Careless TIMBERING Costs Lives and Money

By W. H. Forbes

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FALLS OF ROOF and of coal should be diligently studied by the brightest minds in the industry since these hazards are the cause of approximately 60 per cent of all coal-mine accidents and result in the death of over 1,000 and the crippling of between 5,000 and 6,000 men annually. These and other accidents are recurring unabated, not because of a lack of knowledge of safe and dangerous practices, nor of the technique of safety, but rather because of the lukewarm interest of the major executives in safety or the failure of mine officials to enforce rules and regulations. Where failure is the outcome of management's sincere attempt to teach safety to the miner, the fault may usually be attributed to misguided effort.

VARIOUS solutions for the problem of eliminating accidents from falls of roof or coal have been suggested, some of which are: Standard system of timbering for the specified mining districts; departure from the room-and-pillar system to a more concentrated system of mining; more supervision, that is, one section foreman for every 25 loaders instead of one section foreman for 75 or 80 loaders, as is the common practice; a more positive method for determining when the roof is loose by the use of an instrument to amplify the sound instead of a pick as is the common practice.

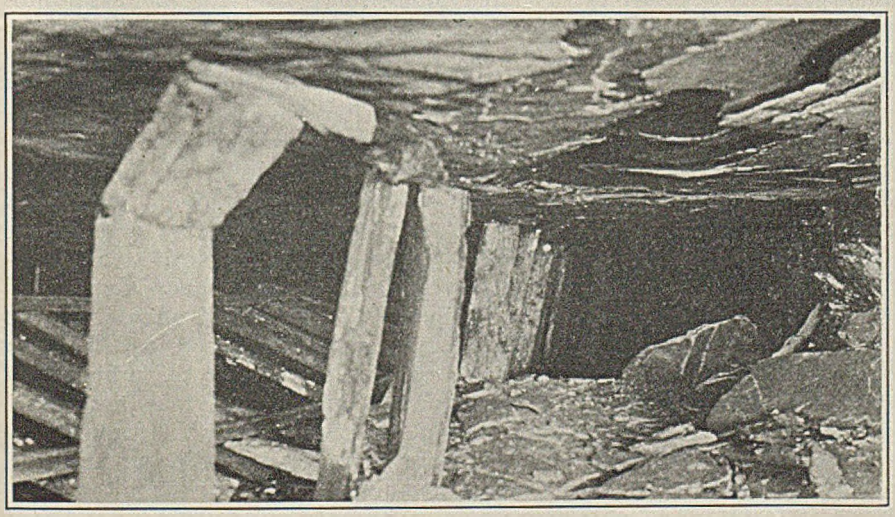
Some have suggested a scientific investigation be made of present practices, involving geo-physics, engineering, organization, psychology and other related factors. All of these suggestions are good, and without doubt would bring about better conditions if followed through. However, after having spent nearly two years on such an investigation, in a co-operative arrangement between the U.S. Bureau of Mines and the West Virginia Department of Mines, the writer is led to conclude that it is possible for any mining company to secure satisfactory results with the present methods of mining—without the aid of special devices for testing the roof or any extensive study of the geo-physics of mines.

MANY mines were inspected during the investigation and studies were made of mining methods; nature and character of roof; coal beds and their characteristics; handling of explosives; drilling, charging and firing of shots; methods and cost of timbering; attitude of officials and employees with respect to safety; attitude of mining companies with respect to enforcing discipline; organization and supervision; causes of accidents; and cost of compensation.

Mines operating in various districts were inspected. In some roof conditions were good and in others poor. The organization of officials varied in degree from good to bad. Hundreds of miners were observed at work at the coal face and a majority of them were found to have their places properly posted and in a safe condition. On the other hand, many miners were seen working under loose and dangerous roofs. When questioned, almost invariably these miners admitted having knowledge that the roof was loose, but stated that in their judgment the roof would not fall for an hour or for several hours. In one instance a foreign-born miner was willing to gamble $100 that the loose slate in his place would not fall for at least 24 hours.

In some mines where miners were found working under loose roof without posts the companies had rules requiring them to post their places to within 10 ft. of the working face. In some cases the rules also provided for an inspection by an assistant foreman at least once every two hours, proving that many coal companies at least intend to have their properties operated safely and efficiently.

Soft Bottom and Small Pillars Lose 50 Per Cent of the Coal Here



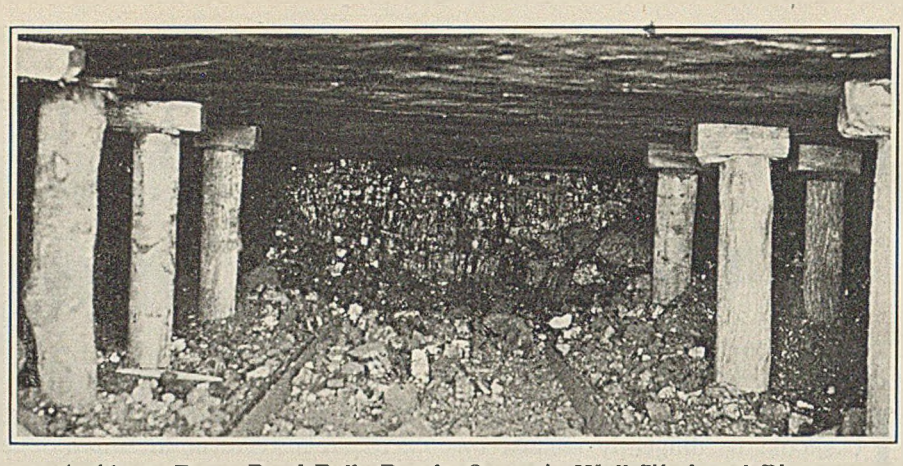
AT ALL MINES visited a plentiful supply of good timber was available, so that in all probability few accidents from falls of roof or coal can be attributed to an inadequate supply of timber. The investigation also revealed that officials and miners alike are generally familiar with the sizes of timber necessary and the various methods of placing them, so that lack of knowledge of this particular phase of mining cannot be blamed for the high accident rate. Many examples of careless timbering

came under observation of the writer, such as the use of chips of wood for cap-pieces or the elimination of cap-pieces altogether and slovenly practices in the setting of posts. The assertion that the majority of coal-mine fatalities result from careless or delayed timbering is based on information gained during the course of the investigation from many mine officials and hundreds of miners with whom the writer met, who continue to believe that it is possible to determine by sound whether the roof will remain in place for a few minutes, a few hours or even a few days or weeks. Miners and mine officials both expressed their views as to the length of time required for certain pieces of slate or rock to loosen up and fall. In the meantime men continued to work without the slightest fear of the roof falling.

Just as long as men engaged in the mining industry continue to disregard such danger and entertain their present false notions, just that long this particular hazard will continue to exact great toll of human life. If the needless sacrifice of human life from this cause is to be stopped or curbed men must realize that a few good posts will hold up more slate than many long years of experience in guessing by sound in determining loose roof conditions.

ALL LOOSE ROOF must be considered as dangerous and just as soon as it is detected it should either be securely timbered or taken down. The day of guess work has long since passed, and in this enlightened age we should attempt to profit by the sad mistakes of the thousands who have fallen victims to faulty judgment in testing roof.

Many slate crews were also observed at work on haulage roads, etc., in a number of the mines visited, and only in a few instances did they set safety posts before commencing work. The use of safety posts by miners at the working face as well as by slate crews is indispensible. It is the best and cheapest insurance against injury from falls of roof. Men observed working under dangerous roof were asked why they had not set a few posts before commencing the job at hand. Invariably they admitted having full knowledge of the dangerous condition of the roof, but said that they could not post the place until the track was laid up or the turn put in, and also that it was sometimes necessary to load one or two cars to make room for the permanent posts. On several occasions the writer was present when officials gave orders such as these: "Watch that slate! It is loose. Better set some posts after you load one or two cars."



Accidents From Roof Falls Rarely Occur in Well-Timbered Places

BOTH MINERS and officials are wrong in following such practices. Under no consideration should men be permitted to work under a dangerous roof, loading out sufficient coal for the accommodation of a permanent post or while waiting for the track to be laid or the turn put in. The first duty should be the immediate protection of men by the setting of safety posts. The loading of coal to make room for track or permanent posts should come second.

In some mining districts the custom is to set posts no nearer than 25 or 30 ft. from the face. Where this system of timbering was observed, the coal bed is overlain with from 2 to 4 ft. of drawslate, which as a general rule separates from the main roof before any timbers can be set. Miners working under such conditions hardly know what it is to hear a good solid ring upon testing the roof which almost invariably sounds drummy. Mines operated with such carelessness have a high accident rate from falls of roof. When timbering is done systematically and is made a necessary part of the day's work, accidents from falls of roof are few and far between. It is evident that nothing is to be gained by failure to keep working places posted to within 8 or 10 ft. of the coal face since the places have to be timbered anyway. Obviously, therefore, the keeping of posts up close to the face is to the interest of miner and company alike.

Another factor contributing to accidents from falls of roof is the reliance of many miners on the bosses for the locating of posts. The miners work under dangerous conditions while awaiting the arrival of the boss. Even though the posts are set immediately after the marks are made, the principle is entirely wrong and the official who follows this practice is as much at fault as are the miners who rely on him for the locating of posts.

Men working at the face should know their jobs well enough and be sufficiently interested in their own personal safety to set posts without being continually told to do so, after they have been instructed a few times, except when some unusual conditions arise which require special timbering. In all well-regulated mines it was observed that a standard system of timbering was followed and that there was little repeated instruction by the company in the setting of posts, excepting instances when new men had been employed for only a few days.

IN MINES thus operated, workmen are made to realize that the setting of posts at regular intervals when conditions are ideal, and the use of additional posts when conditions require more than the minimum provided for by company standards, is of first consideration. In all cases where the workmen do not set timbers after having been instructed a few times, disciplinary measures are resorted to. As a rule it means a two or three day's lay-off for the first offense; six or eight days and in some instances the employees are discharged for the second offense; and always for the third offense. In no case is an alibi accepted—the post must be in place at the proper time or the miner must take the consequences. Invariably the foreman expresses regret at sending a man home, but always makes it clear to the work-

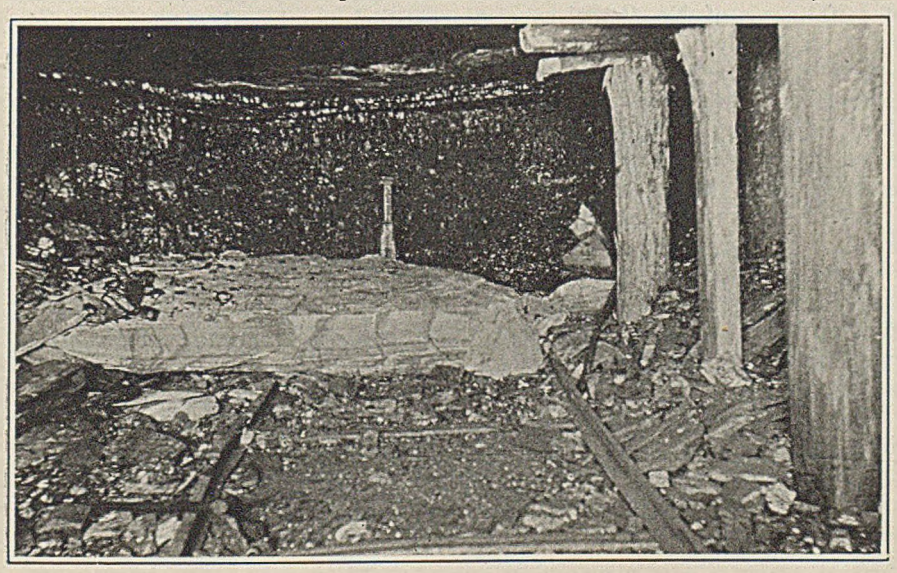
man that it is much better to send him home to his family alive than to carry him home dead. Only in rare cases, however, is it found necessary to discipline workmen for failure to securely post their places, the company officials having been successful in convincing the workers of their desire to prevent accidents.

THE WRITER is of the opinion that the problem will be solved when mining companies decide to operate their mines as all well-regulated industries are operated. The adoption and enforcement of rules and standards will not only solve the accident problem but will also increase the efficiency of every mining operation. It is obvious that the same rules and standards will not be applicable to all of the mines in any one county or district. Each company should adopt its own rules and standards to suit its particular requirement. After rules and standards have been adopted they should be rigidly enforced by a sufficient number of competent officials. Teach a man to be a careful and conscientious workman, and he will continue without great effort to take sufficient interest in his work to do it well and to feel justly proud of a well-kept room or entry. On the other hand if the officials to whom he looks for guidance encourage, by silent consent or otherwise, carelessness and indifference with respect to the keeping of working places in an unsafe condition, then the workman is likely to be careless and indifferent and to lack all of the characteristics of a good workman. The officials by proper conduct and good example can do a great deal toward cultivating safety habits among workmen.

A high standard of foremanship and skill in the handling of labor were never so necessary as they are today. Looking back to what are called "the good old days" in the operation of coal mines is fanciful. The facts for comparison are exactly written in the daily accomplishments, the safety record and increased efficiency.

Accidents from all causes occurring in and about coal mines will be reduced to the minimum just as soon as the presidents, vice-presidents, general managers and general superintendents of the companies pass the word along to the mine officials that they (the officials) will be held strictly accountable for all accidents to employees under their charge. Every accident of a serious nature should be investigated and the responsibility fixed. If the evidence shows that the foreman, assistant foreman or other official has been guilty of negligence, disciplinary measures should be taken. The officials should realize that an injury to an employee is considered a rather serious matter by the management. The writer realizes that many operating officials continually warn men under their charge of prevailing dangers but too commonly they then go on about their business believing their duties have been fulfilled. As a matter of fact, when an official finds a man working in a dangerous place or under dangerous conditions, it is his duty, both morally and legally, to stay with the man until the dangerous conditions have been remedied or the man removed from the place, which should be fenced off until such time as it is made safe by competent persons officially designated to do such work.

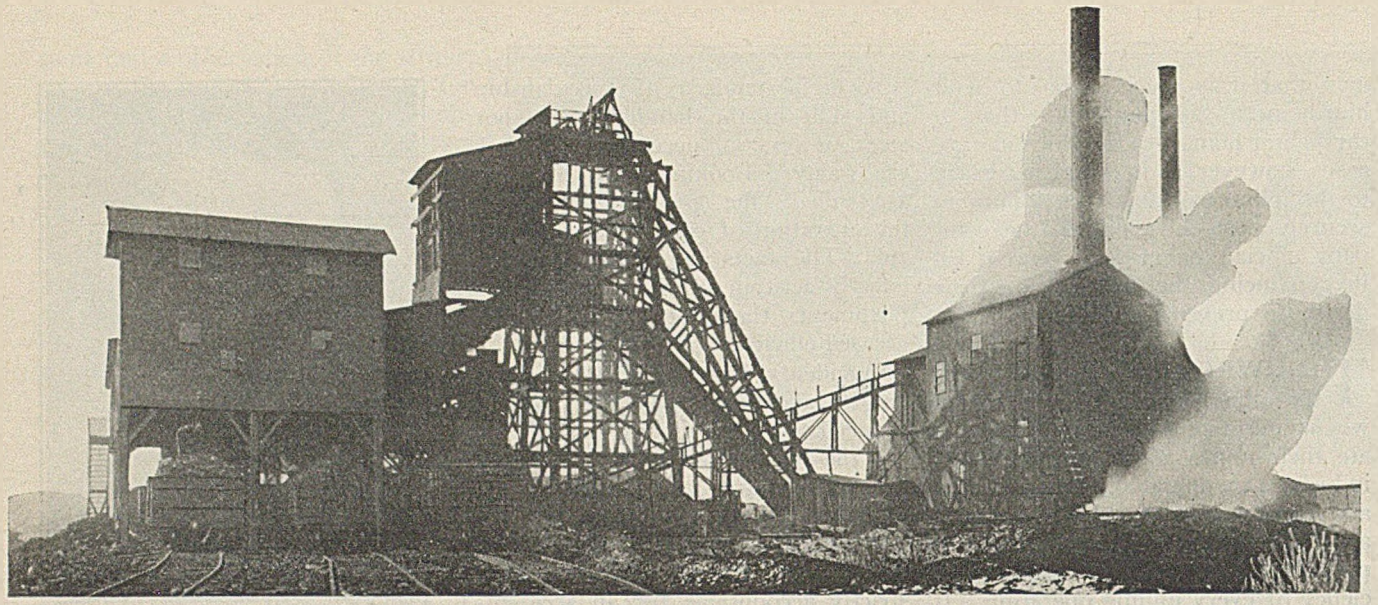
This Fall, Which Easily Could Have Been Prevented, Cost a Life



W. H. Forbes

MANY companies have ample supervisory forces but, due to the fact that no operating rules or standards have been provided, the officials know very little about what they are expected to do. As a result many are found walking about as a matter of routine, waiting for quitting time and pay-day. Section bosses or assistant foremen should be provided with simple report forms made up into notebooks and should be required to report the condition of each place visited, time of visit and the orders given.

Safety depends largely on habit and attitude—attitude of management toward men and of men toward their jobs. If safety is to become a habit, naturally this attitude must first be found in the executive, who is the policy builder for his organization. Man's physical value is exceeded by his mental value. Machinery may be installed which will take the place of many men with strong physical bodies, but no machine or mechanical device has ever been found to substitute for that invisible power within the mind which is called the faculty of thinking. Lying dormant in the mental make-up of many men are potentialities for good to humanity and industrial progress which may be brought into mutually-valuable use only to that extent to which men are induced to think. In no department of industrial activity is this more true than in accident prevention. The matter of establishing a broad humanitarian policy in accident prevention is, therefore, suggested to executive and operating officials as worthy of careful thought and decisive action—it will pay, in many ways, for the effort required.



Kentucky Mine *SAVES* 6 Cents Per Ton

By J. H. Edwards
Associate Editor, Coal Age
Huntington, W. Va.

"WE BELIEVE we have the lowest-cost mine in western Kentucky. One evidence of this is our having been able to run without shutdown for the last several years. Much of our margin over the other mines is due to a lower cost for power. We have no way of telling exactly how much we are saving by operating our own plant instead of purchasing power, but are satisfied that it amounts to at least six cents per ton."

This statement, made jointly by F. V. Ruckman, president, and D. J. Ruckman, secretary, of the Duvin Coal Co., Providence, Ky., may sound like a fairy tale to some operators at this time when six cents represents a nice profit and when the average cost of purchased power per ton at bituminous mines, producing from 30,000 to 50,000 tons per month, is approximately 7.5 cents.

Because the Ruckman brothers are the principal owners of the mine, and have had a background of successful operation, their privilege to make this statement cannot be questioned. The answer can be found in a study of the specific conditions at their mine.

A supply of picking-table refuse, high in percentage of combustible, and purchased-power rates higher than in some other fields, are the principal factors favoring the operation of a private plant. Another factor, water supply, is decidedly unfavorable, but this difficulty has been overcome in a rather daring manner.

The mine, located in Webster County, was opened in 1922 by the present owners. The tract, consisting of 3,300 acres of No. 9 coal averaging 66 in. and lying practically flat, is tapped by a 185-ft. shaft. The coal contains the characteristic "star sulphur" in small irregular shapes that occur without regularity with respect to the top and bottom.

Five thousand tons per day was the possible maximum production kept in view when planning the mine. Therefore, large cars and a speedy hoist were necessary. The car size, 3 tons, was soon settled, but not so easily the hoist.

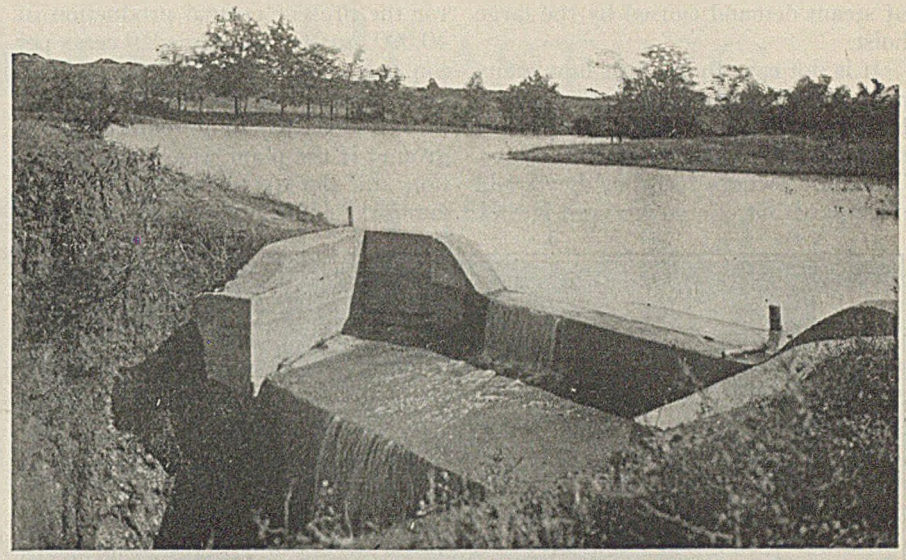
The first question was: Steam or electric? If power was to be purchased it was recognized that an electric hoist would be desirable from the standpoint of complete elimination of boiler plant. If an electric generating plant was to be installed, a steam hoist could be considered, although it was recognized that the electric would be more efficient.

THE PROSPECT of using tipple refuse as fuel, and the known costs of purchased power at neighboring mines, favored a generating plant. However, the location of the mine—several miles from a river and no possibility of getting water from wells—made such a proposition seem hopeless.

But investigation disclosed that the rainfall from about 100 acres of watershed could be caught by building two or three small earth dams all within 2,000 ft. of the shaft. This promised a probable supply; therefore, the individual plant was decided upon but with the idea of "going easy" so as to reduce the loss should the project not materialize as planned.

Because of the normally lower first cost, and a specific opportunity

to purchase one at a very attractive price from a coal company, a steam hoist was chosen. This machine was but a year or so old and had never been installed. It is a Vulcan 26 x 48-in. having 9 to 11 ft. conical drums, and is equipped with steam reverse, steam brake, and overwind protection. As installed, the total lift is 225 ft., yet six dumps per minute are possible. The total cost of the hoist, ready to operate, was but $16,000.



One of the Reservoirs That Furnishes All Necessary Water

THE FIRST generating equipment purchased was a Westinghouse d.-c. non-condensing geared turbo-generator rated 150 kw., 250 volts. Steam for this unit and for the hoist was supplied by two 150-hp. hand-fired horizontal-return-tubular boilers.

In 1924, after two years of operation with this equipment, during which time the water supply did not fail, a 350-hp. Babcock & Wilcox stoker-fired boiler and a 500-kw. General Electric condensing turbo-generator were added to the plant. The boiler is a Stirling type having 3,500 sq.ft. of heating surface and equipped with chain grate stoker. The stoker as well as the boiler was furnished by the Babcock & Wilcox Co. The steam pressure is 175 lb. Natural draft is induced by a 54-in. x 150-ft. steel stack. A Detrick suspended arch is used in the furnace. Other auxiliaries include Diamond mechanical soot blowers, an 800-hp. Worthington feed-water heater, and two plunger feed pumps.

The only fuel used under the boiler is picking-table refuse reduced to 1¼ in. by a small two-roll crusher located at the tipple which is close to the plant. The crusher runs all of the time that the tables are in operation and is fed by an 18-in. belt conveyor located so that the pickers can place directly upon it the lumps of coal which contain the sulphur impurity. Another conveyor delivers the crushed refuse to a 40-ton bin above the stoker in the boiler room. The fuel contains from 20 to 40 per cent iron pyrites.

THE NEW General Electric turbo-generator is a 5-stage, 2,300-volt unit with d.-c. exciter. It exhausts to a Worthington 1,700-sq.ft. two-pass surface condenser equipped with steam ejector, 5-hp. hotwell pump, and 40-hp. circulating pump. Both pumps are centrifugals and are driven by 220-volt squirrel-cage motors.

The circulating water is cooled in an 80x90-ft. concrete pond that has a depth of 5 ft. The equipment, consisting of piping and nozzles, was furnished by the Spray Engineering Co. Eight of the nozzles have been plugged to raise the head on the centrifugal circulating pump and thus reduce the power required. Five nozzles have been turned down to reduce evaporation loss.

