 | 26.5 | 2,616,787 |
| Illinois | 32,360,000 | 14.0 | 4,530,400 | 44,303,000 | 16.0 | 7,088,480 | 60,705,123 | 20.0 | 12.115,662 |
| Indiana | 12,400,000 | 15.5 | 1,922,000 | 14,295,000 | 15.5 | 2,215,725 | 18,624,508 | 20.0 | 3,718,903 |
| Iowa | 3,430,000 | 9.0 | 308,700 | † | † | † | 4,285,369 | 23.0 | 989,425 |
| Kentucky | 35,610,000 | 14.0 | 4,985,400 | 39,964,000 | 16.5 | 6,594,060 | 60,894,039 | 18.0 | 10,923,814 |
| Maryland | 1,370,000 | 16.0 | 219,200 | † | † | † | 2,638,216 | 20.5 | 540,026 |
| Missouri | 3,975,000 | 13.0 | 516,750 | 3,621,000 | 24.5 | 887,145 | 3,963,458 | 29.0 | 1,145,658 |
| Montana | 2,155,000 | 15.0 | 323,250 | 2,378,000 | 28.5 | 667,730 | 3,442,518 | 33.5 | 813,641 |
| New Mexico | 1,220,000 | 25.5 | 311,100 | 1,553,000 | 29.0 | 450,370 | 2,631,512 | 32.5 | 859,312 |
| North Dakota | 1,485,000 | 17.5 | 259,875 | † | † | † | ‡ | ‡ | ‡ |
| Ohio | 13,350,000 | 9.5 | 1,268,250 | 20,411,000 | 12.0 | 2,449,320 | 24,091,756 | 16.0 | 3,894,114 |
| Oklahoma | 1,326,000 | 19.0 | 251,940 | 1,908,000 | 28.0 | 534,240 | 3,795,174 | 36.5 | 1,384,565 |
| Pennsylvania | 76,028,000 | 15.0 | 11,404,200 | 97,659,000 | 17.5 | 17,090,325 | 144,111,440 | 19.5 | 27,914,503 |
| Tennessee | 3,240,000 | 8.5 | 275,400 | † | † | † | 5,405,023 | 14.5 | 785,744 |
| Utah | 2,850,000 | 29.0 | 826,500 | 3,350,000 | 30.0 | 1,005,000 | 5,131,634 | 32.0 | 1,640,510 |
| Virginia | 8,025,000 | 11.5 | 922,875 | 9,699,000 | 13.0 | 1,260,870 | 12,745,100 | 20.0 | 2,564,208 |
| West Virginia | 83,765,000 | 14.5 | 12,145,925 | 101,473,000 | 16.0 | 16,235,680 | 139,031,657 | 17.5 | 24,293,487 |
| Wyoming | 4,140,000 | 19.5 | 807,300 | 4,994,000 | 22.0 | 1,098,680 | 6,700,272 | 26.0 | 1,750,139 |
| Totals for United States | 305,677,000§ | 14.5 | 44,686,815 | 382,089,000§ | 16.5 | 63,696,725 | 537,442,495§ | 20.0 | 106,438,396 |
| Pennsylvania anthracite | 49,350,000 | 36.5 | 18,012,750 | 59,646,000 | 44.0 | 26,244,240 | 74,545,900 | 58.0 | 43,367,491 |

* Average derived from actual figures submitted to *Coal Age* by operators.
** Production multipled by average expenditure per ton.
† Estimate included in United States totals.
‡ Not shown separately. State figures included in United States totals.
§ Including other coal-producing states not specifically shown.

# OPERATING IDEAS

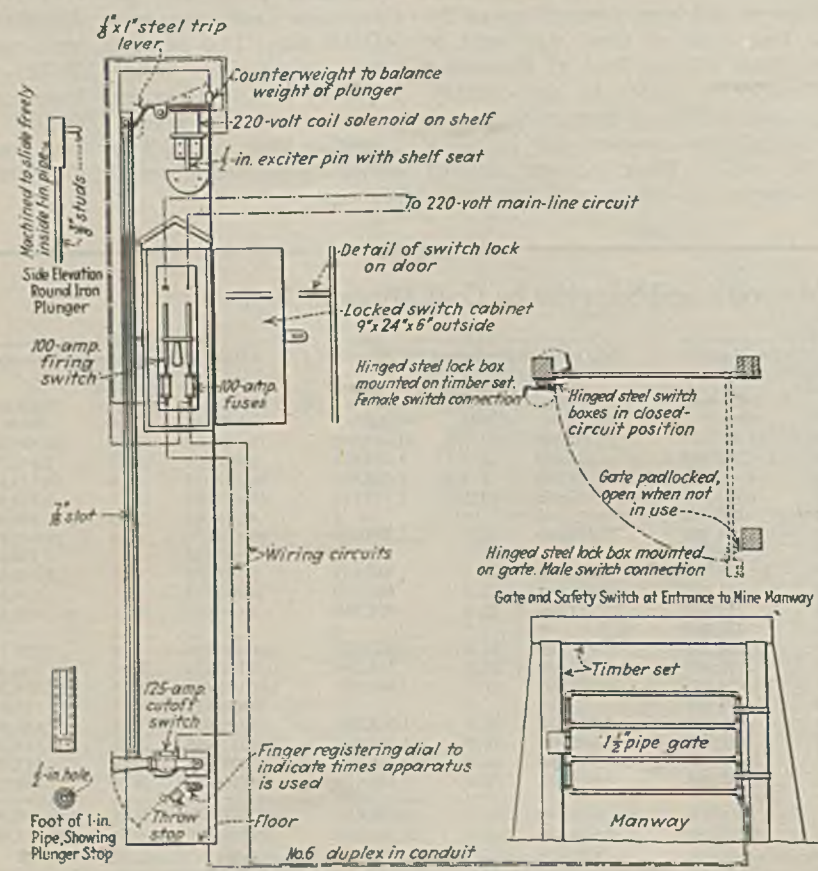
## From Production, Electrical and Mechanical Men

### Safety Shotfiring System

At the No. 1 mine of the Spring Canyon Coal Co., Spring Canyon, Utah, all shotfiring is done electrically from a station at the mine portal, after all the men are outside. The measures taken by the company to insure that all men, including the shotfirers, are out of the mine before shooting are illustrated in the accompanying sketch. The installation also serves the added purpose of cutting current off the firing system without delay. D. J. Parker, district engineer, U. S. Bureau of Mines, Salt Lake City, Utah, describes the installation in Information Circular 6675, which deals with safety practices at the Spring Canyon operation.

Permissible explosives and No. 6 detonators are standard at the No. 1 mine, and all holes are loaded and tamped by the shotfirers. Wooden tamping bars and adobe stemming are used, and charges do not exceed the permissible limit of 1½ lb. per hole. If, in the judgment of a shotfirer, a hole is improperly placed, he refuses to shoot it. Detonators and explosives are carried underground separately by the shotfirers and miners in specially constructed rubberized canvas bags.

