COAL AGE

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

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New York, August, 1932

Hot From Hollywood

ECONOMIC PUNDITS have discoursed learnedly on the power of Hollywood to create business for industry by the cinematization of American material standards of living. The film as a direct sales tool has been effectively used by many commercial enterprises. Now southern New York public utility men, who already have used the visual method to boost the sales of electrical appliances, are carrying projectors into the home to demonstrate to the prospect through a series of still shots "the advantages and comforts of gas heating." Will the coal and allied stoker interests be less resourceful in defending and in widening their own markets for solid fuel?

Lower Power Costs

IN THE SEARCH for lower production costs, progressive management dares ignore no avenue of exploration—old or new. The day, for example, when the coal operator could blandly dismiss the question of power generation with the remark that "my business is producing coal, not generating power," is past. Not only was the assumption upon which that easy decision rested a clever fallacy, but, in many cases, conditions have so changed that its fallaciousness no longer can be concealed. With power absorbing an increasing part—frequently 10 per cent or more—of the operating-cost dollar, study of possible ways of reducing these costs is a problem of real executive concern.

Whether a mine should generate or purchase its power is primarily an economic question the answer to which lies in an accurate analysis of comparative costs. Based upon such analyses, a number of operations have reverted to private power or, where power has been privately generated, have modernized existing equipment with attractive economies. That there are many other mines which could follow in their footsteps with equally profitable results hardly seems open to question.

Particularly should this be true at operations where refinements in preparation have increased the percentage of unmerchantable combustible material which must otherwise be an added burden on the cost of refuse disposal. With stokers made over a wide range of sizes, even the smallest plant can dispense with the expense of hand firing. Where the mine is so fortunately situated that refuse disposal is not a problem, the crusher, which is becoming an accepted facility at more and more operations, gives the plant a flexibility in the choice of fuel which will contribute to a better balance between output and the varying commercial demands for different sizes.

Illinois—and the Machine

COOL-HEADED LEADERSHIP in Illinois has lost no time in seeking to repair the damage done the cause of sound industrial relations in that state by the unexpected rejection of the agreement of the joint scale committee early last month. If the new Springfield pact is ratified by the workers, the earlier rejection of the Chicago compromise may be charged off to passionate misunderstanding. But the significance of the initial overwhelming refusal of the proffered base for a resumption of work should not be lost—particularly upon the union officials.

Open opposition, apparently, found a rallying point in the changes made in the rates on

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mechanical loading and in misinterpretation of the implications of the double six-hour shift. "The menace of the machine" frightened the unthinking into a belief that their future security lay in a return to hand loading. Nothing could be further from the truth. Circumstanced as it is, fuller employment of the machine is Illinois' sole hope for large-scale survival. The fact that in 1931 total Illinois output dropped 17.5 per cent below the 1930 figure while mechanically loaded tonnage fell off less than one per cent irrefutably establishes that contention.

While it cannot be denied that the introduction of the machine in a high-wage field makes the competitive position of the non-mechanized mines in that field more difficult, it must also be remembered that without the machine the maintenance of a comparatively high level of rates would be impossible. Illinois mine labor, therefore, faces two alternatives: it can wholeheartedly accept the machine and thereby create a surplus buying power for the men at the mechanized mines which will open up new opportunities for gainful employment in other industries to the workers displaced or it can acquiesce in reductions which will make hand rates competitive with those existing in other coal-producing states—with no hope for steady working time for anybody.

Some Soft-Coal Safety Factors

Analysis of safety conditions raises the question whether the advance recently made in bituminous mines is permanent or is likely to be lost or extended. Mine inspectors have noted that the smaller mines, having no safety organizations, have in general the highest accident rate. As a result of the depression, a number of these smaller operations have ceased to do business. More of the coal is coming from the larger mines, and the accident rate is decreasing accordingly, and probably will continue to do so just as long as the coal industry continues to suffer from depression.

The mystery is why in previous panics the same result was not attained and why panicky markets have hitherto increased accidents. One reason is because today the big companies are maintaining safety discipline, and the panic affords leverage for their efforts; another that mines formerly were subject to the coal-dust-explosion hazard, and the misstep of any single man might mean the destruction of every man in the mine in which he was working. Thus, if there were twice as many men, the risk was quadrupled. So evident was this to the Phelps Dodge Corporation that the company determined it would have only small mines. Today with rock-dusting, where effectively performed, each individual explosion involves the deaths of only a few men. No longer are the big model mines so menacing. Rock dust has made them inherently safer, and discipline has added to that safety.

Hydrogen Appears Also

Rarely is hydrogen suspected as being a coal-mine gas, yet its presence in modern workings should be suggested by that familiar experiment of adolescent days, the dropping of iron filings or small nails into dilute sulphuric acid, whereupon a gas is evolved that is readily combustible and has an exceedingly bad smell. The gas is hydrogen and the evil odor is derived from sulphuretted hydrogen and compounds of sulphur and iron which have their origin in the impurities of the pipe metal.

Such a gas and such a smell escaped recently from the end of a water pipe in an English mine (*Coal Age,* Vol. 37, p. 202). Apparently the water ran back through the pipe and pump and, as it retreated, it filled the pipe with hydrogen, that gas being retained by a knuckle in the line. Mine inspectors in making analyses found 57 to 90 per cent of hydrogen in the parts of the pipe when the air within it was at rest.

It is interesting to note that one pound of iron will cause to be evolved from hydric sulphide, by replacement of hydrogen, 0.03428 lb. of hydrogen capable of making a 4.25 per cent mixture with 143.3 cu.ft. of air—roughly, 150 cu.ft. of the mixture. Enough iron is lost by a pipe through direct chemical action to account for explosive atmospheres being generated therein. Thus an 8-in. pipe, 303 ft. long, would generate enough gas by the loss of a pound of iron to fill the pipe completely. Such a weak concentration of gas would not burn in the pipe but might burn when expelled from the pipe, some authorities putting 4 per cent as the lower explosive limit of hydrogen.

MODERNIZATION PROGRAM

+ At Eccles Mines Touches Every Major Operating Phase

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MODERNIZATION on an extensive scale has been carried on for the past two years at the Eccles mines of the Crab Orchard Improvement Co., located in the New River field of West Virginia, as a joint undertaking of the Stonega Coke & Coal Co. and the Chicago, Wilmington & Franklin Coal Co., whose financial interests in the New River venture are merged in a holding company, the Admiralty Coal Corporation. The modernization program was initiated to make the mines safer and better places in which to work, to improve the marketability of quality coals and to lower the cost of production. Improvements were made in practically every phase of operation, with particular attention to safety, ventilation, blasting, haulage, pumping and preparation.

These mines were first operated by the Guggenheims in 1905; Stonega took over the ownership in 1923 and continued operation until 1928, when the plants were shut down pending completion of plans by the management for their reconstruction. It was at this time that C. W. & F. decided to add a low-volatile fuel to its line of coals, and half ownership of the Eccles mines was the outcome. Production is distributed through the General Coal Co., a Stonega affiliate, in the East, and through C. W. & F. in the Middle West. The coal is sold as mine-run and prepared sizes for domestic consumption, while the by-product market takes the slack. Actual work of design and reconstruction was engineered by the Allen & Garcia Co.

The Eccles property is in Raleigh County, seven miles southwest of Beckley. It consists of over 8,000 acres of surface which is underlain by two seams, the Sewell at a shaft depth of 275 ft., which is worked by No. 6 mine, and the Beckley at a shaft depth of 535 ft., which is worked by No. 5 mine. No. 3 mine, also in the Beckley seam, has not been operated since 1922. This plant adjoins the No. 5 operation, from which entries are being driven into it. When these are broken through, No. 3 will become a part of No. 5 mine.

No. 6 is a relatively non-gassy mine now producing about 1,200 tons daily. No. 5 mine is gassy and has a present daily output of 2,900 tons. These differences, and the fact that conditions in the larger mines are more difficult generally, necessitated the expenditure of the bulk of the improvement fund at No. 5 mine.

Safety a Major Consideration

All plans were based on factors of safety, especially those relating to No. 5 mine, which, lying at great depth, is quite gassy and in earlier years had two serious explosions. Main shafts were enlarged and relined; falls in airways were leveled off and loaded out where necessary; both mines are completely rock-dusted as a continuing safeguard; in both, Edison Model K electric cap lamps are worn; and the coal is blasted with Cardox shells. A further precaution taken in No. 5 mine is the use of permissible cutting machines and flameproof cable-reel gathering locomotives.

Rock dust is spread by a high-pressure M.S.A. distributor with hose for the airways. Not only is the rock dust kept up to the last crosscut in all going places but it is placed in all old workings and temporarily abandoned places. A feature of the practice is that rock dust is laid down in all open caved areas. The northwest section of No. 5 mine, where a major explosion occurred in 1926, is isolated by a barrier laid with 4,000 sacks of rock dust. This section, incidentally, is not now being worked.

Strict safety standards in the repair of machines going to the face are maintained. All permissible or flameproof parts are put under seal in the shop. Under no consideration can any of these be tampered with except by one of the trained men on the repair crew. If only a finger in a controller sticks or a headlight burns out, the operative is instructed to call a shop man. If the unit is at the face, it is hauled to fresh air before being touched.

Under no circumstances are temporary splices of cable on cutting machines and gathering locomotives tolerated in No. 5 mine. When a cable on a cutting machine is blown or damaged mechanically, it is removed and a spare cable installed. If the damaged cable is on a gathering locomotive, the crew is given a spare motor. Permanent cable splices are made in the underground shop by working together and soldering the inner conductor (concentric cable) and by vulcanization. This last operation is performed in a No. 3 steam-electric vulcanizer furnished by the Mine Equipment Co., St. Louis. This unit is kept hot at all times during the working shift, as it takes about 50 minutes to bring it up to working temperature. A splice is completed in 35 to 40 minutes.

Mechanical splices were found to pull out and stretch the rubber insulation, which is the reason for soldering. As the job is done, no loss in flexibility has been noticed and no trouble has been experienced with burnouts at the splice points. With this practice, in effect for two years, not a single injury from

Drilling for Shell Blasting in No. 5 Mine

cables has occurred. While the practice lacks convenience, it is maintained that permanent splicing by the trained shop men is much more economical in the long run than quick, temporary repairs. More important, this expert attention is far safer than the repair made by any Tom, Dick or Harry.

A repair crew is assigned to each shift. One crew goes on at 7 a.m., another at 4 p.m., and the third at 11 p.m. A blackboard hangs at the motor pit, and on it the motormen and cutters indicate the repairs and adjustments that appear to be needed on the units they operate. These equipments are checked up every day.

Cutting is done at night, and the machine is moved by a locomotive to which it is plugged through a permissible junction box when in operation. The same provision is made for operation of the permissible rock-dusting machine. Only those locomotives that attend these machines are provided with junction boxes.

Pumping Costs Fall

At these mines the pumping problem was not resolved into coping with water of great acidity; in fact, the water in No. 5 mine is slightly alkaline; that in No. 6 has but a trace of acid. Nor was the problem one of handling abnormally large quantities of water. The mines had always been dewatered fairly satisfactorily, but when plans for rehabilitation were considered, it was felt that the cost of pumping was excessive compared to the cost achievable through the use of more modern equipment. The nub of the pumping problem was that the cost continued unabated on idle days as during production.

The pumping system as finally revised is of greatest interest, not because of the employment of novel features but from the fact that the management succeeded in curing certain financial leaks. Investigation showed that the greatest saving possibilities lay in the elimination of attendance labor. In earlier days fourteen men were employed in pumping the two mines. Today the number is reduced to six. This saving has been accomplished by a substantial investment in high-efficiency centrifugal pumps, accessory equipment and piping at nine permanent pump stations. The new pumps replaced a number of units of the same type but of lower efficiency.

Year by year, before the change, the pumping systems had been enlarged by addition of pumps that discharged from one low spot, over a rise, to another, until finally the water was relayed to a sump at the shaft bottom and thence to the surface. These units were powered by 550-volt d.c. motors operated from motor-generator sets, with the result that conversion losses were high. Furthermore, with the equipment at hand, there remained little opportunity to correct mechanical deficiencies.

Water appeared as a constant but moderate flow from the mined-out pillar areas and as a spasmodic flow from the pillar line. The floor of the coal seams formed numerous pockets, which in many territories were natural sumps of considerable capacity. Heavy grades prevailed, and these afforded no opportunity to assemble the water by drainage ditches. As the surface topography is mountainous, where discharge of water direct to the surface via borehole might have been advantageous from a view underground, depth from the surface to the seams would be so great that the static head by direct route exceeded the static head at the hoisting shafts, plus friction in pipes, to the remote sections of the mined-out area.

With conditions as they were, the drainage problem broke into collecting the water by trunk pipe lines to central sumps. In some instances outlying swags were consolidated by grading, not as a direct attempt to simplify drainage but to improve main-line haulage.

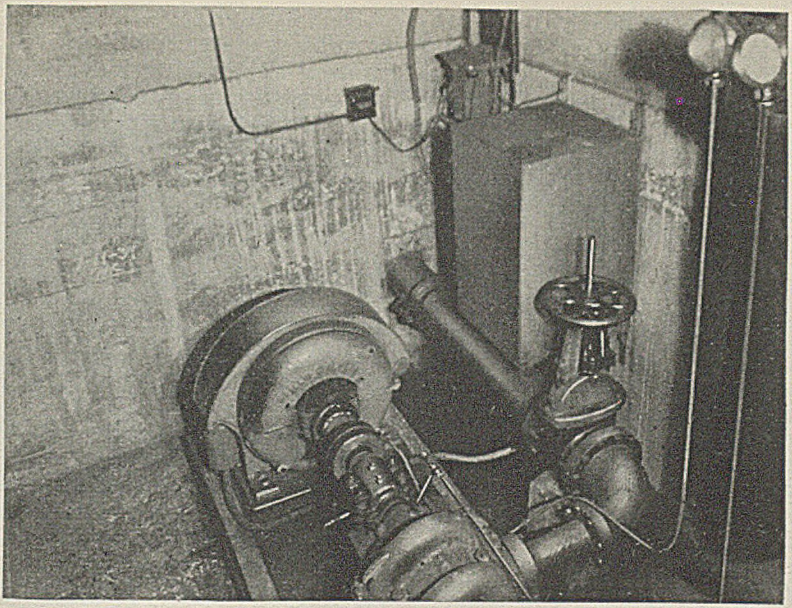
Following a survey of the mine-power distribution system at No. 5 mine, a decision was made to change from surface substation distribution at 550 volts direct current to 250 volts, placing automatic motor-generator sets at the load centers, converting 2,300-volt alternating current. This decision simplified the problem of power supply to the pumps in the mine. It enabled the putting of all permanent pumps on a.c. power, leaving those for d.c. operation which were near the advancing or retreating workings and subject to frequent moves.

Two 750-g.p.m. automatic pumps in No. 5 mine and one 750-g.p.m. pump in No. 6 mine are operated from the 2,300-volt a.c. circuits. Three other underground pumps at No. 5 operate on 220 volts alternating current. Each of these latter pumps has its own transformer, which takes power from the 2,300-volt lines to the substations. These transformers vary from 7½ to 25 kva., depending on the size of the pump and the load. Aside from the main pump in No. 6, the other units in this mine receive power from the 550-volt trolley circuit. Gathering pumps in both mines, therefore, operate off the trolley.

With this plan only a small portion

Table I—Pumping Equipment Characteristics

Mine No.	Location	Control	G.p.m.	Head in Feet	Automatic Priming	Effic. Per Cent	Motor Hp.	Motor R.p.m.	Motor Volts	Suction, In.	Discharge, In.
6	Main Sump, 1st Left.....	Auto.	750	320	Yes	75	100	1,750	2,300	5	4
6	Main North, 2d Right....	Auto.	300	45	No	76	5	1,750	220	4	3
5	Main Sump, 1st Left.....	Auto.	750	535	No	75	150	1,750	2,300	5	4
5	Main Southwest, 1st Right	Auto.	300	134	No	76	20	3,500	220	3	2½
5	Main North Heading.....	Auto.	300	65	No	79	7.5	3,500	220	3	3
3	Main Sump Shaft Bottom.	Man.	750	580	No	74	150	1,750	2,300	5	4
3	Main North Heading.....	Man.	300	45	No	76	5	1,750	220	4	3
5	At Shaft (Fresh water)...	Auto.	125	643	No	59	40	3,500	220	2½	2
3	At Shaft (Fresh water)...	Auto.	100	375	No	53	25	3,500	220	2½	2



A Submerged Pump Installation

of the pump load would occur during the day—namely, that required to dewater the territories actually being worked. The main pumping demand lasts during ten hours of the day and comes on the off-peak load with only normal transformer conversion losses. Even on this schedule a difference of but 1 per cent in the efficiency of the a.c. powered pumps showed a variation of $300 per annum in the power bill. For this reason it was necessary to weigh carefully the relative value of the first cost and efficiency of the pumps available before final decision on the selection of equipment was made.

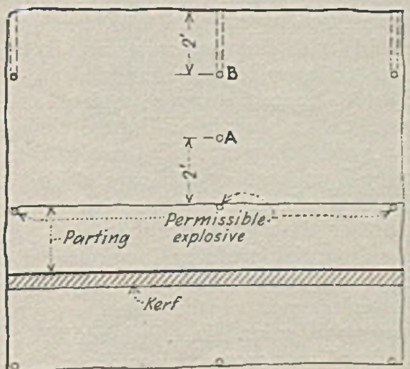
Seven of the nine stations have automatic control, and three of these automatics are installed submerged. One of the latter is equipped for automatic priming. The pumps and motors driving them, as a unit, carried an installation guarantee of 74 to 79 per cent efficiency and were furnished by Allis-Chalmers, and automatic control equipment was furnished by Barrett-Haentjens. Coils on all pump motors were braced for across-the-line starting and were provided with special insulation for mine service. Other characteristics of the pump installation appear in Table I. Water lines are universal cast iron with machined hub-and-spigot joints—a feature which lends itself to installation on a rolling bottom and assures low maintenance.

Blasting Changes Help Profits

In No. 5 mine, the Beckley seam, ranging from 8 to 13 ft. thick, is composed of two distinct coal benches with a laminated parting between. The bottom bench varies from 30 to 40 in. and the top bench from 3½ to 6½ ft. Where the seam has sufficient middle band to justify mining so that the impurities can be removed in a separate operation from the loading of the coal, the seam is cut with a 29-C Jeffrey track-mounted machine having an 8-ft. cutter bar. The cut is placed either in the top of the bottom bench, the top of the band or the bottom of the top bench—depending entirely on the conditions in the place as to whether the same is pitching downgrade, upgrade or is level. Where the middle band is not of sufficient thickness to justify separate mining, Jeffrey 35-BB shortwall machines with 8-ft. cutter bars are used.

Little change was made in the mining layout or the general method of working, which is by rooms and pillars, hand loading, rooms and entries being driven 14 ft. wide and room pillars being left 66 ft. wide. As a rule the roof is sound. Protection is provided in rooms and entries by a double row of props with 4x5 headers, 24 in. long, which project over the track. The timbers are secured with sawed wedges. In pillar work they are set on 4-ft. centers. Those 10 ft. or more in length have a minimum diameter of 9 to 10 in.

Fig. 1—Location of Drillholes in Blasting



Intent upon improving the size quality of its product, the company installed the Cardox method of blasting in both mines. Safety was an additional, though not the primary, inducement. While the cost of blasting is higher by this method than by the use of explosives at these plants, the additional cost (8c. per ton at the No. 5 mine and 4c. at the No. 6 mine) is absorbed by the increment of higher price obtained from the improvement of size, and in normal markets, the realization leaves a worth-while profit besides.

Until recently, 35 to 40 per cent of the mine output was pick coal, but, as time goes on, more and more of the production comes from machine-cut places. There are recognized only two factors limiting the use of cutting machines in pillars: Where the roof is heavy and where individual places are isolated. The shells are used in blasting all machine-cut coal. At first it was thought that permissible explosive would be more convenient for pop shots in pick-mined stumps. Experience, however, has shown that the use of shells in this work is convenient and gives better results. In consequence, though explosives are still used for the purpose, shells gradually are being substituted.

Two sizes of shells are employed in blasting the Beckley seam coal. Externally, they differ only in length, the diameter of each being 1¾ in. The longer shell, B44, has a carbon-dioxide chamber with a capacity of 44 cu.in., whereas the smaller shell, B37, which is the one most used, has a capacity of 37 cu.in. As conditions change, the placement of shells in the cuts must be modified to meet those changes. Space will not permit pointing out all these variations in the methods, so but one typical example is here given.

It has to do with blasting in a place where the entire seam is taken. The seam is about 11 ft. thick, composed of a 6-ft. top bench of coal and a 3-ft. bottom bench, between which is sandwiched a 2-ft. parting, as indicated in Fig. 1. A kerf is cut in the bottom-bench coal directly beneath the parting. Depending on the thickness and structure of the coal, two or three shots are required to loosen the bottom bench. If a center breaker shot must be used, it is charged with a B44 shell, and a B37 shell is employed in each of the two rib shots. But if a breaker shot is not needed, the rib shots are made with B44 shells.