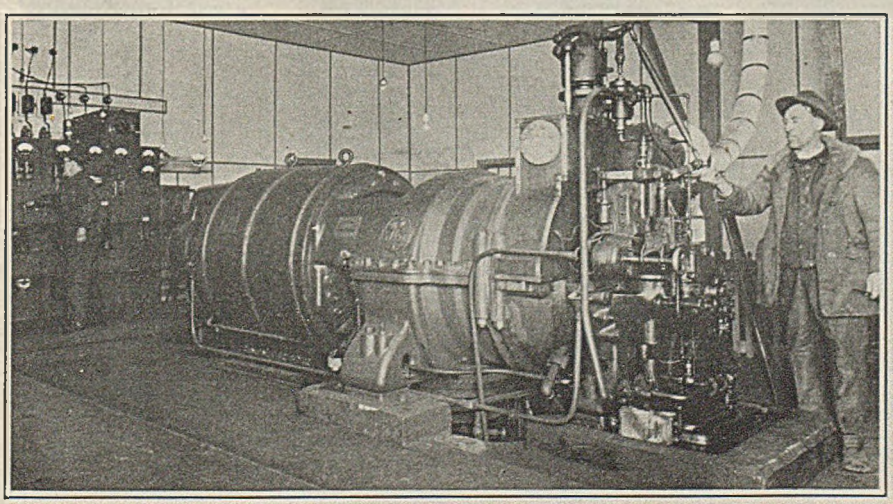
The water supply for bearings, feed water make-up and the cooling-pond addition, comes from two low-head 12,000-gal. wooden tanks. The only source of supply is the surface water from the two ponds. When full they cover less than an acre of ground and neither one of them is over 25 ft. deep.

A third pond is now being completed. This is to store the overflow from one of the other ponds which is not large enough to impound the rainfall of its watershed. With completion of the third pond the total investment in ponds will be $17,000.

The water is fairly good for boiler feed. It is used without filtration or treatment, yet deposits no great quantity of scale. The boiler tubes are drilled about every two months.

Installation of the a.-c. generator made it necessary also to install conversion equipment. This consists of a 200-kw. converter located in the power plant and a 150-kw. synchronous motor-generator set installed at a borehole 2,500 ft. away. Both have automatic d.-c. panels. The mine fan has dual drive through friction clutches. One motor is a 50-hp. d.-c., and the other a 100-hp. a.-c. unit.

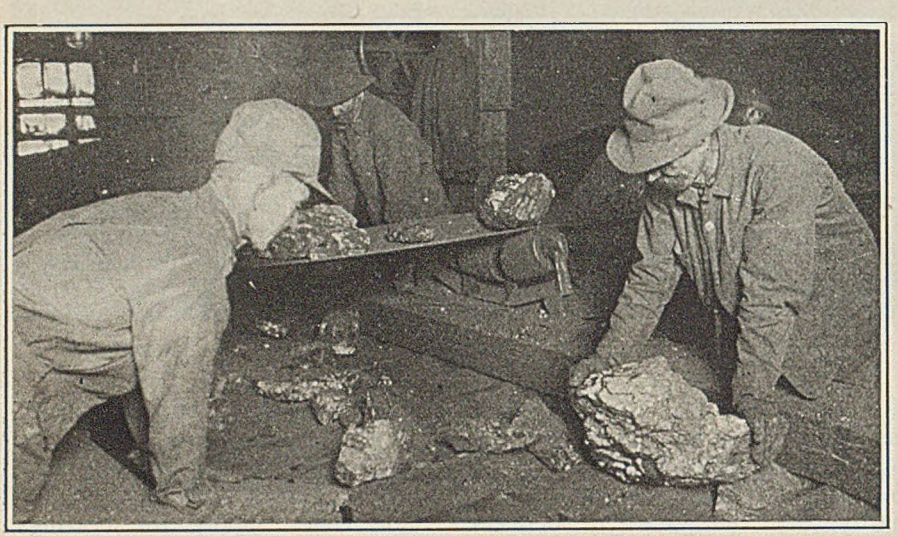
This Modern Turbo-Generator Set Furnishes All Power at the Duvin Mine



BECAUSE practically all of the coal cutting is done during the day, it is necessary to operate the large generator during 8 to 9 hours only. The night load including the fan is carried by the 150-kw. geared direct-current generator. One of the two 150-hp. boilers is kept warm as an accumulator for easing the peaks

of steam demand caused by the large hoist.

It is not easy to say just how many men, if any, are added to the payroll because of the power plant, since most of the crew have other duties. The mine owners feel that they could dispose of but one power man if they were to switch to purchased power and install an electric hoist.



Refuse or Fuel Belt Above the Picking Tables

The plant is operated by three 8-hr. shifts. On the day shift there is a chief engineer, a fireman and an oiler who is also a relief hoistman. On each of the other two shifts there is but one man, who fires the boilers, tends the engine room, operates the hoist and acts as night watchman.

The generating plant fuel cost is practically nothing. In fact, it would take two teams and four men, or one or two men and some expensive equipment, to dispose of the tipple refuse if it were not burned. Cinders from the plant are given away and are hauled by people in the town who are glad to get them.

BEFORE the plant was equipped to burn the refuse, it was the practice to break many of the lumps on the picking table in order to remove the pyrites and save the coal. This resulted in much slack and some pyrites going into the lump cars. Now the lumps containing the sulphur are not broken on the table but instead are sent to the crusher for power plant fuel. This has improved the quality of the lump product.

The total investment in power plant, including the water supply ponds, etc. (but not including the hoisting engine), approximates $105,000. Figuring 6 per cent interest, 5 per cent depreciation, and $2,000 per year maintenance, the total power cost for the present normal production of 40,000 tons per month is 2.9 cents per ton. No labor cost is included because of the probability that as many or more men would be required above ground if the plant was not in operation and the tipple refuse had to be dumped. Here it is well to state that, excepting the hand loading, all work inside of the mine is done by electricity—no live stock is used for gathering.

Adding the 2.9 cents to the 6 cents saving estimated by the mine owners, gives 8.9 cents as their estimated power cost per ton if they were purchasing power and wasting the tipple refuse.

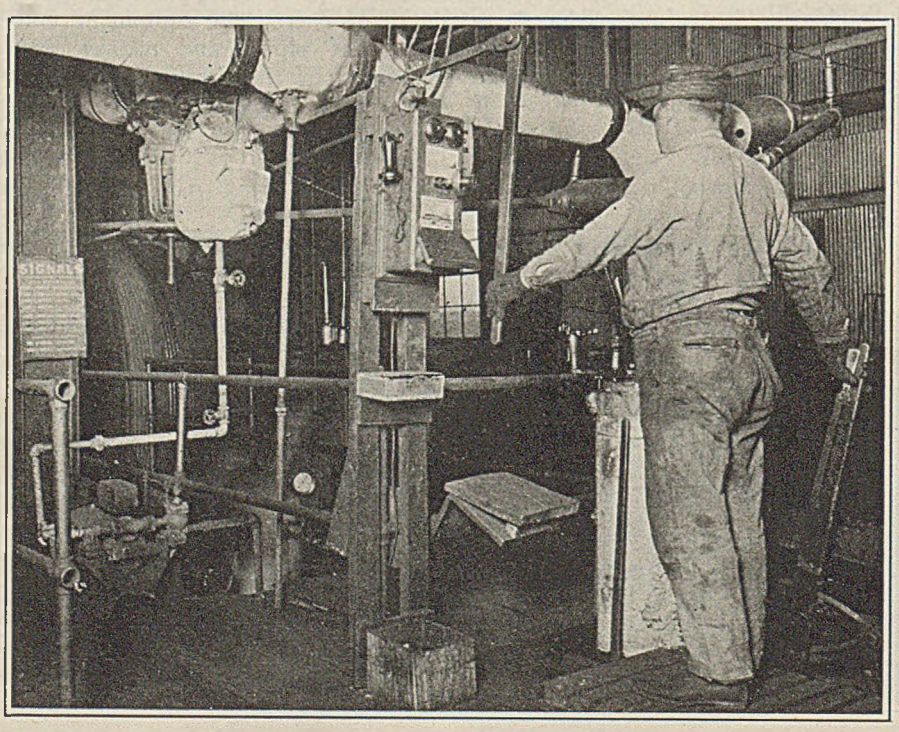
Approaching the proposition from another angle, the estimated power cost per ton would be 6.5 cents if electrical energy were being purchased at the scheduled rate which, in this particular instance, would be approximately 1.86 cents per kw.-hr. including the demand charge. This was calculated on a basis of 3.5 kw.-hr. per ton. To the figure of 6.5 cents should be added a capital charge for the additional cost of an electric hoist as compared to the steam hoist.

IT IS ONLY natural that when a person thoroughly believes in a proposition he can recount many advantages. So it is with the Ruckman brothers with regard to their individual generating plant. It is their experience that the mine-generated power should receive a sizable credit because of the fewer interruptions, and consequent greater safety and larger tonnage, than with purchased power.

Inasmuch as some gas is encountered in the mine, fan shutdowns cannot be tolerated. Therefore, they feel that if power were purchased, an auxiliary power source would be necessary. Now with two motors on the fan and two generating units in the power plant, the possibility of interruption to ventilation is remote.

Another advantage they mention is that of a neater and cleaner top layout because of there being little refuse to dump. The distressing smoke and gas from the almost inevitable dump fire is absent, and the appearance of the mine is improved.

This Modern Hoist Is Fast, Efficient and Safe



Controlled Blasting *Insures* Quality Coal*

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ONE OF THE MOST important factors in the operation of a mining property is the amount and quality of marketable coal obtained from the run-of-the mine material. This is known as the total and prepared yield per car, per ton or per 100 cu.ft., depending upon the unit selected. The mine car will be taken as a basis in describing the importance of the yield. In this connection there are three principal items which seriously affect the quantity of prepared sizes obtained: (1) A car not loaded to capacity; (2) a car containing an excessive amount of refuse; and (3) a car in which the coal is badly shattered.

When a car is loaded to capacity or contains excessive refuse, the mine operator not only pays for a full car of coal which he does not receive but also for the transportation of a partially loaded car through the mine. With excessive refuse there is the additional expense of handling the waste material through the preparation plant and subsequently transporting it to the rock bank. At some mines there exists the practice of docking the miners for these deficiencies, but the results of this practice are negligible compared to the loss incurred by the operator. The most definite indication of bad mining practice is a car in which the coal is badly shattered and consequently contains an excessive amount of fines or steam sizes.

The problem of the mine operator, therefore, is to improve upon the method of extracting the coal and thereby insure against these practices. To accomplish this, he must establish: (1) The kind and amount of explosive which gives the best results; (2) the proper location and depth of holes into which the explosive is inserted.

In determining the kind of explosive to be used, consideration must be given to the various kinds of explosives available. These must be studied from the viewpoint of: (1) Safety—Where explosive gases are given off, black powder cannot be used with safety; (2) Practicability—Where the structure of the seam has been affected by squeezes; in extremely low, hard seams; or in seams where considerable water is encountered in the drill holes, black powder is not practicable; and (3) Quality of Coal Produced—Black powder must be recognized as the producer of the best quality of coal. However, in conditions where black powder would either be unsafe or impractical, tests of the various permissibles and dynamites must be conducted to determine which produces the best results.

TESTS MADE with black powder under approximately one hundred different mining conditions, when compared with the various dynamites and permissible explosives previously used, show the following economies in favor of black powder: (1) An increase of from five to thirteen per cent in the yield of prepared sizes, equivalent to an increase of twenty to sixty cents per ton in average realization; (2) a reduction of ten to twenty per cent in the cost of explosives, equivalent to one and one-half to three cents per ton; and (3) a reduction of ten per cent in the footage of holes drilled, resulting in increased production per producer and increased earnings to the miners.

In gaseous mines, or under conditions where black powder cannot be used, tests indicate that marked economy will result from a determination of which of the high explosives is best suited for the work. However, in selecting a permissible explosive care should be taken to determine its stability and sensitiveness by storing it for a few months and then making tests of its sensitivity.

If the highest grade explosive, as indicated by these tests, does not successfully blast the coal, one of less bulk should be taken for each succeeding test until the bulkiest explosive that will satisfactorily blast the coal is determined. As far as practicable, the same placement of holes should be followed with each explosive. Under average conditions, dynamites containing a low percentage of nitro-glycerine should not be used for blasting coal. This is because of their great density which causes much greater degradation of the coal than do the bulky permissibles.

IN VIEW of the various conditions encountered in mining and, consequently, the large number of tests that would be necessary to successfully determine the best method of placing the holes, the most practical and economical procedure is to conduct a few tests on each of the factors which influence hole placement. These factors are: (1) Depth of hole; (2) width of burden at front and back; and (3) the relation of explosive charge to points of cleavage.

Each test of these factors should consist of a complete cut across the working place, keeping an accurate record of: (1) The amount of explosive; (2) number of feet of hole drilled; and (3) the weight and percentage of the various sizes of coal blasted.

A good, practical rule to follow as a basis in starting these tests is to make the width of the burden at the back of the hole equal to the distance between the charge of explosive and the most distant parting. For example, assume a six-foot seam of one blasting bench with a parting at both the top and bottom. The explosive charge would be three feet from the top and the width of burden should also be three feet. The depth of hole at the beginning of the tests should be about six feet.

Following this test, another should be made with a back burden of three and one-half feet and these tests con-

*Abstract of a paper entitled "Higher Yield of Domestic Sizes and Increased Realization Resulting From Proper Use of Explosives and Mining Practices in Anthracite Mining," presented at the Pottsville, Pa., meeting of the Engineers Society of Northeastern Pennsylvania, Oct. 29.

tinued, with six-inch increments, until the limit is reached—in each test increasing the amount of explosive in proportion to the increase in burden. When the limit of burden is determined, by using this figure and increasing the depth of hole six inches in each test until the limit of this factor is indicated, the depth and width would then be near these limits.

THE RELATION of the explosive charge to the points of cleavage can readily be determined by raising and lowering the elevation of the hole until the line of fracture ceases to be perpendicular to the top and bottom strata. The object is to so shoot the holes as to blast the maximum quantity of coal with the least amount of drilling and the minimum weight of explosive.

Some idea of the economies possible from work of this kind can be had from Table I which shows the results obtained at a mine in the anthracite region before and after the tests.

As the use of dynamite and permissibles in coal was eliminated, black powder was substituted. This change resulted in a reduction of $19,500 in the annual cost of explosives and a saving to the employees in their expenditure for powder of $6,950 per year—from $14 to $108 per man per year.

The improvement of six per cent in the yield of prepared sizes gave an increased realization of thirty cents per ton to the operator. The greater production per producer, the value of which has not been estimated, resulted in marked economies to both the operating company and the producer who thereby increased their earnings. In addition to the increased yield of prepared product (which also applies to the total yield), the quantity of refuse per car was greatly decreased. There also was a material increase in the weight of coal per car, this having been occasioned by increased topping.

The tests given in Table I were made in the Wyoming field of the anthracite region in comparatively flat, thin seams (from 30 to 54 deg.). In pitch mining in the Southern anthracite field, it must be realized that in many mines the coal is more friable. Consequently, it would be difficult to determine what could be accomplished through such work. However, in view of the results obtained in the Northern field, there is certainly something to be accomplished by correct drilling and the proper use of explosives.

It should be made clear that tests have shown that more can be accomplished, by investigations of the type previously described, in thin seams than in thick ones. This should appeal to the mine operator because of the fact that thin seams usually are more difficult and costly to mine and the yield of prepared sizes therefrom generally less. Under many conditions, proper mining practice and the correct use of explosives is the determining factor in the profitable mining of a seam. This is because in thin seams, three feet and less, the tendency is to drill an extremely deep and unbalanced hole and charge it with an excessive weight of explosive—as the coal in such seams is usually hard and the miner wants to make sure of his cut. As a consequence, although the burden is removed, the coal is badly shattered and the percentage of prepared sizes greatly reduced.

A NATURAL question is: "How do the miners like the idea of having someone come into their places to tell them how to mine coal or what kind of explosive they should use, when they have worked in the mines all their lives?" Without the co-operation of the miner it is, of course, practically impossible successfully to carry on a campaign of the kind described. However, at most mines the producers are paid on a piece-work basis, being compensated for the number of tons or cars of coal loaded. If it can be demonstrated that they can accomplish more with the same or less labor and, at the same time, effect a saving in explosives, they at least should be willing to be shown how it can be done.

In undertaking work of this type, it must be realized that certain men will immediately oppose a change of any kind without consideration of its possible value to them—at the same time, they lose sight of the need for co-operation between themselves and their employer. It is, therefore, a class of work that must be diplomatically handled. My experience has been that the best way to attack the problem is to go into the mines, stay with a man while he performs his work in his own way and then help him in performing the same piece of work (which will involve a complete cut across the face) using the proper method and the correct explosive. By keeping a record of the cars of coal loaded, the quantity of powder consumed and the time required under each method, a few calculations at the completion of the test will conclusively show the miner the advantages of the improved methods.

Where jackhammers are used for drilling, it will be found that, as a general rule, explosives other than black powder have been employed. Even though conditions might warrant the use of black powder, there always has been the objection of being obliged to drill holes of larger diameter (2½ in.) for black powder than for the high explosives (1¾ in.).

IN INTRODUCING black powder, there will always be the objection, on the part of the miner, that it requires thorough tamping. Yet, for the best results, the permissible should also be tamped; too often, however, the miner overloads the hole to remove the burden and thereby avoids the need for such tamping. It can be proven to the miner, however, that he will be compensated, both by a decrease in the quantity of explosive required and the smaller amount of drilling necessary to produce an equal amount of coal for the tamping of black powder.

TABLE II—POWDER vs. DYNAMITE

	Pellet Powder	20% Dynamite	Saving
Explosive cost per car.....	$0.3712	$0.5167	$0.1455
Feet of hole per car.....	67½	89½	22 ft.
Time drilling, charging, tamping, etc..	3 hr. 35 min.	3 hr. 54 min.	19 min.

To obtain, as quickly as possible, the results detailed in this article, the tests should be conducted by someone who not only is familiar with the characteristics of explosives but who also has a fair knowledge of mining at the face. His duties should be to test the various explosives and direct the work of determining the best mining practice. With the wholehearted co-operation of the official family, and the adoption of the program here outlined, an improvement in operating results quickly should be realized.

TABLE I—RESULTS (PER TON) OF TESTING EXPLOSIVES

	Pounds of Explosive Ton			Percentage Prepared Coal	Saving in Cost of Explosive		Increase in Tons per Producer per Day
	Dyn.	Perm.	B. P.		To Co.	To Miner	
Before.....	0.065	0.368	0.629				
After.....	0.029	0.106	1.012				
Difference.....	0.036	0.262	0.383				
Change.....	—55%	—71%	+61%	+6%	+0.015	+0.013	+0.48

Research Aids

Timber Preservation

By A. M. Howald and H. P. Munger

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THE ISOLATED location of many coal mines, the low grade of timber used and the fluctuations of timber supply and demand have always made non-pressure impregnation an attractive possibility. While the open-tank method for applying wood preservatives is well established for small operations, its use has been limited largely to creosotes, particularly the more expensive high-boiling special preparations. The use of these special oils, if more than a superficial absorption and penetration is obtained, may defeat the reason for using open-tank equipment—economy.

Specific data on which to base open-tank treatments with inexpensive water-soluble preservatives have not been available. During 1927 as one part of a research program on wood preservation at the Mellon Institute, an investigation of open-tank treatment with zinc chloride was made. This work, supported by the Grasselli Chemical Company, Cleveland, Ohio, has been in progress on different phases of wood preservation since April 1, 1923. Although pressure-impregnated timber, where it can be obtained from a commercial treating plant or where a group of advantageously situated mines can maintain a central pressure plant, is to be given first consideration, it is believed that the results of this investigation fill a distinct need in the industry. In the bituminous districts there are numerous isolated mines having a daily output of from 1,000 to 7,000 tons where the use of water-soluble preservatives by open-tank methods can effect real economies.

The Hillman Coal and Coke Company, Pittsburgh, Pa., co-operated in experiments which were carried out

A. M. Howald

at the Edna No. 1 mine near Adamsburg, Pa. Labor and timber, as well as the treating equipment consisting of two concrete tanks, 3 ft. wide, 2 ft. deep and 12 and 13 ft. long, respectively, were supplied by this company. All treatments were made under the supervision of one or both of the authors.

ALTHOUGH research was limited to 2 to 5 per cent solutions of zinc chloride in water—a standard inexpensive wood preservative since the inception of timber treating in the United States—and to comparisons with creosote, it is unquestionably safe to apply the general method of application evolved to any water-soluble preservative.

Experiments over a period of about two months were sufficient to furnish specifications for treatments leading to good penetration and absorption of preservative. It is not believed that a detailed account of the operations carried out would be of value to the mine operator. Therefore, this article will be limited to a presentation of the results obtained, to cost data and to a description of suitable treating equipment.

It was found, when zinc chloride solution is used as the preservative, that the more usual two-tank process using one tank hot, the other cold, offers no advantages over a one-tank hot and cold process. On the other hand, a one-tank method has the advantages of lower equipment and handling costs.

Desirable conditions for treating common bituminous coal mine wood species by the one-tank hot and cold process were determined. These data are presented in Table I, which also summarizes other necessary general information such as seasoning requirements for the different wood species, absorptions of solution to be expected, etc. Seasoned chestnut, maple, gum, birch, cherry and other less common wood species used in bituminous coal mines were not avail-

TABLE I—TREATMENT DATA FOR DIFFERENT WOOD SPECIES USING ONE OPEN TANK BY THE HOT AND COLD PROCESS

Species of Wood	Recommended Time for Seasoning Months	Recommended Strength of Zinc Chloride Solution Per Cent	Time During Which to Keep Tank Hot Hours	Time During Which to Let Tank Cool Hours	Total Time Hours	Absorption of Solution to Be Expected per Cu. Ft. of Timber Lb.	Recommended Absorption of Dry Zinc Chloride per Cu. Ft. of Timber (Average) Lb.
Red oak.....	10 to 12	2.5 to 5.0	10	14	24	15 to 25	0.5 to 1.2
White oak....	10 to 18	4.5 to 5.5	18	30	48	4 to 12	0.3 to 0.6
Southern pine	4 to 8	2.0 to 4.0	10	14	24	10 to 35	0.5 to 1.5

H. P. Munger

able for the open-tank treating tests. It is, however, reasonable to conclude that none of these would require a longer time for treatment than does white oak, and that most of them could be prepared in the same time and solution as red oak.

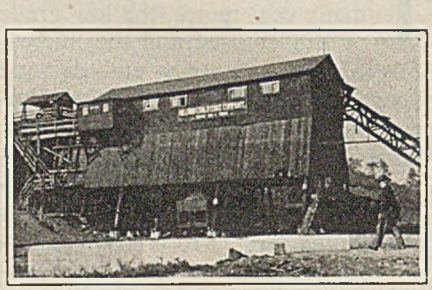
The solution strength is varied to give a desirable absorption of dry salt with the maximum feasible absorption of solution. Due to the high percentage of untreatable heartwood in such species as white oak, the practicable average absorption of dry salt is low even with a 5.5 per cent solution. Treating procedures can be materially simplified by standardizing on a solution of constant strength (3 to 4 per cent) and treating all woods to saturation. Such standardization may be justified by the fact that non-durable species should, and usually do, receive a maximum treatment because they easily can be treated and have a high percentage of sap-wood.

In addition to the specifications given in Table I, certain general requirements must be met. These are based partly on conclusions from experimental work but principally on general wood preservation experience: (1) It is impracticable to treat green or unseasoned timber by open-tank methods. The general experience of wood-preservation engineers is such that this statement may be extended to pressure processes and to all preservatives practically without exception; (2) peeling of the timbers to be treated is essential. To facilitate seasoning and to minimize decay before treatment, this is preferably done in the woods; (3) common wood species used in the bituminous coal regions can be satisfactorily treated with zinc chloride by the open-tank process. A time cycle of 24 hours in most cases, and up to 48 hours for white oak, is necessary. With an open-tank plant of appropriate size and design a long treating cycle is not disadvantageous. Labor per charge is a fixed quantity regardless of the time of treatment, and the overhead on an open-tank plant is small. Some cross-sections of timber are shown in an accompanying photograph which illustrate good penetration and absorption in pine, red oak and white oak obtained by open-tank treatments.

REALIZING that engineering considerations are of great importance in the application of experimental data, consideration was next given to this phase of open-tank treatment. Statistics on coal production and timber consumption were obtained from several large companies in western Pennsylvania. These figures have been made the basis for determining suitable capacities of equipment for applying experimental treating data.