Construction of Master Control Switch. Details of Manway Gate and Safety Switch Appear at the Right



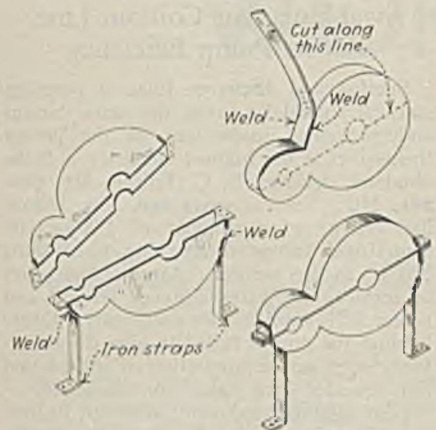

No. 6 wire is used for the blasting circuits, except in rooms, where No. 14 wire is standard. There is a switch in the circuit near the mouth of each entry, and this switch is locked when not in use. In addition, there are three switches in the shotfiring circuit near the manway portal; two of these are double-pole knife switches, and the third is operated by the pipe gate at the portal. The gate is locked open until all the shotfirers are out of the mine; it is then closed and locked. When the two knife switches are closed, the circuit is completed between the mine and the master firing control, of the time-limit type, in the near-by check cabin. Each of the three switches can be opened by only one key. As the three keys are distributed among the shotfirers, the blasting circuit cannot be completed until all three are out of the mine.

After the gate switch and the two knife switches have been closed, the master control is then unlocked and the firing circuit is completed to the 220-volt a.c. supply line. The entire master control is made up of three individual switches. The main switch is of the two-pole type. Before it is closed, a plunger operating in a slotted 1-in. pipe about 6 ft. 8 in. long is raised to the top and connected to the solenoid switch, which automatically releases the plunger when the double-pole switch is closed. At the end of the drop, the plunger opens another switch to break the firing circuit in case the double-pole switch is still closed. Consequently, current cannot be maintained in the firing circuit any longer than the time it takes the plunger to fall, or considerably less than one second. All equipment which makes up the master control is mounted on a 2x12-in. plank.

### Welded Pump Guards

Welding has a wide range of uses at coal-mine shops, and has been employed by C. L. Burdette, electrician, Dunedin Coal Co., Concho, W. Va., in the construction of pump guards at one-third the usual cost. The guards are made of scrap sheet iron about ⅛ in. thick. The initial step in the construction of a guard consists in cutting out the side pieces, which should

# *Operating Ideas from* PRODUCTION, ELECTRICAL *and* MECHANICAL MEN




Three Steps in the Construction of a Welded Pump Guard

be about 1 in. larger than the gears. A strip of sheet iron about 1 in. wider than the gear faces completes the material required. This strip is welded to the side pieces, as shown in the accompanying illustration, after which the guard is cut into two parts, using a cutting torch. Short pieces of ⅛x1-in. angle iron are then welded on each end of the two halves for bolting them together, using ¼- or ⅜-in. bolts. Legs made of strap steel are then welded on, as shown, and the guard is ready for installation.

## Overhauling Cutter Chains

When properly equipped general repair shops are available, John J. Nolan, Terre Haute, Ind., advocates employment of their facilities in overhauling coal cutters and cutting-machine chains. Repairing this equipment at or near the face quite frequently results in the wasteful discarding of parts or in the use of wrong parts or parts improperly installed.

When a chain has been in use for some time and is showing signs of wear, complete overhauling in the general repair shop is advocated. Each part should be thoroughly

## *Low-Cost Travel*

The Operating Ideas pages of *Coal Age* offer the practical coal-mining man a monhtly trip by proxy to other operations where problems quite often similar to those he encounters at home have been met and solved. Lacking the opportunity to visit personally the many mines where progressive ideas are being adopted, these pages offer a convenient substitute at low cost. Others, however, may be benefited by short cuts to low cost, safety and efficiency which you have developed, and *Coal Age* will welcome the opportunity to present them. A sketch or photograph may assist in making the idea clearer. Acceptable ideas are paid for the rate of $5 or more each.

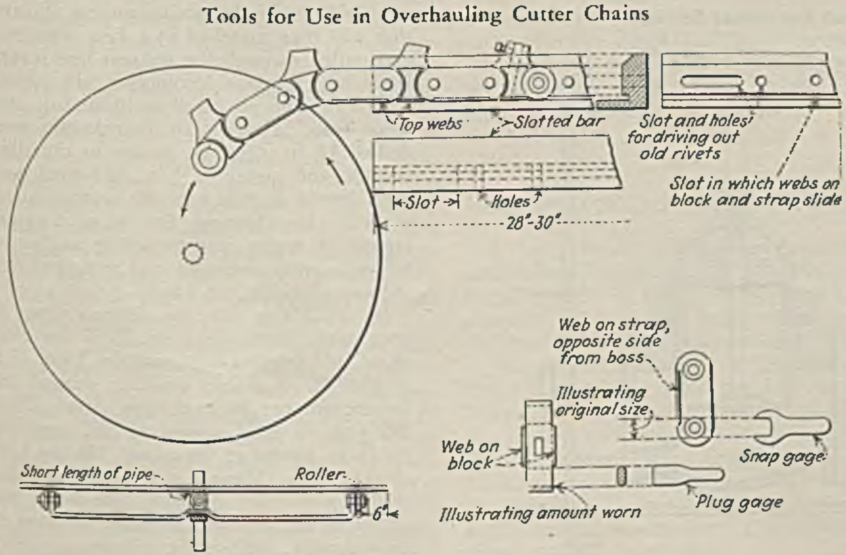
checked for wear, using some predetermined measurements as a guide. The work will be aided by the use a few special tools which have been developed and used by Mr. Nolan. These are shown in the accompanying illustration.

Whether or not to drill out the countersunk portions of the rivets or drive them out in the usual manner will be revealed by a trial in the shop. Blocks and straps should be checked with gages, as shown in the illustration. Those which are not worn too much may be saved for further use. The amount of allowable wear may be determined by reference to the measurements of the holes in new blocks and the bosses on the new straps. Setscrews should be carefully checked for damaged threads and flattened ends (or points), a frequent source of trouble.

In taking the cutter chain apart or in assembling, the slotted bar shown in the illustration is recommended as a means of facilitating the work. The slots and holes in the bar, which is 28 to 30 in. long and heavy enough to furnish a solid base for removing or installing new rivets, allow the old rivets to be punched out as the blocks and straps are slid along it with the webs lying in the groove. By arranging the chain parts to avoid the slots and holes, new rivets may be headed on the same bar.

In overhauling cutter chains, the disk shown in the illustration may be used to hold the wound-up chain. It is made of ⅛- or 5/32-in. steel, and is approximately 36 to 40 in. in diameter. By winding the chain on this disk, it may be handled at the drill press in case it is decided to drill out the rivets.

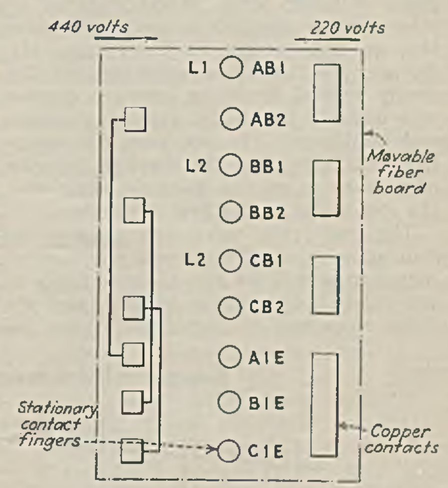
Tools for Use in Overhauling Cutter Chains




## Dual-Voltage Switch

After being called out at all hours to change the motor leads on a portable welder from 220 to 440 volts and back, a versatile coal-mine electrician developed the simple switch described in this article. Details are furnished by Grady H. Emerson, Birmingham, Ala. This switch, it is asserted, also can be used on any dual-voltage motor with double-star internal connection and, with some changes, is adaptable to motors with double-delta connections.