The bottom bench is loaded out before the parting is brought down, in which latter operation, it has been found, permissible explosive gives better results than the shells. Especially is this so where the parting is more than 18 in. thick, for then the parting, which, for the most part, is composed of laminations of coal, bone and ash, is capped with a heavy, hard slate. In this event, a breaker shot and two rib shots are used. In thin parting the breaker shot is not required.

Before the top bench is blasted, of course, the parting is loaded out. Approximately 2 ft. of the coal above the parting is tough and must be broken if blasting of the bench is to be successful. For this reason a breaker shot is placed 2 ft. from the parting horizon, using a B44 shell. Immediately over this first shot a second breaker shot is placed. This hole is started 2 ft. from and is angled to meet the roof. Top rib shots are similarly placed, and all three holes are charged with B37 shells.

Holes in coal are drilled to within but 1 ft. of the back of the cut. If they reached to the back, the coal would break out at this extremity and leave hanging shots at the front. The holes are drilled and charged by the miners, but the blasting is left to the shotfirers, who usually complete their first round by 9 a.m.

At the No. 6 mine all of the coal is undercut by shortwall machines with an 8-ft. cutter bar, and all is blasted with Cardox shells. In this mine the Sewell seam averages 4 ft. thick, and the roof is sound, although in some sections 3 to 10 in. of slate must be taken down. The working layout used in the No. 6 operation is similar to that followed in the No. 5 mine.

Because of the experience in the No. 5 mine and the improvement made in the sizes produced by the use of Cardox, it was decided about a year ago to use the same method of blasting in the preparation of coal in the No. 6 mine. The increased percentage of large sizes obtained in the No. 6 mine after the installation of Cardox more than justified the additional expense involved in Cardox shooting.

Seam characteristics favor the use of the Cardox method, and the additional cost over and above the expense which would be incurred in using explosives is, therefore, low. B37 shells are used exclusively, two of these, placed along the ribs, being sufficient to bring down the coal. As this mine is relatively nongassy, the miners are permitted to drill, charge and shoot the holes.

Electrification Program Brings Economies

Major electrical changes in the modernization of the Eccles mines involved, among other things, a change from 550 to 250 volts for the underground distribution system at No. 5 mine and the installation of two underground substations equipped with commutating-pole d.c. generators, rotating-field synchronous motors, and automatic switch-gear, all supplied by Westinghouse. One station is located near the shaft bottom and the other is installed 5,000 ft. away to a working section. Both are near the load centers of working sections which are expected to have a life of ten years or more, and operate in parallel through the trolley wire. Lower maintenance on electrical equipment and increased safety dictated the change.

Prior to the change, No. 5 mine was supplied with power at 550 volts from two 300-kw. rotary converters on the surface. Present underground units are made up of 300-kw., 275-volt, 4-pole, two-wire compound-wound, self-excited generators, capable of handling a 100 per cent momentary overload, and 432-hp., 2,200-volt, 3-phase, 6-pole, 60-cycle, separately excited synchronous motors, operating at 1,200 r.p.m. The set at the shaft bottom is provided with an eight-panel switchboard, including three manual feeders and connections for an additional feeder if desired in the future. The other set has a four-panel switchboard.

The automatic switchgear at both stations provides for starting and stopping the units by remotely mounted push-buttons or by control switches mounted on the switchboards. Motors are connected to auto-transformers for reduced-voltage starting after the starting impulse has been given and the relays indicate correct starting conditions. When the units reach synchronous speed, the generator voltage is built up, and the motor field excited, after which the motor is connected to the full-line voltage. If d.c. line conditions are normal, the generator then is automatically connected to the mine distribution system. No. 6 mine remains on 550 volts and is supplied from the original surface units.

On the main haulage, the old 4-0 trolley wire in both mines was replaced with 6-0 trolley supported on hangers 15 ft. apart on straight track and 5-6 ft. apart on curves. Steel terminal arc-welded bonds are used on both rails of the 70-lb. main-line track and on one rail of the 40-lb. stub entry track. Cross bonds are put in every 250 ft. and around every switch.

On the surface, except for the preparation plants (described on p. 294 of this issue), all equipment is driven by steam generated by four hand-fired 300-hp. Heine water-tube boilers. This includes fans and hoists. Electric power is purchased at present. No major changes have as yet been made in the power supply.

Increased production at No. 5 and No. 6 plants has resulted in a large power saving. While the output is much greater than in the old days, the ventilation and pumping loads have not increased. This fact, in conjunction with some increase in the efficiency of the machinery employed, has cut the consumption of power from 9 kw.-hr. per ton in February, 1928, to 4.75 kw.-hr. per ton in March, 1932. Included in the March, 1932, average is the additional power consumed by the air-cleaning plant, which, of course, was not a part of the 1928 figure.

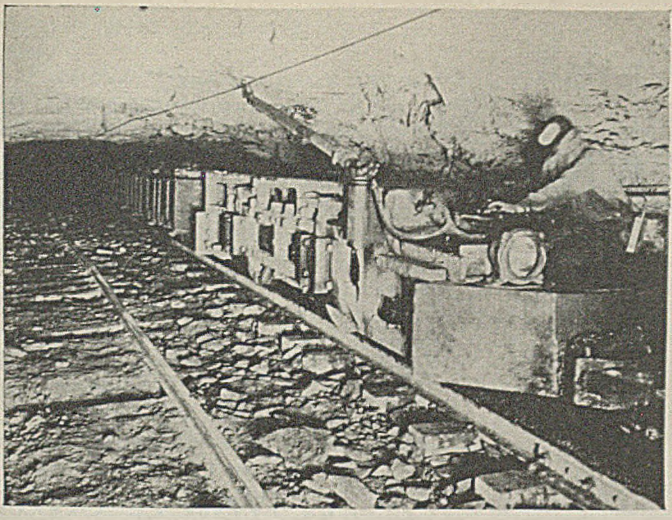
Consumption of power underground in March of this year was 66 per cent of the total purchased, or 282,200 kw.-hr., making the consumption per ton 2.03 kw.-hr. Over-all consumption (surface and underground) of both mines was 427,200 kw.-hr. in March.

Transportation Program Cuts Costs

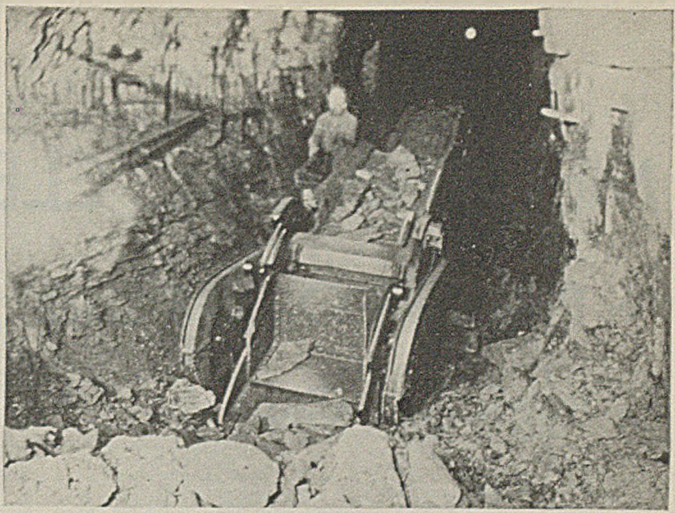
About one-fourth of the new investment for modernization was expended on the haulage system at the two mines. New mine cars were installed throughout, heavy grades on main haulways were eased by cuts and fills, track was relaid with heavier rails, and retied, new trolley wire was hung, and, in No. 5 mine, locomotives were replaced completely. In planning all these changes the yardstick was applied not to determine how good or bad any of the individual features were but rather whether the improvements would yield a substantial profit in lower operating costs and greater safety.

Replacement of the mine cars illustrates this point. Installed in 1926, the replaced cars were modern according to the standards of that time, being of steel sides and wood floor, equipped with anti-friction bearings. But though they were far from worn out, they were replaced, nevertheless, because much better cars were available; cars which would carry more coal and give more continuous service at a minimum of maintenance cost.

Three hundred new cars were installed at each of the mines. These were furnished by the Watt Car & Wheel Co. In general design and construction the lot at No. 6 mine was identical with that at No. 5, except in size. All are of all-steel construction, equipped with Watt-Timken trucks on alloy steel axles. They are further equipped with Allen & Garcia semi-



Shaft-Bound Trip in No. 5 Mine



Loading Out a Grade Cut by Machine

automatic couplers. According to H. R. Sheffler, superintendent of the Eccles mines, the maintenance cost of the cars in the two years of operation since installation has been practically nil, excluding greasing, which requires attention but twice a year.

The new car at No. 5 mine stands 36 in. above the rail and has a capacity of 126 cu.ft., level full, as compared with a height of 40⅝ in. and a capacity of 79½ cu. ft. for the old car. The length of the new car is 145½ in.; that of the old car, 116 in.; the width of the new car is 74½ in.; that of the old car, 59¾ in.

The new car at No. 6 mine stands 30 in. above the rail and has a capacity of 95 cu.ft., level full, against a height of 32 in. and a capacity of 52½ cu.ft. for the old car. Length of the new car is 153½ in.; that of the old car, 116 in.; the width of the new car is 74½ in.; that of the old car, 59¾ in.

One new 15-ton main-line locomotive and fifteen 8-ton gathering units, all of Baldwin-Westinghouse manufacture, with Timken bearings in journals and armatures, were installed in No. 5 mine. The main-line units are of outside bar-steel frame type and have series-parallel, semi-magnetic control; they exert a drawbar pull of 7,500 lb. and have a rated speed of 7.2 m.p.h. The gathering units are of the flameproof, cable-reel type, with permissible motors. These exert a drawbar pull of 4,000 lb. and have a speed of 3.7-4.9 m.p.h.

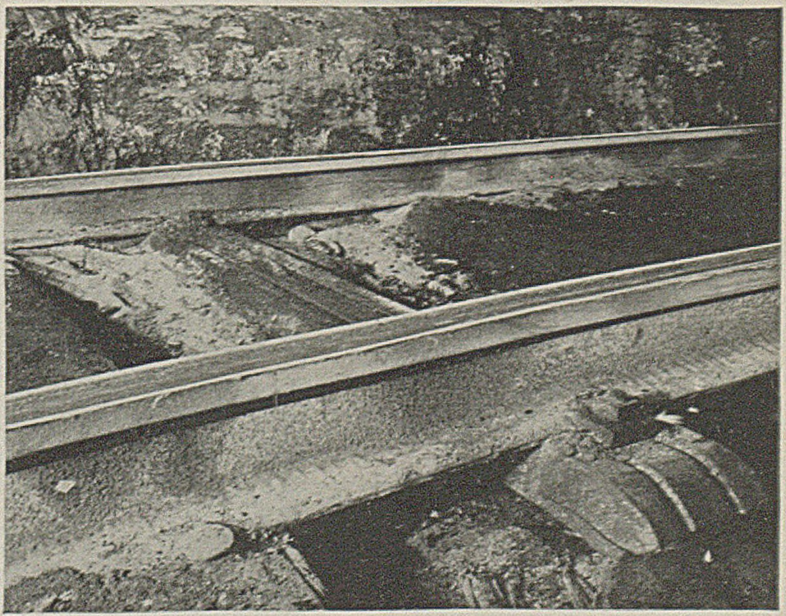
As previously stated, grades are stiff in both mines—in places as much as 8 per cent—and they prevail in no general direction, as the seam bottoms are rolly. Consequently, a great deal of grading was necessary. Much of this work has been done, and more is required. The standards to which this grading must adhere is that in no stretch on the main haulage will the grade be greater than 3 per cent either in favor of or against the loads.

A Myers-Whaley No. 4 rock loading machine is now being used for the grading in the No. 5 mine. This machine was purchased in 1929 for the purpose of cleaning up rock falls on main and sub-entries, following a 10-month shutdown before acquisition by the new management was effected. Experience has shown that a substantial saving is effected in loading by the use of this machine for both purposes. Where weak roof measures are exposed by grading, and where the roof is bad or the ribs show a tendency to rash elsewhere on the main entries, gunite is being applied.

Approximately 10,000 lin. ft. of main-line track has been relaid, using 70-lb. steel in place of 40, which is the weight employed on sub-entries. On main-line track, ties are placed on 26-in. centers, and every fifth is a No. 10 (T-6 section) steel tie weighing 5.75 lb. per foot. Steel ties are used exclusively in rooms. Both types of tie were furnished by the West Virginia Rail Co. In room turnouts a No. 2½ frog is employed. This frog develops a radius of 38 ft., an increase over the radius previously used, which was 29 ft.

Decided gains have been effected in the efficiency of labor as a result of the improvements made. The extent of these gains is clearly shown by comparison of results in a representative month before the changes were made with those in a recent month for No. 5 mine only. In March, 1932, when 25 days were worked, the daily tonnage per inside company man was 17.3, as compared with 10.7 for the month of February, 1928, when 23 days were worked; and the daily outputs per loader in these two months were 14.8 and 12.4 respectively. It is important to note that the ratio of daily output per underground company man to daily output per loader had increased to 173-148 in March, 1932, from 107-124 in February, 1928. The loaders timber and drill shotholes, but they do not extend track.

Steel Ties Keep Main-Line Track to Gage



MECHANICAL CLEANING

+ Puts Crab Orchard Slack In Byproduct Class

By IVAN A. GIVEN

Assistant Editor, Coal Age

A MAJOR step in the modernization program of the Crab Orchard Improvement Co. was the installation of an air-cleaning plant employing Peale-Davis pneumo-gravity separators to prepare Beckley coal from the No. 5 mine, Eccles, Raleigh County, W. Va. Physical and chemical characteristics of the coal played a large part in the decision to install a cleaning plant. Comparatively low in sulphur, with a high fusion temperature and just sufficient ash to make a strong coke, the Beckley slack was ideal for byproduct coking. As this size (½x0 in.) comprised a large percentage of the production of No. 5 mine, a cleaning plant was deemed a necessity to insure that the slack, with a reasonable expenditure for preparation, could always be disposed of in the byproduct market at comparatively higher prices.

A further factor in the choice of a cleaning plant was the problem of breakage in preparing the domestic sizes. With a Peale-Davis table the removal of impurities from the domestic sizes is accomplished mechanically without presizing, and the resulting degradation is thereby eliminated.

Before modernization of the Crab Orchard properties, both the No. 5 and No. 6 mines were equipped with shaker-screen tipples to prepare 5-in. lump, 5x1½-in. egg, 1½x¾-in. nut, and 1½-in. stoker or ¾-in. slack. No. 6 plant, which, just prior to the shutdown before transfer of ownership, accounted for an average output of 800 tons per day, was converted to the present simple screening plant for making standard mine-run, coarse mine-run, and ¾-in. slack. As the coal from the Sewell seam is intrinsically clean as it comes from the mine, no provision is made for the removal of impurities, except for one picker on the mine-run cars to improve the appearance of the shipments.

Separation of slack at the No. 6 plant is accomplished on a stationary lip screen which is equipped with a special adjustable veil. This veil is hand-operated, and the operative by moving a hand wheel can blank off the entire screening surface to load straight mine-run, or a certain part of it to load mine-run with a definte percentage of slack removed. The adjustable veil also enables the operative to iron out variations in the slack content of the mine cars by moving the veil, and thus avoids high concentrations of slack in certain railroad cars.

Layer-loading of the mine-run to reduce degradation is a second unusual operating feature at the No. 6 plant. The mine-run is loaded through a chute equipped with baffles to cut down the speed of the coal as it flows to the car. In addition, the chute is equipped with a hoist so that it can be lowered to the bottom of the car. When the bottom layer is loaded, which is done while the car drops past the chute, the car is pulled back by a car retarder modified by the addition of the necessary gears, shafting and the reversible motor, and the second layer of mine-run is laid down on the return trip. Four layers complete the loading. Loading and car movement are under the control of the coal inspector. Output of the No. 6 operation now averages 1,200 tons per day.

The old No. 5 plant was similar to that at No. 6, though the average production was slightly higher—1,375 tons per day. Revisions at No. 5 included the installation of the new cleaning plant, and a new screening and loading plant to ship hand-picked 6-in. lump and air-cleaned 6x2½-in. egg, 2x1½-in. stove, 1x½-in. nut, 1-in. stoker or byproduct coal, and ½-in. byproduct slack. Production at No. 5 is now 2,600 to 3,000 tons per day, of which approximately 92 per cent is put through the

Surface Works at Nos. 5 and 6 Mines. Cleaning Plant Is on the Hill Behind the Boiler House. No. 6 Headframe Appears in the Background.

cleaning plant—capacity, 315 tons per hour.

Four Peale-Davis separators are employed to clean the coal from the No. 5 mine. Two primary tables handle 6x0- and 1x0-in. raw coal, while two additional tables re-treat material from the two primary tables. Raw coal from the mine is stored in a 350-ton bin at the hoisting shaft, in which 200 tons is kept until late in the afternoon to prevent segregation of sizes. Primary separation in plus and minus 6-in. sizes is made on a shaker screen. The plus 6-in. coal goes to the picking table in the tipple. Minus 6-in. coal, together with the crushed reject from the picking table, goes to the cleaning plant.

Primary air-cleaning is done at a specific gravity of 1.50. Raw coal entering the cleaning plant passes over a ½-in. screen on the reciprocating feeder which serves the two primary tables (*A* and *B* of Fig. 1). Minus ½-in. material from this screen, which takes out only a part of the ½x0-in., goes to the 1x0-in. *A* table, while the remaining raw 6x0-in. coal goes to the *B* table. Clean coal from the *B* table passes over a 1-in. screen. Material passing through this screen is fed to the 1x0-in. *A* table, which also handles ½-in. middlings screened out at the discharge end of this table. Primary refuse from both the *A* and *B* tables goes to the 6x0-in. *D* and 1x0-in. *C* tables for re-treatment. The primary refuse is not crushed before re-treatment. As is the case with the primary tables, the 1x0-in. cleaned coal screened out at the discharge end of the 6x0-in. *D* table is returned to the *C* table for final treatment before joining the cleaned coal on its way to the tipple for screening and loading.

As indicative of the results attained through air-cleaning, a summary of a test made early in 1932 on the 1x0-in. stoker size is given in Table I.

For the "A" and "C" clean coal combined, the average ash lies between 5.40 and 5.50 per cent. Sulphur in the 1x0-in. stoker coal is reduced from 1.20 to 0.85 per cent. Results on the ½x0-in. slack parallel those on the stoker size. In addition to the ash and sulphur reduction, cleaning also raises the B.t.u. content from 14,300 to 14,675, approximately, and increases the fusion temperature of the ash from about 2,800 deg. to 2,850-2,900 deg. Average per cent of reject to the refuse bank is 5.4.

The No. 5 cleaning plant originally was designed to clean 5x0-in. coal at a rate of 200 tons per hour. Later, the upper limit was raised to 6 in., and operating adjustments have made possible the present increased throughput. Provision also was made in the design of the plant for the addition of an extra table if it was decided to clean the No. 6 coal, which in that event would be brought to the plant by a conveyor from the No. 6 hoist.