On an average, it was found that approximately 0.05 cu.ft. of timber, of such quality and in such positions of permanence that it should be treated, is used per ton of coal mined. Although this is only about one-sixth of the total timber consumed per ton of coal produced, in value it represents (as higher class material such as mine and surface ties, timber used in the construction of ventilating systems, etc.) considerably more than that proportion.

On the basis of 0.05 cu.ft. of treatable timber per ton of coal mined, two open-tank plants have been designed. The smaller plant *A*, with a capacity of 225 cu.ft. of timber per



Where Tests Were Made

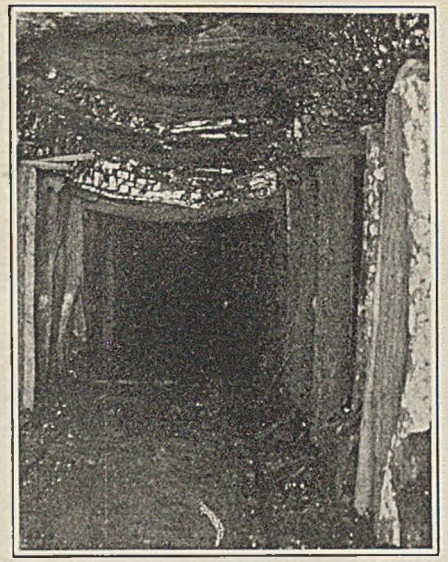
charge, is suitable for bituminous mines having a daily capacity of from 1,000 to 4,000 tons. To meet the requirements of bituminous mines producing from 3,000 to 7,000 tons of coal per day, the larger plant *B* has a capacity of 420 cu.ft. per charge.

The equipment in each case consists of a few simple units and accessories. These are: (1) A steel tank in which to submerge timbers in the zinc chloride solution. The tank is braced with steel angles and beams to be self-sustaining and is equipped with steam coils; (2) an auxiliary round storage tank for excess preservative solution; (3) a set of six steel cages for handling charges of timber. Depending on the length of the timber being treated, two or three cages are required per charge; (4) a chain hoist with overhead track for lifting and submerging the timber cages; and (5) platform scales for weighing the cages of timber.

SPECIFICATIONS and costs of each unit are given in Table II. The prices for plant *A* are based on actual bids, those for plant *B* are estimated. These figures are based on the use of all new construction and may be materially reduced where storage

TABLE II—SIZES AND COSTS OF EQUIPMENT FOR OPEN-TANK PLANTS

Equipment: Main Units	Sizes		Costs		Remarks
	Plant A	Plant B	Plant A	Plant B	
Treating tank—sheet steel reinforced	20' x 4'6" x 5' deep	20' x 7' x 6' deep	$185.00	$325.00	Braced with I-beams
Steel storage tank	Cylindrical 10' x 5'	16' x 5'	70.00	160.00	Mounted horizontally
Steel timber cages—set of 6	3'9" x 5' x 4' high	6'3" x 5' x 5' high	125.00	250.00	
Chain hoist	5 ton	10 ton	454.20	708.40	Yale twin-hook
Platform scales	6 ton	12 ton	187.60	270.00	
Accessory Units					
I-beam overhead track	80' track of 15" I-beam	.....	112.00	112.00	
Steam ejector for handling preservative	2" ejector	.....	22.40	22.40	
Pipe valves and fittings	.....	.....	96.75	200.00	
Timber to build drip pan, support I-beam track, and log and cover treating tank	700 b.ft. at $40 per 1,000	.....	28.00	45.00	
Sump for dissolving and mixing zinc chloride	200 gal. wood tub	300 gal. wood tub	11.00	16.50	
Erection cost and miscellaneous materials	.....	.....	550.00	800.00	Will vary widely with local conditions
Total			$1,841.95	$2,909.30	



Fungus Growth on Untreated Timbers

tanks, mixing sumps, etc., can be constructed of used material at the mine.

The operation of open-tank plants of the type described is simple and, with most wood species, permits the treatment of one charge in 24 hours. On this time basis, the operation (in outline) consists of the following steps: (1) A charge of timber is submerged in the treating tank containing zinc chloride solution at 190 to 210 deg. F. It is necessary to remove sufficient solution from the treating tank to permit the charge of timber to rest on the bottom and allow placing of cross bars to hold it down; (2) solution to cover the timber is then permitted to flow back from the storage tank; the treating tank is covered and kept at 200 to 210 deg. F. for from 9 to 12 hours; (3) the heat is shut off and the bath is allowed to cool for the remainder of the 24 hours; and (4) the timber is removed, after which the bath is reheated and made ready for another charge.

In the operation of pressure-treating plants using zinc chloride, the strength of solution is controlled by hydrometer readings and chemical analyses. Although the cost of such control for an open-tank plant is not prohibitive, it adds unnecessary complications. The following simplified procedure is recommended.

Treatments of one class of timber will generally continue for from one week to a month or more. At the beginning of such a series of treatments the concentration of the bath is brought, by means of hydrometer readings, to the approximate concentration (± within ten per cent) required to give the desired absorption of dry salt with the total solution absorption expected. Treatment is then started and after each charge sufficient dry zinc chloride, or a concentrated solution thereof, to treat the succeeding charge is added. If, subsequently, the total amount of solution is kept nearly constant by the addition of water as required (steam condensate may be used), the concentration of zinc chloride in the bath automatically will be controlled with an accuracy sufficient for practical purposes. With the additional control of weights on some or all of the cages of timber before and after treatment, an adequate check of the absorption of solution and dry zinc chloride can be obtained.

AN ESTIMATE is given, in Table III, of the cost per cubic foot of timber of a thorough zinc chloride treatment. A bituminous coal mine having a daily capacity of 3,000 tons is assumed and the estimate is based on open-tank plant *A*. With this plant 200 charges of 225 cu.ft. each will be treated annually. One man is allowed for operating the plant, exclusive of handling the timber, during the hot period. The labor cost for handling timber is based on costs for similar operations supplied by mine operators. Steam cost is based on the use of a small (40-hp.) boiler with 6 per cent interest on investment in the boiler, and coal at $3.50 per short ton. Where steam is obtainable from a central power plant this item will be greatly reduced. Although the standard treatment with zinc chloride requires only 0.5 lb. per cu.ft., a greater amount has been shown to be valuable under severe conditions. The additional cost is slight and is insurance of adequate life.

To calculate the annual savings that will accrue from treated timber with the costs given in Table III, assumptions are necessary as to the life of untreated timber in mines (3 years), the life of zinc chloride treated timber (12 years), the cost of untreated timber ($0.35 per cu.ft.), the cost of installing timber ($0.40 per cu.ft.) and a compound interest rate (6 per cent). The cost of installation as assumed is based one-fourth on original cost and three-fourths on cost of replacement.

From the data given, it can be calculated by use of the customary formula

$$A = Pr + \frac{Pr}{(1+r)^n - 1},$$

where P is the initial cost, n the average life of the timber in years and

TABLE III—COST OF OPEN-TANK ZINC CHLORIDE TREATMENT PER CUBIC FOOT OF TIMBER

Basis of Cost Calculations	Cost per Cu.Ft. of Timber Treated
Depreciation of plant, 15 per cent annually.	$0.00666
Interest on investment, 6 per cent annually.	.00267
Labor for operating plant. One-man shift per charge of timber at $7.50	.03333
Labor for handling timber. Unloading and piling for seasoning, loading for treatment, weighing and piling after treatment	.03480
Steam for heating, treating and storage tanks	.01075
Interest on timber in storage for seasoning. Timber at $0.35 per cubic foot seasoned 12 mos. Interest 6 per cent	.02100
Preservative, 0.75 lb. zinc chloride at $0.075 per lb. (freight included)	.05625
Total	$0.16546

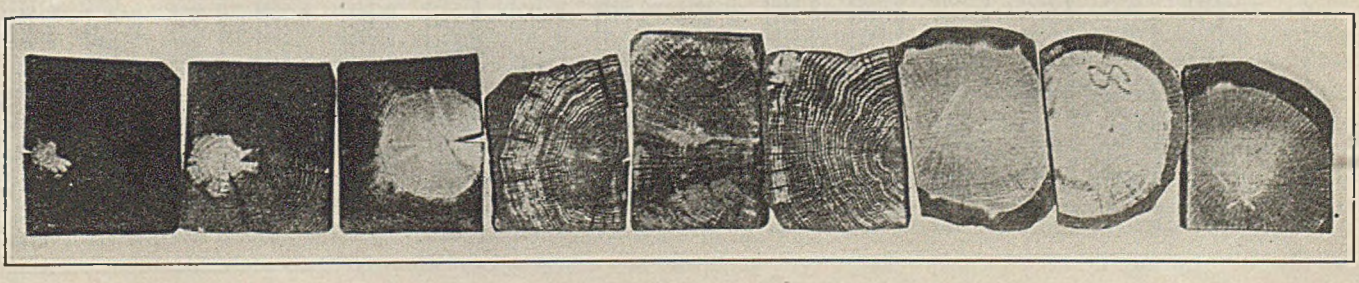
r the rate of interest expressed decimally, that the annual cost of maintaining one cubic foot of untreated timber and one cubic foot of treated timber is $0.2806 and $0.1093, respectively, or a saving of $0.1713 annually for each cubic foot of treated timber maintained.

It will be noted in the formula

$$A = Pr + \frac{Pr}{(1+r)^n - 1}$$

that A, the annual cost, is made up of two additive terms: Pr which cor-

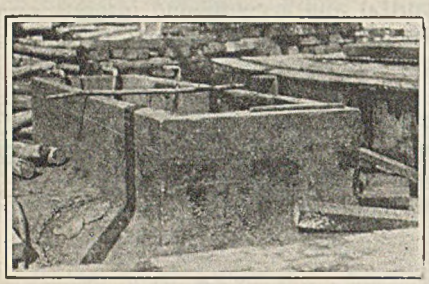
Showing Penetration of Zinc Chloride in Pine, Red Oak and White Oak After Open-Tank Treatment



responds to the simple annual interest on the money invested and

$$\frac{Pr}{(1+r)^n - 1}$$

which is a sinking fund equation and whose solution in this case is the annual installment which, at compound interest, would equal the initial investment in timber at the end of its average life period. The



Treatment Tank at Edna No. 1 Mine

formula should not be used for cost calculations without due consideration of the fact that it assumes continued replacement of timber—i.e., infinite life for the installation, making replacements at the end of each average life period. As the life of the installation becomes a large multiple of the average life of the timber, the above formula becomes an equitable basis for cost comparisons.

Mine timbers are most often used in installations which are not truly permanent but which will be abandoned when the workings are exhausted—for example, in from 5 to 30 years after the timber is installed. It is important to arrive at an estimate of the savings to be effected by timber treatment for such semi-permanent conditions.

Cost calculations for semi-permanent timbering have been brought to what is believed to be an equitable basis by the use of the formula

$$A = Pr + PR + \frac{Pr}{(1+r)^N - 1},$$

where A, P and r have the same significance as before, N is the life of the installation in years and R is the average percentage of timber replaced annually and expressed decimally. According to this formula, A, the annual cost, is made up of three additive terms: Pr or the simple annual interest on the amount invested; PR the cost of annual renewals without interest; and

$$\frac{Pr}{(1+r)^N - 1}$$

a sinking fund term to wipe out the debt at the end of the life of the timber installation.

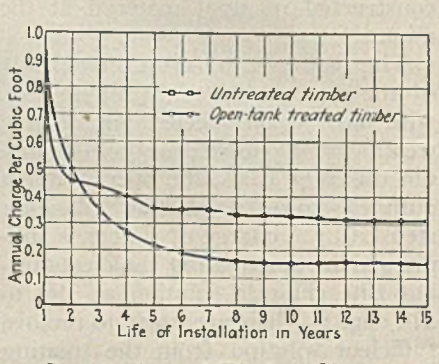
IF A LARGE number of timbers of known average life n are installed and maintained, the average number of renewals per year up to any time desired may be estimated by the mathematical application of the probability theory. Also, the U. S. Forest Products Laboratory has prepared an experimental curve (Committee Report, Proceedings American Wood Preservers Association, p. 161, 1927) showing the relationship between average life, years in service and percentage of renewals of a group of timbers. The curve is based on careful life records of 127,552 railway crossties and corresponds quite closely to the probability theory.

Using the experimental curve of renewals of the Forest Products Laboratory and the formula

$$A = Pr + PR + \frac{Pr}{(1+r)^N - 1},$$

Table IV has been prepared which shows the annual charge for each dollar invested in timber having an annual life of from 1 to 15 years, inclusive, when used in installations maintained for from 1 to 15 years after the timber is placed. It will be noted that the annual cost for timber, when the life of the installation is 15 years or longer, closely approximates the cost when the life of the installation is assumed to be infinite—i.e., for permanent installations.

Using Table IV, and the data previously given for the life of untreated bituminous mine timber (3 years), the life of zinc chloride treated timber (12 years), the cost of untreated timber installed ($0.75 per cu.ft.), the cost of open-tank treated timber installed ($0.916 per cu.ft.) and a life for the installation of 10 years, the annual charge for each cubic foot of untreated timber is 0.4333 × 0.75 or $0.325 and for treated timber 0.1692 × 0.916 or $0.155. This represents a saving of $0.170 for each cubic foot of open-tank treated timber maintained. If the life of the installation is 3 years, 15 years or is permanent, the annual savings per cubic foot of treated



Charts Annual Timber Charges

timber maintained are $0.089, $0.158 and $0.163, respectively.

The accompanying chart shows the annual charges, taken from Table IV, for untreated and for open-tank treated timber at the costs and average life values previously assumed, covering installations having a life of from 1 to 15 years. The curves cross at approximately 1⅓ years showing that if, under the conditions assumed, the installation is to be maintained longer than that length of time, treated timber is an economy.

TABLE IV—ANNUAL COST PER DOLLAR INVESTED IN TIMBER FOR TEMPORARY INSTALLATIONS WHEN THE AVERAGE LIFE OF THE TIMBER AND THE LIFE OF THE INSTALLATION ARE KNOWN

No. of Years Installation Is Maintained	Average Life of Timber in Years														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.6610	1.0900	1.0636	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
2	1.3504	0.8504	0.6034	0.5604	0.5504	0.5464	0.5454	0.5454	0.5454	0.5454	0.5454	0.5454	0.5454	0.5454	0.5454
3	1.2437	0.7373	0.5774	0.4434	0.3994	0.3841	0.3784	0.3764	0.3748	0.3741	0.3741	0.3741	0.3741	0.3741	0.3741
4	1.1951	0.6911	0.5366	0.4388	0.3611	0.3181	0.3031	0.2961	0.2926	0.2911	0.2901	0.2891	0.2888	0.2886	0.2886
5	1.1656	0.6596	0.4812	0.4238	0.3576	0.3026	0.2706	0.2546	0.2478	0.2434	0.2410	0.2398	0.2390	0.2384	0.2378
6	1.1284	0.6379	0.4700	0.3850	0.3504	0.3035	0.2634	0.2381	0.2230	0.2151	0.2111	0.2084	0.2056	0.2055	0.2051
7	1.1148	0.6248	0.4591	0.3648	0.3271	0.3010	0.2648	0.2348	0.2138	0.2005	0.1925	0.1877	0.1854	0.1834	0.1821
8	1.1047	0.6142	0.4441	0.3622	0.3055	0.2840	0.2635	0.2361	0.2111	0.1960	0.1835	0.1757	0.1710	0.1682	0.1662
9	1.0970	0.6061	0.4361	0.3563	0.2975	0.2680	0.2537	0.2247	0.2138	0.1947	0.1801	0.1701	0.1630	0.1581	0.1547
10	1.0909	0.6000	0.4319	0.3470	0.2960	0.2578	0.2402	0.2291	0.2139	0.1960	0.1799	0.1685	0.1589	0.1525	0.1477
11	1.0878	0.5943	0.4254	0.3396	0.2938	0.2541	0.2305	0.2190	0.2097	0.1962	0.1815	0.1679	0.1570	0.1510	0.1439
12	1.0828	0.5813	0.4203	0.3361	0.2883	0.2526	0.2245	0.2102	0.2015	0.1928	0.1818	0.1693	0.1580	0.1493	0.1426
13	1.0785	0.5782	0.4183	0.3350	0.2820	0.2518	0.2227	0.2038	0.1939	0.1874	0.1798	0.1700	0.1582	0.1499	0.1418
14	1.0761	0.5771	0.4148	0.3307	0.2781	0.2476	0.2219	0.2004	0.1883	0.1809	0.1751	0.1683	0.1604	0.1504	0.1426
15	1.0735	0.5750	0.4120	0.3272	0.2770	0.2437	0.2216	0.1997	0.1844	0.1757	0.1700	0.1650	0.1583	0.1510	0.1430
∞	1.0600	0.5600	0.3933	0.3100	0.2600	0.2266	0.2028	0.1850	0.1711	0.1600	0.1508	0.1434	0.1369	0.1314	0.1267

CO-OPERATION *Produces Results*

Robert M. Lambie
Chief, Department of Mines
West Virginia

Robert M. Lambie

FOR NEARLY two years the West Virginia Department of Mines has been engaged in an intensive campaign to decrease the number of preventable accidents in and about the mines. The reduction of avoidable accidents in mining is dependent in a major measure on the co-operation manifested between three groups: The mine management, those actually employed in the production of coal and the state department of mines. Failure of any one of the groups mentioned to function properly, weakens materially the efficiency of the others. For many years it has been accepted that the duty of the state is to protect its citizens by safeguarding their lives and health. The state mine department, state compensation department, state health department and state factory inspection have been developed and their activities multiplied and extended to accomplish this.

We do not believe that the men employed in mining in West Virginia are more prone to carelessness or recklessness than in other coal-producing states. We do recognize, however, that many of our problems are peculiar to the Appalachian coal field.

It is to bring to the men employed in the industry in West Virginia a realization of the dangers to which they are exposed, that the state department of mines is conducting a campaign of safety education. Coal mining, as has been said, is not a relatively unsafe occupation. It is just as hazardous as those engaged in the industry make it. Those who ignore the stop signals at city street intersections usually pay the penalty; so do those who refuse to obey recognized rules of conduct when working underground.

West Virginia has made progress in the reduction of fatal accidents as production increased. In the seven year period, 1906 to 1912, inclusive, there were 2,674 fatal accidents in this state with a production that aggregated 367,115,000 tons. In the next seven year period, 1913 to 1919, inclusive, there were 2,879 fatalities and a production of 564,937,000 tons. From 1920 to 1926, inclusive, the production amounted to 725,000,000 tons and the number of fatalities was 2,991.

These figures show that coal production nearly doubled, with almost no increase in fatal accidents. As the chief of the department during the past seven years I feel that I should state that I am not satisfied with the showing made, and shall not be satisfied until it is improved. It can be improved by the state department of mines exhibiting to both employers and employees its earnest desire to co-operate with them by providing reasonable rules and regulations for the government of the mines, and insisting that the management of mines enforce these rules.

Due to the foresight of pioneer railroad officials and operators, increased production has attracted to West Virginia miners from all parts of the world. These men must become acquainted with conditions of mining unlike those which are found in their native mines. Therefore, it is essential, in order to protect life and limb, that they be apprised of the hazards of their daily routine. It is no less important that the management advise them that non-conformity with safety rules and regulations will mean instant dismissal. Mine management cannot afford to be burdened with costs that accrue from failure of their employees to recognize safety rules; and employers are beginning to realize that avoidance of accidents prevents unnecessary economic ravages.

There has come to the department such an avalanche of approval from mine operators, mine management, and those employed in the mines, that success is assured through intelligent co-operation. Our initial efforts for mine safety and efficiency were aimed at the employers and those who served directly under them. We organized mining institutes that embraced everyone engaged in the coal industry in an official capacity, which meet monthly to discuss problems of safety and management.

We are getting our safety message to the man at the face through the medium of mine safety clubs. The membership of these clubs comprise the entire working force in the mines. Over 500 of these safety clubs have been organized at the 1,200 mines of the state. They meet semi-monthly and are addressed by safety workers, state safety directors, state mine inspectors and by men from outside organizations who are interested in safety work.

IN ADDITION to these institutes and clubs we are conducting a joint study of roof control between the United States Bureau of Mines and the West Virginia Department of Mines. Monthly meetings of representatives of the various operators' associations with the commissioner of compensation and the chief of the department of mines are held. We also teach first-aid to all employees in and about the mines and train and maintain mine rescue squads at central points throughout the coal producing areas. We co-operate fully with the Mining Extension Division of the Engineering Department of the University of West Virginia in their night mining classes and short course in mining. We support all activities of the United States Bureau of Mines which have for their purpose the betterment of mining conditions and the prevention of accidents. We also hold an annual state safety day.

Should COAL MAN and GAS MAN Be Partners?

By R. S. McBride

Assistant Editor
Chemical and Metallurgical Engineering
Washington, D. C.

IN ANY municipal area the distributors of coal, oil and gas should be friendly and not hostile interests if economy of operation and continuity of supply are to be assured. Seeing that they have interlocking purposes the coal producer, coal distributor and city gas man should put their feet under a common table. Everyday the reason for combined effort becomes more obvious for only by joint action can these industrial groups avail themselves of the latest and best in fuel-producing technology.

Together, therefore, they should undertake the regular and economical production of processed fuel for retail distribution. Such processed fuels would be coke, gas, tar and light oil (motor benzol). All these are products which can be efficiently made in any one of the modern types of coke oven and all have an important and proper place in a city fuel supply.

The place of gas for household and industry is too well recognized to require discussion. Some household uses have indeed today been developed almost to the point of saturation, but the industrial use of gas is just beginning; and as industry's requirements are met there will be increasing need for closer co-operation between the three important units in municipal fuel supply.

To realize the importance of the city gas problem, we need not look forward to the time described by some visionaries when all energy will be distributed through the city by pipe line or by electrical conductor. We need only visualize the problems of today or of the immediate future to realize that from three to thirty times as much gas can be sold in our great cities as at present. The substitution of coal gas for water gas is one prerequisite of success, and perhaps that is the change which is most worthy of detailed study.

Under typical city conditions today the price of gas per thousand cubic feet is made up of (1) manufacturing cost, (2) general and distribution expense, and (3) interest and depreciation on the plant and distribution system. For convenience let us assume a city where water gas is supplied and where the manufacturing cost is 40c. per M. cu.ft.; general and distribution expense, 30c.; and return upon the investment 30c., divided into one-third for plant investment and two-thirds for that of the distribution system.

If the water-gas plant is to be replaced by one for coal gas the investment at the works would be much higher. It might even be three times as great, at least for a time, because the old water-gas plant is doubtless carried at some value, however, greatly depreciated, whereas the new coal-gas ovens would have to be entered upon the books at the full present high construction cost. This would mean three times as much money tied up and three times the capital charge for plant, or 20c. more per M. cu.ft. of gas produced than under the former condition.

OBVIOUSLY such change to a new property could be justified only if the operating expenses could be correspondingly decreased or other large advantage gained. As a matter of fact, it would not be unusual for the net cost of manufacture of the coal gas to be 20c. less than for water gas, especially if the market for the byproducts and the coke were favorable. Under such changed conditions one would then find the result 20c. for manufacturing cost, 30c. for general and distribution expenses and 50c. for capital expense. The total would be the same as before, and the price of the gas could be the same.

IF THE CHANGE were as simple as above indicated there are many cities now receiving water gas which would long ago have changed to coal gas. In fact, a doubt whether decreased operating cost would offset increased capital charges and a recognition of the fact that coal-gas systems in the past have not been sufficiently flexible in output so that alone they could satisfy the entire needs of a city with its wide variations in gas demand have limited progress. A water-gas plant can be started or shut down on a few hours' notice, going from no output to full capacity with little difficulty and no complication or danger to the apparatus itself. The coal-gas generating equipment, on the other hand, must be operated over long periods at a nearly uniform rate, both because the investment is too high to permit it to be idle and because the refractory equipment will be damaged whenever it is cooled or heated.

Within the past few years a new system for handling ovens making coal gas has been developed which permits one to change the gas output from full down to half or two-thirds capacity within a short time. The drop from 100- to 65-per cent capacity can be made within 30 min., without fear of damaging the plant. This newer type of equipment attains this flexibility by a double heating system. Either a part of the oven gas or a supply of producer or blue water gas, made in separate machines, can be used to heat the ovens.