In constructing the switch, a piece of fiber ¼ in. thick, 6 in. wide and 14 in. long is laid off as shown in the illustration. Contacts of ⅛-in. copper are fastened on with two screws each to give a clearance




Wiring Diagram, Dual-Voltage Switch

between contacts or about ½ in. Inasmuch as the motor is started and stopped by the compensator, the switch is not expected to carry any load, and the ½-in. clearance is ample. Starter fingers are used to make contact; these are mounted on a well-shellacked block of maple. Small coil springs equipped with adjustable locknuts are installed to hold the fingers against the contacts.

Both the fiber panel and the maple block are mounted in a welded frame, the ends of the fiber panel fitting into slots. With the fingers mounted in the center, the voltage may be changed from 220 to 440 or back by moving the fiber block from one side to the other. The assembly is mounted in a steel box with a hinged cover marked with the voltages. The fiber panel is equipped with an insulated operating handle.

The marking of the factory leads is not shown on the controller, inasmuch as the given marking can be used even where the leads bear no marks whatever, due to the scheme of marking by phases. With *A*, *B* and *C* as the three phases of the motor, *AB1* is the beginning of one-half of the phase connection, and *AB2* is the beginning of the other half. *A1E* is the end or star of the first half of the winding. The second half of the phases is not shown because they are starred together permanently inside the motor. By reference to the sketch, it can be seen that moving the fiber panel in the direction of the arrow marked 220 volts until the contacts meet with the fingers results in a parallel star connection. Movement in the opposite direction results in a series star connection for operation on 440 volts. The switch will, it is declared, work with any dual-type low-voltage motor, but must not be used for starting or stopping, due to the fact that clearances will not permit arc-rupturing.

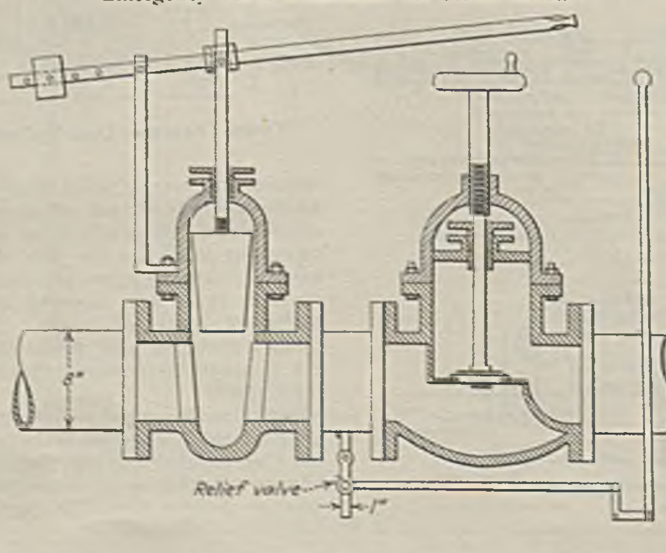
## Emergency Valve Cuts Hazards On Steam Hoists

Quite a number of things can happen in a short space of time when the throttle on a steam hoist jams, or when a small piece of boiler scale, gasket material or other foreign substance lodges on the valve seat or disk, writes E. C. Tillson, Mt. Savage, Md. After experiencing this difficulty several times, an emergency valve was installed to prevent damage to cages and headframes. In one case, the operative, unable to close the throttle, kept the cages running up and down the shaft until the steam was shut off at the boilers.

The emergency valve was made of an 8-in. gate valve. The thread nut was removed to permit the gate to move freely in the valve body without turning, and the valve stem was connected to a lever installed within easy reaching distance of the operative. The steam main was tapped for a 1-in. bleed-off valve to release the pressure on the emergency valve so that it could easily be opened after use. Engineers were required to test the valves once each shift to insure that they were in good working order.

Preferably, the emergency valve should be installed between the throttle and the engine. It was found necessary to use them in a number of instances, Mr. Tillson remarks, and in no case was any equipment damaged.

Emergency Valve Installation for Steam Hoists




## Protecting Electric Cables

Where conditions do not necessitate the installation of armored electric cables and yet some protection from heat and mechanical damage is required, W. E. Warner, Welwyn Garden City, England, recommends the following methods. To increase resistance to fire and heat, a wrapping of asbestos tape can be applied to the cables, followed by a brush coat of sodium silicate. This will dry into a tough, resilient coating, which will resist fire and heat, and also offer some measure of protection against mechanical damage. Gloves should be worn in applying the sodium silicate to protect the hands.

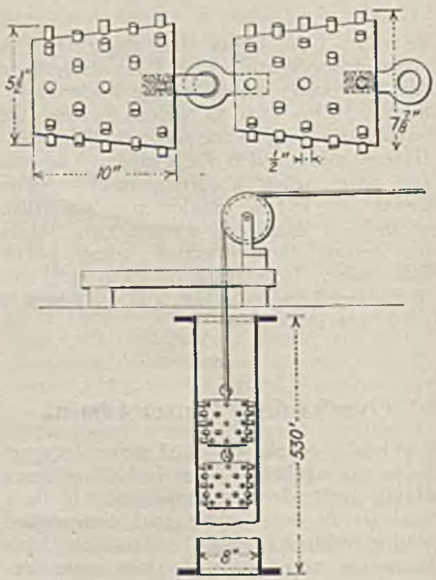
Application of builders' cement is another method of protecting cables against fire. A binder of cheesecloth, wire lath, or hemp or jute rope is first applied to the cable. In preparing the cement, a mix of two parts of sand to one part of cement is used. The lime content of the cement should be low, and a minimum of water should be used. The cement must be applied immediately after mixing. If the coating is applied to a lead-sheathed cable, it first should be coated with an asphaltic paint.

If only a moderate protection is required, the cable can be given a thin wrapping of cheesecloth or muslin, followed by the application of sodium silicate. While the protection is less than with the systems outlined above, the diameter of the cable is not increased unduly.

## Swabbing Out Column Line Boosts Pump Efficiency

Suction and discharge lines at pumping stations should be given the same careful and periodical inspections as the pumps themselves if the highest efficiency is to be obtained, declares E. C. Tillson, Mt. Savage, Md. Several years ago, Mr. Tillson had charge of a number of 1,000-g.p.m. centrifugal pumps discharging up a shaft 530 ft. to the surface. After a few years of service, the water delivery fell off and power consumption rose materially. Overhauling the pumps failed to give the necessary relief, and examination of the suction line revealed little cause for complaint.

Corrosion and sediment, however, had reduced the original 8-in. diameter of the




Construction and Use of Swab

column line to 5¾ in. To clean the pipe, the elbow at the top of the column line was removed and a small sheave, bolted to timbers, was installed over the pipe. The swab shown in the accompanying illustration was then attached to a ⅜-in. wire rope and pulled through the column line several times by a haulage locomotive. In making the swab, two pieces of 6x10-in. soft steel were used. Holes ½ in. in diameter were drilled 1½ in. deep, as shown in the illustration, and pieces of ½-in. soft steel were then driven in and cut off to the desired length. In cleaning the pipe, a small stream of water was turned in at the top to wash away sediment and rust, and thus prevent clogging the swab.

By swabbing out the column line, its area was increased from 29.97 to 50.26 sq.in., and friction head was cut from 45.52 to 10.87 ft. Ammeter readings showed that the current per pump dropped from 300 to 246 amp., a total saving of 162 amp. for the three pumps at the mine. On the basis of results in cleaning out the column line at this particular operation, the work was extended to take in the other stations of the company, with similar results.