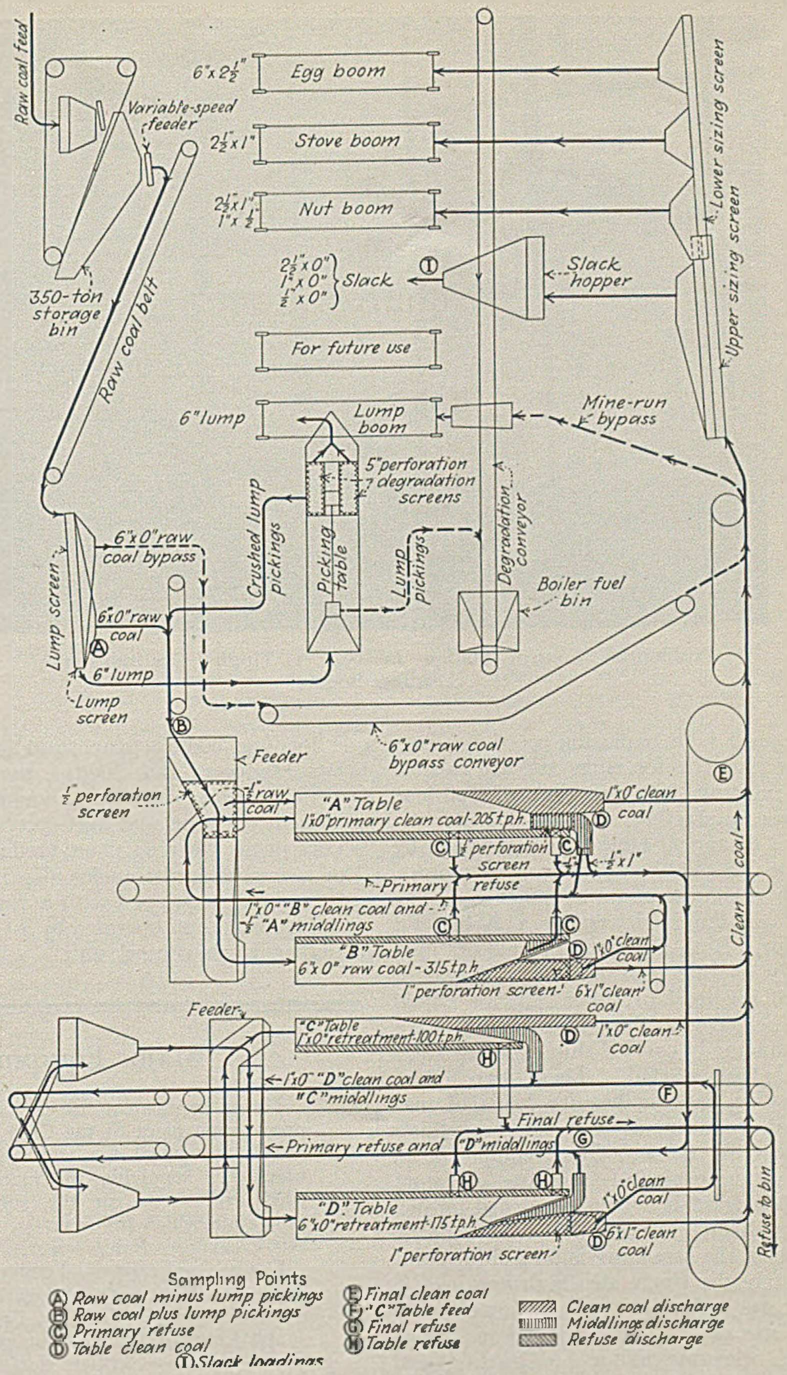


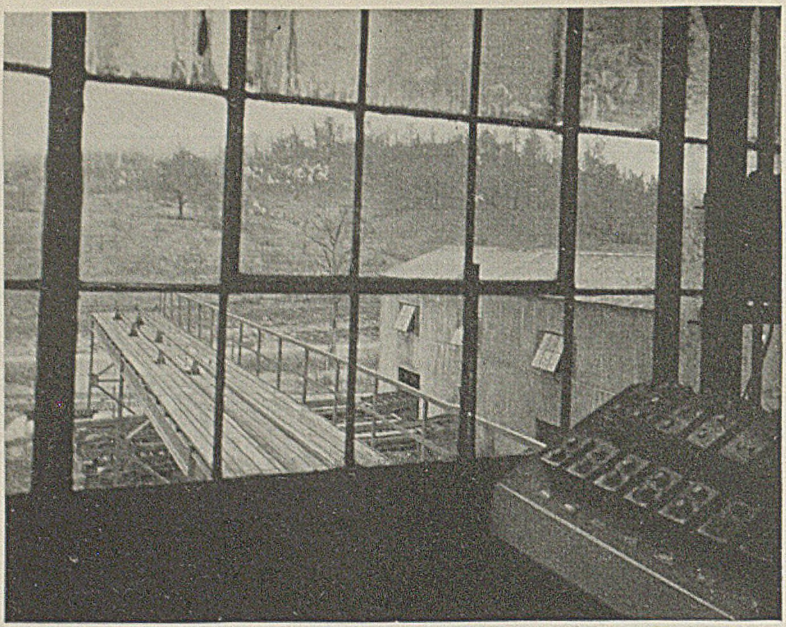
Fig. 1—Flowsheet, No. 5 Cleaning Plant and Tipple

The horsepower of the cleaning plant motors aggregates 631, made up as follows: table drives, 115; table fans, 350; conveyors and elevators, 111; reciprocating feeders, 30; dust-removal fan, 25. Connected horsepower to operate the screening and loading plant and other equipment outside the cleaning plant proper totals 332, making the grand total for the entire No. 5 surface plant 963 hp. *A*, *B* and *D* tables in the cleaning plant are driven by heavy-duty, 30-hp., Type MT, slip-ring motors. *C* re-treatment table is driven by a similar 25-hp. motor. These motors are

Table I—Cleaning Results, 1x0-In. Stoker Coal

(Tested at 1.50 Sp.Gr.)

	Sinks		Floats		Total Ash,
	Per Cent	Ash	Per Cent	Ash	Per Cent
Raw coal	7.00	41.02	93.00	4.58	6.94
"A" clean coal	3.02	39.63	96.98	4.22	5.29
"C" feed	11.95	46.49	88.05	5.44	10.36
"C" clean coal	4.93	35.36	95.07	5.05	6.55



Pushbutton Control Station in No. 5 Tipple Overlooks the Loading Booms

equipped with explosion-proof housings over the collector rings and are capable of exerting 300 per cent of full-load torque in starting.

A, *B*, and *D* table fans are driven by Type TS, 100-hp., synchronous motors, with a maximum power factor of 0.8. *C* table fan is driven by a 50-hp. TS motor. Both *B* and *D* fan motors normally operate considerably in excess of rated full load (150 per cent for *B* and 157 per cent for *D*). These motors have satisfactorily carried this overload since the plant started. These two tables carry by far the heavier loads of material, treating, as they do, everything from 6 in. down. Other equipment in the cleaning plant (conveyors, elevators and feeders) is driven by normal-torque, normal-starting-current, KT motors. Most of the screening and loading equipment in the tipple also is driven by KT motors. One exception, however, is the use of high-slip, high-torque, Type FTE elevator motor for starting and operating the main raw-coal shaker separating the bin material into plus and minus 6-in. sizes.

The cleaning plant and the tipple have independent control systems centering in pushbutton stations in charge of operatives on continuous duty. Each button is equipped with a pilot light to show whether or not the motor it controls is running. Starting and stopping of equipment is in sequence, working back from the tipple and cleaning plant to the feeder under the raw coal bin at the shaft. Individual pushbuttons are located at the table and fan motors in the cleaning plant to allow locking out or stopping of each individual motor in case of accident or for repairs.

Tex-Rope drives are used on the majority of the equipment in the cleaning plant and tipple. Exceptions are: one loading boom (gear train), boom hoists (reducers and chains), the clean coal collecting conveyor, double retreatment elevator, and dust screen conveyors in the cleaning plant (reducers). The raw coal feeder under the 350-ton storage bin is equipped with a variable-speed transmission operated by a Cutler-Hammer Dean control unit.

Surface preparation and refuse disposal in March, 1932, required 145,000 kw.-hr., or 34 per cent of the total power consumption at both mines. Aside from the consumption of two refuse larries and a few comparatively small motors at the No. 6 preparation plant, the major part of the surface power was consumed by the No. 5 preparation plant and tipple, making the consumption per ton of No. 5 coal shipped approximately 1.7 kw.-hr.

Excluding interest and depreciation, the operating costs of air cleaning at No. 5 are as follows: power, 3.32c. per ton; labor (operation and maintenance), 2.00c.; materials, 1.50c.

Routine sampling of the air-cleaned coal is confined to the stoker and slack sizes, on both of which a close check on ash percentage is kept. Each car of these sizes is sampled, using the method described on page 310 of this issue. Ordinarily, these samples are analyzed only for ash. For checking the operation of the plant after adjustments, or for special purposes, general over-all sampling of all products and sizes is carried out. Sampling points for this purpose have been established as indicated in Fig. 1.

The No. 5 tipple is equipped with tanks and spray nozzles for treating all sizes with calcium chloride to keep them free from dust and make them suitable for domestic use. No. 6 coal is shipped without special treatment.

Major Equipment Register: No. 5 Plant

Major equipment in the No. 5 preparation plant of the Crab Orchard Improvement Co. and the manufacturers supplying the machinery used are shown in the summary tabulation which follows:

Air-Cleaning Equipment: Peale-Davis separators — Pennsylvania Mining Machinery Co., with fabrication by J. Eichleay, Jr., Co. and Connellsville Co. Zoning cloth and screens—Beckley Perforating Co. and Harrington & King Perforating Co. Table and dust fans —American Blower Corporation.

General Preparation Equipment: Shaker screens and feeders—Scottdale Machine, Foundry & Construction Co., with drives by Brown Machine Co. Crusher—Jeffrey Mfg. Co.

Conveying and Loading Equipment: Conveyors, elevators and loading booms—Link-Belt Co. Conveyor belt—United States Rubber Co. Conveyor belt idlers—Weller Mfg. Co. Idler bearings—Timken Roller Bearing Co. Boom hoists—W. A. Jones Foundry & Machine Co. Car retarders — Fairmont Mining Machinery Co.

Power Transmission Equipment: Gear trains—Link-Belt Co. Reducers—W. A. Jones Foundry & Machine Co. Tex-Rope drives—Allis-Chalmers Mfg. Co. Variable speed reducers—Stephens-Adamson Mfg. Co.

Electrical Equipment: Conduit—Hawkins Electric Co. Motors—General Electric Co. Safety switches—General Electric Co., Trumbull Electric Mfg. Co., and Westinghouse Electric & Mfg. Co. Switchboard—Marquette Electric Co. Transformers—Westinghouse Electric & Manufacturing Co. Wire —American Steel & Wire Co. and Hawkins Electric Co.

Sampling and Testing Equipment: Connellsville Mfg. & Mine Supply Co., Consolidated Ashcroft Hancock Co., Fisher Scientific Co., Grasselli Chemical Co., J. D. McIlroy & Sons, Mine & Smelter Supply Co., Scottdale Machine, Foundry & Construction Co., and W. S. Tyler Co.

The plant was designed and erected by Allen & Garcia Co., with steel fabrication by the Pan-American Bridge Co. and the Virginia Bridge & Iron Co. Youngstown Sheet & Tube Co. furnished steel sheeting for the job. Grating and stair treads were supplied by the Irving Iron Works and the Universal Mfg. Co.

[FIRST OF TWO ARTICLES ON AIR SURVEYS]

HOW TO MEASURE

+ Pressure Losses in Ventilation

By J. N. WILLIAMSON

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IN ALL coal-mining countries, increased attention and study is being given to mine ventilation. Everywhere groups of workers are actively engaged in a more or less coordinated effort to improve the technique of this fundamentally important service. That it is of much economic importance in our hard-pressed industry is undoubted, especially when it is realized that, in mines, ventilation is one of the principal items of power consumption. At some of the modern collieries in Britain, for instance, the yearly cost of ventilating power exceeds $50,000.

Such studies, however, must be carried further than into the work of the fan if ventilating economy is to be assured; for while the fan may be efficient, excessive air leakage may render most of its work useless. The desideratum in mine ventilation is to ventilate the workings adequately with the least expenditure of power. The useless expenditure of pressure or volume (or both, such as prolifically occurs in the case of leakage) cannot be made evident by measurements in the fan drift, or even completely by routine air measurements underground. Much more rigorous investigation is required.

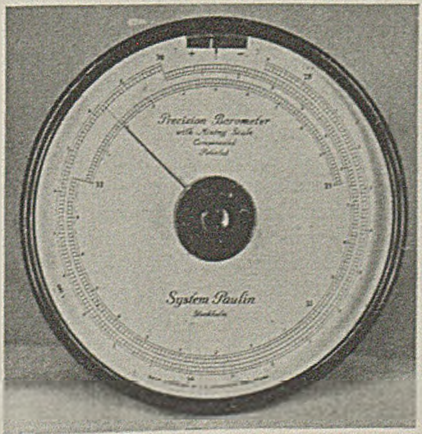
The expenditure of pressure in overcoming the resistance to air flow through the mines varies considerably in different parts of the circuit. In order to improve the air flow in a district which is inadequately ventilated, increasing the fan water-gage frequently is deemed the only expedient. That this method may be very costly, and indeed may be futile, has been often proved in practice. The common-sense method is to locate definitely the regions of high-pressure loss, and when located, to improve the airways at these points as far as is practicable.

Atkinson's laws of air flow in mine galleries, though laid down by him over seventy years ago, have been found substantially correct for all practical purposes. Much controversy has centered round his so-called frictional coefficient, k, but, as was correctly indicated by Atkinson himself, the value of k is not strictly constant even for a given airway but is dependent on the prevailing air density. Nevertheless, we have today several groups of workers determining frictional factors for different conditions and, more often than not, obtaining results which vary for apparently the same conditions.

Though this continued investigation of the laws of flow of air in mines, and the determination of the various frictional factors relating to roadways of various linings, have their value, what the operator is seeking is investigations of the circulation of air through his mine that will yield results of *immediate* value to his own operation. When these are performed in sufficient detail after the manner to be discussed, this result will be attained. As the circulation of air is dependent on pressure differences between the end points of the air circuits and, as we shall see, the determination of these pressure differences involves the measurement of air flow at the selected points, such an investigation may well be called an air-pressure survey. A survey of both pressure and volume should show just where excessive losses are taking place and directly lead to further investigations that are designed to reduce such losses to the lowest economic limit.

In general, the differences of pressure between points in the air circuit are so small that extremely sensitive apparatus is required to obtain reliable measurements. When the difference of pressure between two points not far apart is desired (for example, between the fan drift and the outside atmosphere, at separation doors, etc.) it can be obtained readily by joining up the points with rubber tubing or other connections to the ends of a sensitive water gage. As is well known, this is the fundamental method, and it is to be preferred wherever practicable, as it gives the pressure difference directly and is not affected by the relative level of the two points. Opportunities for the use of the water-gage in the measurement of differences of pressure are limited, however, and its application to the seriatim assessment of pressure losses obviously is impracticable.

Fig. 1—Aneroid in Which Diaphragm Is Supported by Spring; Instrument Utilizes Stress in Spring as Means of Determining Air Pressure



For a point-to-point investigation of pressure losses, the *absolute* air pressures at the selected points must be measured, the losses being then obtained by difference. Evidently only under certain conditions will the measured difference in absolute air pressures between any two points correctly determine the ventilating pressure expended on the air current between such locations. These conditions are: (*a*) That the points lie at the same level; (*b*) that the air temperature and humidity at each point be identical; (*c*) that the velocity at each point be the same; and (*d*) that the measurements be made simultaneously.

Though the first three conditions may possibly be met in practice, that they will be in any instance is, in general, highly improbable. Where more than two points are to be included in the survey, simultaneity of measurement is clearly out of the question. Consequently, the circuit must be traversed from point to point, using the same pressure-measuring instrument. This procedure at once demands: (*a*) That differences in level, and in air temperature, humidity and velocity, be measured and corrections applied to the measured pressure wherever necessary; (*b*) that variations in the atmospheric

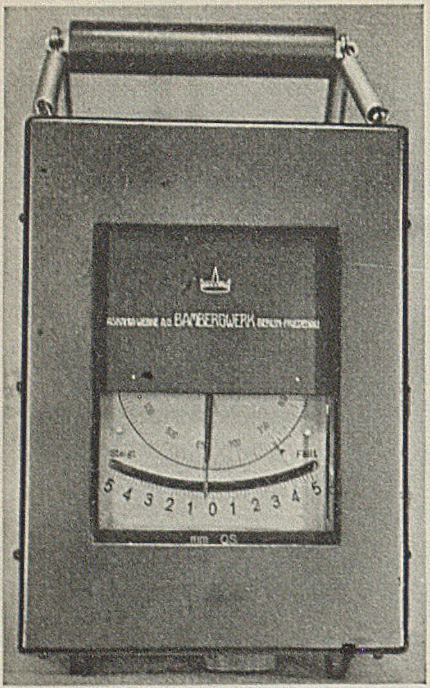


Fig. 2—Type of Aneroid Originally Designed for Flying Service

pressure above ground be measured throughout the period occupied by the survey, with an instrument as accurate as the one employed in the traverse; and (*c*) that, throughout the survey, the mechanical ventilator and other ventilating appliances be operated under uniform conditions.

Among the instruments required for making such an air-pressure survey, the only one at present demanding special consideration is that to be used in the measurement of the absolute air pressure. Such an instrument must be portable, reasonably rugged for underground use, and sufficiently delicate to register pressure losses as low as 0.05-in. water gage. Recent work in Britain by myself and others* has shown that a good type of surveying aneroid barometer, graduated to 0.01 in. mercury over a limited range of pressure (say, 28 to 33 in. of mercury), provided with a fine pointer and movable reading lens, and calibrated by the Bureau of Standards, is suitable for the work, provided certain precautions, to be discussed, are carefully observed.

In the past, aneroids in general have earned a bad reputation for inaccuracy, principally because of their inherent defects—viz., creep or lag, and temperature errors. I do not propose to discuss here this class of defect. Those interested will find a fairly lengthy discussion of these errors in the paper to which reference has been made. In passing, however, it may be mentioned that most aneroids are marked "compensated," thereby inferring that in the reading of these instruments corrections for changes of temperature are unnecessary. Nevertheless, according to the National Physical Laboratory, England, thermal changes in the reading of an aneroid at constant pressure amounting to 0.02 in. of mercury (0.27 in. of water gage) per 25 deg. F. are frequently found even in good instruments, even though they are marked "compensated for temperature."

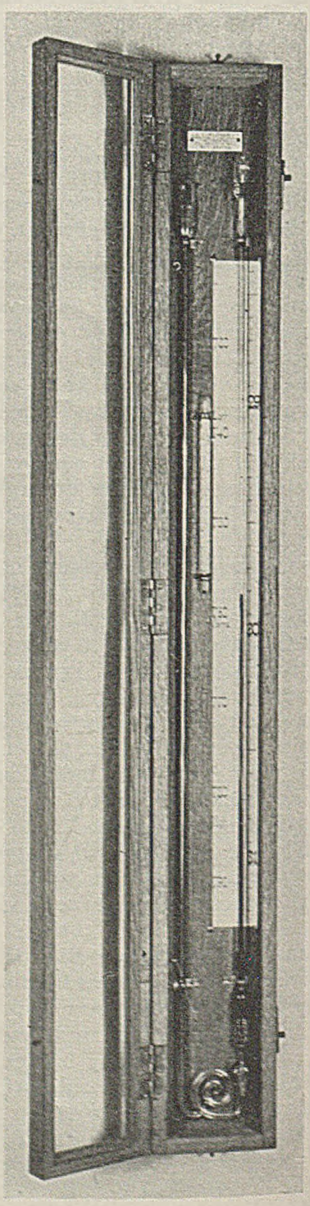
Among the special types of aneroid barometers recently devised for the measurement of pressures underground, two are worthy of mention: namely, "Paulin" aneroid, and the "Askania" statoscope. The former instrument is a product of Sweden and is illustrated in Fig. 1. It differs from the ordinary form of aneroid in that distortion of the diaphragm with changing pressure is prevented by altering the tension on a spring. This spring is controlled from outside the case by means of a knob located at the center of the dial. A "tendency pointer" shows whether the pressure is increasing or decreasing. In using the instrument, the central knob is turned till the pointer indicates zero, a small mirror below the pointer facilitating accurate setting of this zero. The tension required to keep the diaphragm in its normal position depends on the prevailing atmospheric pressure. It is this tension which the instrument measures.

The "Askania" statoscope was originally introduced into aviation service as an aid in keeping an airplane or airship flying between definite limits of altitude. In its recent adaptation for use in mines (Fig. 2) the range of the instrument lies between plus 5 and minus 5 mm. of mercury (plus 2.6 and minus 2.6 in. of water gage). At any known pressure, the reading on the dial is set to zero by turning a milled-head screw located underneath the case. From this point (zero) the statoscope records the changes of pressure within its range. Should the desired pressure measurements exhaust the normal range of the device, the pointer is again set to zero at the last position measured, and the observations therefrom continued.

An instrument that I have found to be invaluable for "control" work in air-pressure surveying is the contra-barometer (Fig. 3). This is a modification of the ordinary mercury siphon-barometer, in that the movements of the mercury are magnified through the medium of a liquid of low density (usually colored aniline). This light liquid rests on the lower mercury column, which latter terminates in a narrow capillary tube. As the pressure changes are measured by the movement of the light liquid in the superimposed capillary tube, the readings are given in the contrary direction to those of the ordinary mercury barometer. Briefly, the advantages of this instrument are: (*a*) That it gives a magnification about ten times that of the ordinary mercury barometer; (*b*) that it is portable, a tap being provided to hold the liquid during transit; (*c*) that, by having an enlarged portion in the upper part of the capillary tube, the length (or height) of the device may be reduced to reasonable limits suitable for the deepest mines.

Its chief disadvantage is that the exact correction for temperature variation and capillary depression is complicated in consequence of the use of two liquids. When used as a "base" instrument, however, to measure the fluctuations of atmospheric pressure during the course of a survey, this disadvantage is eliminated. Indeed, the contra barometer provides an almost ideal "control" instrument, and as such I have invariably used it when making air-pressure surveys underground.

Fig. 3—Contra-Barometer With Two Liquids, One Mercury and the Other Colored Aniline



*"Air-Pressure Surveying in Mines" (Seventh Report of the Ventilation Committee, Midland Institute of Mining Engineers, May 21, 1931), by Messrs. Williamson, Ritson, Cooke and Statham.

[THE FIRST OF TWO ARTICLES ON ELECTRIFICATION AT VALIER]

POWER CHANGES

+ For Machine Loading

Extend Use of "A.C." at Valier

LOADING machines cannot be successful from the standpoint of consistent production and maintenance cost unless adequate voltage is maintained and power interruptions are cut close to the irreducible minimum. That ideal condition is closely approached at the Valier (southern Illinois) mine of the Valier Coal Co. by reliance on alternating current for cutting, drilling and loading. This mine, with a capacity of 1,000 tons per hour, mechanically loads its entire output, which, prior to the April suspension, averaged approximately 6,400 tons per day.