When there is a big demand for city gas, all the oven gas is sold. When the demand is low, about one-third of this gas is retained to heat the ovens, and no fuel gas need be made. A complete change can be made from one extreme to the other within a

short time, or the management may stop at any intermediate point dictated by the demand for gas.

THIS VARIATION in output according to the wishes of the management gives also another indirect advantage. It permits a substantial variation in the ratio between the production of coke and the production of gas. In some cities all the coke which is made can be sold at a profitable figure for household fuel. In other cities there is relatively little demand for this coke, and it is difficult to dispose of it at a suitable price. According to prevailing conditions or the local circumstances, therefore, it is important to be able to get such a proportion of gas for a given quantity of coke as will best satisfy the needs of the community.

Every oven makes some coke smaller than nut or furnace size and consequently of lower value and the sale of this coke is often a serious problem to the gas-works management. But this difficulty can also be eliminated by the double heating system, for the fine coke is used in such a plant for making the fuel gas in either a gas producer or a blue-gas generator. For these purposes it is an entirely suitable and efficient fuel. The plant properly equipped is, therefore, freed from the problem of finding a market for the fine coke.

There seem to be no limits to the market for gas, assuming the cost to be low and the price schedules right, or for those light oils which can be used in motor benzol for blending with gasoline. There are, on the other hand, distinct limits at present upon the requirements for tar and coke, which are the other two principal products of coking.

SOME HAVE IMAGINED that if the supplies of coal tar increase the output of the tar refinery, which makes creosote oil, road tar, roofing pitch and like products, must be increased also. Such an assumption puts a needless limitation upon progress. We need not assume that the extra tar made in such a coking plant would be refined at all. Even today more than half the coal tar manufactured in the United States is burned for boiler fuel or for a similar heating purpose. If another hundred million gallons is manufactured, there is no reason why it, too, should not be so used.

As the supplies of lighter fuel oil become less, because this oil is cracked into gasoline at the petroleum refinery, a new and larger market is opening for coal tar in industrial heating or boiler firing. Coal tar can be efficiently used in this manner and with practically all of the advantages of oil. It has a high evaporative efficiency; boiler-room labor with tar is no greater than with heavy oil and, with properly designed burners, it can be substituted as a fuel in an oil-fired boiler plant much more readily than any form of coal.

Actually, therefore, we need have no fear of tar surplus. The only question will be as to the price which it will command as a substitute for oil. This price probably will be determined, not by the price of oil nor by the price of lump coal, but by the price of powdered coal, which is really its most direct competitor.

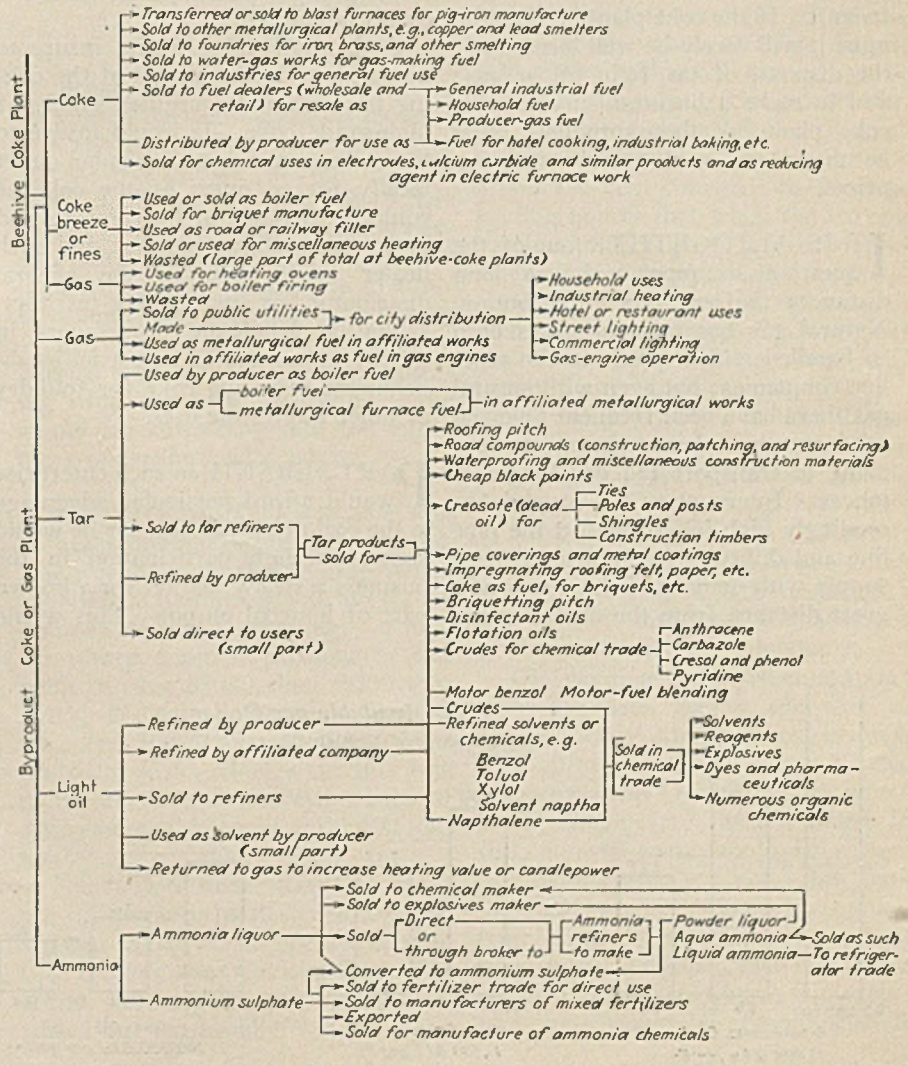
THE PROBLEM of finding a market for the coke is somewhat more difficult. It affords an almost ideal substitute for anthracite where this fuel has previously been much used. But in areas where bituminous coal has been the customary household fuel, the higher cost of coke per ton is a decided handicap. Fortunately, if there be a partnership between the gas man, coal producer, and coal distributor, it will not be difficult to judge the prospective coke markets, both industrial and household, and to plan the extent and the system of coking operations correspondingly. Moreover, as modern technology makes it possible to produce almost any desired ratio of coke and gas, the plant operations can be varied so as to meet the expanding coke market.

The development of a market for household coke will be the real task to be accomplished. The first consideration in solving this problem will be to select a coal containing a low percentage of ash and that fusible only at a high temperature. The next consideration should be the choice of coking procedure in order that the coke shall be as dense as possible, reasonably free-burning and otherwise well suited to household heating use.

A coke made from such coal by proper procedure must, of course, be

Where Coke-Oven Products Go

(Adapted from U. S. Bureau of Mines)



carefully sized so that the customer will get material suited to his needs and free from fines or dust. But even with all these precautions it is often necessary to start a campaign for the education of the individual coke user. The technique of furnace operation with coke is quite different from that with any other solid fuel. When understood the operation involves no difficulties; but until the technique is learned only dissatisfaction is likely to result with new coke customers.

LARGE coal-processing plants located at the mine mouth have often been proposed as one solution of our national fuel problem. Such a location is, however, for several reasons highly undesirable. It is vastly better to place the coking plant at a point near the center of consumption of its products. This means that the plants must be placed either near a city or, when serving a metallurgical industry, near the blast or steel furnaces which will use the coke, gas and tar. The movement of the coal from mine to centers of consumption of coal products costs much less than would the movement of the products made from it. If the coke plant be near the mine it will rarely be well located for the disposal of tar, light oil or gas; and to make a business success of a coke plant, all these products must be made and sold at advantageous prices.

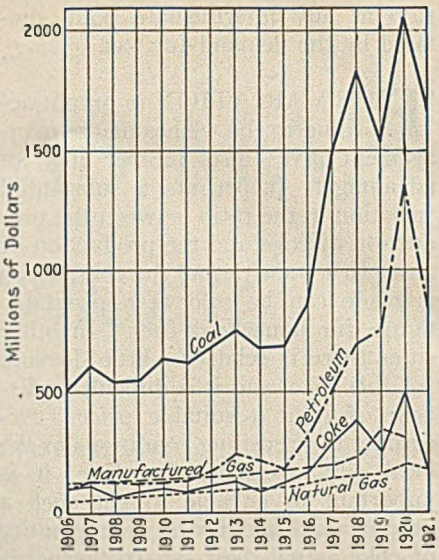
IT IS ALTOGETHER out of the question to pipe coal gas long distances before city distribution. Natural gas has in some cases been so handled with a profit to the pipeline companies; but even with natural gas there have been frequent financial misfortunes when attempts were made to transport the gas long distances. Interruption of supply, exceedingly high investment in the pipe line and difficulty in co-ordination of supply with demand if the one is at a great distance from the other are but the more obvious of the complications and objections. All of these factors and many others, including availability of labor, point to the advantage in placing of coke works in or near to a large municipality.

At such municipal location, the coking business ties in well with that of the public-utility company which distributes gas throughout the city and with the fuel business of the retail coal dealers. When so located the coke company or affiliated dealer can market the tar by tank wagons to such customers as are commonly supplied with fuel oil in similar fashion. And, it would rarely be difficult to find a local oil man who would use the output of motor benzol as one of the constituents of his blended automobile fuel, if he could be assured of continuous supply at a fair price.

Such a concern operated jointly by the interested groups should not itself go into the public-utility business. The public utility would, though partner in the enterprise, be only one of the customers so far as product sales are concerned. In like manner the local fuel dealer should be both partner in the enterprise and purchaser of the coke.

Such relationship would insure to him a share in the profits of the coking business and a regular supply of high-grade coke. It would insure to the coking enterprise a regular outlet locally for so much of the coke as could be disposed of by vigorous and up-to-date selling methods; and such dealer might also be the general distributor for surrounding territory, selling at wholesale to retailers in nearby towns and to industrial establishments requiring coke for foundry or other large-scale uses.

PARTNERSHIP in such enterprise would afford particular advantage to the coal producer also, for he would secure through participation in the business a steady market for a known part of his coal output. This would stabilize employment at his mine and go a long way toward solving operating difficulties. His participation in the coking enterprise as partner would insure that he would furnish a first-class coal supply at the lowest price possible.



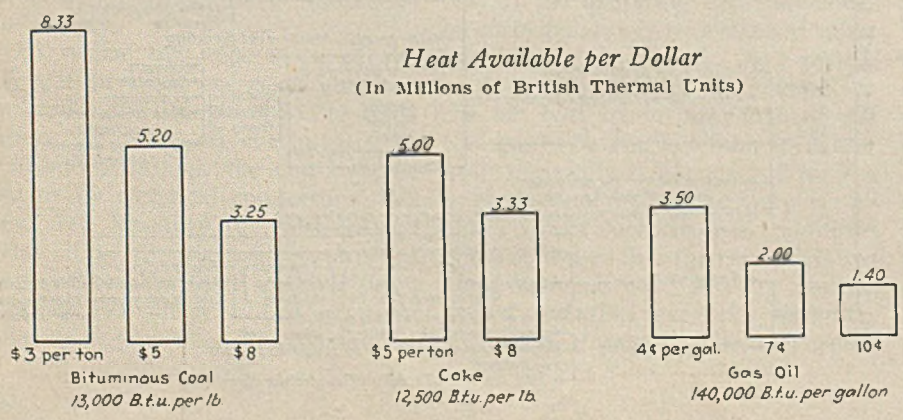
What Our Fuels Are Costing

IT MIGHT also be possible to secure the financial participation of some petroleum concern with country-wide interest, in order to afford at all points prompt market for the motor benzol and the tar. On the other hand, there is no reason why each local division should not manage such affairs with local petroleum blenders or local distributors of fuel oil.

At any point where two-thirds of a ton of coke will sell, f.o.b., plant, for as much money as a ton of coking coal would cost, other conditions also are likely to be favorable. It is probably the exceptional situation where the income obtainable from gas, tar, light oil and ammonia will not be ample to pay operating expenses and a splendid return upon the investment in plant and working capital.

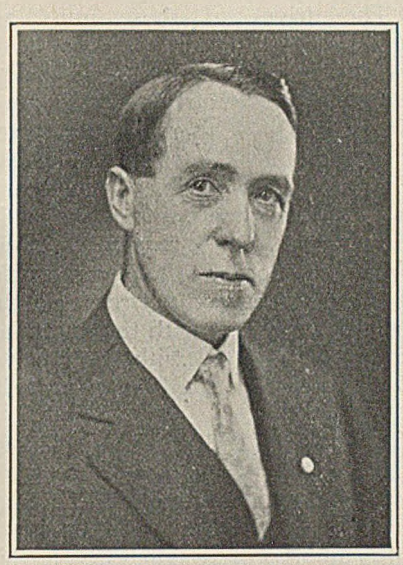
TO START such a business on a large scale will require many millions of dollars. It is not a task to be undertaken lightly, nor one which can be abandoned without financial disaster when once under way. But apparently the time is now ripe for such a partnership and co-operative effort. There is no doubt of the community of interest among those who should handle these fuels and furnish the raw material for their making. The only question is, Will it pay? If not, a start should not be made; but wherever it will, the start should be made *now*.

Heat Available per Dollar
(In Millions of British Thermal Units)



RIDING COAL ON RUBBER*

By E. C. Auld
Assistant Chief Engineer
H. C. Frick Coke Co.
Pittsburgh, Pa.



E. C. Auld

SO SUCCESSFUL was the 22,930-ft. conveyor belt line at the Colonial mine of the H. C. Frick Coke Co. that when it became necessary a little over a year ago to make preparations for a further increase in river tonnage, no question was raised as to the methods of transportation to be adopted. The inland mines at Filbert, Footedale and Buffington were selected to supply this coal. They are being consolidated with Lambert, Ralph and Palmer which are already delivering coal to the river through the Palmer shaft. Together they will provide an output of 12,500 tons a day at a new river loading plant to be known as Palmer Dock.

The present Palmer river-loading plant will be abandoned, the coal now being loaded there being handled over the new system which will be similar to that at Colonial Dock. Though designed for a much larger tonnage, the Palmer conveyor line is not as long as the Colonial system. Its total length is 15,398 ft. and the total lift 522 ft.

All the mines in this group are being supplied with 71-bu. wagons of solid type which are furnished with roller bearings. The main underground dump, which is electrically operated, is designed to handle a trip of thirty of these wagons at a time. One dumper will discharge 10,000 tons a day, whereas at Colonial Dock two are so employed. As soon as a trip from any mine gets a "clear light" it enters the dump, pushing out the empty trip by which it is occupied. This empty trip then runs free down a grade to one track of a double track empty landing. As soon as the last car enters the dump, the snapper pushes a button signalling the motorman that his trip is clear. The motorman then uncouples his locomotive and enters the empty landing to get the trip he has just put there.

As soon as the locomotive has passed the switch heading to the parallel empty track, it throws a clear light for another loaded trip to enter the dump. The dumping cycle is only 19 sec. The empty trips alternate on parallel tracks. One can be entering while the other is leaving. The empty tracks leading into the mines cross under the loaded tracks.

FOR THE PALMER coal a separate dumping point is provided. The wagons in that mine have swivel couplings, permitting them to be dumped without uncoupling. A two-car rotary dump is provided at this point capable of handling 2,500 tons a day. The main conveyor is designed to carry 1,800 tons an hour from the point where it receives this coal to the river. All conveyors back of this point are designed for 1,400 tons hourly.

The feeders under the main dump are of a new type designed for this system. They are to operate as multiple feeders, as at Colonial Dock. The apron feeders at the latter plant rusted out too rapidly, for the water in the coal dripped through them continuously. The new feeder is simply a circular plate revolving horizontally beneath an opening in the bottom of the bin. The plate is solid and protects the gears beneath it from the water which the coal contains. It is the only part of the feeder that comes in contact with the coal, and it is designed for easy removal. A scraper just above the plate delivers the coal to the belt at any angle desired.

Two feeders of the same type are provided at the Palmer dump. One of these operates continuously and the other is arranged to operate whenever the load arriving on the belt allows additional tonnage to be added at this point. The motor driving this feeder is interlocked in such a manner with No. 6 motor (which drives the next conveyor back of the loading point) that when the current consumption drops to a certain predetermined point this feeder starts operation, doubling the tonnage of Palmer coal and keeping the five belts from this point to the river fully loaded at all times.

Storage is provided at both dumps to allow mine cars to be discharged promptly and returned to the working face. At the main dump 1,400 tons of storage capacity is provided and at Palmer 175 tons. To keep the belt system operating at rated capacity, a trip of mine cars must be discharged every 5 min. at the main dump.

The landing arrangements, however, are such that a trip can be dumped every 2 min., if coal is available. Starting with an empty bin and dumping a trip every 2 min., it would be 30 min. before the bin would be full, and 19 trips would have been handled meanwhile. Yet 5 min. later the dump would be ready for another trip. To get the desired tonnage, 84 trips must be dumped each day and if handled at the rate of one trip each 5 min., this would be accomplished in

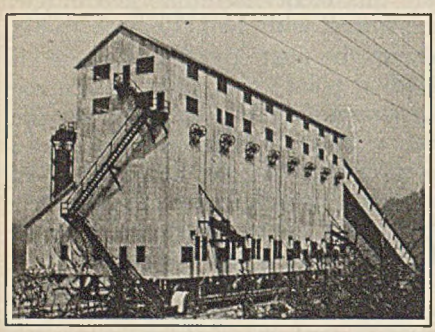
*Excerpt from a paper prepared for the Engineers' Society of Western Pennsylvania and presented at a combined meeting of that society with the Pittsburgh section of the American Institute of Mining & Metallurgical Engineers, Oct. 20.

7 hr. All the equipment has been designed to accomplish in that length of time, the task demanded, so that an hour can be lost any day without reducing the output.

THE RATIO OF STORAGE to output is twice as high at the main dump as at the Palmer dump, but the latter has a provision to double the rate of withdrawal from the bin whenever the feed from the main dump decreases sufficiently to allow the belts to carry the load. This makes the storage almost equally effective in the two instances.

The conveying system consists of twelve units. The manner of numbering these is the same as at Colonial Dock, the No. 1 unit being at the river and numbers running consecutively back to No. 11 under the main dump. No. 12 unit feeds the coal from the Palmer dump to No. 5 belt on the main line. It is designed to carry a regular load of 400 tons per hour, this being doubled whenever the main conveyor can take the additional tonnage. It is a 42-in. belt, operating at a speed of 500 ft. per minute and set at right angles to the main conveyor.

THE FIRST THREE units of the system will operate at a vertical angle of 17 deg. 21 min.



River Ipple From Shore

Conveyor No. 1 which is the only conveyor operating outside reaches from the slope mouth to the top of the river tipple. Nos. 2 and 3 are in the 651-ft. slope itself which extends from the surface to the coal seam.

There are only two horizontal angles on this system—one at the intersection of Nos. 3 and 4 conveyors and one at Nos. 1 and 2. The first five conveyors are 60 in. wide and designed to carry 1,800 tons per hour. Nos. 6 to 10 inclusive are 48 in. wide, and No. 11 which is located under the main dump is 60 in. wide. The latter operates at a speed of 350 ft. per minute, that lower speed being desirable because it is a feeding belt.

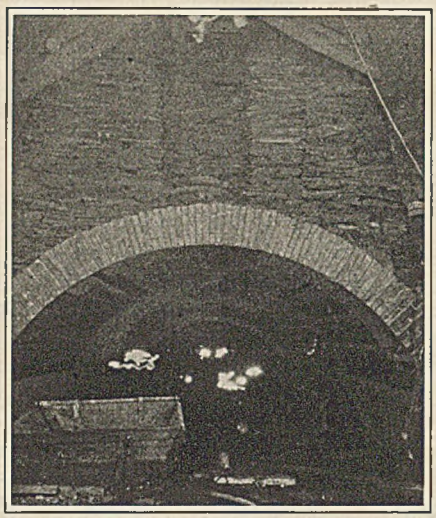
All units from No. 4 back are mechanically interlocked in the same manner as at Colonial Dock so as to prevent one unit coasting further than another when the power is shut off. This system is calculated to coast 40 ft. as the outcome of its own inertia. This coasting can be readily controlled by the mechanical interlock on all conveyors on the regular grade of the coal seam, but this could not be done on the slope units.

The drives of those units are equipped with flywheels, No. 3 being thereby provided with stored energy to carry it 50 ft.; No. 2, 60 ft.; and No. 1, 70 ft. This requires a stored energy of 500,000 ft. lb. on the No. 3 unit, 950,000 ft. lb. on the No. 2 unit and the same on the No. 1 unit. These three units require a 60-in. 9-ply belt in order to take care of the additional stresses, whereas all the rest of the system with the exception of No. 12 is fitted with 8-ply belts; No. 12 conveyor is a 42-in. 6-ply belt.

ONLY ONE RADICAL change has been made in this conveyor system as compared with the Colonial Dock system. This is in the head, tail, snub and drive pulleys. On this system all pulleys will be made with flat faces, crowns being entirely eliminated. It has been found at Colonial Dock that, with the crown-face pulleys, the strain on the center of the belt is so great that, in many cases, the outside of the belt does not even touch the driving pulley till the center is stretched so much that the strains are transferred to the edge of the belt. The troughing carriers will be expected to train the belts satisfactorily over the flat pulleys, as they have done at Colonial Mine since the pulleys were changed.

Two cleaning brushes are provided for each unit of the system, these brushes being driven by small individual motors. As the coal to be carried will be fairly wet a large quantity of small particles will probably have to be brushed off the belts just after they pass over the head pulley. To deliver this coal onto the tail end of the next unit these tail pulleys will be carried back under the head pulley a sufficient distance to allow this material to be deposited behind the ordinary load placed on the conveyor by the intersection chutes. This will eliminate the need to shovel up the material brushed off the belts as has always been necessary on the Colonial conveying system.

The extreme belt tension on the system will be on the No. 3 unit, where the stress will be 30 lb. per inch per ply. On the rest of the system it will average about 28 lb. In installing the belts on this system all but one splice will be vulcanized on each unit. As soon as the initial stretch is taken out of these belts, the



Roof Support of Belt Gallery

one mechanical splice in each will be replaced by a vulcanized joint making the belts endless.

From experience with the Colonial Dock conveying system it is demonstrated that belt conveyors are an economical means of transportation of coal over a long distance. In order that it may be economical, however, the tonnage must be large. Any system to operate over four miles underground should have a capacity of not less than 8,000 tons a day.

An underground conveyor system costs over twice as much to install as the total cost of all the equipment involved. Grading, heading protection and drainage are expensive in an installation of this kind and on a main-line conveyor it is not advisable to leave the stability of the roof open to question.

THE SYSTEM can be operated economically where the installation cost is not high enough to run the sinking-fund charge above 6c. per ton on the tonnage to be carried, the expression sinking fund meaning the charge which would return the money expended at the end of the estimated life of the plant. This, of course, depends on the system being so designed as to stand up under operating conditions so that repairs and maintenance are not too high. Belts can be expected to carry from eight to ten million tons, and all the other machinery should be readily maintained for at least 20 years.