# WORD from the FIELD

## Bituminous Research Organization To Secure Charter

Organization of a bituminous research laboratory was unanimously approved at a meeting of the Technical Research Committee of the National Coal Association in Washington, D. C., Jan. 25. The program will be based on the installation of laboratory facilities for a minimum research campaign of three years, national in scope and covering the development of methods and equipment for the wider utilization of bituminous coal, as well as preparation and application problems. Research on the fundamentals of coal will in large part be left to established institutions equipped for that type of work.

Plans call for securing a charter for Bituminous Coal Research, Inc., in February to carry out the program. John C. Cosgrove, president, Cosgrove-Meehan Coal Corporation, was elected president of the Technical Research Committee. Mr. Cosgrove appointed the following as a committee to promote the new organization: Douglas Gorman, president, Cumberland Coal Co.; Howard N. Eavenson, president, Clover Splint Coal Co.; W. A. Marshall, president, W. A. Marshall & Co., Inc.; W. D. Ord, president Empire Coal & Coke Co.; and W. M. Ritter, Red Jacket Consolidated Coal & Coke Co.

## Freight Rates Under Fire

Joining with the American Farm Bureau Federation, Farmers' Educational and Cooperative Union of America, National Grange—Patrons of Husbandry, and the National Lumber Manufacturers' Association, the National Coal Association petitioned the Interstate Commerce Commission on Jan. 25 for a general reduction in freight rates on basic commodities.

In response to the petition, the Commission, on Feb. 7, requested the railroads subject to its jurisdiction to file replies and appear at hearings on Feb. 25 to show cause why the proceedings requested by the petitioners should not be instituted. Rate levels will not be considered at the Feb. 25 sessions.

The present level of freight rates also was attacked by the National Coal Association in a brief filed with the National Transportation Committee on Dec. 31. At hearings in Washington, D. C., last month a number of operators and operators' associations, together with the National Retail Coal Merchants' Association, joined with other business organizations in opposing the carriers' request for an indefinite continuance after March 31 of the surcharges authorized by the Commission early last year.

In the anthracite industry, the Delaware, Lackawanna & Western Coal Co., New York City, filed a formal complaint with the Interstate Commerce Commission on Jan. 23 attacking as unreasonable the general level of anthracite freight rates from origin points in the Lehigh and Wyoming regions served by the Lackawana and Central of New Jersey railroads. In this action, D., L. & W. broke away from other anthracite producers, who declined to join in petitioning the Commission for a general reduction in rates on all basic commodities. Several days prior to the Delaware, Lackawanna & Western complaint, anthracite carriers and interested shippers agreed on a general reduction in westbound freight rates effective April 1. The proposed reduction is $1 per ton to territory west of the Pittsburgh-Buffalo line, including Chicago, with corresponding cuts for intermediate points.

### *Coal Production Off*

Bituminous coal production dropped to 27,093,000 net tons in January, according to preliminary estimates by the U. S. Bureau of Mines. This compares with a total of 31,110,000 tons in December, 1932, and 27,892,000 tons in January a year ago. Anthracite output in January decreased to 3,805,000 net tons, as compared with 5,089,000 tons in the preceding month and 3,897,000 tons in January, 1932.

## Cooperative Advertising Planned

A cooperative advertising and merchandising program to combat competitive fuels in the Northwest is being planned by coal and equipment men in the territory. The committee in charge of the work includes: B. R. Gebhart, director of public relations, Illinois Coal Bureau; Wesley E. Keller, secretary, Northwestern Coal Dealers' Association; John A. Maher, Maher Coal Bureau; Eben McKenzie, advertising consultant; J. H. W. Mackie, Twin City Coal Exchange; and Charles E. Spencer, manager, Anthracite Coal Service.

## A.I.M.E. Program Covers Mineral Industries

A wide range of topics affecting the mineral industries will be discussed at the 142d annual meeting of the American Institute of Mining and Metallurgical Engineers, to be held in New York City, Feb. 20-23. Papers dealing with coal-mining problems include: "Subsidence of Surface Overlying Workings at the Montour Mine," H. C. Howarth; "Subsidence at the Merritstown Shaft, Near Brownsville, Pa.," F. W. Newhall and Leo N. Plein; "Yieldable Metal Props for Underground Support," R. D. Parks; "Field and Scope of the Health and Safety Committee," Scott Turner; "Cost of Accidents in Mining," H. W. Heinrichs; "Basic Trends in Mineral Industries Education," Edward Steidle; "Mining Schools of France, Germany and Great Britain," W. B. Plank.

Other addresses in this group are: "Relationship of Ore Dressing and Coal Preparation," E. A. Holbrook; "Evaluation of Coal for Coke Applied to the Production of Pig Iron," Roy P. Hudson; "Effect of Variations in Coke Ash on Pig-Iron Analysis," H. W. Johnson; "Use Classification of Coal for Stationary Steam Generation," T. W. Harris, Jr.; "Relationship Between Round- and Square-Hole Screens for Coal," H. F. Yancey and R. F. Zane; "Application of the Micropyrometer for Determining Fusibility of Coal Ash," Roy P. Hudson; "Plant Capacity and Carrying Charge, and the Effect Thereof on Value of Coal Properties," W. H. Craigue; "Competitive Relation of Coal and Petroleum in the United States," W. Spencer Hutchinson and A. J. Breiten; "Some Physical Properties of Pennsylvania Anthracite and Related Minerals," J. Leland Myer; and "Coal-Mining Profits From Steel Castings," William M. Sheehan.

## Indiana Strip Mine Opened

Baker-Dora Coal Co. has opened up a new stripping operation on the Chicago, Milwaukee, St. Paul & Pacific R.R. at Jasonville, Ind. Two Bucyrus-Erie shovels have been installed for stripping the 35 ft. of overburden. Sufficient acreage has been obtained for twenty years of operation at 1,500-2,000 tons per day, and a modern preparation plant equipped with shaker screens and loading booms has been installed. Republic Coal & Coke Corporation, Chicago, is the sales agent.

# New River Operators Reduce Wages in January; Illinois Arbitration Fails

A WAGE reduction of approximately 15 per cent went into effect Jan. 16 at the mines of members of the New River Coal Operators' Association. About 9,000 men were affected by the reduction, and operators gave as reasons the continued downward trend in commodity prices, competition from other fuels and failure to receive freight rate reductions. The rate for loading-machine-cut coal was reduced from a minimum of 35c. to a minimum of 30c. per ton, while the rate for motor runners was cut from $3.60 to $3.06 per day. Coincident with the wage reduction, operators announced substantial reductions in house rent, coal and other service charges. The new scale is given in the accompanying table.

Interest in the Illinois situation in January centered on efforts of Governor Horner, under a truce against picketing, to arbitrate the differences between the United Mine Workers and the insurgent Progressive Miners of America. After a series of conferences which began on Jan. 13, the Governor announced the failure of his attempts on Feb. 4, and outlined a strict law-enforcement policy for Christian County and other areas which have been the scene of clashes between the two groups.

Refusal of the Jeddo-Highland Coal Co. to discharge George Gernhardt, tax collector for Black Creek township and an employee at the Derringer colliery, resulted in a strike of the 4,000 men employed at the eleven operations of the company on Jan. 16. On order of the Anthracite Board of Conciliation, the men returned to work on Jan. 23.