The use of a.c. power in this mine is not a new practice. It had been utilized for some years to drive the cutting machines. The advantage of high-voltage distribution and inherent ruggedness of a.c. motors demonstrated by this experience, and the fact that the mine was already equipped with 2,300-volt distribution circuits and transformer circuits, led to the specification of a.c. motors for the loading-machine and pit-car-loader equipment.

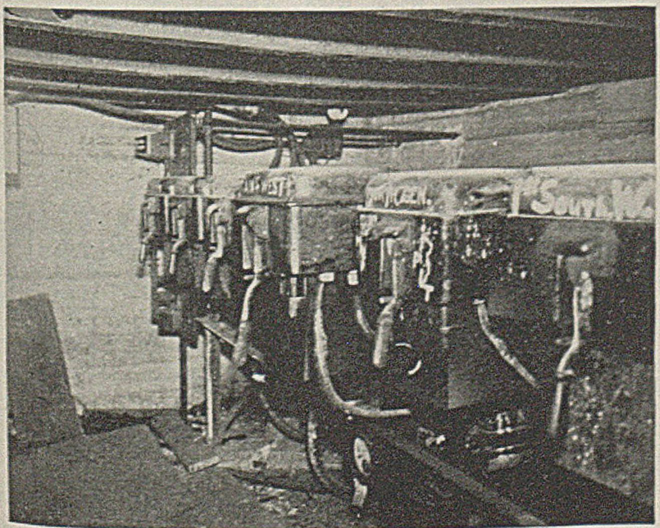
This expansion of the a.c. load naturally called for radical changes in the electrical distribution system, which were made in the summer of 1929. Elimination of direct current for powering the loading machines and drills suggested a further change which would make the locomotive in gathering service independent of this power in advancing places. This final touch was added by converting a number of cable-reel locomotives to the combination trolley and battery type. Other changes also were made in the haulage, not the least important of which was the complete redesign of the shaft bottom equipment.

The additional load imposed by the 13 loading machines and 52 pit-car loaders regularly in use, and the more exacting power requirements, made it necessary to rebuild the a.c. distribution, beginning on the outside. Switches and buses of the old 2,300-volt distribution board were of insufficient capacity, the panels carried no provision for metering, and the overload relays were of a bellows type which had proved unreliable.

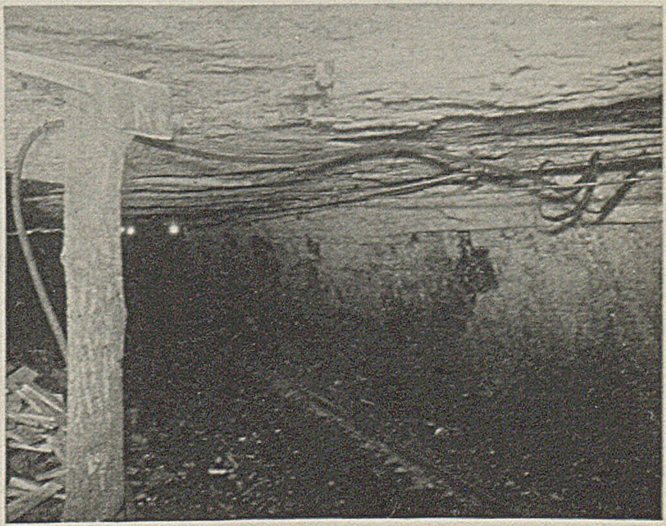
Where the old panels were located in a corner of the auxiliary hoist house there was insufficient floor space for the new board. Instead of erecting an addition or a new building, the new board and oil switches were mounted on a mezzanine floor erected across one end of the hoist house and extending above the hoist motor. This has proved to be an excellent location. The new panels are equipped with indicating ammeters, graphic wattmeters and integrating watthour meters. Relays are of the induction type.

The power is purchased at 33,000 volts and is transformed to 2,300 volts at one substation located near the shaft. Three 666-kva. and three 500-kva. transformers, all owned by the coal company, make up the equipment. The 2,300-volt

Oil Switches are Installed at the Bottom of the Shaft for Controlling Underground Circuits, Which Carry 2,300 Volts



Spring Clip Terminals Connect Trailing Cables to A.-C. Feeders. Hooks in Roof Hold Cables Clear in Crossing Tracks



energy is all distributed from the new board just described.

All d.c. substations, which are used only for operating haulage equipment, are located inside of the mine and, in common with the a.c. equipment for mining and loading, are fed through the auxiliary shaft rather than through outlying boreholes. This requires a large-capacity 2,300-volt feeder in the shaft. Before the change to mechanical loading this shaft feeder consisted of three 300,000-circ.mil single-conductor lead-covered cables. This line was replaced by a 750,000-circ.mil three-conductor wire-armored lead cable, insulated for 5,000 volts.

The shaft is 600 ft. deep and the cable is suspended with all of the weight carried by two clamps at the top. This large cable terminates in a switch room near the shaft bottom. Herein are located an incoming panel and main oil switch together with six other oil switches. These control four circuits to d.c. substations and two circuits feeding a.c. cutting, drilling and loading equipment. One of the latter takes care of the east side of the mine and the other the west side. Oil switches are used also back in the mine where branches are taken off these 2,300-volt feeders.

Lead-covered steel-armored cables were first tried for inside distribution, but trouble was encountered by corrosion of the armor and cracking of the lead sheath, so in 1928 Trenchlay cable was adopted as the standard for these mine circuits. This cable depends entirely on rubber as the protection against moisture. The lighter weight as compared to the lead-and-armor type saves considerable expense in installation.

The mine is developed on the three-entry system with the haulway in the center and the Trenchlay cables are placed on the bottom in one or both of the aircourses. Only where the cable crosses a haulway or would be subject to foot travel is it laid in a trench and covered. In no case is it hung on the rib or top.

With the exception of a 3/0 cable feeding a 500-kw. d.c. substation 3,600 ft. from the shaft, all of the 2,300-volt circuits are 1/0 cable which is $1\frac{3}{8}$ in. outside diameter. The maximum distance from the shaft that the 2,300-volt lines now extend is 8,000 ft. Approximately 100 volts, or less than 5 per cent, is the maximum drop in the 2,300-volt transmission to the 220-volt transformer substations. For the present tonnage, the quantity of active 2,300-volt 1/0 Trenchlay cable is 31,300 ft.

By use of an exploring coil and telephone receiver, trouble in a Trenchlay cable is easily and accurately located. While the exploring coil is being carried along close to the cable, the latter is energized by 220 volts a.c. through a resistance. If there is a ground, 2,300 volts is applied to break down the insulation and the 220 volts then applied and the exploring coil employed to locate the break-down. Taps and splices in Trenchlay cable are made by using patent connectors on the conductors, then covering the tap or splice with rubber tape and following this with friction tape. The joint is then incased in a split cast-iron junction box without compound.

Transformer substations consist of one or two portable units. Each unit consists of three 25-kva. oil-cooled distribution transformers arranged in a steel box which is mounted on a mine truck. In the box with the transformers are mounted a 2,500-volt 200-amp. oil circuit breaker and three single-pole porcelain cutouts fused to 40 amp. Mounted on the outside of the box and connected in the secondary circuit is a triple-pole 200-amp. safety switch fused to 400 amp. Transformers are equipped with 10 per cent boosting taps.

The load per transformer truck consists of one 30-hp. loading machine, one 50-hp. mining machine and a post-mounted coal drill. This load does not heat the transformers to the point where it is necessary to raise the box cover, which can be done if ventilation is thought necessary.

Two loading machines, two cutting machines and two drills make up a panel group; therefore two of the transformer trucks is the usual arrangement at each station. Ordinarily the 220-volt circuits from each are kept separate—that is, not operated in parallel. Moving a station and reconnecting ready for service ordinarily is done by two men during one shift.

The secondary lines consists of three single-conductor 4/0 weatherproof stranded wires hung on the roof by porcelain knobs. There also is some old 2/0 wire used in pit-car-loader territory. The total of both sizes installed in active territory is 28,100 ft. of line, or 84,300 ft. of wire. One-thousand feet is the standard set for the limit of length of

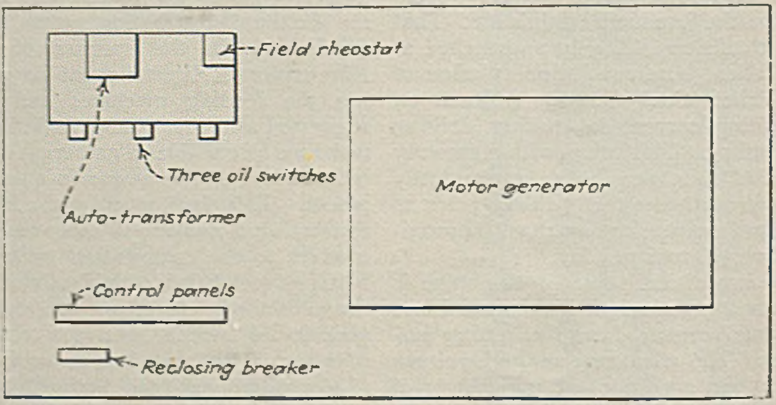
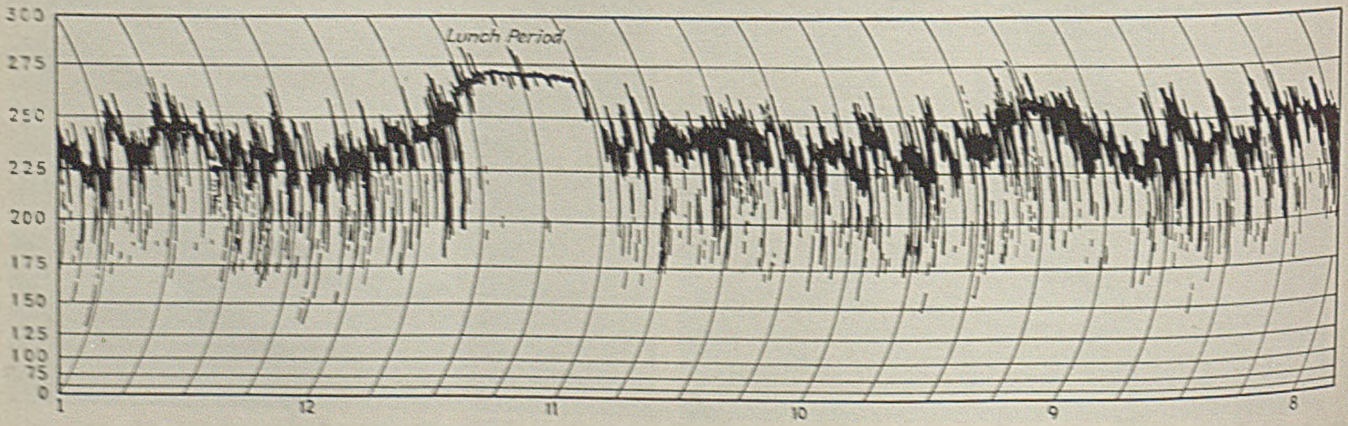
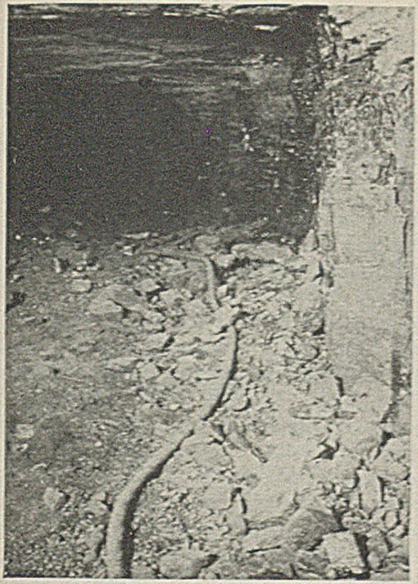


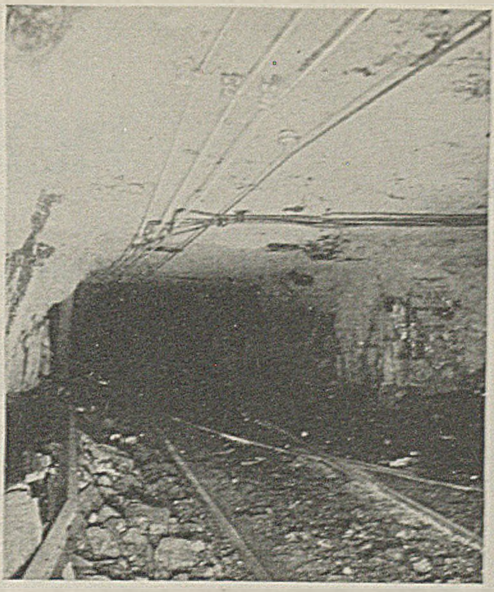
Fig. 1—Plan Indicating Arrangement of 500-kw. Substation in Small Room

Fig. 2—A.C. Voltage at End of Line on Butt Entry With Cutting, Drill and Loading Machines Working

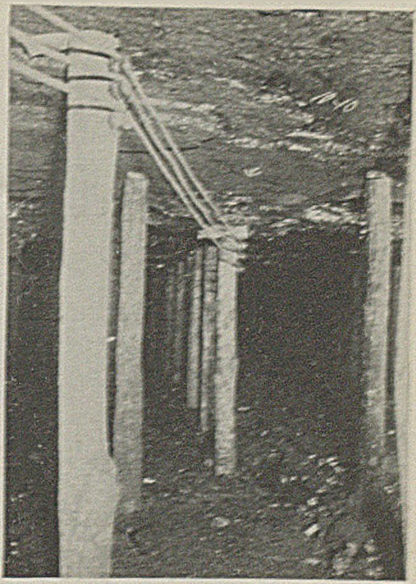




Typical Installation of Trenchlay Cable in Aircourse



Three-Wire 220-Volt A.C. Line in a Butt Entry With Branch Into a Room Neck at the Right



A.C. Line Is Carried a Short Distance Into Every Third or Fourth Room

these 220-volt feeders. This, plus the 300-ft. trailing cables used on the machines, represents the distance limit of 220-volt transmission. Both mining machines and loading machines use No. 4 three-conductor all-rubber trailing cables 300 ft. long. Reels are used on the mining machines but not on the loaders.

Loader, cutter and drill cables are connected to the 4/0 feeder lines by spring clips attached at points where the weatherproof insulation has been skinned off for about two inches. These clips are not fused and are constructed so that with appreciable strain they will pull off of the wires instead of loosening the line. For protection of the machine trailing cables and 220-volt distribution lines dependence is placed on the 400-amp. secondary fuses and the 40-amp. primary fuses at the transformers.

In every third or fourth room a tap from the 220-volt feeder line on the butt entry is extended in about 40 ft. These wires are on porcelain knobs attached to the props. In these rooms, track switches are laid through breakthroughs to the adjoining rooms and the haulage is handled through the center room. This saves the work of attaching hooks in the butt entry roof at each room neck, which would be necessary to keep the trailing cable close to the roof where it crosses the haulway. The latter arrangement is used, however, at many rooms where for various reasons branch lines are not erected.

Voltage at the face during cutting and loading is maintained at an average of 230. An accompanying illustration (Fig. 2.) reproduced from the chart of a recording voltmeter shows the typical variation at the end of a 220-volt distribution line during working hours. The momentary drops below 200 volts are due to the starting of the motors. Across-the-line starters are used on the loading machines and cutters as well as on the smaller motors of pit-car loaders and drills.

The coal seam varies from 7 to 10 ft. in thickness and as a whole is free from severe local grades. Methane liberation from the entire mine totals slightly over a half million cubic feet in 24 hours. The Joy loading machines have permissible electrical equipment, but the pit-car loaders do not. It is contemplated that all new electrical equipment for use at the face be permissible. Size No. 10 three-conductor rubber trailing cable is the standard for pit-car loaders.

As a rule, one shortwall mining machine is assigned to cut for each Joy loader and one for each group of six pit-car loaders. The cutting equipment includes one Goodman mounted bottom cutter which cuts for 16 pit-car loaders. A post-mounted electric coal drill follows each shortwall. The mine is equipped with one Jeffrey double-head truck-mounted drill which follows the mounted cutting machine.

Table I—Comparative Performances of Plain and Stellited Bits

	Plain Steel Bits 1927 and 1928	Tipped Bits Five-Day Test
Bits heated and resharpened per day	5,822	626
New bits added per day	178	122
Bits tipped per day	.....	748
Bits sharpened by grinding per day	.....	765
Total bits sent into mine per day	6,000	1,513
Total tons coal cut per day	6,144	6,007
Tons coal cut per bit	1.02	3.96

Joy loaders are oiled by a crew equipped with a lubricating machine. This machine carries two 200-gal. tanks and automatic air-pressure equipment. Both the lubricating oil and the hydraulic oil dispensed to each machine are metered and recorded each time. Excessive requirements indicate trouble. Most of the loading maintenance is done in the working section. Spare repair units such as heads, rear conveyors, clutches, and pump parts are kept on hand ready for sending to the working section for application to a disabled machine. In case of chassis or motor trouble, the loader is placed on an "ambulance" truck and hauled to the motor pit near the shaft for repair.

All wire hanging is done at night by a crew using two special trucks pulled by a locomotive. One truck or car carries supplies and tools, including an electric drill. The other carries a reel of trolley wire and a reel of the 4/0 weatherproof feeder wire.

Cutting-machine performance has been improved by tipping bits with Stellite. But one-third as many bits are in circulation as when the plain steel bits were used. The bits are ground once or twice between rerolling and retipping. A gas torch is considered preferable to the electric arc for applying the Stellite for the reason that the arc appears to soften the added material. One pound of the material tips 1,600 bits.

(The second and concluding article, covering transportation and hoisting at Valier, will be published next month.)

INSURANCE

For 1.5 Cents Per Day

By J. M. DOMBHART

Local Auditor
Railway Fuel Co.
Parrish, Ala.

SHORT working time in recent months has greatly reduced the earnings of the employees of the Railway Fuel Co., as it has those of other workers in the Alabama coal fields, but even before that time the company was confronted with the need of providing for its men during periods of illness and of furnishing them with surgical and hospital attention in cases to which the State Compensation Law did not apply. From the time the mine was opened, the company had provided and paid a resident physician to supervise the health of its employees and members of their families in both sickness and accident, so long as the patient was confined to his home.

However, whenever the illness warranted the services of a nurse, or surgical and hospital attention, the employee had to bear the expense. For this he was rarely financially prepared, so the cost usually was financed by contributions from other employees. This help usually was stigmatized as "charity," and the sums contributed might be either more or less than were required, depending on the popularity of the individual and the running time of the mine.

For a while it was hoped that insurance might solve the problem, and employees were urged to purchase accident and health policies with an old-line insurance company. But the premiums were higher than the average miner could afford, and settlements, often inadequate, were not made until after the patient recovered. Before long the men began to recognize the shortcomings of the plan and canceled their policies.

Early in 1928, a "hospital fund" was created, financed by contributions of $1 from each employee, to be paid whenever the funds were low. The money was to be used solely for worthy and needy cases, and then only for ambulance service, a cot in the ward at the hospital, ether and surgical or medical fees. No provision was made for a private room at the hospital, for administering gas, or for special nurses. The fund was handled by three local officials. Each case was treated on its merits, and claims frequently were denied. The payments averaged $8 per employee per year. The stigma of charity hung over this fund also. Payments were regarded as contributions rather than as dues. Moreover, no part of the fund was used for burial expenses. Several burial associations offered burial insurance, but these would have been prohibitively costly if they had applied to all dependents of the employees.

Finally, an employees' relief association, financed and administered solely by the employees, was established to afford the contributors and their dependents health and burial benefits. Late in June, 1930, the plan was presented to the employees and approved by more than 95 per cent of them. On July 1, 1930, the association was organized.

It is managed by a board of directors of five men, including the superintendent, mine engineer and mine foreman, who hold office permanently. Each year two others are elected. The company physician and local auditor of the company are permanent members of the board, but without vote. One serves as medical officer and the other as secretary-treasurer. Neither receives compensation for this particular service. Action by three voting members of the board is final.

When a patient who is a beneficiary needs, in the opinion of the medical officer, hospital or surgical attention, the latter is empowered to render such aid. In case of a death, the chairman of the board makes arrangements for the services of a mortician. Each case is passed on by the board and approval given before payment is made. Free services are given for a period not to exceed 26 weeks, but not for any disability due to accident while on duty, for which the employer, of course, must provide.

Members or dependents of members in good standing, for cause other than accident while on duty, are furnished with a burial—embalming, shroud, casket and hearse service within a radius of 50 miles, or rail service within a radius of 300 miles, provided that the retail cost shall not exceed $95 for those under 6 years, $125 for those between 6 and 15 years, and $250 for those of 16 years and over.

About 500 employees with an average of 2¼ dependents, or approximately 1,625 persons, are thus protected either by the company's free service, the compensation law, or the relief association, the last being the largest single factor. Defective vision and deformities in children have been corrected at the expense of the relief association, and diseased tonsils or adenoids removed. During the first year, 185 claims for medical, surgical and hospital attention totaling $4,068.68 were paid, and 19 claims for burial expenses totaling $2,155. The association has donated $50 for charity and $1,000 to local schools. Operating expenses totaled $36.25, covering stationery, printing and a surety bond for the treasurer.