10,000 Tests *Charted to Guide* PREPARATION

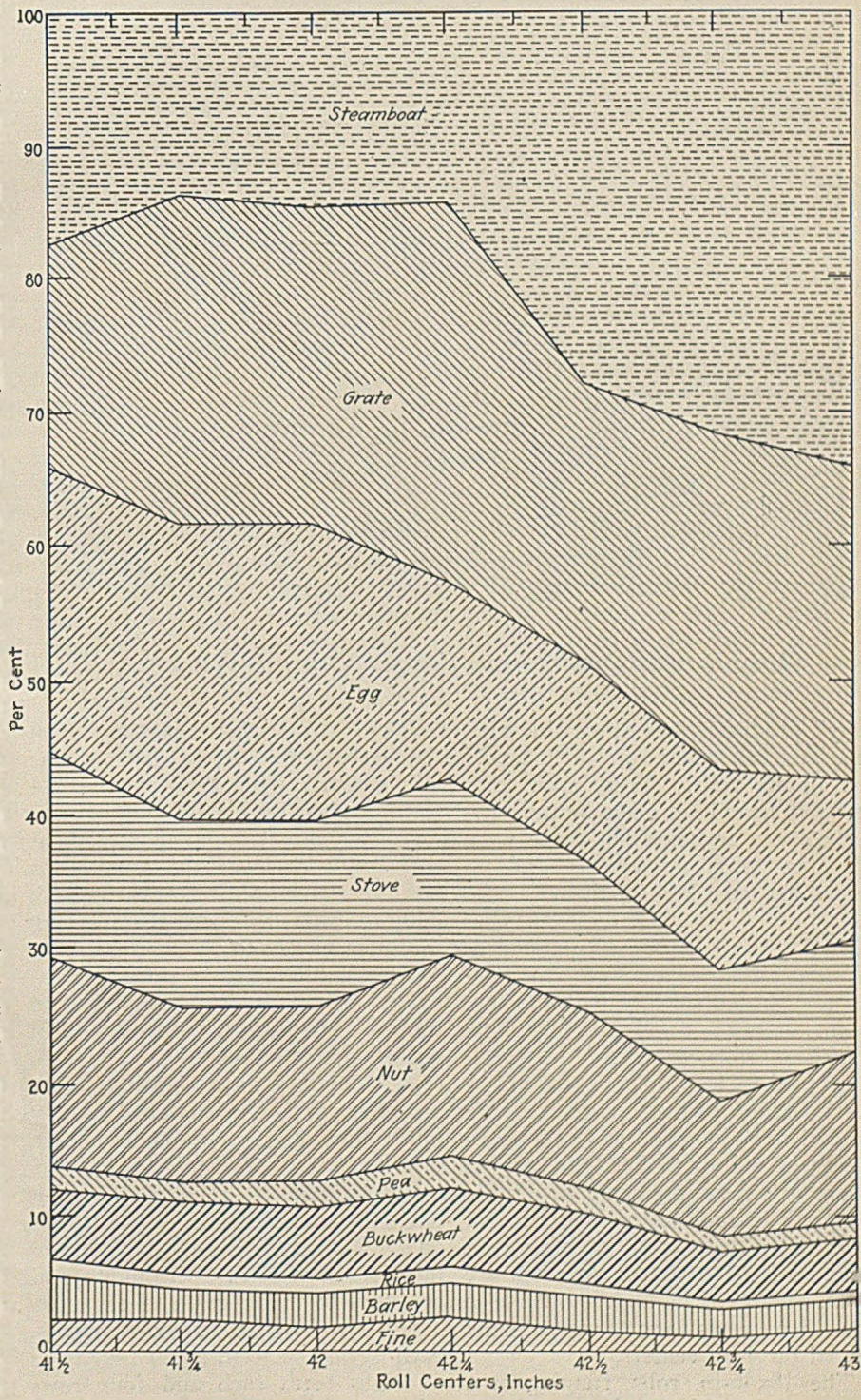
By Frank J. G. Duck
Assistant Editor, Coal Age
New York City

IN WEIGHING or considering all test data relating to anthracite crushing rolls, it must be borne in mind that many factors in addition to mining methods, preparation and loading, influence the yield of prepared sizes and also the final selection of roll size, and other details. The nature of the coal (hard, soft, friable, etc.), its cleavage and the yield of various sizes desired, affects the distance between the rolls, the shape and spacing of the teeth, etc. These factors must be given serious consideration and, as the quality of anthracite varies not only from region to region but also from seam to seam and even from different parts of the same seam, they individually should be determined for each breaker or colliery.

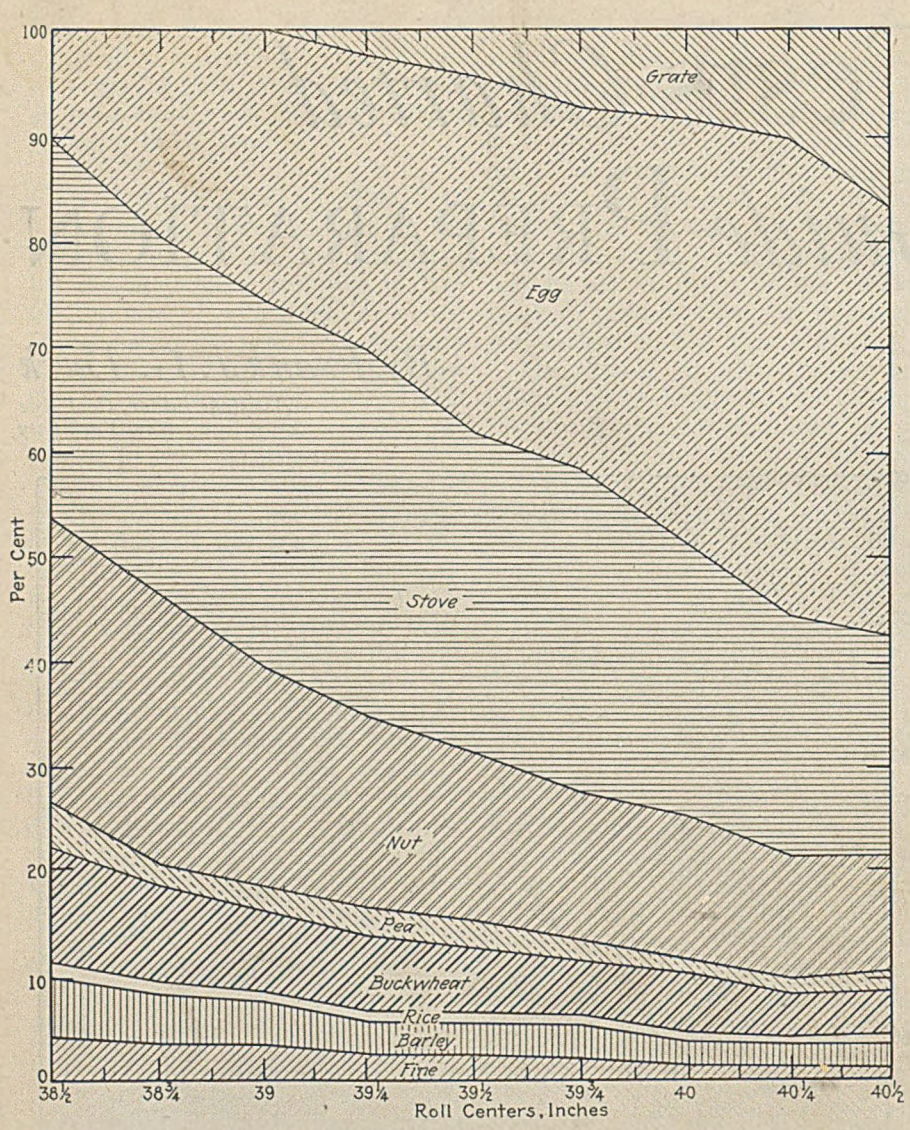
Previous articles (*Coal Age*, Vol. 32, No. 3, September, 1927, p. 146-8; Vol. 32, No. 4, October, 1927, p 201-2) have shown the improvements made in crushing-roll practice and design in recent years. This material, as well as that which follows, also should be of interest to the bituminous producer. The author is convinced that it is only a matter of time until the coal that now goes to the rockdump, with the slate and other impurities removed at the bituminous tipple, will be recovered. Seldom does this refuse contain less than 30 per cent of coal, and in some cases 80 per cent of the material thus discarded is good, salable fuel.

A PLANT equipped with crushing rolls and suitable means of recovering the coal freed from the refuse can be installed at small cost. Such an installation should be centrally located and all of the "rock" removed at several tipples transported to it for treatment. There is every reason to expect that the coal so reclaimed would pay for such a plant within a short time.

Not all companies test their rolls. Some operators hold that frequent periodic and careful analyses of the sizes produced in the crushing operation not only have no practical value or significance but also are a waste of time. One of the largest "com-



Variations in Yield of Different Sizes With Changes in Spacing of No. 1 Rolls



Shows Results Obtained From Various Settings of No. 2 Rolls

pany" producers has taken this attitude and has never run an "official" test of its rolls. True, such tests probably have been made by the various colliery foremen but these were for their own satisfaction and no record has been kept of them.

THIS COMPANY has standardized on three roll sizes (all having manganese steel segments): 60x60 in.; 48x46 in.; and 27x36 in. The 60x60-in. rolls are used to break lump coal to egg and are driven, by gears having 44 teeth, a pitch of $4\frac{5}{8}$ in. and a 10-in. face, at lineal tooth speeds of 360 or 372 ft. per minute. There are eight segments to a roll; 162 teeth in each segment—set in six rows of thirteen teeth each and six rows of fourteen each; the teeth are $1\frac{1}{2}$ in. square, $2\frac{7}{8}$ in. high and those in any two rows are longitudinally spaced on 4-in. centers.

The 48x46-in. rolls, running at a tooth speed of 330 lin. ft. per minute, break to three sizes depending upon the gears employed to drive them: When fitted with gears having 44 teeth, a pitch of $3\frac{15}{16}$ in. and an 8-in. face, they break lump to steamboat coal; with gears of the same pitch and face having 42 teeth, they break lump to grate; and with gears having the same pitch and face but carrying 41 teeth, they crush steamboat to stove. There are eight segments to the roll; 42 teeth per segment—set in six staggered rows of seven teeth each; the teeth have elliptical bases, $2\frac{1}{2}$x$1\frac{3}{4}$ in., are $3\frac{3}{4}$ in. high and, in any given row, are longitudinally set on 6-in. centers.

The 27x36-in. rolls, fitted with gears having 33 teeth, a 3-in. pitch and a 7-in. face, operate at a lineal tooth speed of 356 ft. per minute, and are used to break grate to egg coal. They are fitted with six segments, each having 68 teeth set in four rows of eight teeth each and four rows of nine each. The teeth are $1\frac{1}{2}$ in. square and $2\frac{3}{4}$ in. high, and are set on longitudinal centers of $3\frac{11}{16}$ in.

The rolls just described are giving entire satisfaction at all collieries of this company which has more than fifteen operations in the Northern anthracite field. The distance between roll shells is, of course, varied at each breaker to suit the physical characteristics of the coal.

In marked contrast to the attitude of the producer just mentioned, is the stand taken by another company operating about a dozen collieries in the same (Northern) field. This organization attaches so much value to crushing-roll analyses that it has charted the composite results (shown in the accompanying illustrations) of approximately 10,000 such tests—5,000 each on their No. 1 and No. 2 rolls.

They have standardized on 36x46-in. rolls and these are checked at least once a month. Three hundred pounds of lump coal are always used to test the No. 1 (or lump coal) rolls which break to steamboat and grate. The plain hawk-bill teeth of the No. 1 rolls are $2\frac{11}{16}$ in. square and $4\frac{1}{16}$ in. high. These are set in regular rows, eight teeth to a row; 22 teeth to a circle; sixteen teeth to a segment; and eleven segments per roll. The rolls operate with a lineal tooth speed of 346 ft. per minute.

The No. 2 (or grate and egg) rolls crush steamboat and grate to grate and egg coal. These are also tested with 300-lb. samples of grate coal and are fitted with plain hawk-bill teeth $1\frac{1}{2}$ in. square and $2\frac{1}{4}$ in. high. The teeth are set in staggered rows, fourteen teeth in a long row and thirteen in a short one. There are 44 teeth to a circle; 54 teeth to a segment; and eleven segments per roll. The tooth speed of the No. 2 rolls is 287 lin.ft. per minute.

THE CHARTS are self-explanatory and have demonstrated their value in many ways. It is only necessary to compare the results obtained from any periodic roll test with the composite graphs to determine whether or not the performance is up to standard; if it is desired to increase or decrease the yield of a given size a certain percentage—due to variations in the market demand—the approximate roll setting can be found by reference to the charts; or, knowing the market values of the various sizes, it is possible to determine (with the aid of the charts) those roll settings that will result in the maximum financial returns.

What the British Learned *in 1926*

STEEL arches in coal mines for the support of roads and steel props for use in working places are advocated by Henry Walker, chief inspector of mines in Great Britain, in his sixth annual report. He quotes J. Masterton, divisional inspector for Scotland, who says:

"In one of the largest Lothian collieries where some of the workings are at a depth of 2,500 ft. and all the working faces and roads are supported by steel, the only persons employed underground from May to November were a few oversmen who adjusted a prop here and there on the working faces.

"The miners, when they decided to resume work, walked into the colliery workings as into a factory, and the entire staff of 1,200 men underground was producing full output within three days, a feat never paralled in Britain, I should think, in a mine of such size and depth."

The same authority, Mr. Masterton, says in his report: "The first cost is greater than that of timber, but is repaid many times over in a year or two."

Mr. Masterton describes a non-fatal accident "of an unusual and alarming kind" which happened at Valleyfield Colliery, Fifeshire, when three stone miners and two bricklayers were burned. "The rockmen had given notice that they were going to leave because the work, which was in a hard sandstone, was too wet. They were on their last shift squaring up the place. They intended to erect their last steel arch close up to the face so that they would be paid to that point.

"THE last arch had already been erected by the faceman but it was not correctly set and to make room for its proper location one of the men took a pick and struck a blow at the rock at one side of the face. A bricklayer was watching him and seeing the sparks that flew from the pick he was about to cry to him to be careful when a second blow was struck and he observed that the gas was ignited by the sparks and saw the flame linger a moment, and then rush toward him. He dropped on the floor, but his left hand and the back of his vest were burned."

E. H. Fraser, senior inspector of the division, on making experiments with the stone miner's pick which had been used, found that sparks flew at nearly every blow. "Here," says Mr. Masterton, "is a case where an ignition appears to have been produced by a single blow of hardened pick steel on highly siliceous rock. The case is interesting, suggestive and disturbing."

At least two cases have occurred in Sterlingshire in the past 13 years where brushers have declared that they lit gas by striking rock with a pick. "For this reason the pick and samples of stone were sent to Dr. R. V. Wheeler at the Safety in Mines Research Board. As samples of the gas from the place where the accident happened contained 2 to 2½ per cent of ethane in addition to methane, a gas mixture corresponding to this was used for the experiment.

Reporting on the tests, Dr. Wheeler said that over one hundred trials were made in atmospheres containing varying percentages of methane. On each occasion small sparks were thrown a short distance. These were bright red, but they would not ignite natural gas containing 2½ per cent of ethane.

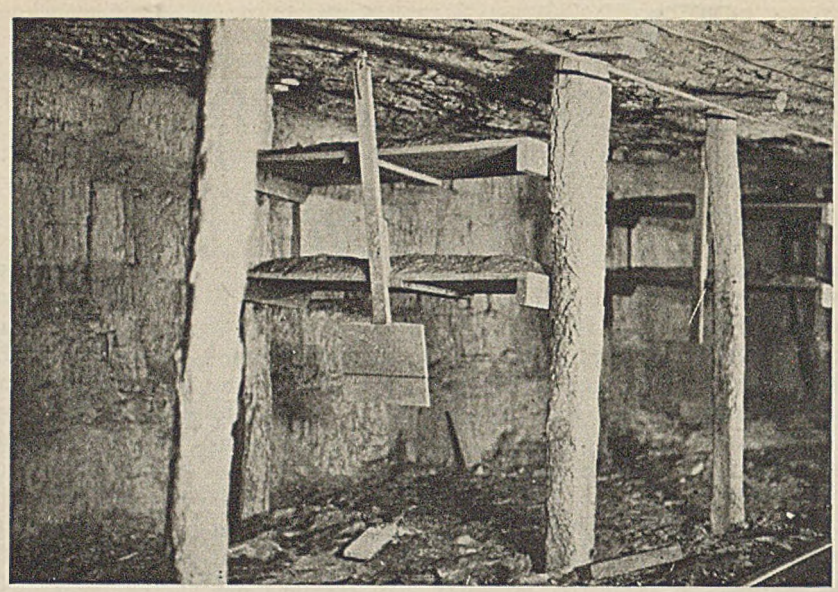
"FOR the purpose of carrying out the tests in an explosive atmosphere, the pick was clamped to a shaft in a large explosion chamber. It could be raised by means of a rope and lever actuated from a distance and on being released it was pulled by means of a strong spring against the rock clamped beneath it. The position of the clamp by which the rock was fastened could be so adjusted from the outside that the pick could be made to strike the rock at different points during the continuance of an experiment. Spring washers were used beneath the bolts which held the clamp. Consequently the rock gave a little on impact with the pick thus aiding in the simulation of a glancing blow."

In view of the heated debates as to the value of coal dust, it is interesting to note that last year in Great Britain, five persons were killed by five explosions of firedamp and that 55 were injured by 35 explosions. Evidently the inflammations were not spread by coal dust. Relative to one instance of an accident by burning in which the man walked to the shaft bottom and died seven days later, Mr. Masterton remarks that "no man who is unfortunate enough to be burned by an inflammation of gas, even though he may feel perfectly fit and well, should exert himself beyond responding to that natural tendency which it is probably wrong to resist; namely, to put a little distance between himself and the resulting afterdamp.

OUTPUT, PERSONS EMPLOYED AND DEATH-RATES AT MINES UNDER THE COAL MINES ACT, GREAT BRITAIN

	Persons Employed Above and Below Ground	Death Rated per 1,000 Employed— Explosions of Firedamp and Coal Dust[3]	Falls of Roof and Sides[3]	All Accidents[4]	Minerals Raised, Tons	Death Rate per 1,000,000 Tons of Mineral Raised
1873–1882[1]	503,428	0.65	1.12	2.24	152,221,629	7.42
1883–1892[1]	571,719	0.32	1.00	1.81	182,646,507	5.65
1893–1902[1]	732,391	0.18	0.76	1.39	215,790,835	4.70
903–1912[1]	957,848	0.17	0.74	1.33	267,730,134	4.76
913–1922[1]	1,091,391	0.10	0.71	1.15	251,454,646	4.92
1913	1,127,890	0.51	0.68	1.55	301,611,353	5.81
1914	1,133,746[2]	0.03	0.65	1.08	279,085,473	4.37
1915	953,642	0.05	0.89	1.36	264,497,263	4.90
1916	998,063	0.03	0.89	1.32	267,062,950	4.92
1917	1,021,340	0.02	0.89	1.34	260,120,059	5.27
1918	1,008,867	0.20	0.86	1.39	238,917,503	5.86
1919	1,191,313	0.03	0.62	0.94	239,600,939	4.67
1920	1,248,224	0.03	0.55	0.88	239,636,679	4.60
1921[5]	1,144,311	0.02	0.42	0.66	168,042,549	4.49
1922	1,162,754	0.08	0.59	0.95	255,971,696	4.32
1923	1,220,431	0.06	0.60	1.06	283,958,247	4.57
1924	1,230,284	0.03	0.62	0.98	275,301,859	4.36
1925	1,117,828	0.03	0.61	1.02	250,907,326	4.53
1926[6]	1,128,209	0.01	0.68	1.08	131,004,185	4.95

All figures prior to year 1921 are for Great Britain and Ireland, thereafter for Great Britain only. [1]Average. [2]From January-July, on last day in December 981,264 persons were employed. [3]Underground workers only. [4]All employed. [5]The death-rates are based on the months January to March and July to December. [6]The death-rates are based on the first four months.



Rockdust Barrier

Safety *by* Foresight

At Mines of C. F. & I. Co.

By Robert McAllister
Chief Mine Inspector, C. F. & I. Co.
Denver, Colo.

OBVIOUSLY it is not within the power of man or men to provide safety measures so automatic and so self-sustaining that they perform their functions without close official supervision. Comparing the safety measures of today with those of twenty years ago, it is readily noted that the personal element—as a factor in the success of safety measures—has not progressed at the same pace as the physical.

The workman at the face has an indifference to danger that cannot be overcome by educational means. This indifference will eventually lead to the passing of mining laws making neglect of safety a statutory offense. The coal-mining laws of Colorado prescribe many safety measures all of which are rigidly enforced by the management and underground officials of the Colorado Fuel & Iron Co. in co-operation with the chief coal-mine inspector and his staff.

This company has divided its coal mines into groups of divisions according to the counties in which they are located: Las Animas, Huerfano, Fremont and Gunnison. Each division has a safety committee comprising three men appointed by the management and three men selected by the employees.

The first group is usually taken from the men engaged in work that is primarily of a safety nature, such as the chief mine inspector, the superintendent of first-aid and mine-rescue training and the chief chemist. These same three men act in each of the four divisions.

It is the duty of the safety committee to visit each mine three times a year and make a thorough investigation of conditions underground and on the surface. It presents a report to the management embodying recommendations as to the means that should be taken to increase safety. It investigates all fatal accidents and determines, if possible, their direct causes, recommending such precautionary measures as will prevent their recurrence. This committee of six men, inspects the haulage roads, aircourses, manways, electrical equipment, ventilation, timbering, working places, rock dusting, humidity, fire protection, underground first-aid stations and the enforcement of both the company rules and the Colorado mining laws.

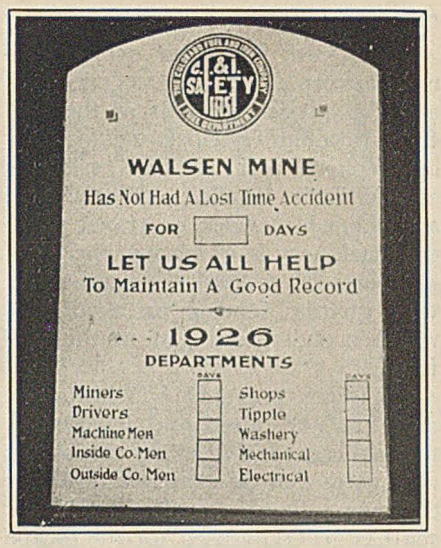
IN ADDITION, each mine has a local safety committee with the superintendent acting as chairman. It is the duty of this committee to keep in daily touch with conditions underground and on the outside.

The Colorado Fuel & Iron Co. has installed fans with a capacity of 200,000 cu.ft. per minute and provided dual drives or twin fans so as to insure a constant circulation of air. These drives consist of a steam engine, the exhaust of which is for humidification and an electric motor for use in emergencies, or two electric motors for mines which are naturally humid.

An automatic safety device, controlled by the ventilation pressure, blows a whistle loud enough to attract the attention of the man in charge when the air current fails. These fans have a capacity that enables them to deliver one-third more air than is normally desired and provided, thus anticipating all emergency demands.

Aircourses are constructed of such generous dimensions as insure the least possible resistance to the passage of the air. These are kept free from obstruction. Intake aircourses are used for haulage and electric lines. The returns are used for manways. Traveling on the haulage roads is prohibited. Only those employed on them are allowed to enter them.

The air is split so as to avoid the use of doors. This is accomplished



Accident Board

principally by the construction of a three-entry system with overcasts for the crossing of air currents, but where the two-entry system with continuous circulation is employed which has to be regulated with doors, provision is made at each pair of cross entries for two doors at a distance greater than the length of a whole trip of cars. All automatic doors are protected with ordinary doors for use in emergencies. As frequently as the situation will warrant, a chemical analysis is made for methane, carbon dioxide and oxygen in each return aircourse.

All the mines use electricity, alternating or direct current, with voltages ranging from 250 to 550 as may be required. These lines are installed along the intake aircourses. The use of mining machines is prohibited at any working face where the chemical analysis of the air shows one half of one per cent or more of methane. Electric hoists, electric pumps and trolley locomotives are allowed to operate only in circulating air having less than 0.2 per cent methane.

All feed lines are inspected to ascertain whether they have proper insulation and roof support. At all partings, at all main entry branch-offs and at places where men are obliged to work or pass, trolley lines are protected by a guard consisting of parallel wooden strips, one on either side of the trolley wire.

TROLLEY LINES and motor partings are provided with kick-out switches operated by the motorman, who from his position on the locomotive pushes the switch in as he enters a cross entry or a parting and pulls it out as he leaves. This precaution protects the drivers and mules as they deliver cars to, or take them from, the partings.

Signal lights are also provided on the inby approach to these side tracks. These show a light when the motorman kicks the cross-entry switch into position. Gates are placed across the outby end of the parting to prevent mules from running into the trolley line beyond the kick-out switch. Open switches and take-offs for mining machines are provided with a hinged door supported at the roof and so arranged to be clear of the switch or wires when down.

Hoistmen are provided with a switch by which they can cut the current in the power line on rope haulage slopes in case a trip should break and run away. They do not throw the switch back until advised by telephone or messenger that the line is not injured. All electrical installations underground must be approved by the chief mine inspector of the company.

PERMISSIBLE powder is used exclusively. It is placed in magazines which are located more than 1,000 ft. from any building or mine entrance, and it is distributed from small magazines located not less than 300 ft. from any building or mine entrance. Miners purchase their daily supplies of permissible powder in quantities not to exceed 1½ lb. per shot. A record of powder sales is kept by the powder man daily and charged to the miner's account. Each miner is provided with a waterproof powder cadger holding 6 lb. of powder.