National Guard troopers were ordered back to the Wilder field of Tennessee early in January, as a result of an outbreak of violence following their removal shortly before Christmas. The shooting of five men from ambush and numerous beatings handed out by masked bands caused the sheriffs of Overton and Fentress counties to request the troops.

Violence again flared up in the McAlester-Hartshorne field of Oklahoma early in January. The home of Louis Messina, general manager, Craig Valley Coal Co., Haileyville, one of the several operations which refused to come into the union fold, was damaged by a bomb early in the month, and employees of the company were fired upon from ambush.

With the exception of reductions in the day wages of 59 men, the present Nova Scotia wage scale was extended for one year from Feb. 1 after approval by the United Mine Workers. The agreement also provides for extension of the scale for an additional year with the consent of both parties. It is expected that members of the insurgent Amalgamated Mine Workers will adhere to the agreement, provided no attempt is made to oust them from the mines they control.

NEW RIVER SCALE

| | Per Ton, Minimum |
|---|---|
| **Loading and Cutting — Rooms and Entries:** | |
| Drilling, shooting and loading, machine-cut coal | $0.300 |
| Cutting, shortwall machines | 0.055 |
| Pick mining | 0.355 |
| **Yardage — Rooms:** | |
| Handling top or parting, per inch per yard over 4 in. | 0.040 |
| Shooting top or bottom, per inch per yard | 0.050 |
| **Yardage — Entries:** | |
| Handling top or bottom, per inch per yard over 4 in. | 0.050 |
| Shooting top or bottom, per inch per yard | 0.080 |
| | Per Day |
| **Inside day labor:** | |
| Machine runners | $3.40 |
| Machine helpers, motormen, wiremen, trackmen, slatemen, bratticemen, timbermen, drivers (two or more mules) pipemen | 3.06 |
| Cagers | 2.86 |
| Brakemen, tripriders, wire helpers, track helpers, drivers (one mule) | 2.72 |
| Pumpmen, couplers (men), greasers (men), trappers (men) | 2.58 |
| Couplers, greasers and trappers (boys) | 1.70 |
| All other inside labor | 2.58 |
| **Outside day labor:** | |
| Blacksmiths | 3.40 |
| Drum runners, car repairmen | 3.06 |
| Dumpers, top tipple men, blacksmith helpers | 2.72 |
| Car droppers, cleaners and trimmers, greasers and couplers (men) | 2.45 |
| Slate pickers and common outside labor | 2.24 |
| Greasers and couplers (boys) | 1.70 |

## Complete Personnel of A.M.C. Coal Division

A. J. Musser, Clearfield Bituminous Coal Corporation; A. B. Jessup, Jeddo-Highland Coal Co.; and R. C. Becker, McGraw-Hill Publishing Co., have been selected as vice-chairmen of the Coal Division of the American Mining Congress. As announced in the preceding issue, R. L. Ireland, Jr., Hanna Coal Co., is chairman of the division this year.

Members of the board of governors for 1933 are: R. M. Shepherd, Allegheny River Mining Co.; J. B. Warriner, Lehigh Navigation Coal Co.; C. E. Abbott, Tennessee Coal, Iron & R.R. Co.; G. P. Bartholomew, American Smelting & Refining Co.; J. A. Long, Woodward Iron Co.; R. E. Taggart, Stonega Coke & Coal Co.; E. J. Newbaker, Berwind-White Coal Mining Co.; Otto Herres, United States Fuel Co.; S. B. Johnson, Lorain Coal & Dock Co.; and Messrs. Ireland, Musser and Jessup. The policy committee consists of W. J. Jenkins, Consolidated Coal Co. of St. Louis; Paul Weir, Bell & Zoller Coal & Mining Co.; C. J. Ramsburg, Koppers Co.; J. F. Callbreath, American Mining Congress; and Messrs. Warriner, Ireland and Becker.

### *Permissible Plates Issued*

Two approvals of permissible equipment were granted by the U. S. Bureau of Mines in November, and one in December, as follows:

(1) Thomas Mineral Cutting Machine, Inc.; coal cutter; 5-hp. motor, 230 volts, d.c.; Approval 249; Nov. 1.

(2) LaBour pump; 5-hp. motor, 500 volts, d.c.; Approval 248A issued to the Harris Pump & Supply Co.,; Nov. 23.

(3) Jeffrey Mfg. Co.; Type 58 loading machine; 3-hp. motor, 250-500 volts, d.c.; Approvals 250 and 250A; Dec. 10.

## New House Uses Anthracite

A new-type steel and asbestos house, designed for mass production at low cost and heated with the new combination range and heating unit developed by the Jeddo-Highland Coal Co., was opened for inspection at Harleigh Village, near Hazleton, Pa., last month.

## Anthracite Water Tunnel

A $500,000 anthracite drainage project was announced in January by A. B. Jessup, general manager, Jeddo-Highland Coal Co. The project will consist of a two-mile tunnel to drain the third level of the Hazleton Shaft of the Lehigh Valley Coal Co. to the Jeddo-Highland mines, from which the water will go to the Butler Valley tunnel. The project will be in charge of the Jeddo Tunnel Co., which has let the work to contractors.

## *Personal Notes*

R. H. SHERWOOD, Indianapolis, Ind., president, Central Indiana Coal Co., was elected a director-at-large of the National Coal Association early in January.

W. C. STRATTON, chief engineer for the past twelve years, has been made general superintendent of the Gary (W. Va.) operations of the United States Coal & Coke Co., vice Col. Edward O'Toole, resigned. Mr. Stratton will have as his assistant HARRY M. MOSES, formerly superintendent of the Bunsenville mine of the United States Fuel Co., Indianola, Ill.

MERLE D. VINCENT, executive vice-president, Rocky Mountain Fuel Co., since 1927, resigned Jan. 31 to resume his law practice.

G. M. GILLETTE, formerly vice-president, Pittston Co., Scranton, Pa., took charge of the Pennsylvania bituminous operations of the Northwestern Mining & Exchange Co. on Feb. 1. The position of vice-president was abolished by the Pittston Co., and operations will be in charge of L. C. BRUNSWICK, general manager.

CLAY F. LYNCH, Scottdale, Pa., has been made vice-president of the H. C. Frick Coke Co., succeeding the late Thomas Dawson. Mr. Lynch will retain his position as general superintendent, which he has held for a number of years.

WALTER BARNUM, chairman of the board, Pacific Coast Co. and president, Motorstoker Corporation, New York City, has acquired personal control of the latter company, and will intensify efforts to develop new market outlets.

Gen. Brice P. Disque

## Disque Heads Anthracite Institute

Gen. Brice P. Disque, for the past year executive director of the Anthracite Institute, New York City, was elected president on Jan. 11, succeeding S. D. Warriner, president, Lehigh Navigation Coal Co. General Disque came to the institute after twelve years in the importing, exporting and commercial fields. He entered commercial life in 1919 after retiring from the army with the rank of Brigadier General.

## Congress and Institute Meet In Pittsburgh in May

The American Mining Congress has scheduled the 1933 annual convention of practical coal-mining men for the week of May 8 at the William Penn Hotel, Pittsburgh, Pa. In connection with the convention, the Manufacturers' Section of the Coal Division will hold a national exposition of coal-mining equipment. The Manufacturers' Section has recommended that the convention and exposition be limited to three days—May 10-12, inclusive.