At the surprisingly low cost of $1.50 per month per employee, or 46c. per beneficiary, or about 1½c. per day, the employees of this company and their families have enjoyed better health than at any similar plant in the territory and have been freed from much anxiety. The board can levy additional assessments in case of emergency, but has accumulated from the established dues $2,700. Labor of the best type has by these means been attracted to the company's service.

Management Proves Modernization Pays

Modernization, in the hands of a forward-looking management, is always a real cost-cutting tool.

For example, by eliminating two-thirds of the mines it had in operation ten years ago and through the rehabilitation of active properties, equipment and methods in recent years, the Logan division of the West Virginia Coal & Coke Corporation was able to show a substantial net saving in expenditures per ton for labor, supplies and power in 1931.

The inspiring story of what the West Virginia Coal & Coke Corporation has done in the modernization of electrical equipment, transportation, ventilation, pumping and drainage, preparation, refuse disposal and mining methods to increase the effective working time of each piece of equipment and every man will be told in the September *Coal Age*.

[THE FIRST OF TWO ARTICLES ON PREPARATION PLANT LIGHTING]

ILLUMINATION

+ An Essential Requirement In Modern Preparation Plants

By J. H. EDWARDS

Consulting Editor, Coal Age

Lighting a Conveyor Gallery

BLIND MEN find practically no opportunities for employment in big industries. Machines are in use or can be built to accomplish all operations that do not require a roving eye. The electric eye, as yet a device of fixed or narrowly limited zone, is displacing human labor for duties such as sorting and counting objects that are more or less uniform. For numerous types of routine work humans are still employed principally because of their moving eyes. The productive efficiency and safety of practically every employee retained by industry depends on eyesight and, therefore, upon illumination.

Coal preparation plants are no exception. Although mechanical cleaners have displaced a number of men, manual picking tables are still in general use for preparing sizes above 3 to 4 in. Lighting of picking tables, therefore, continues to be the most important phase of preparation plant illumination. Other phases such as general illumination, local illumination at points of inspection and maintenance, and in many instances illumination of plant tracks, all merit careful consideration.

Tests made quite recently in a new plant of a large producer showed light intensities of but 1.5 to 2.5 foot-candles on tables where eleven men were picking. These low readings were made on a dark day and represent the sum of weak natural illumination from improperly placed skylights and from a mediocre equipment of electric lights.

When it is realized that the intensity of natural outside illumination in the shade of a tree on a day of medium brightness seldom drops below 50 foot-candles and may reach figures approaching 500, the average of 2 foot-candles on these picking tables appears ridiculously low. To work with best efficiency and minimum eyestrain, those men in the plant just mentioned should have at least five to ten times as much light; in fact, some illuminating engineers would say ten to twenty times. Moreover, where work is dark, or moving, or speed of vision is essential, as in coal cleaning, these foot-candle values must be bettered and supplemented by a carefully chosen color quality. Even 100 foot-candles is favored under special circumstances (see *Coal Age*, Vol. 36, p. 183).

With illuminants properly arranged to minimize glare, the range of practical intensity appears to be rather wide. A range of 15 to 50 foot-candles should cover the minimum intensities for all conditions. Translating this to an approximate practical value in terms of Mazda incandescent lamps, the minimum total wattage of lamps per square foot of picking table surface should fall between 8 and 25. If, however, it is certain that lamps and accessories are always kept clean, 5 to 15 watts per square foot might be taken as a minimum.

A survey made by *Coal Age* of preparation practice at plants built in the last three years disclosed a range of from 0.3 to 20 and an average of 8.5 watts per square foot of picking-table surface. Unquestionably the illumination as an average is not up to the high standards of other engineering details. A few plants, however, do have excellent lighting facilities.

Because the lighting system is easy to install, usually it is omitted from the carefully made plans covering the new plant, and finally it is installed in haste and without careful engineering. Illumination meters are owned by few, if any, coal companies, and without such means of measuring light intensity the practical electricians have had no opportunity to gain a proper understanding of the principles and effects involved. There has been available for about fifteen years a practical foot-candle meter which now lists at $21.50. A recently developed type which uses neither batteries nor standard lamp and is direct reading lists at $95.

The *Coal Age* survey indicated that outside advice was solicited at but 9 per cent of the plants. In 74 per cent of the cases the coal company designed the illumination, and in 17 per cent it was handled by the plant contractor.

Whether the daylight type of incandescent lamp, the mercury vapor lamp, the mercury-and-incandescent combination unit or any peculiar color source has an appreciable advantage over the

(Turn to page 305)

Preparation Fundamentals

This article is the ninth in a series on the fundamentals of modern coal preparation. Preceding articles in the series were:

I. Suiting the Plant to the Preparation Job, by J. B. Morrow; February, 1931 (Vol. 36, p. 57).
II. Structural and Construction Problems, by Andrews Allen; March, 1931 (Vol. 36, p. 125).
III. Electrification Problems in Dry Plants, by W. D. Turnbull; May, 1931 (Vol. 36, p. 247).
IV. Electrification Problems in Wet Plants—I, by E. J. Gealy; July, 1931 (Vol. 36, p. 346).
V. Electrification Problems in Wet Plants—II, by E. J. Gealy; September, 1931 (Vol. 36, p. 477).
IV. Refuse Disposal at Cleaning Plants, December, 1931 (Vol. 36, p. 630).
VII. Re-treatment of Coal Middlings, by H. F. Yancey; January, 1932 (Vol. 37, p. 11).
VIII. Power Transmission in Preparation Plants, July, 1932 (Vol. 37, p. 273).

Subsequent articles in this series will appear in later issues.

SLATE COSTS

+ Can Be Controlled

By DAVID A. LOSCALZO

Chief Engineer
Raleigh Coal & Coke Co.
Raleigh, W. Va.

EXPENSE incurred in the handling of slate may at times mount so high that little or no margin remains between production cost and realization. The only sound corrective is a system of slate cost control by which fluctuations are kept in line with coal tonnage changes. A system of graphs with slate and coal tonnage characteristics will provide this control.

This chart is made by plotting semimonthly periods against the total tonnage, total slate cost, total yards, slate cost per ton, slate cost per yard, and tons per yard. In this example slate is paid for by the inch-yard in places advancing and the pillar slate is paid for on the tonnage basis. The slate cost is calculated and the number of yards paid for is known; therefore, the costs per yard and per ton are easily gotten, the latter from the total tonnage and total slate cost, which is known. The number of tons per yard is gotten from the total tonnage and the total number of yards.

Before explaining the use of the chart, let us consider the characteristics of normal operation. Under conditions then existing the tonnage can be maintained uniformly at a specified level and the slate cost should, therefore, be fairly constant. If the slate cost is constant, the number of yards and cost per yard also should be constant. The tonnage being uniform and the slate cost and number of yards constant, cost per ton and per yard likewise should be constant. These assumptions are not entirely met in practice, but the closer they are approached the better the control over slate payments.

If these values held true, the curves on the chart would be straight and parallel lines. However, with the irregularity of production at the present time, the curves are not straight; but they are proportionately parallel, and should be so maintained for best results.

The accompanying table, from which the graphs were plotted, is made up of figures which, though assumed, demonstrate the use of the chart. Separate charts can be kept for each section of a mine when the tonnages are known, and the record of the mine itself can be kept on another chart. If several mines are operated, each can be treated separately. The graph showing the totals of the mines will be the final analysis and prove the most interesting. With these data, should there be an increase or decrease in slate cost, the fact will be easily seen.

Referring to the chart, the tonnage from Jan. 15 to 31 shows an increase and the slate cost increased in about the same proportion, so that the two lines are parallel; but the number of yards paid for jumped out of line (too high); the tons per yard dropped from 19 to 16 tons; the slate cost per yard dropped from $1.25 to $1.09; the cost per ton increased from 6.7c. to 6.8c. This illustrates several points of interest. Although the number of yards paid for was increased by 100, the cost per yard decreased 16c. It is evident that during this period a large tonnage was obtained from advancing places which carried slate yardage. The increase of 0.01c. in cost per ton, due to the increase in total yardage cost, was brought about by the exceptionally large number of yards paid for.

During the period between Jan. 31 and Feb. 15, the tonnage decreased and the slate cost increased, while the number of yards decreased in line with the tonnage fall; and the tons per yard, slate cost per yard, and the slate cost per ton increased. Because of the fact that slate cost increased, although the number of yards diminished, payments per yard were heavy. It is an easy matter to check back and find out where the heavy costs were incurred and whether they were justified. The cost

Control Graphs of Slate Cost and Tonnage Characteristics

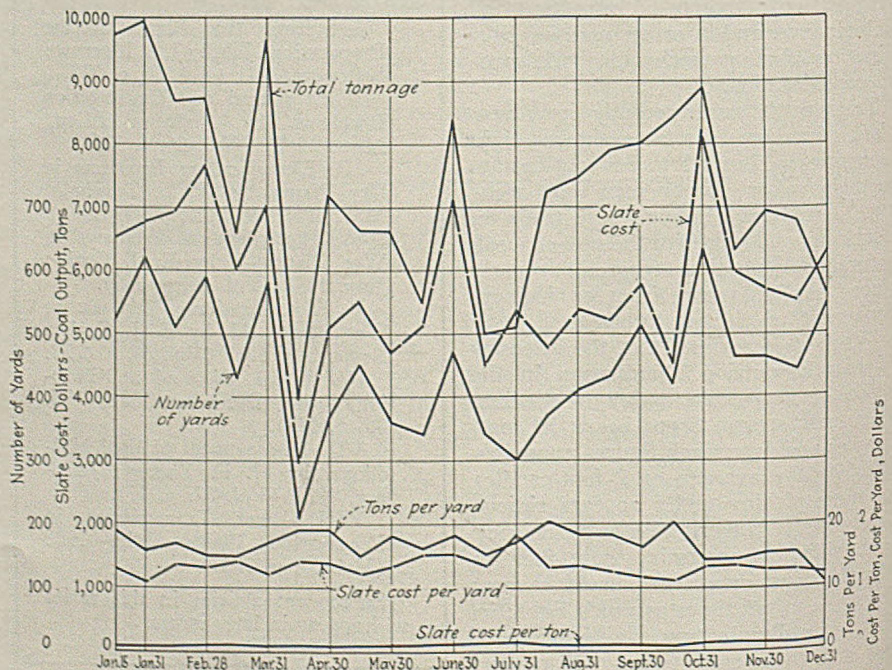


Table of Slate Costs and Tonnage Characteristics From Which Graphs Are Derived

	Tonnage	Slate Cost	No. of Yards	Cost Per Yard	Cost Per Ton	Tons Per Yard
January 1-15	9,730	$651.91	520	$1.25	$0.067	19
January 15-31	9,960	677.28	620	1.09	0.068	16
February 1-15	8,680	694.40	510	1.36	0.080	17
February 15-29	8,720	767.36	590	1.30	0.088	15
March 1-15	6,610	601.51	430	1.40	0.091	15
March 15-31	9,620	702.26	580	1.21	0.073	17
April 1-15	3,950	296.25	210	1.41	0.075	19
April 15-30	7,200	508.40	370	1.37	0.070	19
May 1-15	6,630	550.29	450	1.22	0.083	15
May 15-31	6,620	470.02	360	1.31	0.071	18
June 1-15	5,490	510.57	340	1.50	0.093	16
June 15-30	8,370	711.45	470	1.51	0.085	18
July 1-15	4,980	448.04	340	1.32	0.090	15
July 15-31	5,080	533.40	300	1.78	0.105	17
August 1-15	7,220	476.52	370	1.29	0.066	20
August 15-31	7,440	535.68	410	1.31	0.072	18
September 1-15	7,860	518.76	430	1.21	0.066	18
September 15-30	7,990	575.28	510	1.13	0.072	16
October 1-15	8,380	452.52	420	1.08	0.054	20
October 15-31	8,860	815.12	630	1.29	0.092	14
November 1-15	6,290	597.55	460	1.30	0.095	14
November 15-30	6,910	566.62	460	1.23	0.082	15
December 1-15	6,760	547.56	440	1.24	0.081	15
December 15-31	5,620	623.82	540	1.16	0.111	10

per ton naturally rose, with tonnage down and slate costs up.

A study of the periods to July 15 reveals little change, but during the period of July 15 to 31 something happened to the curves. In this period the slate cost line crosses the tonnage line, and the slate cost per yard graph crosses that of tons per yard. Finally, the slate cost per ton has jumped to 10.5c. What has happened? The tonnage was low, slate cost high, the number of yards dropped, tons per yard increased and cost per yard increased, but not proportionally with slate cost. Checking a condition of this kind, it will be learned that a large number of entries, carrying heavy yardage cost, were being driven. This answers the question of why the number of yards decreased and the cost increased.

The periods following, to Oct. 31, show the tonnage increasing. Slate cost and number of yards are low because the expensive entry driving has been curtailed. During Oct. 15 to 31 high-slate-cost entries are again started because the tonnage has gradually been increased. The curves during this period again parallel one another until December is reached, when low tonnage and a recurrence of the condition existing during July 15 to 31 is witnessed.

From an operating standpoint, the graphs show where the tonnage is coming from and the accompanying slate cost. They indicate when entry driving should be increased or curtailed if charges for development cannot be allocated elsewhere. When slate cost rises it becomes easy to determine whether the reason was faulty or indifferent measuring, which is where the blame usually is placed. At times that is unfortunate, for the real cause may involve other factors.

For best results the graphs should be plotted semi-monthly and fluctuations studied immediately to determine the cause for the change before the oncoming half ensues. With this information at finger tips, slate cost can be controlled.

▼ ▼ ▼

Plant Illumination

(Concluded from page 303)

plain incandescent lamp depends on the color, wetness and character of the coal and impurities. It is a matter requiring experiment on the specific coal involved. In most cases where it has been the decision that a certain type of light showed advantages, the investigators failed to record that the difference was of high magnitude. Apparently for the average plant, light source selection has been treated as of secondary importance compared to intensity and proper arrangement of units.

Current practice, as indicated by the survey, shows plain incandescent lamps used in 78 per cent of the plants, daylight incandescent lamps in 18 per cent, and mercury vapor in 4 per cent.

As indicated by rather general use, porcelain enameled steel reflectors are quite satisfactory for shielding the lamps from the eyes of the pickers and as a means of increasing the utilization efficiency of the lamp. But unless the reflecting surface and the lamp itself are kept reasonably clean, the illumination may drop as much as 50 per cent below normal.

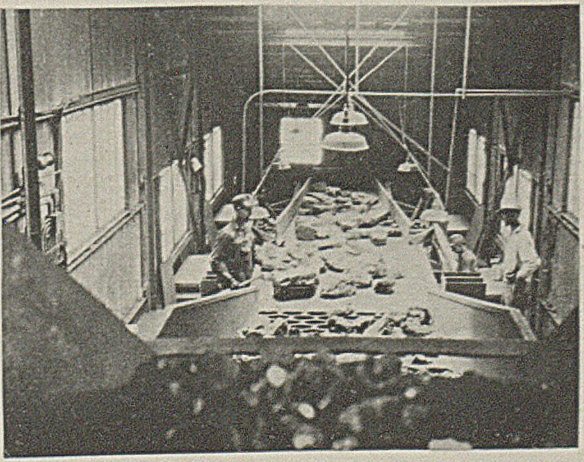
A reflector with dust-tight glass cover over the bottom is a desirable arrangement, especially in the extremely dusty plants. This glass cover affords less opportunity for dust to adhere and is more easily cleaned. But the unit should be absolutely dust-tight, not nominally so.

Nineteen per cent of the plants that reported in the survey as using incandescent lamps over picking tables use the so-called dustproof reflectors. Of these installations, 88 per cent were reported as failing to keep out all dust. At one plant the "dustproof" reflectors were discarded in favor of open reflectors because of the rapid influx of dust and the difficulty of removing the cover for cleaning.

In plants having an excess of very find coal dust, a special absolutely dust-tight reflector unit should be used. A breather attachment, possibly of the diaphragm type, may be necessary to minimize the tendency for air to pull dust in through the joints when the unit cools after the power is cut off.

In numbers, installations with lamps of 100-watt size lead. Next in popularity is the 200-watt, and the largest size reported as used above picking tables is the 500-watt. Mounting heights above the picking table surface range from 2½ to 7 ft. and the average is 4 ft. Spacings range from 1½ to 10 ft. and average 4½ ft.

(The concluding article on preparation plant illumination will be published in the September issue of Coal Age.)



Good Light Is the First Requirement for Efficient Picking

NOTES

. . . from Across the Sea

BECAUSE of its safety and relatively low cost, pneumatic gob stowing is receiving increased attention in Europe. The use of water involves long distribution mains and a heavy expense for handling large quantities of acid water. Hence, water storage is undesirable, even when the American system of erecting batteries to hold back the filled material is replaced by the far less expensive European practice of using only wire netting or loose sacking to hold deposited refuse or of delivering the rock and water to the dip of the workings, in which case netting, sacking or the building of batteries is unnecessary.

A system of backfilling by air, using a continuously operating gun, has been developed by Demag in Germany and later improved by a Czechoslovakian engineer. Some 50 or 60 units of this type are already in use in Europe. Later, the Mining Engineering Co. made three installations in England. As seen in Fig. 1, the equipment is quite simple. A shallow hopper, *A*, is continuously filled by a conveyor. Compressed air at 60 to 70 lb. per square inch pressure is delivered into the live-air chamber *B* and leaves by three openings, *C*, in the side of the chamber. The air strikes the material as it falls in the hopper *A* and partly floats it and partly drives it through a large pipe, *D*, with the aid of a lubricating air cushion of atmospheric air drawn in around the pipe at *E*, as water is drawn into an injector and by more compressed air admitted through the pipe *F* above the material in the hopper. The ejector pipe *D* is extended to a point near the stowage pile.

It is recognized that no system of stowage will completely fill the area to be stowed, and this system leaves 15 to 20 per cent of voids, much as hydraulic stowage does. Arrangements can be made to have the stowage gun provided with two barrels, so that when one pipe is being moved, stowing material can be delivered by another pipe. The stowing material is brought in by either a shaking conveyor or a belt. Provisions are made for lengthening or shortening the shaking conveyor. The machine itself can be shifted on skids, as can be seen in Fig. 2.

The barrels are made of nickel chrome steel ⅛ in. thick and are readily removable. Boiler ashes, washery refuse, bone coal, and rock may be used for stowage, as the machines will transport any material under 4-in. diameter. The large pieces are projected from the end of the pipe about 10 ft., and the finer stowing material up to 30 ft. With a shaking conveyor, 27 cu.yd. can be stowed per hour; and with a belt conveyor, 50 cu.yd. The air consumption averages 600 cu.ft. of free air per minute, and the cost of the machine runs from $562 to $1,500, at the present rate of exchange.

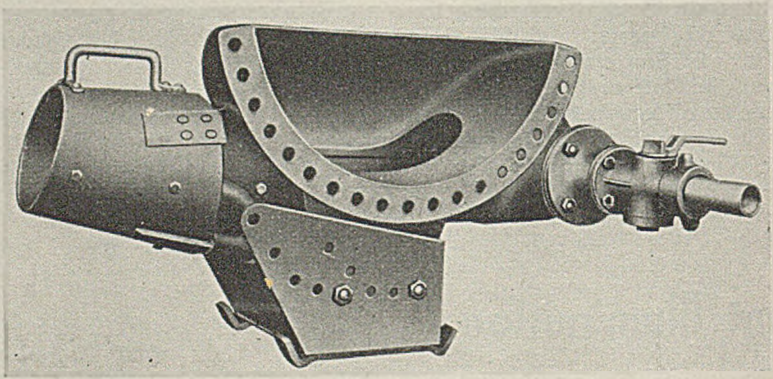
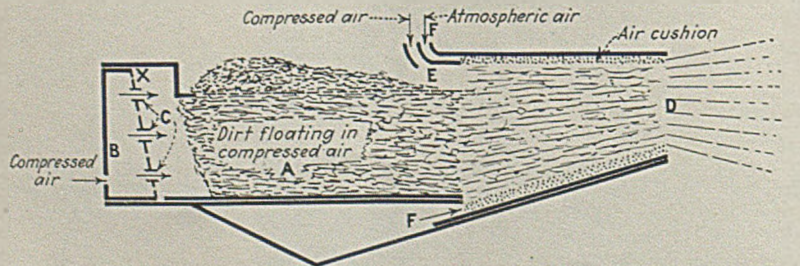


Fig. 2—Single Stowing Jet for Working With Shaker Conveyor; Can Be Tilted to Deliver at a Steep Angle

A modification of the cement gun has been used in Germany for backfilling, the cost of which per 100 cu.ft., as based on the delivery of air from a local compressed-air plant and on the stowage of 3,000,000 cu.ft. per year, is said to be as in the accompanying table.

Where the compressed air is taken from the mine supply, the equipment cost will be only $500; amortization, $0.017; interest, $0.010; and power, 2 kw.-hr. per cu.ft., or $0.250. The aggregate charge covering the foregoing charges and others already quoted give an aggregate charge of $0.672 per 100 cu.ft. and $0.181 per cu.yd. But these charges include only the costs of placing the material after it has been delivered to the machine.