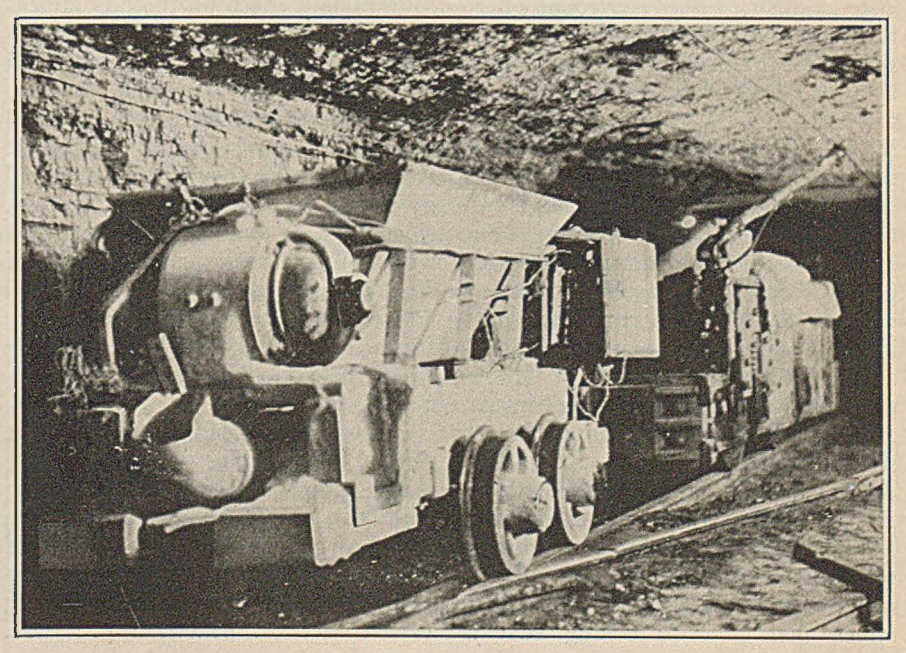
Only those who have passed an examination before a deputy state coal-mine inspector and who have received a state certificate showing that they are proficient in the use of the safety lamp, knowledge of the state mining laws, the handling of powder, use of powder, use of blasting caps and the detection of mine gases with the flame safety lamp are allowed to fire shots. These men enter the mine one hour after the last man has been reported out and proceed to prepare shots for electrical detonation.

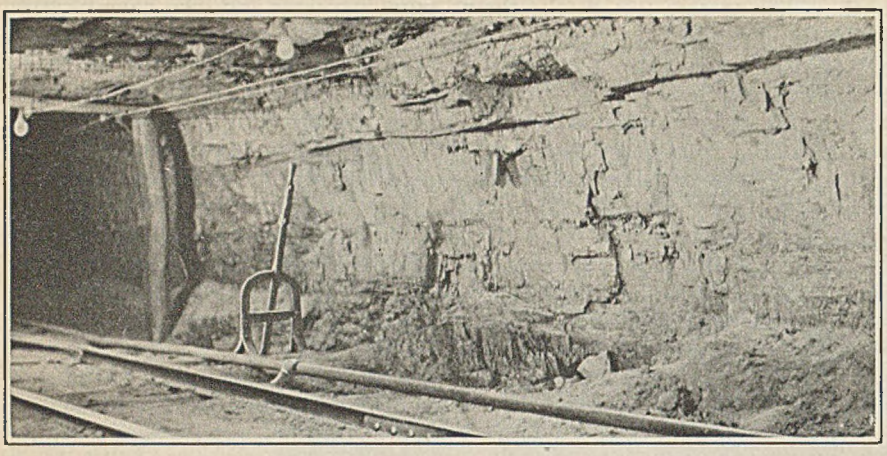
PRIOR to the entrance of the shotfirer into the mine, the miners undercut the coal, even where machines are not employed; they drill holes in the coal to a depth of 6 in. less than the depth of the kerf which are so placed in every case that one shot will not depend on another. The miners prepare enough dummy cartridges—which are cylinders of paper filled with clay—to completely fill each hole they have drilled and at the end of the shift they place these cartridges close to the working face, side by side with the powder.

Shotfirers advance against the direction of the circulating air. After the series of shots has been properly prepared and connected with wires for direct detonating or by delay fuses, the shotfirer goes into the last complete crosscut between rooms and fires the shot by a twist of a hand battery.

Record is kept of every misshot. The shotfirer is not allowed to return to note the condition within four hours of his first trip in the place. In case of a misfire the miner is required to drill a second hole not less than 18 in. away from the one which

Rockdusting Machine





Entry After Rock Dusting

failed to ignite. This is exploded on the following night.

After the shotfirer has exploded all the shots in the rooms of his "run," it is his duty to return and inspect each place for a fire or any unsafe condition brought about by the shooting. He is required to make, for the inspection of the fireboss, a complete report of all shots fired and of the condition of the working places thereafter. For this a detailed blank is provided.

On the report, *A* signifies a place that was not properly timbered for shooting and where the holes accordingly were not shot; *B*, a place where the hole was drilled deeper than the undercutting and was therefore disregarded by the shotfirer and *C*, a place where the miner had put powder in the drill hole to insure a good break. This last is an offense for which miners are discharged.

Shotfirers are provided with Edison electric safety lamps and an improved flame safety lamp and have instructions to ignore any room where the roof has not been made safe or where the presence of gas is indicated by the flame safety lamp.

MANY DIFFERENT timbering methods are in use: Single prop, prop with cap, legs and crossbars, lagging and forepoling. The most general specification calls for props placed at not over 4-ft. centers and at a like distance from the working face with temporary safety props as the coal is being loaded. On return aircourses where the timbers rot rapidly, steel sets are being used to some extent.

Coal dust is being fought both by air saturation and rock dusting. Moisture is provided by steam, by air saturated with moisture, by sprays, and direct sprinkling. Intake air in mines that produce coking coal is first heated by passing it for a distance of 100 ft. or more past radiators set on the sides of the intake aircourses. Exhaust steam is discharged direct from the engine which drives the mine fan. Enough sprays are placed at regular intervals along the main aircourse to bring the intake air up to the saturation point.

All haulage roads are provided with a sprinkling system with men employed to wash the roof and sides free from dust. Return aircourses are sprinkled from branch pipes which pass through the stoppings from the main entries into the returns. The cutter-bars of the coal-cutting machines are being provided with sprinkling pipes. In mines producing coking coal, the rooms are wet down before the coal is shot.

At the entrance to the mine, empty cars are sprayed with water the loads being sprinkled as they leave partings for the tipple. Humidity readings are taken by the company's chief inspector on all intake and return aircourses as a check on the humidification system.

Humidification has been replaced to some extent by rock dusting. Rockdust barriers have been installed in a sufficient number to protect the zones in which they are placed, and in between these barriers the roof, sides and bottom have been coated with a film of rock dust. Samples of dust across the entries, roof, sides and bottom, are taken at regular intervals for analysis and used to determine when the rock dusting has to be renewed.

Electric safety lamps are used for general illuminating purposes. Flame safety lamps are given only to men who have passed a state examination and shown a proficiency in the use of the lamp. Men at the face are required to use goggles when handling a pick—a most beneficial provision.

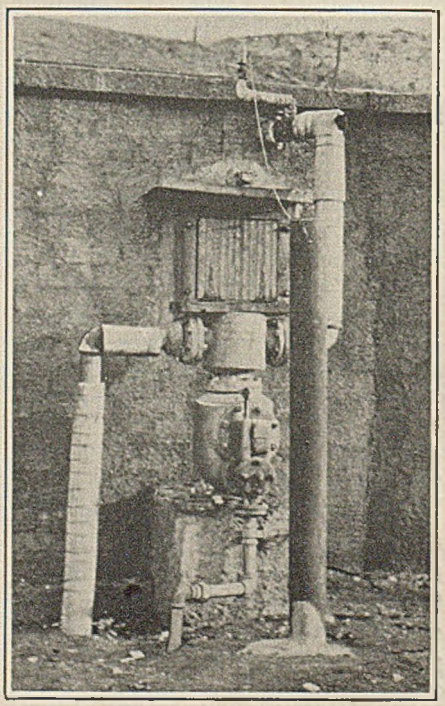
TELEPHONES HAVE BEEN provided for rapid communication between all partings underground and the various stations at the surface. Locomotive trips are dispatched by telephone, and rope trips on slopes are similarly handled. Where men are obliged to work or travel while the machinery is in motion, the moving parts of machines are protected with guards, fencing or hand rails whether underground or at the surface.

At mines operated by shafts the men are not raised and lowered in the coal cages but in safety equipment with gates that close automatically as the cage is lowered. The intake air shaft is generally used for the escape shaft, and the return air shaft for hoisting coal and for conveying men who are going on or coming off shift.

First-aid training and mine-rescue work is in charge of a superintendent with that work as his sole occupation. Pullman-type safety cars are used for this work. They are fitted for use in any emergencies that may arise. The U. S. Bureau of Mines also aids in the training of the miners.

Vocational courses in advanced first-aid training are provided. Each mine has fully equipped first-aid stations both underground and on the surface. Major-injury cases are transported by ambulance to the company's Minnequa Hospital, which is located at Pueblo. Safety bulletins and poster services at every mine show the workers how to discriminate between safe and unsafe practices.

Automatic Fan Whistle



SHAKING CONVEYORS *Banish*

Coal Bucking and Rock Handling

By R. Dawson Hall
Engineering Editor, Coal Age
New York City

The shaking conveyor principle is by no means new in America. It has been used for years on the surface for screens and for distributing coal in breakers. As a result, structures in which it has been used have not had to be constructed as lofty as they would have been had the shaking principle not been introduced, the product has not been broken and the mine output has been accurately sized. The shaking conveyor is poking its nose underground and finding places which, without its help, could not be worked. It is calculated to ease labor, to increase output and to assemble coal at a point convenient for full-trip loading.

WHERE A SEAM of coal is thin, or where it lies on a pitch that is too steep for a car and yet not so steep that coal will run on a steel plate without "bucking" it by hand, the use of a shaking conveyor, or shaking chute, for the transportation of coal from the working face to the car in the gangway is advisable. Such a means of transportation has made possible the mining of beds that have, heretofore, been considered too thin for operation because of the large quantity of rock that had to be moved for the introduction of a car or of a "buggy" into the working place. The shaking conveyor has profoundly modified many problems, so that mines about to close have been given a new lease of life.

The equipment is termed by some a shaking conveyor and by others a shaking chute. Roughly and inaccurately a division may be made between these closely-allied types of equipment. The shaking conveyor has a large capacity and a definitely differential motion that gives the conveyor a lifting quality, so that coal can be transported on the level or even up an incline. The shaking chute has nothing but a harmonic forward stroke and a harmonic return stroke, which it is claimed may sometimes advance the coal especially where a bumping action is provided. Usually, however, it is intended merely to move the coal downgrade.

PROGRESS in the use of the better class of shaking conveyors has been retarded by the fact that much of the work in the anthracite region is merely second mining and that those who perform it find themselves obliged to work small isolated pillars from which a capacity cannot readily be obtained equal to that which is generally procured in German and British mines where a system has been set up such as keeps the conveyor working more or less steadily. However, where the coal is virgin, some such systems are being, and have been, installed by some far-seeing operators, and it is likely that, in the future even where second mining is all that remains, plans will be adopted that will make it possible to obtain a large capacity from a single pillar or to bring coal from several pillars to a common conveyor which will thus receive and transmit a large tonnage.

Among the early users of shaking conveyors is H. O. Staples, president of the Grand Tunnel Coal Co., of West Nanticoke, Pa. He is operating five of these units, all Eickhoffs, four for driving entries and one for backfilling. Mr. Staples, in an interview, said: "By the use of shaking conveyors we are making progress in the development, for longwall operations, of a small area of coal running from 2 ft. 6 in. to 3 ft. 2 in. in thickness, which will be mined entirely without lifting bottom or taking down top. So far we have not advanced with our development far enough to complete the longwall face, but the development coal, despite the fact that it comes from narrow roadways only 12 ft. wide, is not costing us any more than coal from other workings in the mine where the seam is about 20 ft. thick.

"THE AREA to be worked by longwall lies close to the outcrop at a point where the hill is steep. The bed being worked is the Ross. Under it lies the Red Ash which has been mined out, causing the roof to fracture. Two roads, each 12 ft. wide, connected at intervals by inclined crosscuts have been driven by the use of shaking conveyors up to the property line, a distance of 600 ft. By the use of swiveling attachments, it has been found possible to convey the coal from both roadways with the aid of only a single drive head. The conveyor pans are 30 in. wide at their extreme edges but the width of the troughed portion at the top is only $21\frac{7}{16}$ in. The power for driving is compressed air.

"As soon as the double entry had been driven to the property line, two single roadways were driven, one to the left and one to the right and each 12 ft. wide. These are parallel to the property line and have been extended 400 ft., where they will meet two similar single roadways from the outcrop. The outby ribs of the two 400-ft. roadways will then be used as longwall faces."

Asked about the ventilation conditions, Mr. Staples remarked that: "Conditions are exceptional. The roof of the coal bed is fractured to

the surface as a result of the operations in the Red Ash bed below so that air can enter and leave through these fractures. In consequence, there has never been any lack of air."

He added that: "A conveyor on each longwall face will carry the coal to the main entry and another conveyor will transport this coal to the outside of the mine where it will be discharged into a bin and thence into mine cars. The headings are progressing at a speed of about 20 to 25 ft. per day. So far duckbills have not been used, but when the longwall face is started they will be introduced. The face will give 250 tons of coal daily.

"YOU WILL be interested," said Mr. Staples, "in a conveyor which is not only transporting sandstone from a rock tunnel but also delivering it to certain chambers adjacent so as to furnish support to these workings, thus affording protection to the rock tunnel. The conveyor lifts the rock almost to the level of the roof and thus completely fills the rooms with débris. The inclination up which the rock is lifted is about 5 per cent. The area being mined dips toward the opening about 15 per cent. The entrance has been made above the coal and driven level for a short distance at the outcrop."

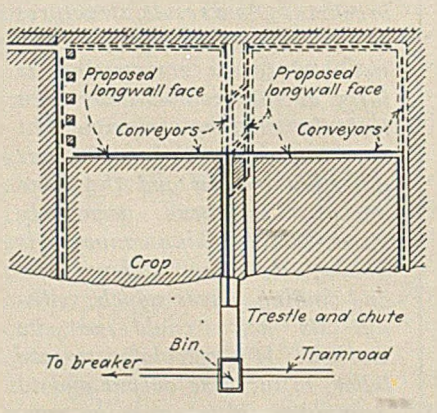
H. H. Kudlich, general superintendent, Grand Tunnel Coal Co., remarked that the Grand Tunnel mine workings went back to the time when Dr. Fell made his first experiments in the working of anthracite. Three times the plant had been abandoned as worked out. Nevertheless there was a large acreage still available. This coal was in pillars surrounded by falls, was thin, was under the river and would have to be backfilled and worked in the presence of gas. Modern methods alone would make operation possible.

"The little area now about to be worked by Eickhoff devices has from 75 to 250 ft. of cover, which is creviced parallel to the face which it is proposed to work. The conveyor is run at about 60 strokes per min., which is enough to give it the needed capacity. The coal rises gently from the crop so that the inclination of the seam will be in its favor.

"As the Grand Tunnel mine proper, where it approaches the river, has gas and doubtless will have more the further operations go down and go under the river, air motors have been purchased for the driving of the conveyors, though the immediate application would have favored the installation of electrical equipment. Had the drive been electrical the conveyor could have been reversed and the men and props taken into the face on the conveyor. However, Lorain steel jacks will be used in the longwall face. When these and the necessary blocking have been taken into the mine, the transportation problem as far as materials are concerned will be solved.

"THE SOUTH, or left, entry would cave tight if the longwall were extended all the way to it. Consequently, a row of pillars 15 ft. square will be left along that entry, so that, when the longwall to the north of it is complete, another face can be opened to the left or south of it and that coal can be taken out also.

"The backfilling in the chambers of which Mr. Staples spoke is in an



Longwall Face Planned at Grand Tunnel Mine

area that has already been subject to squeeze. It is the intention to use the Eickhoffs extensively for the purpose of filling these open spaces. The squeezing and collapsing of the places is particularly undesirable as the coal being mined is below the level of the Susquehanna River and, only by giving the roof adequate support, can the river water be kept out."

S. D. Dimmick, vice president and general manager, Glen Alden Coal Co., who has been operating successfully chain conveyors at Dodge colliery with longwall since 1912 and indeed is still working both longwall and conveyors at that operation, said that he was using an Eickhoff shaking conveyor at the Storrs colliery to the north of Scranton. This coal is transported by one such conveyor along a face sloping at 45 deg. in a horizontal angle to the direction of the second Eickhoff conveyor line. This is in turn not straight but follows a sinuous path with both vertical and horizontal irregularities delivering the coal up a 5-per cent grade to the cars on a distant roadway.

"The coal," said Mr. Dimmick, "was originally 10 ft. thick, but a crush has passed over the area, and the coal has been squeezed down to 7 ft. At present, only one of these shaking conveyors has been installed. It is used in connection with the recovery of coal from an area developed by a gangway driven on the strike. From the gangway rooms were driven right and left. The rooms have caved and without conveyors could be reopened only with difficulty. The parting rock, of which there was a great deal, had been piled on either side of the room roadways, and to enter any one of these rooms it is necessary to make a skip along the pillar.

"IF THIS skip is made for the purposes of a roadway, it can not be constructed less than 10 to 12 ft. wide, but as, in the instance cited, it was intended for a conveyor it was made only 5 ft. in width. As the pillar is greatly weakened by making a skip, it is important to restrict the width of that work to proportions as narrow as will suffice for the purpose proposed. Five feet is enough for a conveyor and pathway for the miners.

"The pillar has already been brought halfway back. Three men work at the face and one at the chute. The shaking conveyor which is 24 in. wide is electrically operated and has roller bearings. The drive head is set about 80 ft. from the gangway. No duckbill is provided but a swivel arrangement is made which enables the pillar to be drawn at an angle of 45 deg. to the general direction of the room. A duckbill would not serve the purpose as there is much dirt which has to be thrown over the conveyor into the gob. The movements of the drive head are regulated by the man at the chute. There are three shifts daily and 12 cars of 2½ tons, or 30 tons in all, per shift, that is 90 tons per day, are obtained from the working. The conveyor has a 20-hp. engine.

"The equipment will be used to recover all the pillars to the left and right. Those to the rise, of course, will not require as much power for their operation as those to the dip."

George F. Lee, president of the George F. Lee Coal Co., who has 20 shaking conveyors at his Chauncey

colliery and expects soon to receive enough to bring that number up to 36, said that: "If it were not for the shaking conveyor, my mine would probably have been shut down by this time, for the Bottom Ross seam running below 30 in. in places, and never exceeding that figure, would not be worked satisfactorily by any other method. I am using the shaking conveyors underground only.

"FOR A TIME I ran an electrically-operated Eickhoff on the rockdump raising the rock up an inclination of about 10 per cent. It did the work satisfactorily, but as it was working on breaker waste, much of it from the Chance wet separators, it was wet. The water was also acid. The combination of the corrosion of the acid and the wear of the rock ate the conveyor or trough excessively so it was necessary to abandon this method of rock disposal which, from a mechanical point of view, was entirely successful. The conveyor was moved inside where it has to contend with much less water. I have two Eickhoffs for the heavy work and will soon have 34 Siemens-Schukertwerke shaking conveyors for use in separate rooms."

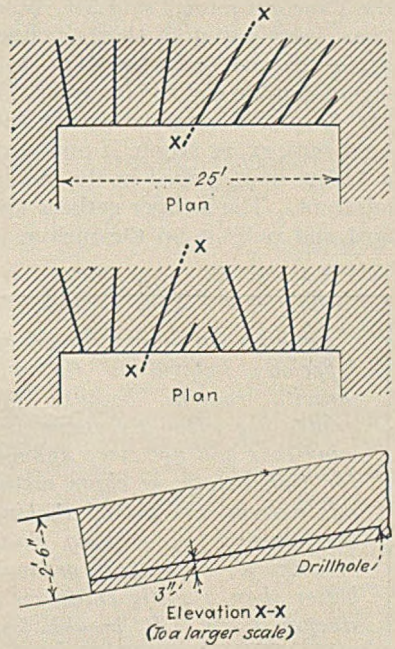
Fuller Reynolds, mine foreman, Chauncey colliery, who, by the way, is a graduate of Carnegie Tech., said that the Eickhoff conveyor with a 10-hp. motor had transported coal 340 ft. part of the way down a 2-per cent grade, then up a 2-per cent and then down a similar grade showing that it is quite flexible and does not need an even grade for operation.

Mr. Reynolds said: "The mine originally operated in the Red Ash bed where the coal ran from 25 to 35 ft. in thickness. With the approach of the exhaustion of that bed, the Top Ross which is a considerable distance above it was entered and worked. Its thickness is about 4 ft. 3 in. This seam has been now largely first mined, and the roof has fallen. It would be extremely expensive to open up these workings with the purpose of removing the pillars. So we are extracting the Lower or Bottom Ross which is from nothing to about 27 ft. below the Top Ross.

"BUT THIS seam is only 30 in. thick and sometimes thinner and to lift bottom on anything but the gangways would be prohibitively expensive. In view of the fact that even gob gangways, in which the rock is gobbed along the side of the roadway, are costly we are trying to make some of these low, operating them with Eickhoffs into which the Siemens-Schukertwerke conveyors will discharge. The gangway will be driven wide, and enough rock, about 20 in., will be lifted to permit the S.-S. conveyors to discharge into the Eickhoffs satisfactorily.

"The S.-S. machines have two heavy springs that store up energy during the forward motion of the conveyor trough. When a certain cam in the machine releases, a heavy spring throws the chute or conveyor suddenly back, thus producing the much-desired differential motion—a slow forward movement that carries the coal steadily toward the terminal chute and a rapid backward motion that slides the chute beneath the coal. The movement is about 3 in. on each reciprocation.

"WITH the S.-S. machines we are using only a 5-hp. motor which is run at 870 r.p.m. This is an ordinary induction mine motor using 440-volt 60-cycle current. The conveyor makes a tenth as many complete cycles of movements as the motor makes revolutions or 87 forward, and an equal number of backward, strokes per minute. That is enough for average product, though wet coal should have about 100 strokes each minute.



Two Ways of Shooting Coal at Chauncey Colliery

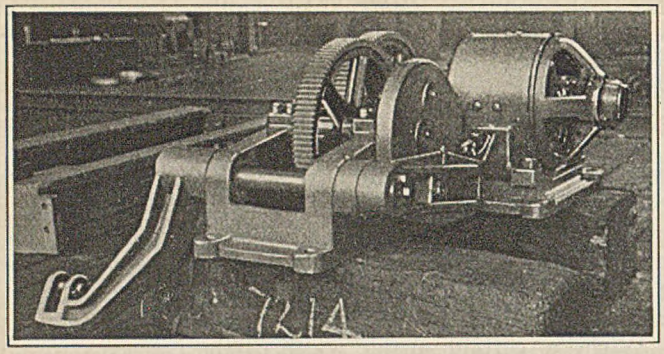
"We used to hang our conveyor sections from the roof or a crossbar, but too often one chain would be longer than another, and moreover there would be a tilt with each movement of the conveyor pan. That latter condition is unobjectionable near the chute, but the effect is harmful on the other parts of the system.

"So now we use a common wooden roller, such as is provided to support ropes on a rolleyway or plane. This is placed under the conveyor at points about 8 ft. apart. The rollers are of 4-in. diameter and 14 in. long. The inside width of the conveyor pans is 12 in. and the depth 4 in. An 8-ft. section weighs 80 lb. These sections are fastened together by three $\frac{5}{8}$-in. bolts which pass through angle irons which are welded to the underside of the pans.

"IT IS interesting to note that where the two Ross beds approach each other in places, as they frequently do in a most erratic manner, a small rockhole is driven into the upper bed from the lower. From this rockhole narrow rooms are driven, splitting the pillar in the Upper Ross thus exposed. The coal on either side of the narrow room is finally brought back. All this is done by an S.-S. conveyor. Thus, in places, may be seen a conveyor carrying coal from the upper Ross bed to a rockhole leading to the Bottom Ross and another conveyor taking that coal to the gangway for loading into cars. In this way the Upper Ross is being stripped of its coal methodically. All the pillars will ultimately be taken out but, to do that, it will now never be necessary to open up the miles of badly caved roadways in that bed.