The annual meeting of the Mine Inspectors' Institute of America also will be held at the same hotel on May 8 and 9. May 10 will be given up to an inspection of machinery shown by Mining Congress exhibitors. John F. Daniel, president of the institute, has appointed J. T. Ryan, Mine Safety Appliances Co., as chairman of the program committee.

## Midwest Research Institute

Formation of a research institute to promote the use of Illinois and Indiana coals was the subject of a meeting of Illinois and Indiana operators held in Chicago, Feb. 1. R. H. Sherwood, president, Central Indiana Coal Co., Ind., presided, and Oliver Grimes, managing director, Committee of Ten—Coal and Heating Industries, outlined the possibilities of common research efforts in fighting oil and gas.

## Ask Embargo on Soviet Coal

An embargo on Soviet anthracite was requested on Dec. 29 by Charles Dorrance, president, Penn Anthracite Collieries Co., Scranton, Pa., in a letter to Ogden L. Mills, Secretary of the Treasury. Reminding Secretary Mills that an embargo was ready for his signature at the time Congress imposed the excise tax of 10c. per 100 lb. on all imported coal and coal products in the Revenue Bill of 1932, and that the case for an embargo had been proved in a hearing before the Commissioner of Customs early last year, Mr. Dorrance requested that the embargo be placed in force so that the industry could uphold it in public hearings on each cargo of Soviet anthracite.

## Coal Clubs Meet

With Gen. Brice P. Disque, president, Anthracite Institute, and Walter Gordon Merritt, attorney, as the principal speakers, the Anthracite Club of New York held its third annual banquet at the Hotel Astor, New York City, Jan. 19. Approximately 1,000 representatives of the anthracite operating, wholesale and retail industries were present, in addition to representatives of equipment manufacturers and allied heating industries.

Over 700 members and guests attended the fifteenth annual dinner of the Coal Club of Philadelphia, held in that city on Jan. 26. With Louis C. Madeira, 3d, presiding, Charles Milton Newcomb, Delaware, Ohio, supplied a part of the entertainment of the evening, and H. T. Collings, professor of commerce, University of Pennsylvania, discussed "Standards in Business."

## *Association Activities*

D. T. Pritchard, Huntington, W. Va., vice-president, Algoma Block Coal Co., was elected president of the Hazard Coal Operators' Exchange at the annual meeting held on Jan. 20. William Burlingham, Hardy-Burlingham Mining Co., Hardburly, Ky., was chosen vice-president, and J. E. Johnson was again elected secretary, while Swift Parrish was again chosen assistant secretary and treasurer.

K. U. Meguire, Louisville, Ky., president, Dawson Daylight Coal Co., was elected president of the West Kentucky Coal Bureau at the annual meeting held in January. Other officers were chosen as follows: vice-president, R. R. Kirkpatrick, general manager, Beach Creek (Ky.) Coal Co.; secretary, C. E. Reed, Louisville, Ky. (re-elected).

At the annual meeting of the Central Pennsylvania Coal Producers' Association, held last month, B. M. Clark, president, Rochester & Pittsburgh Coal Co., Indiana, Pa., was again chosen president. J. W. Searles, president, Pennsylvania Coal & Coke Corporation, New York City, was elected vice-president, and Walter A. Jones, Altoona, Pa., was reelected secretary-treasurer.

Walter L. Robison

*For a number of years vice-president in charge of operations, Mr. Robison was elected president of the Youghiogheny & Ohio Coal Co., Cleveland, Ohio, on Jan. 23. Mr. Robison, who succeeds S. H. Robbins, has been active in the Ohio coal industry for several years, and has taken a large part in national movements for the betterment of the bituminous industry.*

## Economic Problems to Feature National Coal Meeting

Economic problems in the bituminous industry will be the major theme of the 1933 annual meeting of the National Coal Association, to be held at the Drake Hotel, Chicago, June 15-17, inclusive. The program is in charge of a committee composed of T. B. Davis, president, Island Creek Coal Co.; R. H. Knode, president, Stonega Coke & Coal Co.; A. D. W. Smith, president, North-East and South-East coal companies; George K. Smith chairman of the board, Sunday Creek Coal Co.; George B. Harrington, president, Chicago, Wilmington & Franklin Coal Co.; and Grant Stauffer, president, Sinclair Coal Company.

## *Coming Meetings*

American Institute of Mining and Metallurgical Engineers; annual meeting, Feb. 20-24, Engineering Societies Building, New York City.

Canadian Institute of Mining and Metallurgy; annual meeting, April 4-6, Royal York Hotel, Toronto, Ontario, Canada.

Mine Inspectors Institute of America; annual meeting, May 8 and 9, William Penn Hotel, Pittsburgh, Pa.

American Mining Congress; annual convention and exposition, May 10-12, Pittsburgh, Pa.

National Coal Association; annual meeting, June 15-17, Chicago, Ill.; annual dinner, June 16.

## Moweaqua Blast Caused by Gas

Ignition of methane gas released by a fall of roof which broke the seals on an abandoned section was the cause of the explosion in the Moweaqua (Ill.) Coal Corporation mine on Dec. 24, according to the findings of a commission appointed by the Illinois Department of Mines and Minerals. The commission also offered the supposition that the explosion, which killed 54 men, may have been augmented by coal dust, though little evidence that dust was an active agent was found.

## *Industrial Notes*

Ely C. Hutchinson, editor of *Power*, a McGraw-Hill publication, since Jan. 1, 1930, resigned last month to become president of the Edge Moor Iron Works, Edge Moor, Del. Prior to going with *Power*, Mr. Hutchinson was president and general manager of the Pelton Water Wheel Co.

E. A. Livingstone, formerly with the A. O. Smith Corporation, New York City, has been appointed sales representative of the Babcock & Wilcox Co. and the Babcock & Wilcox Tube Co.

L. W. Shugg, since 1909 engaged in the exhibit work for the General Electric Co., has been appointed division manager of the publicity department and manager of conventions and exhibits, vice Frank H. Gale, retired.

F. J. King, chief engineer, Linde Air Products Co., New York City, has been elected president of the Compressed Gas Manufacturers' Association.

Edward P. Connell, comptroller, has been elected vice-president of the Falk Corporation, Milwaukee, Wis.

Calcium Chloride Association, 4200 Penobscot Building, Detroit, Mich., has been organized by the Solvay Sales Corporation, Dow Chemical Co., Michigan Alkali Co. and the Columbia Alkali Corporation to promote the interests of the calcium chloride industry. The association succeeds the Calcium Chloride Publicity Committee.

J. I. Thompson, vice-president, Koppers Construction Co., Pittsburgh, Pa., has been elected president of the Koppers-Rheolaveur Co. and the American Rheolaveur Corporation, succeeding Percy S. Gardner.

## *Obituary*

Robert F. Tatman, 53, secretary-treasurer, Thompson-Lea Coal Mining Co., died at his home in Philadelphia, Pa., Jan. 30, of pneumonia.

Patrick H. Savage, 62, superintendent, Black Creek Coal & Coke Co., died at Birmingham, Ala., Jan. 9. Mr. Savage's connection with the Alabama coal industry covered a period of 40 years.

Edward R. Coleman, 65, bituminous operator and banker, died of a heart attack in Philadelphia, Jan. 15. Mr. Coleman was a director of the Ebensburg Coal Co. and Coleman & Co., Inc., wholesalers.

C. W. Atkinson, for 35 years superintendent of the Jenkinjones (W. Va.) mine of the Pocahontas Fuel Co., died in January from injuries sustained in a fall at his home.