Fig. 1—Cross-Section of Pneumatic Gob Stower



Cost of Backfilling With Cement Gun

	Per 100 Cu. Ft.
Amortization at 10 per cent on initial investment for compressor and backfilling machine costing $15,000	$0.050
Interest, 1 year	0.030
Power, about 16 kw.-hr. per 100 cu. ft.@1c. per kw.-hr.	0.160
Wear on pipe lines, 2,000 ft. long, $3,000	0.100
Wear on three bends	0.015
Maintenance of machine and pipe lines	0.030
Amortization of installation cost, assuming machine is not moved for two years, $2,500	0.083
Wages, 3 men, 1 year	0.167
Cost per 100 cu.ft.	0.635
Cost per cubic yard	0.172

It is also said that a machine with a pressure of 13 lb. per square inch will deliver 48 cu.yd. of material per hour a distance of 200 ft. through a 6-in. line, and use 2,000 cu.ft. of air and 92 kw.-hr. of electricity. It will also, with a pressure of 27 lb. per square inch deliver 59 cu.yd. of material per hour a distance of 2,000 ft. through an 8-in. line and use 4,000 cu.ft. of air and 316 kw.-hr. of electricity.

TESTS made by J. Ivon Graham and A. Shaw have shown that most of the gas samples taken from holes drilled in coal contain over 85 per cent of methane; the carbon-dioxide percentage varies from 0.0 to 5.6 per cent, and the nitrogen percentage from 1.5 to 20 per cent. In some cases, hydrogen is found as a trace, its presence being detected by the fact that the gas can be burned at a temperature below 250 deg. C. In other cases small quantities of higher hydrocarbons, such as ethane, propane, etc., are found.

After three weeks' extraction in vacuum, said Mr. Graham recently in an address before the North Staffordshire Branch of the National Association of Colliery Managers, the gas evolved corresponded in composition to pentane, C_5H_{12}. These higher hydrocarbons were found only where the gas was leaving the coal in comparatively small quantities. This seemed to show that it was only the coal in which the gas was almost spent that delivered these compounds. The methane, which comes off more readily, had, in these instances, become almost exhausted.

Moisture in coal, said Mr. Graham, interfered with the "sorption" of methane and carbon dioxide. Under a pressure of one atmosphere and a temperature of 10.8 deg. C., dry coal would take up 260 c.c. of methane and 950 c.c. of carbon dioxide per 100 grams, but when 10.3 per cent of moisture was present and the temperature was the same, it would "sorb" only 90 c.c. of the first and 390 c.c. of the second gas per 100 grams. At higher pressures the same rule held, though the difference became somewhat less marked; thus at 30 atmospheres at the same temperature, 2,200 c.c. of methane and 5,480 c.c. of carbon dioxide were taken up by dry coal and 1,310 c.c. of the first and 2,800 c.c. of the latter when 10.3 per cent of moisture was present. These figures are for Barnsley bituminous clarain, known to the trade as Barnsley Softs, all crushed so as to pass a 200-mesh screen.

A new cause of vitiation of the mine atmosphere, said Mr. Graham, had resulted from the introduction of the cutting machine where it operated in the coal. He suggested that when machine cutting is introduced, the ventilation of working places be increased. When roof coal falls over a large area, and in doing so becomes badly broken, it may in a few minutes deliver an immense quantity of its gas, and thus vitiate the mine current considerably. If it falls without much breakage, the effect is less unfortunate.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Fuel, Gas, Water and Lubricants, by S. W. Parr, late professor of applied chemistry, University of Illinois; Fourth Edition. McGraw-Hill Book Co., New York City. 371 pp., 5½x8 in.; cloth. Price, $3.

Today mining men are so sales conscious that this book, written by such an authority as the late S. W. Parr and revised by a number of competent authorities, is sure to make appeal and to answer some of the many problems with which the mining men are now confronted. Every coal company of size has its combustion engineer, and some have even well-organized departments.

The book is divided into two almost equal parts, lectures and laboratory methods, the former covering the whole subject of the chemistry and quite briefly that of the mechanics of combustion. After a few short chapters on the history of coal, fuel research and calorimetry, follow the constitution and classification of coal, its oxygen absorption, its ignition temperature, its methods of storage, its impurities, the smoke it makes, carbonization methods, coke and briquets, fuel gas, wood, liquid fuels, boiler waters and lubricants, with a chapter on coal contracts which A. C. Callen has revised, and one on the embrittlement of boilers by sodium carbonate waters, a subject Prof. Parr made peculiarly his own. He advocates the addition of sufficient sulphuric acid to neutralize 70 per cent of the sodium carbonate alkalinity.

In reference to smoke, the statement is made on p. 117 that if the marsh gas, with an ignition temperature between 650 and 700 deg. C., and ethylene, with an ignition temperature of about 300 deg. C., "strike a sufficiently cooler surface to lower their temperature below the ignition point, their function is altered from heat producers to smoke producers." This point, which does not receive further comment in the book, casts a new light on the production of smoke, which is quite generally thought to occur only when the temperature exceeds that of ignition and the gases are burned with insufficient oxygen.

R. Dawson Hall.

* * *

The Competitive Position of Coal in the United States. National Industrial Conference Board, New York City, 288 pp., 6x9 in. Price, $3.

While this volume offers little that is new to the coal man familiar with the stream of economic discussion in recent years, it has the undoubted advantage of bringing many of these data, and particularly the statistical background, together between the covers of one book. The volume is part of a broad study of the competitive position of world energy sources undertaken by the staff of the National Industrial Conference Board. This particular section of the study is divided into four parts. Part I is a general survey of the relative position of the United States in the world coal industry. Part II is a study of consumption by uses and consumer classes, based primarily on figures assembled in the 1929 Census of Manufactures. Part III analyzes regional consumption. Part IV is a general summary and epitome of the economic problems confronting the industry.

The main problem facing anthracite, as this volume sees it, is the narrowing area of distribution and the increasing competition for business within that area. Readers with long memories may recall that this same point was made in a study of anthracite marketing which appeared in *Coal Age* back in 1925. The solution of the problem, it is pointed out, lies along the line of greater efficiency and convenience in the use of this fuel by the domestic consumer or in a lower delivered price to the householder. Both avenues of approach are being used at the present time.

Reviewing the status of the soft-coal industry since 1923, the authors find that the consumer has been well served and at reasonable prices, but that the lot of the miner, with opportunities for employment and wage rates both diminishing, has not been a particularly happy one. Summarizing the external problems, the book states:

> The bituminous coal industry, regarded from the point of view of the operator, presents some exceedingly difficult problems, as well as some encouraging aspects. Competition from other sources of energy has shown a substantial increase, but its full effect can now be estimated and adaptations to meet the situation can be made. Competition of fuel oil has probably almost reached its limit and may even show a decline in the near future. The increase in natural-gas consumption that may be expected to occur as soon as the pipe-line program is completed may result in the displacement of possibly 20,000,000 tons of coal, the effect being felt most seriously in the Rocky Mountain and Eastern and Western Interior coal fields, and to some extent in Alabama, Illinois and Indiana. While the market area of the Appalachian field may be affected by recent new gas developments in western Pennsylvania and New York, the amount will be relatively small. Increasing efficiency in the consumption of coal has seriously interrupted the upward curve of coal consumption and doubtless will continue to exert its influence for some time.

With so many critics ghoulishly tolling the demise of King Coal in the competitive battle, such optimism is heartening. And yet the estimate on maximum losses to natural gas seems to err on the side of understatement. The present difficulties of the natural-gas industry should not blind the coal operator to the menace, actual and potential, which the network of pipe lines holds. Holding the enemy too lightly is a good way in which to lose a battle.

"Continuous operation is the crux" of the bituminous problem, and increasing mechanization, with its transfer of a greater part of production costs to overhead, makes the problem more critical. "Stabilization of production," declare the authors, "requires not only the elimination of excess mine capacity but also the effective prevention of its recurrence." There is no constitutional warrant for the exercise of federal dictatorial powers to control production; the industry, plunged into depression as the "result of a planless and highly individualistic past," must work out its own salvation.

"The evolution of the coal industry in the direction of fewer and larger coal-producing companies, using all the resources that modern production technology, merchandising methods and industrial management have made available" may provide the answer. The future alone can determine how the movement toward consolidation and modernization will succeed. "The results of merging and consolidation will be worth the price that must be paid if the final outcome is the elimination of inefficient producers and distributors, of destructive and unsound competitive units, and of unbalanced production."

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Misfire and Premature Blasting Safeguarded

Accidents from shooting have been reduced in number at the mines of the Lehigh Navigation Coal Co., in the anthracite region, by special precautions taken to reduce misfires and premature explosions. Premature shots are avoided by fastening all lead lines with wooden cleats nailed on the timbers, the wires kept apart

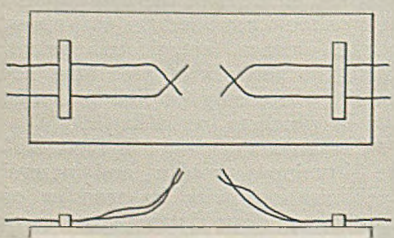


Fig. 1—While Shots Are Being Prepared

and free of compressed-air lines, sheet iron and other material. Misfires caused by the slow burning of powder in the shothole are minimized by so preparing the primers that the match-head shell is outside the cartridge. Details of these practices were given at the last meeting of the Mine Inspectors' Institute of America, in Wilkes-Barre, Pa.

At a safe distance from the working face, a safety break is made in the lead lines by fastening them with two wooden cleats about 18 in. apart, which are nailed to a board about 2 ft. long, the latter being nailed to a vertical timber (see Figs. 1 and 2). The wires are cut between the cleats and shunted by twisting them together. After the miner has connected the shots to the lead lines at the working face, he goes to the safety break, makes the connections and then proceeds to the firing station. In this way the miner is protected from premature explosions due to misunderstanding on the part of his buddy or other workmen who might connect the firing battery to the lines and fire the shot while the miner is at the face.

One of the most important phases in correction of unsafe blasting practices was brought about through an investigation of a complaint made by miners at one operation, who said that the permissible powder in use often failed to explode. It was found that in some holes fired by delay electric blasting caps the powder had burned and raised sufficient pressure to push out the tamping and yet had not detonated. Part of the unburned powder could be found strewn in front of the holes.

The ignition of powder was caused by improper preparation of primers. Many of the miners, in compliance with printed instructions of explosive manufacturers, imbedded the entire delay electric blasting cap in the cartridge. When the current was passed through the system and the match heads were fired, the flash of fire from the vent hole in the match-head shell was intense enough to ignite the powder.

When powder burns in the shotholes of a mine, an extremely hazardous condition results. The ignition causes misfires and delayed shots; holes are not shot in proper rotation, and there is danger of igniting

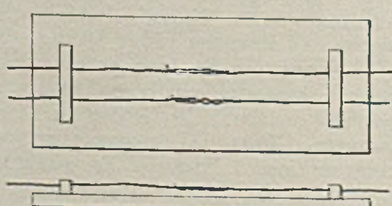


Fig. 2—After All Is Ready for Firing

gas which may be liberated by the preceding shots; gases evolved by burning powder are injurious to health and burning powder might start a mine fire.

This disturbing condition was corrected by preparing the primers with the match-head shell placed on the outside of the cartridge and by fastening this shell in place by a short piece of connecting wire wrapped around the cartridge and match-head shell, making one turn over the leg wires close to the end of the shell. In this way it is impossible for the cap to become detached from the cartridge, nor will powder be ignited by the match head.

Slate Gate Positions Shown By Indicating Lights

Control of the slate gates in the No. 5 and No. 6 headhouses of the Crab Orchard Improvement Co., Eccles, W. Va., is in the hands of the cager at the shaft bottom. Both gates—one for each compartment of the shaft—are opened and closed by reversible fractional-horsepower motors connected to the gates by worm-gear speed reducers. A cam on the end of a shaft carrying an individual gate rotates either

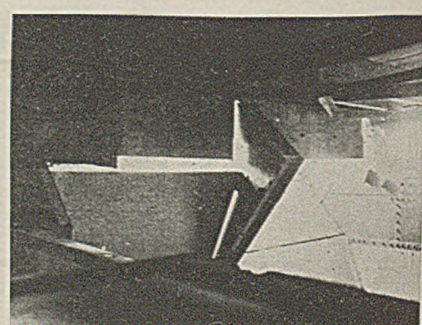


Fig. 1—Slate Gates in No. 6 Headhouse

forward or backward to strike contacts and close the circuits to the respective indicating lamps on the shaft bottom. Red for open and green for closed are shown in Fig. 2. The slate gates—one open and one closed—are shown in Fig. 1.

When a car of slate is to be dumped, the cager presses a pushbutton on the bottom, which transmits a starting impulse to the gate motor in the headhouse. The motor in turn opens the gate to receive the slate when it arrives at the top. As soon as the slate is discharged, the cager

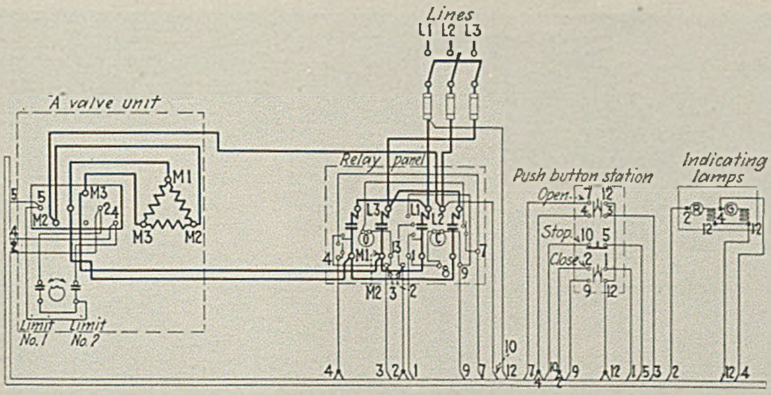


Fig. 2—Control and Indicating Circuits for Operation of Slate Gates

presses another button, which starts the motor in the opposite direction to close the gate in readiness for dumping coal. Opening and closing of the gates is controlled by limit switches.

Allen & Garcia engineers designed the system. Electrical equipment was furnished by Cutler-Hammer, Inc.

Cable Insulations Each Have Their Particular Fields

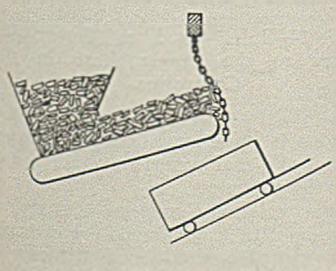
Of the three general types of power transmission cable insulation, varnished cambric, paper and rubber, the latter excels in moisture resistance, but, because it is deteriorated by corona, it has a shorter life than the other two and cannot stand high operating temperatures as well. Rubber can be used without a lead sheath under almost any condition of moisture; paper is never used without a lead sheath; varnished cambric may be used without sheath if not subjected to rain, drip or excessive condensation.

Generally speaking, the use of rubber insulation is confined to voltages below 10,000, varnished cambric to a range below 20,000, and paper to the highest voltages. Varnished cambric and rubber cables find their greatest uses in power-station wiring, and paper cable in high-voltage under ground transmission.

Chains Adapt Apron Feeder To Automatic Control

Prevention of spillage from the end of an apron feeder which loads mine rock and plant refuse into skips presented a problem in the design of the refuse disposal system recently installed at Mine No. 2 of the Boone County Coal Corporation, Sharples, W. Va. The accompanying sketch shows how a curtain of heavy chains was hung so as to lie against the discharge end of the apron feeder, thus preventing dribbling after the feeder is stopped and the skip moved from beneath.

To Prevent Dribble From the End of the Feeder



Loading of the skips is automatic by virtue of a timing feature which allows the feeder to operate a predetermined length of time after the landing of a skip. The curtain consists of $\frac{3}{4}$-in. log chains hung on 4-in. centers. The point of suspension is several inches back of the end of the feeder. This arrangement, coupled with the fact that chains are of heavy weight, causes the curtain to exert an appreciable force against the pieces of rock that might otherwise fall. Although the arrangement does not stop all dribbling, it is sufficiently effective to limit the spillage to a negligible quantity.

No Waiting

When coal starts from the face to the tipple, delays must be cut to the minimum. Each piece of equipment should be capable of operating without breakdowns for the entire time the mine is running. But interruptions, by accident or otherwise, must be expected in the normal course of events, and then the question of getting the equipment back into service as quickly as possible comes up. Then is when the money- and time-saving idea comes into its own. *Coal Age* attempts to present the latest of these ideas, and welcomes suitable material for publication in these columns. Send in your idea. A sketch or photograph may make it easier to understand. Acceptable ideas are paid for at the rate of $5 or more each.

How to Clean and Lubricate Hoisting Ropes

Unless wire rope in hoisting service is kept properly lubricated, corrosion probably will set in and the assurance of safety will change from a mechanical certainty to a matter of chance. Good lubrication, and by that is meant correct lubrication, is an economy in that it keeps down replacement cost and delays to operation caused by rope failures. In so far as lubrication is concerned, wire rope should be considered a machine element with a rubbing surface which must be protected from wear by a film of oil.

When first installed, a new rope is thoroughly impregnated with a suitable lubricant. During operation, however, much of this is forced out by tension and sudden stresses to the surface, and from

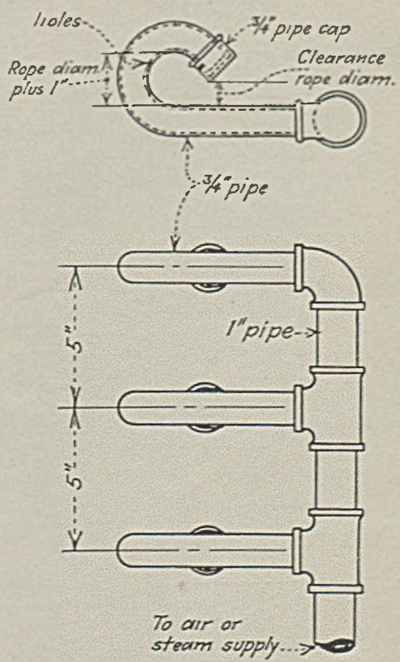


Fig. 1—Pipe Type Cleaner for Removing Dirt and Grime From Hoisting Rope

there it is removed by whipping action of the rope and by water. This supply naturally must be replaced.

In the May issue of *Wire Engineering*, published by John A. Roebling's Sons Co., a tried two-step method of lubrication is described, involving the application of a light oil for penetration to the hemp center, and a heavy protective lubricant for preventing corrosive and abrasive actions at the surface. Before these are applied, however, the rope must be thoroughly cleaned and dried; otherwise, the full benefit of the fresh lubricant will not be realized.

This is best accomplished by directing on the rope streams of compressed air and superheated steam, or a combination of the two. This last not only aids the removal of dirt and grime but it also has a desirable drying action. Steam at low temperatures leaves a condensate on the rope and defeats the purposes of the preliminary treatment. A satisfactory cleaner is the pipe type shown in Fig. 1, or a sleeve type, which should be mounted flexibly at the shaft collar or on the headframe after the cage or skip has been lowered to the bottom. Six to ten ⅛-in. holes should be drilled as jets in each ring. One or two banks of cleaners may be used, depending on how much dirt is to be removed. And, of course, the rope should be wound slowly during the cleaning.

In applying the light, penetrating oil the rope should be lowered slowly into the shaft, using the device shown in Fig. 2.

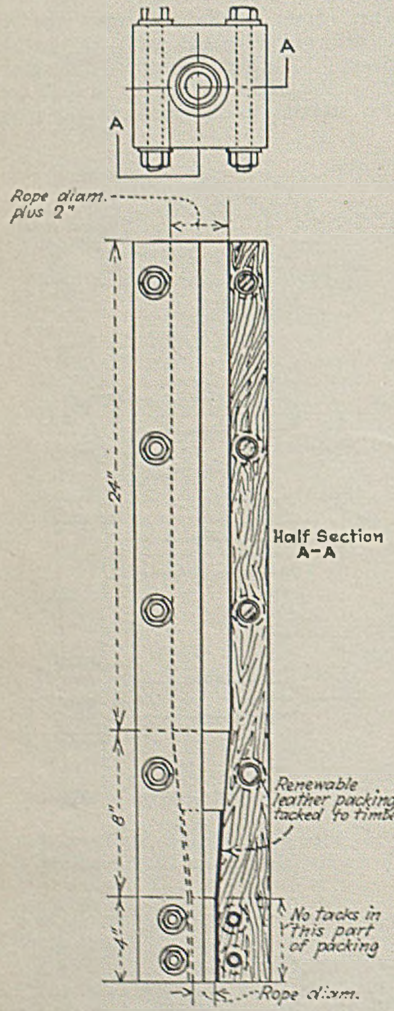


Fig. 2—Lubricator for Hoisting Rope

This device consists of two timbers smoothly faced on the mating surfaces and bored to form a funnel-shaped reservoir. In the neck of the funnel a leather sleeve is tacked and waste or packing is stuffed into the conical section, both serving to prevent leakage and to act as a wiper. The device is bolted about the rope and attached to the headframe over the shaft. A similar device is used for applying the protective or surface lubricant.

That portion on the rope between the sheave and the hoist drum is applied by brush or by sheepskin. Two important precautions should be observed, one being that the oils are heated to at least 200 deg. F., and the other that none but quality lubricant be used. Black oil and common varieties of cylinder and machine oils will not give satisfactory results.