"The men working these conveyor places," says Mr. Reynolds, "enter in the morning and load three or four cars which contain about 2½ tons of prepared-size coal, two cars having been left standing overnight in the gangway for each place. Each car holds about 100 cu.ft. or 6,500 to 6,800 lb. including coal of all sizes and refuse. By about 10 a.m., all the coal is loaded out, and the conveyors are through with their work for the day. The men then post the place and extend the conveyors.

"They then drill the face with a jackhammer. Seven or eight holes are used as shown in the illustrations. The coal is shot between 1:30 to 2. p.m., and then it is obligatory that the men go home. No one is allowed to go back to see what the shots have done. I believe that it is in going back into places fouled with powder



Flory Conveyor Designed by the West End Coal Company

smoke to find out the result of the shot and to load out coal that is the cause of many accidents. The men cannot see the dangers and fail to post bad rock. All the loose rock has not fallen. They may even try in the darkness to drill the face to get down standing coal and run their drills into unexploded shots. But if they delay their return till the morning, they are fresh and the air is good. They are in the best psychologic condition to prevent accidents by careful timbering and face examination. At least I believe this to be true, and the facts, up to the present, seem to bear me out.

"THE method of ventilation is simple. There is no gas. Gangways are driven single with the aid of fabric tubing and a fan. Crosscuts driven between rooms furnish a return airway as soon as they are completed. In the rooms the coal is shot by 60-per cent gelatin. The shots are placed 3 in. above the bottom where a streak of impurity makes the coal of little value."

"In each room is one miner and a helper," said R. Doland, the superintendent of the mine. "The latter is paid by the former. In opening up a room it is driven 26 ft. without the aid of any conveyor and without lifting bottom. During that period the coal is dragged along the floor of the room with a large hand-scraper such as is used for withdrawing ashes from a furnace grate or ashpit. As the miner can stand upright in the high gangway to do this it is not such a trying occupation as it might appear to be.

"The roof is cracked in places by the cavings due to the extraction of the Red Ash seam below. Moreover in places it seems to be a little shaky and weak. For the most part, however, it is hard and dependable. The bottom rock is even harder than the roof."

First to use mechanical shovels in the anthracite region for the cleaning of old roadways, Floyd G. Wilcox, president and general manager of the West End Coal Co. and the Price-Pancoast Coal Co., has always set an example of progressive management. He and his engineers with the S. Flory Manufacturing Co., of Bangor, Pa., have been developing machinery for the transportation of coal from the face to the mine car. The drive has a sliding crank which moves to and from the center of the shaft about which it revolves as the pressure on the connecting rod on the return stroke changes to a tension. This gives a differential motion. In no case, however, has this device been used on adverse grade.

"The Price-Pancoast Coal Co., at the Pancoast mine," said Mr. Wilcox, "has been using a short incline to bring the coal in a scoop up to the top of a mine car for dumping. The car is placed near a pillar, and a light scraper, or scoop, is operated by a 15-hp. hoist placed in the gangway adjacent. The scraper gathers up the coal and pulls it up the incline. To eliminate degradation the scraper is not pulled to the gangway for loading but only a much shorter distance, the car being spotted well within the room. Long scraper hauls break the coal unduly.

Shaking conveyors should be especially helpful in the anthracite regions because the grades are often excessive for mine cars and not steep enough for full-battery or chute methods without the aid of shaking mechanisms. A shaking chute or conveyor on an easy grade is better than a static chute on a steeper pitch. It breaks less coal. Where an effort is being made to check the speed with which coal passes down the chute by giving it an indirect course from the face of the working to the gangway the grades could be made a little less steep than will suffice for static chutes, and shaking conveyors or chutes installed to move the coal to the mine car.

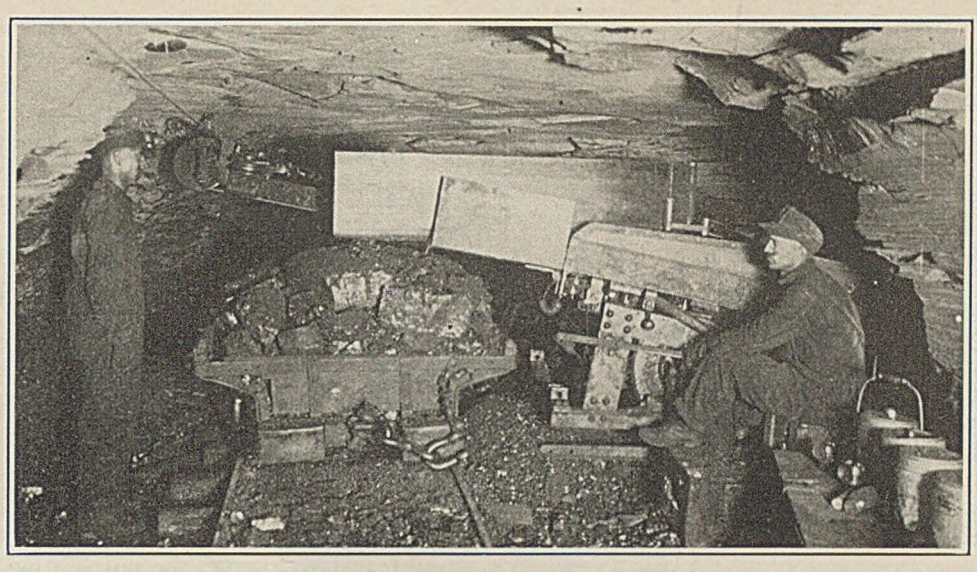
"IN ROOMS that are caved we do not want to remove any more rock than necessary, we do not want to take the car to the face and we propose to put in a shaking conveyor from the face loading point to the car loading point at the gangway; the coal will be dumped from the scraper into the conveyor and by the latter into the car, which fact will facilitate the work greatly.

"When the time comes to withdraw any section it will be loaded on the conveyor and brought to the gangway in the same manner.

"The Flory outfit is being used to bring coal from chamber faces and pillars to the gangway, but is used only where the chambers or pillars pitch upward from that point. We have driven as much as 300 ft. with a 5-hp. motor, but shorter shaking chutes have been driven by 3-hp. motors. Two to four men shovel into the shaking conveyor end.

"We follow no schedule of operations. As soon as a place is drilled it is shot, and the loading of coal into the conveyor follows immediately, if the shift is in operation. The strokes vary from 30 to 50 per min. With steep grades fewer strokes are necessary than with easy grades. These shaking chutes are used in places where the coal is as low as 30 in. with 4 in. of parting."

R. Y. Williams, mining engineer of Weston, Dodson & Co., describing the operation of the Eickhoff ball-bearing conveyor in the longwall work at Beaver Brook colliery, Beaver Brook, Luzerne County, Pennsylvania, said: "The grades on the conveyor vary from nearly flat up to a maximum of 18 deg. The average production handled is about 130 tons per day, and the maximum has been 180, but the machine has a larger capacity than we have hitherto been able to use. The equipment is in operation at times during the eight hours constituting the day shift, but the average period of use is probably five hours. At its maximum extension, the conveyor has never exceeded 265 ft. An electrical drive of 15 hp. is provided, the electrical supply being 440 volts alternating current. The thickness of the coal is 20 in., but that of the whole bed is 42 in."



BETTER COAL *from* LONGWALL *Operation*

By W. E. James

Superintendent
Southern Smokeless Coal Co.
Beurg, W. Va.

SEVERAL YEARS AGO I laid out a mine for the Carbon Fuel Co. in the Cabin Creek district of southern West Virginia in panels measuring 500x1,200 ft. The seam of coal was 5 ft. thick and had a strong laminated slate roof and a fireclay bottom. The panels were worked by the longwall retreating method, the coal being undercut by a shortwall machine. As this was capable of cutting only about 250 ft. in a shift, the loading of the coal, which was done by manual labor, was materially retarded.

The track was laid along the face and parallel with it. The cars were handled by a gathering locomotive having 550 ft. of insulated cable. This unit gave highly efficient results.

THE ROOF was supported at the working face by four rows of 12-in. diameter round posts, the fourth being moved forward to a new location, 8 ft. from the face, after each cut was cleaned up. This system of timbering was rigidly enforced for the entire panel and gave excellent results.

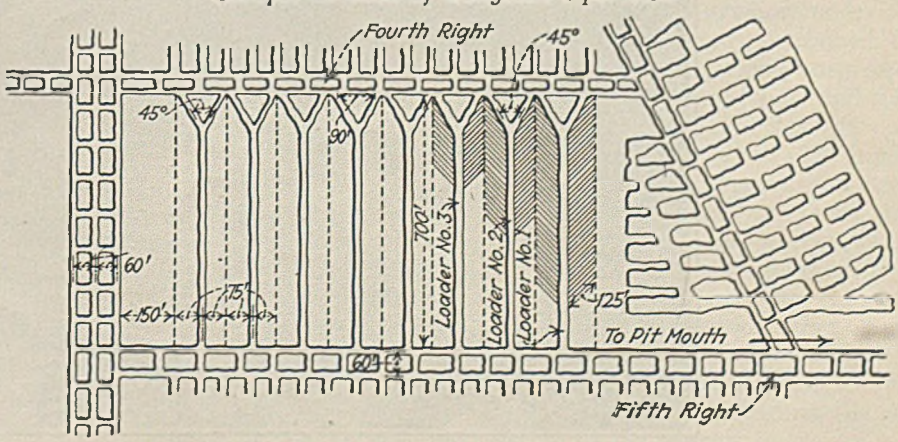
On one occasion, a disaster threatened, and the timbering had to be reinforced at a point adjacent to a roll, but no loss was sustained other than that of a few posts.

THE FIRST BREAK in the roof did not occur until the face had retreated more than 300 ft. and even then the rock had to be blasted. Thereafter falls occurred regularly at or near the fourth row of timber.

Though the system was unquestionably successful and showed a decided reduction in the production cost of coal, it was necessary to abandon it because of the irregularity with which railroad cars were supplied. The mine averaged in consequence only three days a week. The entire scheme was so complete in every detail that C. A. Cabell, president of the company, secured patent rights on the system.

IN RECENT YEARS I have examined a number of mechanical devices designed in a measure to eliminate the human element in the loading of coal, which is always more or less a source of trouble. I have come to the conclusion that where

Scraper Method of Longwall Operation



mining conditions favor its adoption nothing yet compares in actual results with the scraper loader for a thin seam of coal, say from 36 to 42 in. thick with a good roof and a substantial bottom. Several of these loaders are doing good work in the Cabin Creek field, some of them averaging 150 tons per shift of eight hours.

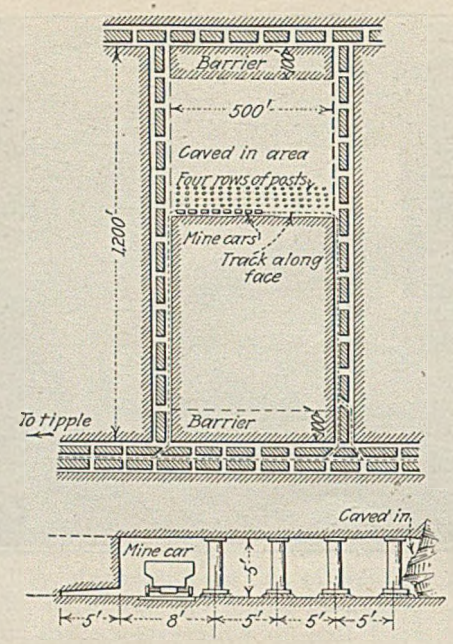
About 18 months ago, I had an opportunity to lay out a section of a mine in the Winding Gulf field for one of the largest corporations in the state. The design was similar to the single V-system described in R. Dawson Hall's article in the August number of *Coal Age* as used by the Pennsylvania Coal & Coke Corporation.

THE ACCOMPANYING sketch shows the general plan. The V-face was adopted because of its advantages in the control of the roof which is of supreme importance and must not be overlooked.

To insure the successful operation of the scraper loader a competent man must be designated to supervise closely every detail of its performance, such as cutting, loading, timbering and shooting as well as haulage.

It should be classed as a unit of its own, apart from the rest of the mine. It should have the exclusive use of its equipment, which should consist of a shortwall machine, a gathering locomotive and an ample supply of mine cars, so that it will be possible to make operation continuous. Delays of every description have proved disastrous to all types of mechanical loaders.

By referring to the sketch it will be noted that the angle of the V is maintained at 45 deg., and that each of its legs is 125 ft. long, thus



Longwall at Carbon Fuel Co. Mine

making a 250-ft. face, which is a day's work. With an undercut of 5 ft. the average loading per shift is 70 cars or approximately 150 tons. While the loader is busy on the left side, the cutting machine is making a kerf on the right, both sides or legs being cut and loaded out every working day.

For best results with longwall a seam of coal should be selected which is not too thick, which has a hard structure capable of bearing pressure, and which will part freely from the roof. Longwall or any modification of it is of inestimable value in the preparation of coal for the market. Its details can also be readily changed so as to be adaptable to local conditions. Moreover, as it allows the upper strata to settle gradually, it saves the overlying seams from the damage which room methods involve.

LONGWALL has the advantage of quick development, concentration of work, easy supervision and maximum recovery. All the coal is extracted at one operation, the roof settling down behind as the face retreats, so that the recovery is almost 100 per cent.

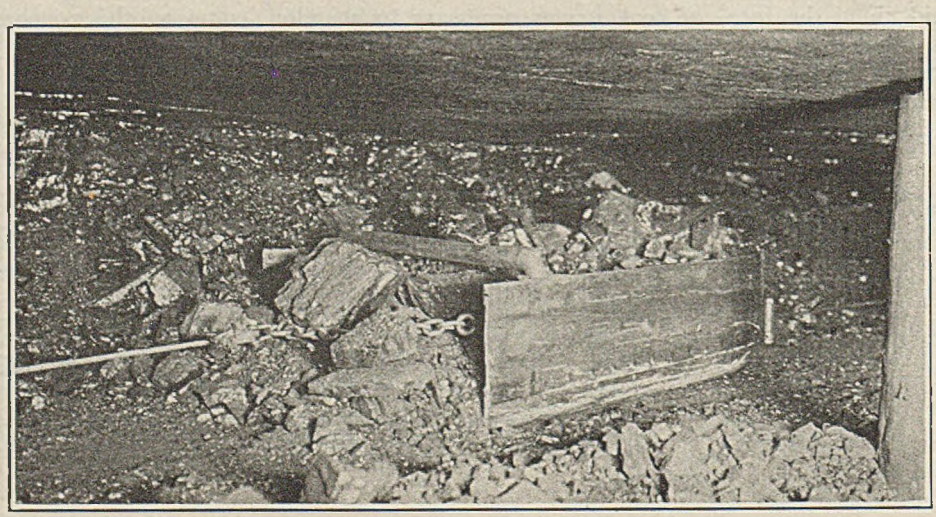
It fits in admirably where rock is available for packing and there are other débris such as bone, slate or other impurities unavoidably present that can be used for such a purpose without excessive handling. Where packwall material is not available, timber in the form of cribs or round posts are substituted and though this adds slightly to the cost, the expense is not prohibitive and the substitution serves the purpose well.

WITH LONGWALL the transportation of coal is facilitated and even the ventilation of the mine is simplified as with this system a continuous current is passed along the working face, thus clearing away and diluting any sudden accumulation or outburst of gas that may appear locally.

So manifest are these advantages as to indicate the desirability of working all thin beds, that have a sufficient cover and other favorable conditions, by this system or some modification of it.

The greatest obstacle in the way of successful mechanical loading thus far lies in the transportation facilities which are often so inadequate that the loading machine is kept waiting for empties. Thus the installation and method are almost invariably condemned before they have had a fair opportunity to demonstrate their value to the mining industry. Faulty transportation will render futile almost any machine or method.

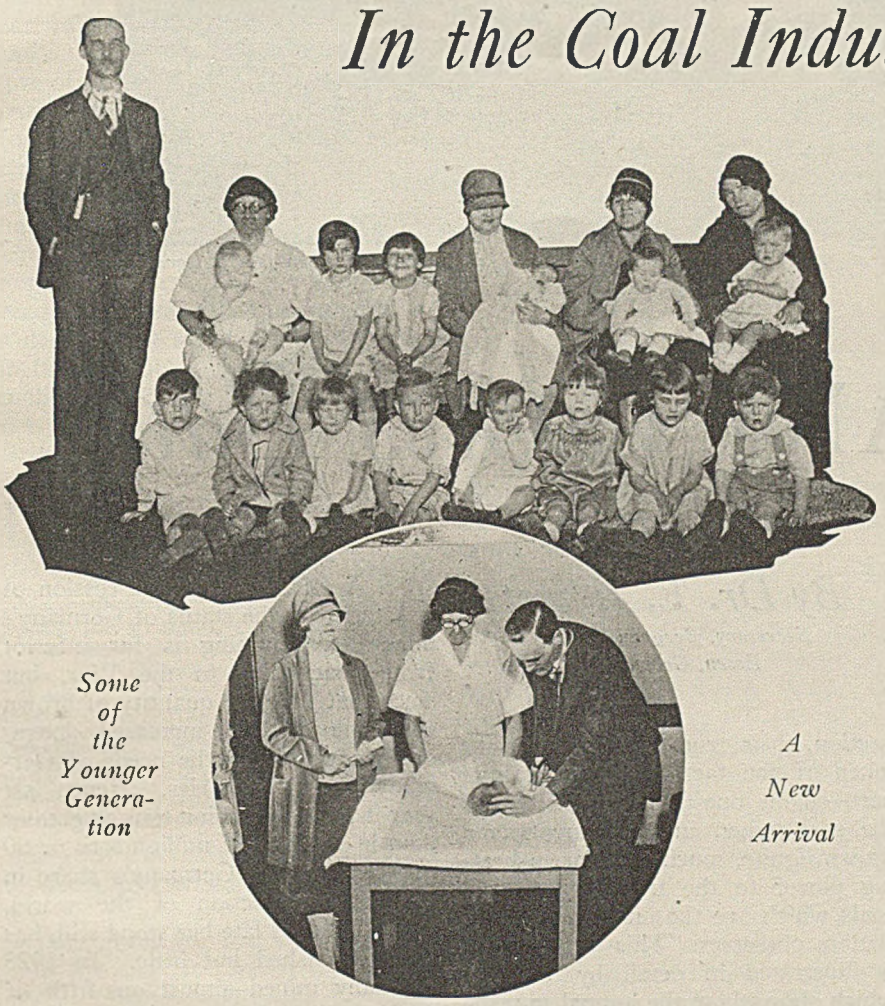
Loader and Carrier in Single Unit



WOMEN

In the Coal Industry

By One of Them



Some of the Younger Generation

A New Arrival

FOR years woman has been debarred from active participation in the coal industry. Of course there were isolated cases to the contrary, such as women weighmasters, but these were the exceptions that proved the rule. Of late, however, throughout its Logan County operations the West Virginia Coal & Coke Co. has been utilizing the Woman's Club of Omar, W. Va., as a department of civic improvement and public welfare. This club, consisting of 100 members, is composed of the wives and daughters of company employees.

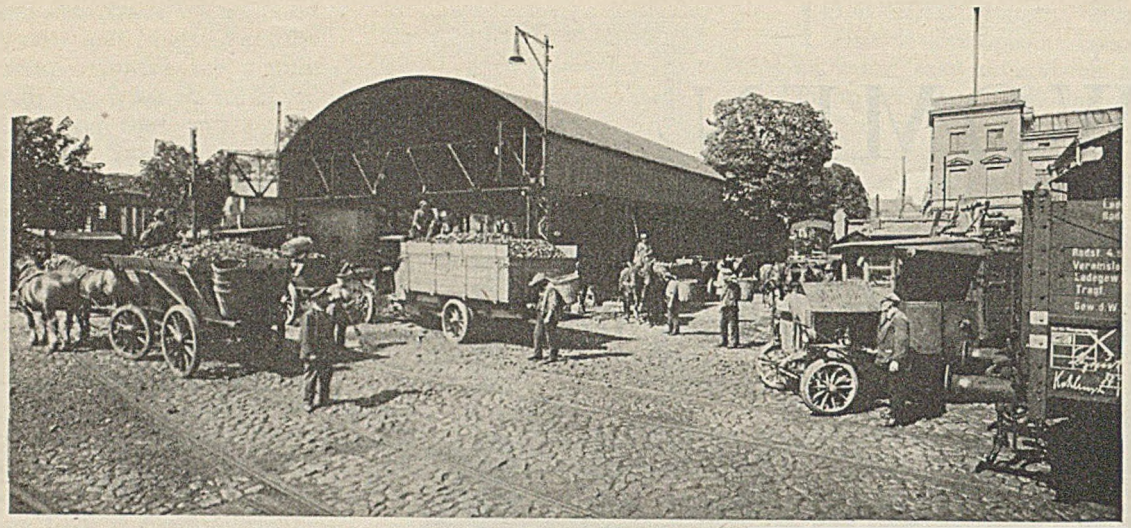
This policy has now been in effect for six months and the results have far exceeded expectations. William H. Grady, former general manager of the company's West Virginia operations, is responsible for this innovation which bids fair to solve some of the most serious problems that heretofore have confronted the industry. The economic status of woman in any coal-mining community is an important one and it was recognized that in certain directions she might be made a dominating influence.

THROUGH its new woman's department the company is carrying out an elaborate program of economic improvement. This is already showing results in the shape of better morale. The personnel of the Woman's Club includes graduate and public health nurses as well as experienced social workers. Its public health program, through the co-operation of the Logan County Health Department, already embraces baby clinics, day nurseries, public health school programs, milk funds, provision of hot lunches, reports of sick and needy, as well as prenatal work. Because of prompt protective measures, such as isolation, inoculation and preventive propaganda, all epidemics of contageous diseases so far appearing in the mine villages have been wiped out almost on discovery. These results alone fully justify the interest women have taken in community life.

AMONG its other activities this organization holds clean-up weeks, flower shows, harvest festivals and the like. On these occasions cash prizes are awarded and much enthusiasm displayed. The economic value of the miner's gardens is emphasized. After the harvest festival last year it was estimated that over half a million dollars worth of vegetables had been raised by company employees for their own consumption.

Libraries and reading rooms have been opened as well as recreation halls and women's clubrooms. In these latter, the programs rendered vary from instruction in contract bridge to "short cuts in housekeeping." One of the most outstanding achievements of this club, however, has been accomplished in the playgrounds. All fourteen of the company playgrounds are now under the full-time supervision of trained directors. Here programs of organized recreation are carried out, and folk dancing, handcraft and dramatics are taught. By this means the fundamental principles of good sportsmanship, truth and honor are inculcated. The influence of this movement on the child life of the community is thus of inestimable value.

These and numerous other activities, all making for healthy living and content, are integral parts of the company's policy that are in the sole charge of the women.



Coal Yard at Koenigsberg, Germany

GERMANY *Comes Back*

By Dr. E. Jungst

Secretary, Bergbau-Verein
Essen, Germany

IN THE main only three countries are engaged in both the production and export of coal—the United States, Great Britain and Germany. Two generations ago, Great Britain had a great preponderance over the other two countries. In 1870 that country mined approximately 53 per cent of the total world output, only 16 per cent being produced in Germany and only 14 per cent in the United States. Ten years later the American Union had reached second place with 19.6 per cent and about the end of the century it had already outstripped Great Britain, producing 31.9 per cent as against its rival's 29.8 per cent. Germany, also, had increased its proportion to 19.5 per cent.

In the year before the War the distance between Germany and Great Britain had been still further diminished, Great Britain producing 21.8 per cent and Germany 20.7 per cent of the world's coal. In that connection, it is true, account must be taken of the fact that a substantial part—about one-fourth in 1913—of the coal mined in Germany was a brown lignite, much inferior in heating power to the true, or mineral, coals which are the only fuels Great Britain possesses. This development is illustrated in detail by Table I which shows how the annual tonnage of the world shifted among the leading countries with the passing of the years.

The development, so favorable to Germany, suffered a sudden interruption during the War and in the period that followed. The regulation brought about by the Treaty of Versailles seriously and irreparably checked the development of the German coal industry. Due to the cession of Alsace Lorraine and the greater part of upper Silesia and to the temporary assignment of the Saar territory to France, Germany's unmined resources were reduced from 452* to 272 million tons. The brown-coal supply, on the other hand, was practically unaffected by the territorial grants of the Peace Treaty. The coal reserves of the principal countries are as set forth in Table II.