Harold Albert Clark, 39, assistant general sales manager, McGraw-Hill Publishing Co., was killed Jan. 27 in an automobile crash near Woodbridge, N. J. Mr. Clark began his business career with the Hercules Powder Co., and entered the publishing business in 1921 as advertising representative of *Chemical & Metallurgical Engineering*, and later represented *Engineering & Mining Journal* and *Coal Age* in New York.

Edward H. Kellogg, 41, for the past six years general manager of the Mine Safety Appliances Co., died at his home in Pittsburgh, Pa., Jan. 9. Mr. Kellogg was graduated from Kansas State College in 1911, and at the outbreak of the World War was stationed in Washington in chemical research work, later going overseas in the chemical warfare service.

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The Late W. H. Warner

## W. H. Warner Dies

William H. Warner, president, W. H. Warner & Co., died Jan. 12 at his winter home in Lake Wales, Fla. Mr. Warner, who was 84, started his business career with the Brown Iron Co., Mineral Ridge, Ohio, immediately after being graduated from Western Reserve University, and three years later went into the production and marketing of coal.

## Mine Fatalities Drop in 1932; December Deaths Up

Accidents at all coal mines of the country resulted in the deaths of 1,168 men in 1932, according to records compiled by the U. S. Bureau of Mines, a reduction of 295 deaths from the 1931 total of 1,463. The 1932 death rate, based on a production of 355,017,000 nets tons (anthracite and bituminous), was 3.29 per milion tons. The present total of deaths probably will be increased slightly, due to some injuries in 1932 that had not proved fatal at the end of the year, but with due allowance for this increase the death rate last year probably will compare favorably with the figure of 3.312 per million tons in 1931, a banner year for safety in coal mining. Last year, 304,000 tons of coal was mined per fatal accident; revised figures for 1931 show a total of 302,000 tons mined per fatality.

Six major disasters—that is, disasters in which five or more men were killed—occurred in 1932, causing the deaths of 145 men. Three of these disasters occurred in December, with a toll of 91 lives. The remaining three took place in January, February and June. Based exclusively on these major disasters, the 1932 fatality rate was 0.408 per million tons, as compared with 0.127 in 1931, when six disasters caused the loss of 56 lives. The 1932 disasters occurred at the rate of 1.69 separate disasters (as distinguished from the number of deaths) per 100,000,000 tons. The 1931 rate was 1.36 per 100,000,000 tons.

In December, 1932, coal-mine accidents caused the deaths of 162 bituminous and 38 anthracite miners, according to information furnished the U. S. Bureau of Mines by state mine inspectors. This compares with 78 bituminous and 21 anthracite fatalities in November, and 82 bituminous and 25 anthracite deaths in December, 1931. The death rate at bituminous mines, due to the explosions mentioned above, rose from 2.55 in November to 5.21 in December. The anthracite death rate also rose to 7.47 in December, as compared with 4.92 in November. Comparative figures are as follows:

BITUMINOUS MINES

| | Dec., 1932 | Nov., 1932 | Dec., 1931 |
|---|---|---|---|
| Production, 1,000 tons.... | 31,110 | 30,632 | 30,595 |
| Fatalities.... | 162 | 78 | 82 |
| Death rate per 1,000,000 tons.... | 5.21 | 2.55 | 2.68 |

ANTHRACITE MINES

| | Dec., 1932 | Nov., 1932 | Dec., 1931 |
|---|---|---|---|
| Production, 1,000 tons..... | 5,089 | 4,271 | 4,679 |
| Fatalities.... | 38 | 21 | 25 |
| Death rate per 1,000,000 tons.... | 7.47 | 4.92 | 5.34 |

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

FATALITIES AT UNITED STATES COAL MINES (ANTHRACITE AND BITUMINOUS) AND DEATH RATES BY CAUSES OF ACCIDENTS IN 1932

| Cause | Number Killed 1931 | Number Killed 1932* | Killed per 1,000,000 Tons 1931 | Killed per 1,000,000 Tons 1932* |
|---|---|---|---|---|
| All causes.... | 1,463 | 1,168 | 3.312 | 3.290 |
| Falls of roof and coal.... | 836 | 600 | 1.892 | 1.690 |
| Haulage.... | 231 | 180 | .523 | .507 |
| Gas or dust explosions: | | | | |
| Local explosions.... | 32 | 22 | .072 | .062 |
| Major explosions.... | 56 | 145 | .127 | .409 |
| Explosives.... | 40 | 32 | .091 | .090 |
| Electricity.... | 65 | 48 | .147 | .135 |
| Surface and miscellaneous.... | 203 | 141 | .460 | .397 |

* 1932 figures subject to revision.

# WHAT'S NEW IN COAL-MINING EQUIPMENT

## *Safety Headgear*

Portable Lamp & Equipment Co., Pittsburgh, Pa., has introduced a new protective headgear for underground use. The "Cool-Cap," as it is called, is said to combine unusual safety with all-day comfort for the wearer. The safety crown is formed and ribbed from pres-

"Cool-Cap"

sure-molded moistureproof fiber. Both visor and lamp holder are of strongly sewed cowhide. The lamp holder is designed for either carbide or electric lamps.

Crown design, it is said, affords nine liberal openings for ventilation. In conjunction with a soft leather headrest and a felt-lined band conforming to the contour of the head, this feature, the maker states, assures unusual comfort, coolness and fit. Light weight, 180-deg. visibility and low cost are further advantages pointed out by the company, which states that the headgear has been officially accepted by the Mining Section of the Pennsylvania Compensation and Inspection Bureau as complying with its specifications for safety hats.

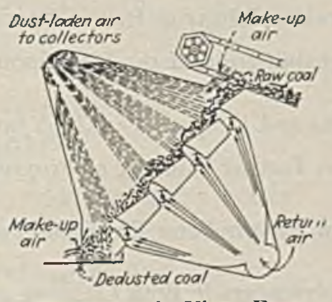
## *New Blasting Agent*

Atlas Powder Co., Wilmington, Del., announces "Blakstix," a new blasting agent for coal. Blakstix, according to the company, is made of the same materials as granular black blasting powder, but the ingredients are so processed that the violence of gas development is materially reduced. As a result, it is said, the gas gains increased purchase on the coal and pushes, rather than hurls, it from position. The output of coarse coal, therefore, is said to be larger, and lumps will not develop weaknesses in preparation and shipment.

Blakstix runs about 124 cartridges (1¼x8 in.) per 50-lb. case, or about 20 per cent more than pellet powder. As it can be used, according to the company, cartridge for cartridge with pellet powder, a distinct saving in blasting costs is possible. The company also points to a reduction in smoke and fumes. For resisting moisture, Blakstix is packed in a new spirally wound glued shell. It is available in all normal sizes for blasting coal.

## *Dust Extraction System; Coal Breaker*

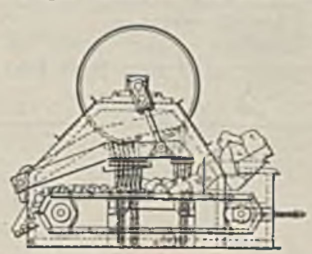
McNally-Pittsburg Mfg. Corporation, Chicago, has acquired the American rights to the new Norton-Collins dust-extraction system, developed by Norton's (Tividale), Ltd., England, for removing fine dust from coal without prescreening prior to washing, air-cleaning




Diagrammatic View, Dust-Extraction Chamber

or shipment. The system consists of a dust-separating chamber, exhaust fan, coarse dust collector, fine dust collector and secondary air filter. Any desired quantity of raw coal can be handled per hour, according to the company.