Car Sampling Made Easy At Crab Orchard

Convenience and reduction of labor dictated the adoption of the sampling methods used at the No. 5 tipple of the Crab Orchard Improvement Co., Eccles, W. Va., for routine sampling of slack cars. The main objectives of the system are: representative sampling without the shoveling and disturbance which accompany sampling

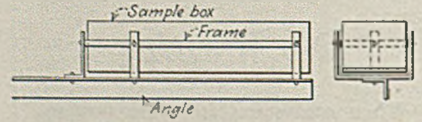


Fig. 1—Sampling Box and Supporting Frame

directly from the car; and reduction in the bulk of the sample before it is taken to the laboratory to reduce carrying, spillage, and loss of coal.

Samples are taken directly from the stream of coal flowing from the slack chute to the railroad car. Equipment consists of a sheet-iron box (approximately 6x8x30-in.), which is carried in a frame on the end of a swinging arm (Fig. 2). The arm is made from a steel angle, and is fastened to an upright column which rotates in suitable bearing stands.

To secure a sample, the arm carrying the box is swung out under the slack chute, and is then pulled back to the platform. As the box passes back and forth under the chute, it cuts the entire stream of coal, both coarse and fine, thus giving a more representative sample. The box containing the sample (approximately 40 lb. of coal) is slid out of the supporting frame and dumped into a Sturtevant crusher.

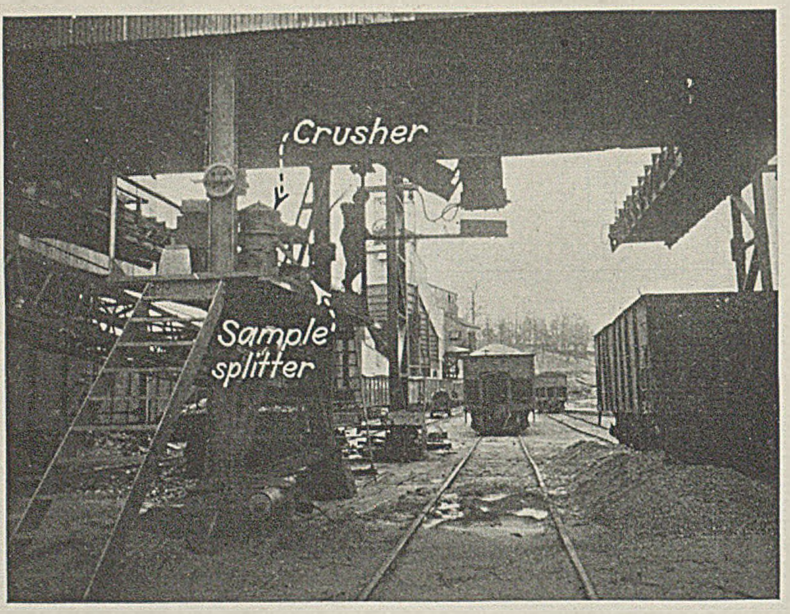


Fig. 2—Slack Sampling Station at No. 5 Mine. Sampling Box Is Shown Under Chute

This crusher discharges into a sample splitter fastened to the platform. The crushed sample is caught in a quart paper container, while the discarded coal flows directly to the railroad car.

Mine Locomotive Redesigned To Advantage

In the reconstruction of three 10-ton locomotives with outside wheels and brass journal boxes at the Spangler division mines of the Pennsylvania Coal & Coke Co., central Pennsylvania, a number of features were redesigned incidental to the primary object of changing the gage from 42 in. to 36 in. Among the changes, roller bearings were installed in the journals, the units were changed to an outside frame type, the bumpers were reinforced, the wiring scheme was changed to give greater reliability and accessibility, the resistors were shielded and a safe tool box was incorporated. The redesign was made by J. F. MacWilliams, electrical engineer, and

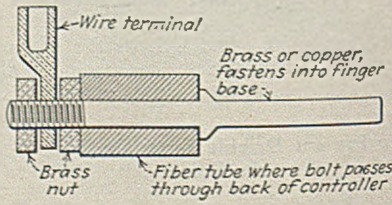


Fig. 1—Bolts Used to Fasten the Wires to the Finger Base in the Controller

the reconstruction was under Harry E. Davis, of the coal company, the latter giving the details below:

In the original bumpers the channels supporting the wood and draw pockets showed a tendency to bend, drawing the

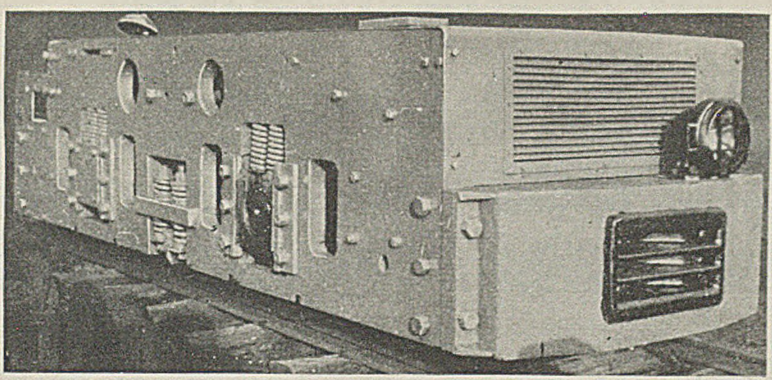


Fig. 2—How the Outside-Wheel Locomotive Appears After Reconstruction, With New Features Added

sides in. To correct this fault, the practice during the last six years or so has been to weld triangular steel plate stiffeners in the corners of the angles that hold the bumpers to the sides. These triangular pieces are about 1 in. thick; they run back along the side frame as far as the sand boxes will permit and extend out one-third the length of the bumper on each end. It is important to note that these stiffeners are welded to the angle irons and not to the bumper channels or sides of the locomotive.

In several years of service not one of the bumpers with this redesign has bent. Thus, a deal of trouble has been eliminated, for when the end frame bends, the locomotive is thrown out of line with respect to the axles, with the result that the suspension bearings, journal bearings, and end-thrust receivers wear away rapidly.

The new journal boxes (see Fig. 2) are of steel built up by an electric welder, large enough for boring out to receive SKF spherical type roller bearings. These bearings are not permitted to take any of the thrust. The thrust is taken up by a $\frac{1}{2}$-in.-thick brass plate which is recessed in the end plate of the journal box. The end plate is $\frac{7}{8}$ to 1 in. thick and is fastened to the box with four to six bolts. Only $\frac{1}{16}$ in. of play is allowed.

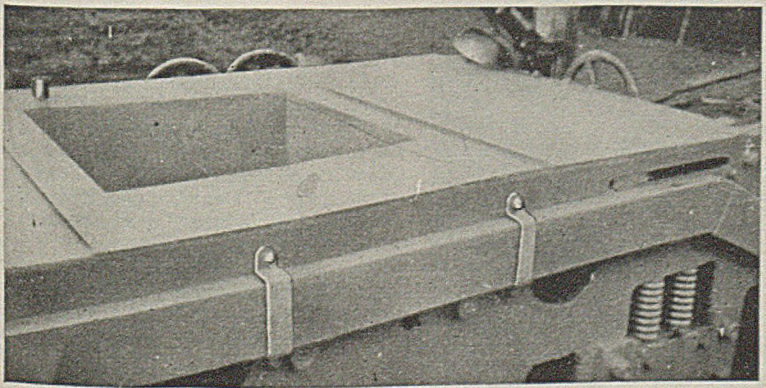
Some question may arise as to how these wheels are permitted to work up and down with so little play provided. This compensation is handled by the journal box guides which are veed. The guide plates that these work in have several $\frac{1}{32}$-in. liners under them through which the wear is taken up. Alemite oil cups are fitted to the end plates and permit oil to enter at the end of the bearings. The guides, it should be said, are planed off to permit overtravel, a feature which insures straight wear.

Wiring is carried in a channel-iron conduit along the outside of the locomotive, as illustrated in Fig. 3. With this arrangement the wiring is protected and, at the same time, it is easily accessible. In this fashion the wiring is carried directly back to the controller, where it is fastened to the finger base with a type of bolt shown in Fig. 1.

The controller is set in the control cab on the wiring side, and from the conduit to the controller the wires are inclosed with sheet steel. Therefore no dirt or grime can come in contact with them and "short" the leads. The space between the cab and the motors, wheels, etc., is sealed, and so the wheels cannot throw sand, water or dirt in and around the controller or to the floor of the cab. This partition, incidentally, makes a convenient place for mounting the headlight resistor and switch.

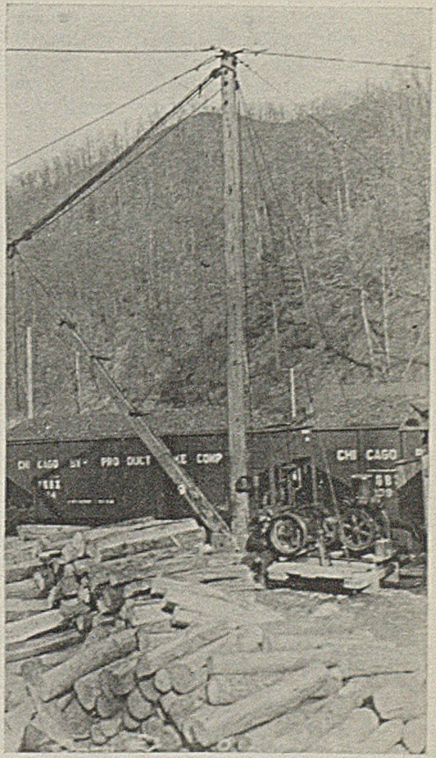
Trouble from the grounding of resistors by moisture has been overcome by building a low type front. This gives adequate ventilation and excludes dirt, rain, and snow from the resistors. Ground wires from each motor are fastened to a spring which makes contact on the side of the wheel, with the result that a minimum of the return current passes through axles and bearings. A recessed tool box in the lid of the locomotive provides a safe and convenient place for carrying retrackers, chains and links. This box is 28 in. square at the top and 22 in. square at the bottom. It is 8 in. deep and is drilled for drainage.

Fig. 3—Outside Wiring Conduit and Recessed Tool Box on the Reconstructed Locomotive



Power Plant Swings With Boom On Supply Derrick

At a mine in southern West Virginia, writes C. H. Farmer, Montgomery, W. Va., the problem of unloading heavy materials and supplies from the railroad or handling them in the storage yard has been simplified by the installation of a derrick.



Power Plant Mounted on the Structure and in Balance With the Boom Is an Unusual Feature of This Materials-Handling Derrick

The derrick was placed so that it could reach the railroad car, all points in the storage yard, and the supply track leading to the mine. An unusual feature of the installation is the mounting of the gasoline engine and hoist drums on the derrick structure opposite and in balance with the boom, so that the power plant revolves in transferring material from the railroad car to the storage yard or mine-supply track. Two men with the derrick handle weights which ordinarily would require half a dozen, and, in addition, the accident hazards inherent in the manual handling of heavy materials are materially reduced.

The usual type of derrick is operated from a power plant located to one side of the foundation, and connection is made to the boom and turntable through wire cables which run along the ground. This contrasts with the equipment here described, which has proved to be entirely satisfactory.

WORD from the FIELD

Appalachian Coals Files Defense In Injunction Suit

Following the filing of a sweeping denial of the charges of the Department of Justice that Appalachian Coals, Inc., has entered into a conspiracy to monopolize and restrain trade in bituminous coal, officials of the organization settled down last month to mapping the line of defense to be followed during the hearings on the government's injunction case, which began Aug. 1 before a three-judge federal court at Asheville, N. C.

Declaring that operation of Appalachian Coals, Inc., will have the effect of promoting, rather than restraining, trade in high-volatile bituminous coal, the brief filed by the sales agency last month, among other things, denies the allegations of the Department of Justice that the plan evolved by the operators in New York City, Dec. 3, 1931, contemplates concerted action between the different regional sales organizations, and asserts that the contract entered into between Appalachian Coals, Inc., and the producer defendants contains no agreement, actual or implied, for the regulation or control of production or the fixing of prices.

New Plant Construction

New contracts for topworks and construction under way or completed at various coal operations in July were as follows:

Blue Bell Coal Co., Harrisburg, Ill.; contract closed with the McNally-Pittsburg Mfg. Corporation for a strip mine tipple equipped with shaker screens for making four sizes and four 25-ton bins for truck loading; capacity, 50 tons per hour.

Norwood-White Coal Co., No. 8 mine, Herrold, Iowa; contract closed with the Link-Belt Co. for tipple for preparing and loading lump, egg, nut, and slack; capacity, 200 tons per hour.

Mines Operate Safely

Empire Coal Mining Co., Clearfield, Pa., was presented with the Joseph A. Holmes Safety Association certificate of merit at ceremonies held last month at Barnesboro, Pa. Superintendent John D. Leadbetter accepted for the Empire "A" mine, which produced 533,820 tons from pillars and worked 149,961 man days from Oct. 31, 1924, through 1931 without a fatality.

Signal Knob Coal Co., Ansted, W. Va., has operated its mine continuously since 1907 without a fatality. Daily production is approximately 400 tons, and 150 men are employed.

Bidding Reveals Low Coal Prices

With by far the majority of bids for mine-run coal for New York state institutions and agencies running below 90c. per ton, f.o.b. mines, Kellys Creek Colliery Co. offered 15,600 tons of mine-run from the Maiden Mine, Maidsville, W. Va., at 60c., according to a summary of the bids opened June 30 and released July 25. Howard Gas Coal Co., Elrico, Pa., was the highest bidder on one item of 60 tons of mine-run at $1.10. Over 127,000 tons of mine-run was offered at 80c. or less, and an equal quantity was offered at from 81 to 90c., inclusive.

Bids on lump coal, largely $\frac{3}{4}$ in., ranged from 80c. to $1.25, with the major item, 14,500 tons, offered at 90c. Five thousand tons of slack was offered by the Kellys Creek Colliery Co. at 69.3c. Other bids ranged up to 87c. C. E. Bortz, Hoard, Pa., was the low bidder on nut-and-slack, offering 7,000 tons at 85c. Producers Coal & Coke Co., Heshbon, Pa., offered 8,500 tons at 87c.

Hamill Team Wins Meet

The team representing the Hamill No. 1 mine of the Hamill Coal & Coke Co. won first prize in the Garrett County (Maryland) first-aid meet, held at Shallmar, July 23. Second place went to the team representing the Wolf Den mine, Shallmar Mining Corporation.

John F. Daniel

Empire Agreement Threatens Anthracite Exports

Presaging a possible reduction in exports of Pennsylvania anthracite to Canada, delegates to the Imperial Economic Conference, now in session at Ottawa, proposed a reciprocal arrangement for the exchange of Welsh anthracite for Canadian timber last month. Under the terms of the proposed agreement, which was referred to a committee for discussion, anthracite producers would lose 25 per cent of their remaining Canadian business. As a further step in the promotion of the use of British coal in Canada, it also was proposed that the tariff of 40c. per net ton on anthracite be increased to 75c. The coal and timber exchange plan was opposed by Nova Scotian producers, who have fought British shipments in an endeavor to expand their own participation in the Canadian market.

Kemmerer Starts Improvements

Extensive improvements which may cost as much as $100,000 are reported to be now under way at the Frontier and Sublet (Wyo.) mines of the Kemmerer Coal Co. Included in the list of activities is the driving of a new opening at one of the present mines and the construction of an outside tramway to the tipple. Objectives of the program are reported to be increased production and greater safety.

Brotherhood Coal Properties Sold

Coal mining properties of the Brotherhood of Locomotive Engineers, opened up in 1924 and 1925, were sold at auction last month to the Red Parrott Coal Co., Cleveland, Ohio, for $368,000. Ten thousand acres of coal in Boone County, West Virginia, passed in the sale, which is subject to court confirmation.

Daniel Heads Inspectors' Institute

C. A. McDowell, secretary, Mine Inspectors' Institute of America, calls attention to errors in listing institute officers for the new year on page 240 of the June issue of *Coal Age*. The correct list follows: president, John F. Daniel, chief, Kentucky Department of Mines, Lexington, Ky.; first vice-president, P. J. Friel, mine inspector, Shamokin, Pa.; second vice-president, John G. Millhouse, director, Illinois Department of Mines and Minerals, Springfield, Ill.; third vice-president, Thomas Stockdale, state mine inspector, Freeman, W. Va. The other officers were correctly given.

Illinois Miners to Vote Again on Wage Scale; Northern West Virginia Strike Fails

SPURRED by prospects of an interruption in plans for a general resumption of mining in Illinois growing out of the rejection of a wage and working agreement by the rank and file on July 16, union officials bent their efforts in the last days of July toward securing approval of a contract amended to meet the objections of the miners. The original agreement was adopted at Chicago on July 8, and opposition fostered by radical elements within the membership of the various locals and directed against the machine-loading, experimental six-hour day, division of work, and dirty coal penalty provisions developed almost immediately, culminating in a vote of almost three to one against adoption. The rank and file apparently were led to believe that the agreement unduly favored mechanical loading mines, with the result that unemployment would be increased, and that establishment of the six-hour day would mean working twelve hours without additional pay.

A committee of operators and miners met at Springfield, Ill., July 23 to begin revision of the agreement in preparation for a second referendum. In succeeding days, the experimental six-hour day, inserted at the request of the union, was eliminated by the committee, and minor revisions were made in the division of work section by striking out "in the judgment of the operator" in the clause recognizing the right of men thrown out of employment by mechanization to share in work up to the point where it would impair the efficiency of the mine, and suspension periods for loading dirty coal were reduced. No change was made in the wage scale, given, together with available comparative rates from the old scale, in the accompanying table. To offset to some extent the effects of the wage reduction, the operators agreed to a reduction in the price of house coal and explosives.

The new strip-mine wage scale was referred to a special committee, which agreed that the wages of all miners making more than $6 per day should be reduced 19 per cent, and that all men receiving $6 should be reduced to $5 per day. This agreement will be voted on at the same time as the deep-shaft agreement.

Upon completion of the revisions, Illinois union officials embarked upon a vigorous campaign to insure its adoption in the next referendum, even going so far as to call upon John L. Lewis, who has been barred by injunction from Illinois, to throw his influence behind the agreement. Certain elements among the rank and file, however, continued to manifest their dissatisfaction, with the result that Illinois officials were driven away from meetings at Belleville, July 29, and Johnston City, July 30. A mass meeting at West Frankfort, July 28, laid plans for a state-wide campaign against the agreement.

Pending the completion of the new referendum, a number of Illinois companies reopened mines under temporary agreements providing for continuance of the old basic scale of $6.10. Included in the list were: Indiana & Illinois Coal Corporation, West Virginia Coal Co. of Missouri, Peabody Coal Co. (one strip mine), and the Superior Coal Co. (four mines employing 2,500 men).

Members of the Indiana Coal Operators' Association, who have held out for a $4 scale, refused to be moved by prospects of an Illinois agreement. At a meeting on July 12, the association voted against reopening negotiations with the Indiana union, and passed a resolution empowering members to "deal with the miners in the various locals direct in making wage scales that will be competitive and in conformity with the agreement" providing for a $4 scale, previously arrived at by a joint wage conference and refused by the miners.

Indiana National Guardsmen were ordered to Dugger on July 21 to put down picketing at mines in the district in defiance of a court injunction. One thousand union sympathizers surrounded the cooperative mine of the Hoosier Coal Mining Co., Dugger, and held 27 men in the workings for two days until Governor Leslie succeeded in prevailing upon the owners to close down temporarily.

One man was killed and seven were injured in a battle between union sympathizers and miners at the Dixie Bee cooperative mine of the Eureka Coal Co., Terre Haute, Ind., Aug. 2. Nearly 1,000 were pitted against 60 miners. Martial law was declared in the district by Governor Leslie on Aug. 3, and 1,000 National Guardsmen started to move in to keep order. The governor prevailed upon the company to discontinue operations pending adoption of a wage agreement in Indiana.

With more men going to work, violence in the Ohio coal fields decreased to some extent in July, though a number of clashes continued to occur. Miners entering the Millfield mine of the Sunday Creek Coal Co. were fired on by union sympathizers on July 27. National Guardsmen returned the shots. Earlier in the month a mob which tried to prevent miners from entering the shaft of the Wolford Coal Co. mine, near Uhrichsville, was dispersed by tear gas dropped from a National Guard airplane.

Tuscarawas field miners were reported to have entered into a temporary agreement at the end of July providing for a loading rate of 40c. per ton and a day rate of $3.50. Hanna Coal Co. officials began preparations for reopening the Fairpoint mine, in eastern Ohio, under Governor White's wage scale of 38c. per ton for loading and $3.28 for day work. Approximately 4,000 men in eastern Ohio and 1,200-1,500 men in southern Ohio were reported to be working at the end of July.

Production at northern West Virginia mines was little affected by the general strike at non-union operations called by Van A. Bittner, international representative, United Mine Workers, on July 4. Only a few of the non-union operations were picketed, without serious effect on the number of men working. Bittner carried his fight against the Consolidation Coal Co., now operating under a federal receivership, to President Hoover on July 28, requesting the President to call a conference of company and union representatives to

Permissible Plates Issued

One approval of permissible equipment was granted by the U. S. Bureau of Mines in June, as follows:

Goodman Mfg. Co.; Type 319-C shearing machine; 25-hp. motor, 250 volts, d.c.; Approval 214; June 18.

The following cables were added to the list of "Specially Recommended Cables" after Jan. 1, 1932:

BM-16—Royal No. 3 twin cable (7x19 stranding).
BM-17—Amerclad No. 2 twin cable (19x7 stranding).
BM-18—General Electric No. 2 twin cable (19x7 stranding).
BM-19—Rome "Super-Service" No. 6 twin cable (7x7 stranding).
BM-20—Royal No. 6 twin cable (7x19 stranding).
BM-21—Royal No. 2 twin cable (7x19 stranding).
BM-22—Royal No. 4 twin cable (7x19 stranding).

Proposed Illinois Scale, Compared With Old

	Proposed Scale, Per Ton	Old Scale, Per Ton
Loading — Hand:		
Pick mining	$0.64@$0.84*	$0.87@$1.07
Loading — Mechanical:	Per Day	Per Day
Cutting machine operator and helper	$7.00	$10.07
Mobile loading machine operator	7.00	10.07
Helper	6.25	9.00
Entry-driving machine operator	7.00	10.07
Loading machine operator (rock)	6.00	10.07
Shearing machine operator	6.00	10.07
Drillers, shooters, snubbers	5.75	....
Clean-up men	5.70	....
Loaders on pit-car loaders and conveyors	5.70	8.04
Inside Day Men:		
Motormen	5.40	7.00
Trip riders and grippers	5.00	6.10
Tracklayers, timbermen	5.00	6.10
Helpers	5.00	5.95
Electricians, large loading and cutting machines	6.00	....
Electricians' helpers, wiremen, bonders, conveyor repairmen, cagers, drivers, water and machine haulers	5.00	5.95
Handling horsebacks in conveyor sections	4.75 & 5.70	....
Trappers, flaggers, switchthrowers	3.00	....
Pipemen, slate and rock handlers, bratticemen; spraggers, couplers, blockers, empty car pullers, and oilers on shaft bottom, other inside day labor	4.75	5.95
Shotfirers	0.75†	8.24*
Outside Day Men:		
Picking labor (boys)	3.00‡	3.50
Picking labor (men)	4.00	5.61
Tipplemen and other outside common labor	4.00	5.61

*Basic scale, Danville district, 68c. per ton. †Per hour. ‡When slate or sulphur pickers use sledge or pick, scale is $4 per day.

discuss a contract with the United Mine Workers.

National Guardsmen moved into Johnson County, Arkansas, July 25, after organization efforts of the United Mine Workers in the Southwest had culminated in an attack on officials of the Clarksville Coal Co., who refused to let union sympathizers enter the mine to solicit members. Injuries to Bob Griffith, pit boss, resulted in the arrest of two men, while peace officers are seeking 25 others concerned in the riot. Except for the Clarksville battle, organization efforts at other mines in the county were carried on without resort to violence.

A strike of 450 miners, affecting six mines in the McAlester district of Oklahoma, took operators by surprise on Aug. 2. David Fowler, international representative of the United Mine Workers, in charge of organization activities, issued the order. The miners were reported to be demanding that wages be increased from $3.06 to $4.72 per day, though no mention of an increase was made in the strike order.

Northern Wyoming mines, employing 1,000 men, closed down indefinitely on July 1, following the collapse of negotiations for a new wage agreement. Operators proposed cuts varying from 20 to 32 per cent, but with the exception of those in the Gebo district, finally compromised on a 20 per cent reduction. Gebo operators, however, insisted on a reduction in the loading rate of from $1.02 to 76c. The miners refused, and negotiations were called off in all the districts for an indefinite period.

Supports Anthracite Research

The Anthracite Institute has voted $5,000 to support the anthracite research program of the Greater Pennsylvania Council, according to an announcement by Gen. Brice P. Disque, executive director. The research, which will be carried on at the School of Mineral Industries, Pennsylvania State College, will deal with the physical and chemical characteristics of anthracite.

Obituary

Harry Van Mater, president, Royal Fuel Co., Colorado, died at Honolulu, June 30, at the age of 70. Mr. Van Mater began his Colorado career in 1893 as manager of the Colorado & Southern R.R., and in 1904 organized the Rocky Mountain Fuel Co., of which he was president until his retirement in 1929.

Charles E. Maurer, one-time president of the Pittsburgh Vein Operators' Association, now the Eastern Ohio Coal Operators' Association, and for many years prominent in the coal industry in Ohio, Pennsylvania and West Virginia, died at his home in Ravenna, Ohio, July 15, at the age of 68.

Van H. Manning, consulting engineer and director of the U. S. Bureau of Mines from 1915 until 1920, died at his home in Forest Hills, N. Y., July 13. After his resignation from the Bureau of Mines in 1920, Mr. Manning was director of research for the American Petroleum Institute until 1924, when he was appointed a special consultant for the Bureau of Mines.

William Y. Humphries, 38, vice-president and treasurer, Chartiers Gas Coal Co., Pittsburgh, Pa., died suddenly at Hyannisport, Mass., July 2.

Adrian Sicard, president, Peerless-Cahaba Coal Co. and West Helena Coal Co., Birmingham, Ala., died in New York City, July 18, following an operation. Mr. Sicard, who was born in France, had been engaged in coal mining in Alabama for fifteen years.

Personal Notes

Charles E. Stuart, president, Stuart, James & Cooke, Inc., consulting engineers, New York City, returned July 1 from a four months trip to England, France, Germany and Russia. During his trip, Mr. Stuart assisted in the formation of the Cardox Co. of France, under the auspices of Air Liquide of France. The new company will have charge of sales in France, Belgium, the Saar, Spain and Italy.

L. T. Dee, vice-president, Lion Coal Corporation, Ogden, Utah, was reelected president of the Southern Wyoming Coal Operators' Association at the annual meeting held in July. Forrest Richardson, vice-president, Sheridan Coal Co., Omaha, Neb., was chosen vice-president, and L. W. Mitchell, Rock Springs, Wyo., was reelected executive secretary.

J. A. Meyers, president, Apex Coal Co., Pittsburg, Kan., has been placed in charge of the affairs and general policies of the Southwestern Interstate Coal Operators' Association consequent upon the removal of the offices of the association from Kansas City, Mo., to Pittsburg, Kan., and the resignation of W. L. A. Johnson as general commissioner and assistant treasurer. Mr. Johnson, however, will continue as joint interstate commissioner in the settlement of disputes between the union and operators belonging to the association.

Moroni Heiner, formerly vice-president of the Utah Fuel Co., Salt Lake City, Utah, and associated with the mining industry in the state for 30 years, was elected president of the company in July, succeeding the late W. D. Brennan.

Industrial Notes

James R. Mills, manager of sales of the Carnegie Steel Co., Cleveland, Ohio, succeeds Charles C. Cluff, manager of sales, New York, who has retired. Mr. Mills is succeeded at Cleveland by Francis C. Hardie, who was assistant manager of sales for the Illinois Steel Co., Chicago.

Poole Foundry & Machine Co., Baltimore, Md., has appointed the Ladd Equipment Co., Pittsburgh, Pa., district representative for western Pennsylvania, West Virginia and eastern Ohio.

Elliott Service Co., New York City, has opened a new branch office at Detroit, Mich., in charge of A. M. Bennet.

Ohio Brass Co., Mansfield, Ohio, has disposed of its line of wood cross-arm hardware, wood guy-strain insulators and steel pin insulators to Hubbard & Co., Pittsburgh, Pa., which is licensed to manufacture and sell pole line hardware developed and patented by the Ohio Brass Co. The Hubbard organization will manufacture the equipment dealt with in the present arrangement, but both companies will cooperate in sales and in future development work.

Worthington Pump & Machinery Corporation, Harrison, N. J., has consolidated the design, engineering and manufacturing activities at the Cincinnati (Ohio) works with those carried on at Buffalo, N. Y. The Cincinnati district sales office, however, is continued.

Coal Mine Fatalities Decline

Coal-mine accidents caused the death of 38 bituminous and 9 anthracite miners in June, 1932, according to information furnished the U. S. Bureau of Mines by state mine inspectors. This compares with 43 bituminous and 12 anthracite fatalities in May and 69 bituminous and 23 anthracite deaths in June, 1931. The death rate at bituminous mines dropped to 2.14 per million tons in June, 1932, while the anthracite fatality rate decreased to 3.53. Comparative figures are as follows:

	June, 1932	May, 1932	June, 1931
Bituminous Mines			
Production, 1,000 tons	17,749	18,384	29,185
Fatalities	38	43	69
Death rate per 1,000,000 tons	2.14	2.34	2.36
Anthracite Mines			
Production, 1,000 tons	2,550	3,278	4,544
Fatalities	9	12	23
Death rate per 1,000,000 tons	3.53	3.66	5.06

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

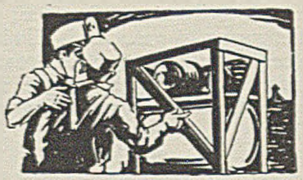
FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

Cause	Bituminous		Anthracite		Total	
	Number Killed	Killed per 1,000,000 Tons	Number Killed	Killed per 1,000,000 Tons	Number Killed	Killed per 1,000,000 Tons
January-June, 1931						
All causes	529	2.787	214	6.785	743	3.357
Falls of roof and coal	305	1.607	112	3.551	417	1.884
Haulage	103	.543	26	.824	129	.583
Gas or dust explosions:						
Local explosions	4	.021	7	.222	11	.050
Major explosions	41	.216	5	.159	46	.208
Explosives	8	.042	16	.507	24	.108
Electricity	23	.121	1	.032	24	.108
Surface and miscellaneous	45	.237	47	1.490	92	.416
Jan.-June, 1932						
All causes	402	2.780	115	4.760	517	3.064
Falls of roof and coal	215	1.487	63	2.607	278	1.648
Haulage	62	.429	17	.704	79	.468
Gas or dust explosions:						
Local explosions	3	.021	2	.083	5	.029
Major explosions	54	.373	...	.....	54	.320
Explosives	7	.048	8	.331	15	.089
Electricity	18	.125	4	.166	22	.131
Surface and miscellaneous	43	.297	21	.869	64	.379

*All figures are preliminary and subject to revision.

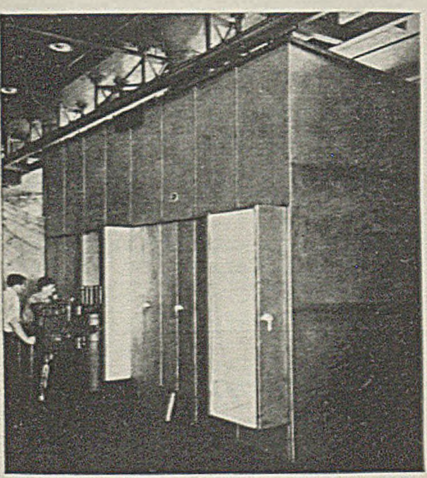
WHAT'S NEW

IN COAL-MINING EQUIPMENT



Electrical Equipment Offered For Coal-Mine Use

General Electric Co., Schenectady, N. Y., has developed a moderate-duty, metal-clad switchgear employing oil circuit breakers for use where no building exists or where indoor space has not been provided for additional equipment. The switchgear includes a standard indoor metal-clad frame, instrument, transformer, and bus compart-



Medium-Duty Outdoor Switchgear
Safety Switch Hook

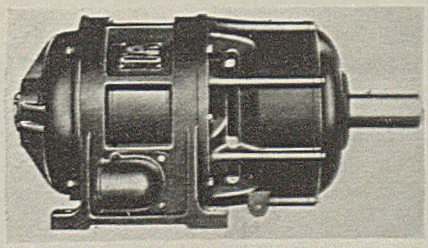
ments, and a standard removable oil circuit breaker. Units may be elevated by a manual operating mechanism or by means of a power-drill socket. The equipment is assembled at the factory and shipped in as large a group of units as can be handled. Lifting lugs are provided.

General Electric Co. also has developed a new safety switch hook for station operation which is composed entirely of insulating material for maximum protection against accidental contact. Reduction in space requirements with this hook is emphasized by the maker.

A new line of splashproof induction motors is a further development of the General Electric Co. Top half of the specially constructed end shields is solid, to exclude dripping water and other liquids. Cooling air enters the ventilating openings in the bottom half of the end shields. A special baffle prevents splashing of the motor windings. The motor frame is protected from liquids by a one-piece cover. Motor leads enter through a watertight conduit box.

General Electric Co. also announces a new line of d.c. motors designed for a wide variety of applications through the changing of only a few different parts. New and different pulley end shields are said to afford maximum protection to motor windings, while drop-forged feet reduce possibility of breakage. According to the company, the improved insulation resists moisture and weak acids, and properly proportioned stabilizing windings make possible unusually steady operation. In addition, it is declared, the speeds of all constant-speed motors can be increased 25 per cent (more in some ratings) by field control.

A line of gear motors is a late addition to the General Electric Co. line. Adaptable, it is said, to a wide range of machinery, the gear motor consists of a normal speed motor in combination with a built-in internal-helical planetary-gear speed reducer. A wide choice of output speeds is possible, according to the company, and compactness, high efficiency, full rated motor horsepower at the output shaft, economy of installation and operation, and simple design are emphasized. In addition, gear motors with special electrical characteristics are offered. Standard gear motors are offered with shaft speeds down to 13 r.p.m. and in ratings up to 75 hp. for the

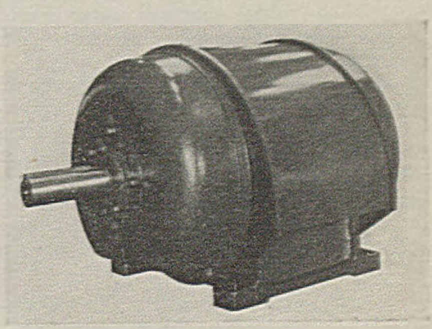


Gear-Motor, Ball-Bearing Squirrel-Cage Motor Design

polyphase squirrel-cage and wound-rotor types. Single-phase gear motors range up to 5 hp., while d.c. models are offered up to 7½ hp.

General Electric Co. also announces the completion of its line of full-voltage starters for squirrel-cage induction motors up to 1,200 hp. All switches conform to NEMA requirements. Size 2 switches are now rated 15 hp. at 220 volts, 25 hp. at 440 and 550 volts. Size 3 switches are rated 25 hp. at 220 volts; 50 hp. at 440 or 550 volts. These switches include new thermal overload relays which follow more closely the heating characteristics of the motor. Cast-iron or boiler-plate cases are available for damp or dusty atmospheres, and any magnetic switch can be obtained in oil-immersed forms. Explosion-proof cases are available.

The General Electric line of combination switches using a magnetic switch and a fusible or non-fusible motor circuit



General Electric Splashproof Induction Motor

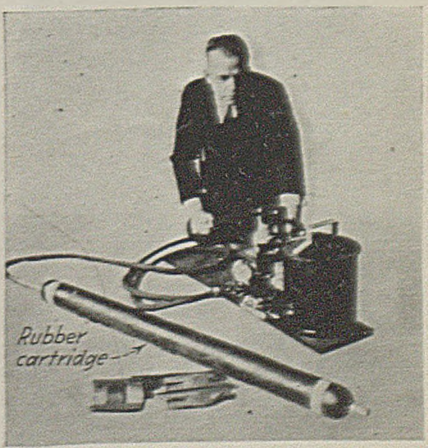
switch has been augmented by the addition of a device rated at 25 hp., 220 volts, and 50 hp., 440 or 550 volts. These combination switches use the same thermal overload relays as the standard full-voltage starters.

Hydraulic Cartridge of Rubber Used in Coal Breaker

For use instead of explosives in breaking down coal, the Meyer Rotary Engine Co., Denver, Colo., offers a hydraulic breaker employing a rubber expansion cartridge. This cartridge is placed in drillholes and is expanded to break down the coal after undercutting and shearing by pumping it full of water. No tamping is necessary, and the company states that the breaking-down action takes place in ½ to 1½ minutes. The rubber in the cartridge has a tensile strength of 4,700 to 5,000 lb. per square inch. Walls in the 3-in. cartridge are ½ in. thick. In the 4-in. cartridge, the walls are ¾ in. thick.

Pressure is applied by means of a hy-

Hydraulic Coal Breaker, Showing Cartridge, Pump and Connecting Hose



draulic pump made with a small plunger ⅝ in. in diameter, which operates inside a large plunger 1¾ in. in diameter. The large plunger is used to fill the cartridge, after which it is locked in the pump casing, and breaking pressure is applied with the small plunger, which has a 4-in. stroke. Under test, the 4-in. cartridge is said to have withstood a pressure of 3,000 lb. per square inch, while it has been found that from 350 to 1,500 lb. per square inch is sufficient for all coal-breaking tasks thus far encountered in lignite, bituminous and anthracite mines in Colorado. Nine quarts of water is used in producing the necessary pressure. The cartridge can be used over and over.

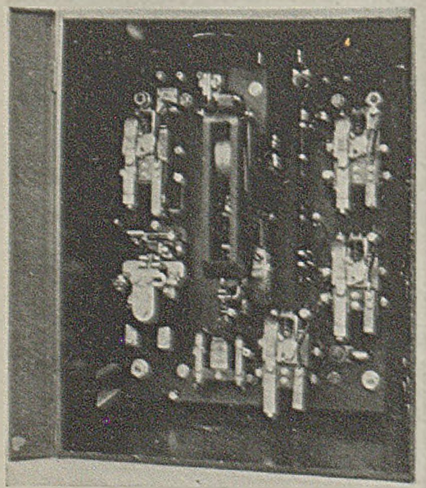
Advantages claimed are: elimination of the explosion hazard; elimination of explosives cost; reduction in slack production; roof and timbers are protected; shooting, and moving of equipment may be accomplished while the coal is being broken down. Including pump, water, hose and cartridge, weights are: 3-in. cartridge, 105 lb.; 4-in. cartridge, 120 lb.

Non-Reversing Time Limit Starter

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces a new time starter for use with non-reversing, constant speed, d.c. motors on pumps, fans, hoists, conveyors, loading machines and other mining equipment. Definite time-limit acceleration, the company says, is obtained by using the "Timetactor," which gives a compact, simple and positive time-limit method of accelerating a motor for the greatest voltage range covered by a magnetic starter. The "Timetactor," it is said, will operate to cut out the accelerating resistor on any voltage which will hold the line contactor closed, due to the fact that it is electrically opened and mechanically closed. Heavy-duty contactors provide an effective arc-rupturing system with a high capacity. Thermal magnetic overload protection is provided.

The Westinghouse company also announces a new electrical supervisory system (Polaricode) for remote control of equipment. "Direct selection" is said to permit selection and operation of control circuits in less than one second. Polaricode is available for use on two- and four-line wires. The two-wire system, it is said, provides for control of up to 25 remote units; with the four-wire system, 2,500 may be controlled. Both the systems permit a number of remote stations to be operated on the same two or four wires, and also provide remote metering and synchronization without extra lines.

Westinghouse 75-Hp. Non-Reversing Time-Limit Switch



Rubber and Friction Tape

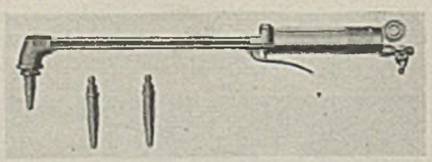
B. F. Goodrich Co., Akron, Ohio, offers a new combination rubber and friction tape for electrical work. The tape, the company says, is made of fabric completely embedded in a rubber compound with a degree of adhesion far beyond that of the usual friction tape. Wire joint, it is stated, need be wrapped only once, as the single wrap is practically as permanent as the original insulation. Advantages claimed are: single-ply test, 8,000-10,000 volts; remarkable adhesion; good resistance to moisture, drying out, or uncoiling after application; breaking strength, 38-41 lb. for a single ply; high resistance to heat, cold, abrasion and unraveling; clean to handle.

Testing Sieve Shaker

Newark Wire Cloth Co., Newark, N. J., offers the new "End-Shak" testing sieve shaker for handling from one to thirteen 8-in. testing sieves. The company stresses the fact that the shaker, which is driven by a ¼-hp., 1,750-r.p.m. motor, will accomplish the greatest passage of material through any sieve or sieves in the shortest possible time interval. Elimination of most of the variable factors in sieve testing also is claimed, because the sample is spread evenly over the screen; a combination reciprocating and rotary movement actuates the entire screen surface; jumping and bouncing of particles is eliminated; and noise, wear and tear on parts are done away with. Weight of the shaker, including motor and automatic time switch, is 275 lb.

Cutting and Welding Torch

Tips, Inc., Baltimore, Md., has added the Type NVM cutting and welding torch to its line of welding apparatus. Ability to cut or weld any thickness of metal within the limits of the process is claimed for the torch by merely changing tips. The high-pressure valve is operated by a lever below the torch. Replacements, according to the company, can be made without disassembling the torch. The 90-deg. head of the NVM torch is designed to take standard Type NV conical seated tips, having the same standard as those used in Airco Davis-Bournonville cutting torches Styles 8000, 3000A, 3000B, etc.



Milburn Type NVM Cutting and Welding Torch

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