Dust-extraction is accomplished in the separating chamber by allowing the raw coal to cascade by gravity over a series of inclined shelves. An air current is directed through the falling coal by a series of nozzles equipped with adjustable regulating valves. From the separating chamber, the dust goes to a hood connected to the suction inlet of an exhaust fan, which discharges it into a centrifugal collector. In this col-



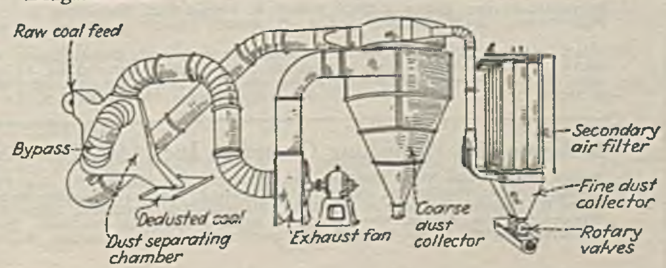
Skeleton View, Norton Coal Breaker

lector, the greater part of the coarser dust is deposited. From the collector, a portion of the air volume passes to an air filter, where the finest dust is removed. The main air stream, however, returns to the separating chamber.

With the nozzles fully open, the entire volume of air is blown through the raw coal, thus assuring maximum dust extraction. With the nozzles partly closed, a portion of the air is deflected through the bypass. This condition provides for extraction of the finest sizes of dust only. The plant is designed so that the volume of air leaving the separating chamber is greater than the volume entering it, thus assuring a dust-free atmosphere. The controls for modifying the size and quantity of the dust removed can be adjusted while the plant is running, the maker states.

Features stressed by the maker are: simple operation; sturdy construction; low initial cost; low maintenance cost, arising from the fact that the system includes only one moving part; and automatic separation of the dust into two sizes, the finer of which is suitable for pulverized fuel.

Diagrammatic View of Norton-Collins Dust-Extraction System




The McNally-Pittsburg company also offers the Norton vertical-pick coal breaker. With this breaker, the coal is carried under two sets of vertical picks, one arranged for preliminary breaking, the other for final sizing. The drive is so arranged that the plate conveyor carrying the coal is moved forward intermittently to coincide with the upward stroke of the picks.

The breaker is designed, according to the manufacturer, so that the plate carrying the picks can easily be changed for making other sizes by removing it through doors in the side of the breaker. To prevent damage through the entrance of hard minerals or pieces of metal, the conveyor is carried on a spring-mounted anvil. A materially greater percentage of large sizes with this breaker is claimed.

## *Gasoline Locomotive*

Lima Locomotive Works, Inc., New York City, offers two new gasoline locomotives, bearing the following designations: Type L-100-G (100 hp.) and Type L-200-G (200 hp.). Both locomotives are of the mechanically driven four-wheel type, and are said to have the power, traction and sturdy construction for operation under a wide variety of service conditions.

All driving connections between the engine and the wheels are by means of gears and clutches. No chains or side rods are used, thus, it is asserted, reducing maintenance and adjustments. All axles and shafts are equipped with completely inclosed roller bearings running in oil to insure long wear and reliable operation with a minimum of attention. The spring arrangement is said to provide three-point suspension without the use of cross-equalizers, enabling the locomotive to adjust itself readily to uneven track. Other features include: a special air-brake system which operates the brakes on cars with standard air-brake equipment in conjunction with the locomotive brakes; short wheelbase; and complete inclosure to prevent the entrance of abrasive materials and dust.

Both locomotives are available in track gages from 36 in. up. Other details are: 100-hp. machine—standard height, 10 ft. 3 in.; length over bumpers, 14 ft.; drawbar pull, from 8,350 lb. at 3 m.p.h. to 2,300 lb. at 15 m.p.h.; 200-hp. machine—standard height, 10 ft. 6 in.; length over bumpers, 18 ft. 4 in.; drawbar pull, from 17,500 lb. at 3 m.p.h. to 4,100 lb. at 15 m.p.h. Weight of the 100- and 200-hp. locomotives is 30 and 60 tons, respectively. Wheelbase is 6 ft. for the 100-hp. and 7 ft. for the 200-hp. machine.

## *Endless Rubber Belt*

B. F. Goodrich Co., Akron, Ohio, has developed what is claimed to be a simple, practicable and efficient method of making rubber belts endless where the factory-made endless belt or the conventional types of lace fasteners cannot be used. The belt for which this method was developed is known as "Highflex Junior"; it is available in widths of 6 in. and under. This belt is built up of a greater than usual number of specially woven fabric plies, and is designed to facilitate making it endless right on the machine. To facilitate splicing, the company has developed a special cement and tie gum. James C. Heintz Co., Cleveland, Ohio, supplies a low-priced, automatically controlled, portable electric vulcanizer, and a light templet for laying out and stepping down the ends of the belt can be obtained.

B. F. Goodrich Co. also offers a new line of rubber paints, known as "Acidseal Paints." The base is a commercial form of rubber isomer, which gives the following advantages: exceptional adhesion on a properly prepared surface; a drying time of one hour; unusual retention of elastic properties of rubber, thus conforming to the expansion and contraction of the support; and a protective coating that minimizes corrosion. The paints also are water-resisting.

## *Roller Chain*

"Silverlink" roller chain is the latest development in roller chains offered by the Link-Belt Co., Chicago. This chain, according to the company, has the following features: heat-treated sidebars of rolled alloy steel for added strength, toughness and

"Silverlink" Roller Chain

resistance to corrosion; detachable case-hardened nickel-steel pins (rivets furnished if desired); solid steel case-hardened bushings; heat-treated alloy steel rollers for strength, resilience and maximum resistance to shock; and uniformity and close clearances for accuracy of pitch and smooth operation.

Silverlink roller chain is available in all sizes from ⅜ to 2½-in. pitch, in single and multiple widths, and with wheels for any horsepower, as well as conveying attachment links in wide variety. Complete drives are carried in stock in sizes up to 225 hp., with speed ratios varying from 1:1 to 8:1.

## *Synthetic Resin Bearing*

Joseph T. Ryerson & Son, Inc., Chicago, has developed a new bearing made of a synthetic resin similar to Bakelite, using a textile material as a base. This strong belting material, it is said, reinforces the resinoid, which completely fills and saturates it. The composite material is then subjected to great heat and pressure, with the result that it is no longer fusible or soluble. According to the company, the material cannot

Ryertex Bearings

be resoftened by heat, will not absorb water or oil, and is resistant to most acids, though attacked by hot alkalis. Bearings made of this material are designated "Ryertex," and will, it is said, show a Brinell reading of 30-40 and a Scleroscope reading of 70-80. Life is four to ten times that of babbitt and bronze, it is stated, and the saving due to longer life and decreased power consumption will run as high as 50 per cent under favorable conditions.

# Contents, Coal Age for February, 1933

*With which is consolidated "The Colliery Engineer" and "Mines and Minerals"*





EDITORIAL STAFF: Sydney A. Hale, Editor; R. Dawson Hall, Engineering Editor; Ivan A. Given, L. C. McCarthy, Paul Wooton; J. H. Edwards and A. F. Brosky, Consulting Editors. Publishing Director, H. W. Clarke.

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