*All tons as quoted are net tons of 2,000 lb.

AS A RESULT of the cession of territory the status of Germany's mineral-coal mining is far inferior from that prior to the War, but since that time the quantity of brown coal mined has increased extraordinarily to meet the needs of Germany's own industries. Hence last year it was 154 million tons or greater than in 1913 by 57 million tons or 60 per cent. Thus Germany's share in the coal production of the world, which latter of late has stood still, has also diminished but little. In 1925 Germany mined almost one-fifth of the world's output, but this must be rated down to 15 per cent if the small heating value of brown coal is taken into account. Table III shows the mineral-coal production of Germany as compared with five other of the principal coal-mining countries.

Though Germany occupies third place as regards the production of mineral coal its brown-coal output has

TABLE I—PERCENTAGE SHARE OF LEADING COUNTRIES IN WORLD'S COAL PRODUCTION

Year	Germany	U.S.A.	Great Britain	Austria-Hungary	France	Belgium
1870	15.96	14.07	52.68	3.92	6.26	6.43
1880	17.86	19.59	45.11	4.47	5.85	5.10
1890	17.41	27.90	35.97	5.36	5.08	3.97
1900	19.50	31.86	29.79	5.09	4.35	3.06
1910	19.10	39.09	23.08	4.12	3.29	2.05
1913	20.67	38.53	21.76	4.03	3.04	1.70
1924	17.98	38.30	20.04	2.58*	3.32	1.73
1925	19.95	38.43	18.36	2.31*	3.52	1.70

* Mines transferred to Czechoslovakian rule.

Note: With due consideration to the condition of the world's coal market brought about by the British miners' strike in 1926, the comparison here and elsewhere has been carried only to the year 1925.

TABLE II—ACTUAL COAL RESERVES OF MOST IMPORTANT COUNTRIES
(In Millions of Net Tons*)

	Mineral Coal	Lignite	Total† of Coal
Germany	193,332	14,715	199,247
United States	2,189,022	2,053,554	3,014,551
Great Britain	208,865	.....	208,865
Czechoslovakia	5,057	13,823	10,614
France	18,460	1,798	19,183
Belgium	12,122	.....	12,122
Poland	161,585	3,966	163,179
Russia	62,218	1,800	62,941
Siberia	72,771	118,844	120,546
Canada	314,973	1,045,192	735,139
China	1,096,476	661	1,096,741

* Excluding the probable coal reserves. † Brown coal converted into terms of mineral coal.

always been first. The countries which produce brown-coal outputs worth mentioning, aside from Germany, are Czechoslovakia with 20.9 million tons, Hungary with 6.1 million tons, Austria and Canada with 3.3 million tons each.

Important features of the coal industry in Germany are its side lines, particularly the production of coke and its byproducts, also the manufacture of briquets. As regards the output of coke, Germany had even before the War far outstripped Great Britain. Its production of 38.1 millions of tons in 1913 was about 15 million tons larger than that of the United Kingdom and, since the war, despite the territorial concessions already indicated it has maintained, in a degree, that superiority. Although in 1925 its output had declined to 29.5 million net tons it was still 4 million net tons larger than that of Great Britain.

IT SHOULD be noted that about one-half of the English coke is derived from gas plants and that in

TABLE III—MINERAL COAL PRODUCTION OF MOST IMPORTANT COUNTRIES
(In Millions of Tons)

Country	1900	1910	1913	1924	1925
Germany	112.7	168.4	209.5	130.9	146.1
United States	269.7	501.4	569.8	571.5	578.0
Great Britain	252.1	296.1	321.8	299.1	276.2
Austria-Hungary	13.7	16.6	19.6	15.9	14.1
France	36.0	41.4	44.2	48.5	51.8
Belgium	25.9	26.3	25.1	25.8	25.5

Table IV the corresponding quantity produced in Germany, which in 1924 was 4.7 million tons, is not contained in the figures for that country.

In the manufacture of briquets of various shapes and sizes Germany leads, even disregarding entirely the product made from brown coal. Its output of mineral-coal briquets is 5.5 million tons and that figure is rivaled only by France with 4.1 million tons. Great Britain produced only 1.3 million tons and Belgium 2.5 million. However, it may profitably be emphasized that the production of briquets has by no means recovered from the setback which it suffered during the War and in the period following. Last year the production was about one-quarter less than in 1913, a result that was not affected seriously by territorial concessions.

In the year 1925 the mine coke plants produced 1,082,000 tons of tar valued at 43 million marks, 273,000 tons of benzol valued at 79 million marks and 442,000 tons of sulphate of ammonia valued at 78 million marks. The production of coke without saving the byproducts of its manufacture has become the exception in Germany. In 1925 of 17,117 coke furnaces operated only 246 failed to produce byproducts. On the other hand in the United States as well as in Great Britain the quantity of coke produced without byproduct recovery still constitutes one-fifth of the whole. Table V shows the value created by the processing of the coal.

TABLE IV—COKE PRODUCTION OF MOST IMPORTANT COUNTRIES
(In Millions of Tons)

Country	1901	1910	1913	1924	1925
Germany	10.1	28.3	38.1	27.4	29.5
United States	21.8	41.7	46.3	44.3	51.2
Great Britain	....	21.6	23.1	27.8	25.6
Austria-Hungary	1.4	2.4	3.0	2.4*	2.2
France	2.1	3.0	4.4	2.9	3.4
Belgium	2.0	3.4	3.9	4.6	4.5

* Mines transferred to Czechoslovakian rule.

From this table it will be seen that of the total values derived from the mining and processing of coal 1,903 million marks or 86.6 per cent were from mining, and 54 million marks or 2.4 per cent were from the increase in value due to coking and 27 million marks or 1.2 per cent were from the briquetting of the coal.

In the mining of brown coal, the total values derived from its mining and processing are 585 million marks in which 389 million marks or approximately two-thirds must be credited to the mining and 189 million marks or 32.4 per cent to the briquetting of the coal. The production of byproducts, which adds barely 1 per cent to the value, plays a substantially smaller part than in mineral-coal mining.

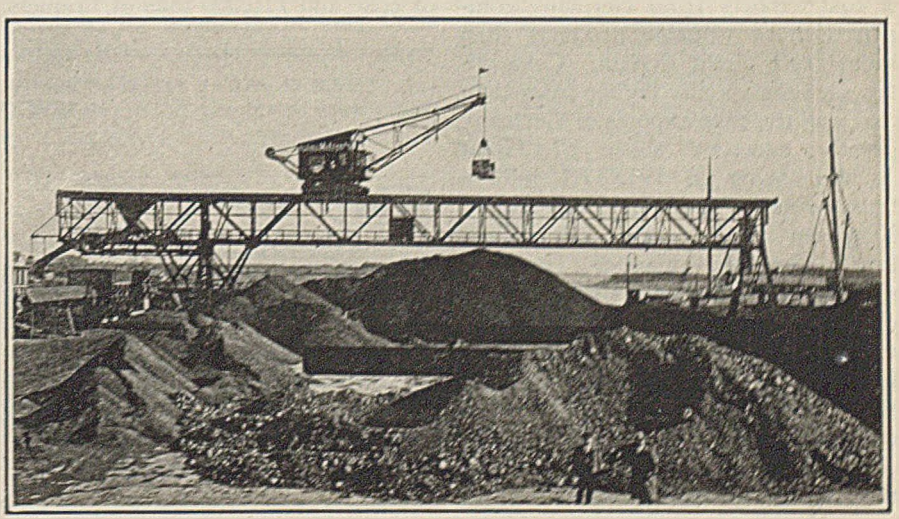
A word may not be out of place, here, as to the difference in the natural conditions under which coal is mined in the three most important coal-mining countries. Germany has natural conditions far less favorable than those of Great Britain and still less favorable than those of the United States. In its principal mining area, the Ruhr district, the thickness of the coal averages about 3 ft. 3 in., whereas in Great Britain it is about 4 ft. 1 in. In American soft-coal mines the average thickness is 4 ft. 11 in. and in the hard-coal mines even more than 6 ft. 6 in. Furthermore the average depth at which the Ruhr coal is mined is about 2,000 ft. The depth of the English coal is little more than half as great. In the United States two-thirds of the soft coal comes from drift mines, and the shaft mines are shallow, averaging in depth only about 262 ft. The average depth of anthracite shafts exceeds this a little.

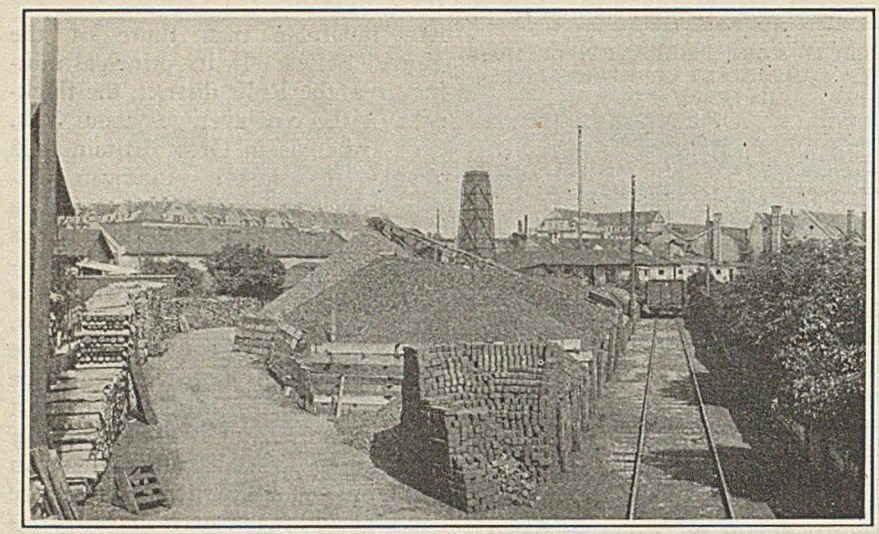
THE ADVANTAGES that Great Britain's mines have over those of Germany are increased still further by the location of its mines with reference to the sea. The average distance of English mines from tidewater is 25 miles whereas the Ruhr coal has to travel 140 miles to Rotterdam. It is because of this difficulty that Germany has sought to consolidate its mines into big companies by the creation of selling combines or syndicates.

Table VI shows which countries depend on their own production, which have to import coal and which export a surplus. The greatest number by far have to import coal. The only exporting countries worthy of note are Great Britain, Germany, the United States, Poland, the South African Republic and Australia.

Germany is more important as an exporter of coal than its share in the world's production would suggest. This is because the United States, which produces about one-half of the world's output plays but a secondary

German Coal-Handling Plant at Hadersleben, Denmark





Coal, Briquets and Wood in Munich Yard

part in the world's coal market, its exports of coal, except in abnormal years, being largely restricted to the American continent and the islands belonging thereto. Consequently the task of supplying coal to nations who do not produce enough coal to satisfy their needs is shared between Germany and Great Britain.

The coal exports of Germany made colossal strides in the generation preceding the World War, showing an increase—when coal, coke and briquets are combined after due conversion into a single figure—from 12 million to 50 million tons. Nevertheless, during the year before the War the German coal exports were still substantially less than the British, but they had developed in a much shorter time. They were, moreover, even greater when estimated by value instead of by weight. The value of the German coal exports in 1900 was only 36 per cent of the value of the British, but in 1913 they were 64½ per cent as large.

IT IS CLEAR, therefore, that the coal exports from Germany comprised more valuable products than those from Great Britain. Coke obtains a substantially higher price than coal, and the coke exports of Germany greatly exceeded those of Great Britain, being in 1913 7.1 million tons, whereas those of the United Kingdom totaled only 1.3 million tons. In like manner Germany shipped more briquets than the rest of the world. Where Great Britain exported 2.25 million tons in 1913, Germany sent 3.48 million tons to the foreign market, including those made of brown coal.

Germany found a market for its mineral coal largely in the countries adjoining. Her best customer was Austria-Hungary which, in the last year of peace received 13.39 million tons, to which were added over a million tons of coke and 154,000 tons of briquetted coal. Holland occupied second place, accepting 7.9 million tons of coal, 331,000 of briquets and approximately an equal quantity of coke. Belgium imported in the same year 6.3 million tons of coal, 1,036,000 tons of coke and 485,000 tons of briquets and France received 3.5 million tons of coal, 2.6 million tons of coke and 331,000 tons of briquets.

Another country, Switzerland, took 1.8 million tons of coal, 397,000 tons of coke and 716,000 tons of briquets. Altogether these countries received in the last year of peace, expressing the figures as of coal only, 42 million tons and thus accounted for 85 per cent of the German exports. The other 15 per cent was distributed, 6.3 per cent to Russia, 2 per cent to the Scandinavian countries, 2.8 to Italy, 0.7 to Spain, 0.4 to Roumania, 0.6 to Asia Minor and North Africa and 0.4 to South America.

TABLE V—BRIQUETTED COAL PRODUCTION OF MOST IMPORTANT COUNTRIES
(In Millions of Tons)

Country	1900	1910	1913	1924	1925
Germany	1.7*	4.8	7.7	4.8	5.5
United States	...	...	0.2	0.6	0.9
Great Britain	...	1.8	2.4	1.3	1.3
Austria-Hungary	0.1	0.2	0.2	0.1†	0.2†
France	2.0	3.4	4.1	3.5	4.1
Belgium	1.5	3.0	2.9	2.2	2.5

* Only Ruhr district. † Mines transferred to Czechoslovakian rule.

THE IMPORTANCE of Germany as a coal exporter was shaken to its foundation by the outcome of the War. Its coal resources were greatly impaired as has been noted. To this must be added the coal reparation obligations which in conjunction with the decrease in mining operations caused Germany to find difficulty in meeting its own domestic requirements, so that constantly decreasing quantities were available for free exportation.

In 1920, expressed in terms of coal, 9.6 million tons were available for free exportation; in the year following it was reduced to 5.6 million tons. It increased in 1922 to 6.9 million tons only to decrease to 1.8 million during the year of the Ruhr invasion. In the following year the official statistics show that the free exportation had increased to 4.4 million tons. In the last two years free exports have risen to 21.2 million tons of mineral coal with 1.9 tons of brown coal and 44.3 million tons of mineral coal with 4.3 million tons of brown coal respectively.

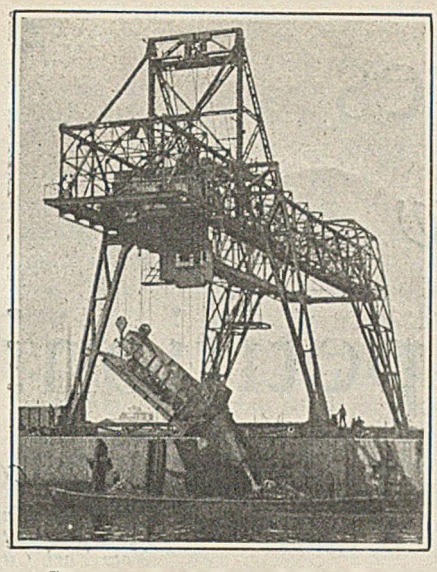
If the coal, coke and briquets compulsorily delivered are added to the free exports, the totals for 1925 and 1926 will run to 37.5 and 60.3 million tons of mineral coal and 3.1 and 5.5 million tons of brown coal respectively, which are quantities that were not reached in 1913 despite the larger quantity mined in that year.

Thus Germany has not only re-

TABLE VI—TOTAL VALUE OF PRODUCTION OF MINERAL AND BROWN-COAL MINING IN GERMANY

	1913		1925	
	Million Marks	Per Cent	Million Marks	Per Cent
Mining	2,135	88.8	1,903	86.6
Increase in value due to coking	68	2.8	54	2.4
Tar	27	1.1	42	1.9
Benzol	32	1.3	78	3.5
Sulphate of ammonia	116	4.8	77	3.5
Illuminating gas	3	0.1	11	0.5
Manufacture of pressed coal*	19	0.8	27	1.2
Mineral Coal Mining as a Whole	2,402	100.0	2,196	100.0
Mining	191	65.9	389	66.4
Increase in value due to coking	1	0.3	....	0.1
Tar	3	1.3	4	0.7
Other byproducts	....	0.1	....	....
Manufacture of pressed coal	91	31.4	189	32.4
Wet pressed stone manufacture	1	0.6	....	0.1
Brown Coal Mining as a Whole	291	100.0	585	100.0

* By deducting the value of the pitch addition.



Chuting Coal Out of Car End, Hamburg, Germany

gained its former importance in an extremely short period but even expanded its business. It is true that its exports do not go in the same direction as they formerly did due to changes in the political boundaries of European countries and to the obligation to deliver reparation coal. The states which seceded from Austria-Hungary after the War, in 1925 brought only one-seventh as much mineral coal as before the conflict, at which time the Danube monarchy took first place among the countries consuming German coal.

AN EXTRAORDINARY increase, however, is shown by France (5.9 million tons) and by Italy (1.3 million tons) which countries are entitled to reparation coal, whereas Belgium and Luxemburg jointly though their boundaries have not changed, show a reduction in imports of 1.4 million tons. In the matter of export to Holland, Germany has approximately maintained its position of 1913. At that time it furnished 8.0 million tons; in 1925 it supplied 14.16 million, which is all the more remarkable because Holland, as against the period before the War, has increased its own production of mineral coal about four times (7.5 million tons as against 2.1 million).

The deliveries to Switzerland have dropped off considerably. In 1926 that country received from Germany 838,000 as against 3,000,000 tons in 1913. This is due on the one hand to the development of water power and on the other to the importation of Saar coal which used to be credited to Germany but now appears under the head of imports from France. The Russian market which in 1913 absorbed 3.1 million tons has been entirely eliminated.

The shipment of German mineral coal, which is quite preponderently from the Ruhr district, has been, of late, by no means restricted to the adjacent and nearby countries. The overseas markets are assuming greater importance. Thus the three Scandinavian countries in 1925 with 1.34 million tons received even larger quantities of coal than in 1913. South America imported 389,000 tons of German coal as against 251,000 tons in 1913. Asia Minor and North Africa are again receiving German mineral coal, 251,000 tons having been thus consigned in 1926. Considerable quantities also went to the United States to make up deficiencies due to the anthracite strike. Mexico took 142,000 tons.

GERMAN re-establishment in the world's coal marts has been a necessary corrective for the progressive restriction of the home market, a development which started in 1924 and which came to an end only in 1926, when the economic condition of Germany improved. In this effort it experienced great difficulty owing to the British subsidy which made it possible for British coal dealers to reduce the price of export coal from 26 shillings in the second quarter without government subsidy to 17 shillings and 7 pence in the last month prior to the strike. Because of this decrease in price the Ruhr region lost much of its foreign trade.

The sturdy growth of the production in Holland and the complete recovery from war damages in northern France where the output now exceeds that of the pre-war period have proved severe obstacles to the growth of German coal exports. That the Germans do not have to thank the fortunate accident of the British strike is shown by the result of the year 1925 during which trade may be pronounced normal.

The success in the re-establishment of Germany's coal trade has its foundation in part in the economies planned in 1924 and effected in 1925 and 1926. These have their negative side in comprehensive mine suspensions and their positive side in the increased use of machines, in the adoption of scheduling of rope trips and in other measures. With regard to future trade there is always the apprehension that it will be possible for England to catch up.

That country still has the advantage of her natural conditions. German coal mining, as ever, must find means to meet the inherent disadvantages of its situation if it wishes to assert its position in the world market. The lead Germany has obtained for a certain period over British coal mining has of late disappeared as a result of the longer working hours that Great Britain has adopted.

TABLE VII—FOREIGN TRADE IN COAL OF MOST IMPORTANT COUNTRIES
(In Thousands of Net Tons)

Europe:				
Germany	1913	14,259	50,342	+36,083
	1925	9,083	37,141	+28,058
Great Britain	1913	33	109,872	+109,839
	1925	16	79,756	+79,740
France	1913	26,326	2,006	—24,320
	1925	34,650	5,745	—28,905
Belgium	1913	11,931	7,834	—4,097
	1925	13,176	4,842	—8,334
Italy	1913	11,939	48	—11,891
	1925	11,590	201	—11,389
Holland	1913	15,918	7,011	—8,907
	1925	9,922	4,649	—5,273
Poland	1925	269	9,307	+9,038
Russia	1913	11,054	107	—10,947
	1925	69	357	+288
Sweden	1913	6,133	.....	—6,133
	1925	4,884	.....	—4,884
Switzerland	1913	3,882	16	—3,866
	1925	3,148	1	—3,147
Austria-Hungary	1913	16,755	3,199	—13,556
	1925*	7,580	3,061	—4,519
Spain	1913	3,559	.....	—3,559
	1925	1,913	10	—1,903
Hungary	1925	1,315	321	—994
America:				
United States	1913	1,923	32,760	+30,837
	1925	1,253	26,771	+25,518
Canada	1913	19,084	1,546	—17,538
	1925	17,906	811	—17,095
Argentina	1913	4,490	.....	—4,490
	1925	3,514	.....	—3,514
Brazil	1913	2,368	.....	—2,368
	1925	1,934	.....	—1,934
Chile	1913	1,765	.....	—1,765
	1925	258	17	—241
Africa:				
So. African Repub.	1913	42	855	+813
	1925	8	1,758	+1,750
Asia:				
China	1913	1,999	1,667	—332
	1925	3,150	3,362	+212
India	1913	723	850	+127
	1925	460	380	—80
Japan	1913	4,455	4,243	—212
	1925	1,919	2,970	+1,051
Australia	1913	45	2,363	+2,318
	1925	49	1,148	+1,099

* Czechoslovakia and German Austria.

TABLE VIII—GERMAN IMPORTS AND EXPORTS
(In Thousands of Tons)

Year	Mineral Coal	Coke	Mineral-Coal Briquets	Mineral Coal	Brown Coal	Brown-Coal Briquets	Total Brown Coal
Imports							
1913	11,615	653	29	12,479	7,699	133	7,920
1925	8,384	76	41	8,518	2,529	168	2,805
1926	3,159	56	3	3,234	2,221	134	2,442
Exports Without Reparation Deliveries							
1913	38,101	7,065	334	49,493	66	949	2,153
1925	15,038	4,161	882	21,184	36	875	1,962
1926	32,227	8,133	647	44,263	87	1,914	4,298
Total Exports Including Reparation Deliveries							
1925	25,752	8,348	881	37,481	36	1,369	3,050
1926	42,470	12,449	1,749	60,262	87	2,485	5,554

Can Company Stores *Meet the New* Competition?

By Dr. N. A. Brisco

Director, School of Retailing
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New York City

BUYING MERCHANDISE to sell at retail is one of the oldest of the arts but the newest of the sciences. Formerly it was thought that if one had neither the time, the wit, nor the opportunity to master a profession, he could always turn to storekeeping and make a living. In later years, however, the supremacy in competition evidenced by chain stores and others who apply scientific methods in retailing have brought all those engaged in retail distribution to realize that success in the future will come to those who conduct their stores on the basis of scientifically applied knowledge rather than on the old basis of haphazard guess.

The company store differs from the unit store chiefly in its management. Many have prophesied that in the near future the company store will gradually disappear and become a tradition. Nevertheless, it is true that the future of the company store will depend upon the efficiency with which it is conducted. Today there is usually lacking in the company store the efficient management that is found in the progressive unit stores and the chain stores. It is rather the exception for the manager of a company store, for instance, to have expense control. There is little excuse for this condition. Improved methods in retailing constantly being developed by chain stores and more progressive unit stores are adaptable to the company store.

The manager of a company store should be alert for new methods and new ideas that will enable him to conduct his store more economically and more efficiently. This attitude toward better retailing methods is essential if the company store is to compete successfully with chain and unit stores.

Dr. Paul H. Nystrom, in "Chain Stores," says that a store laboring under the difficulties of an unsuitable building, displeasing appearance, difficult entrance, poor fixtures, inadequate displays and inefficient selling methods, is certain to lose possible sales. A building adapted to handling and displaying merchandise at minimum cost will save considerable overhead. More attention should be paid to location of store, convenience in receiving merchandise, economy in storing stock, economy of space in displaying goods and minimum expense and greatest efficiency in delivery. Furthermore, chain stores make a specialty of carrying goods that are in demand and these goods are bought at the best possible price and terms.

The external features of a store suggest to the customer its nature and for that reason the store front should be attractive and distinctly individual. Note the attractive appearance of the average chain unit store. The entrance and windows should radiate cheerfulness.

The customer of the average company store is more independent in her shopping than was the case ten years ago. She enjoys shopping and does not hesitate to go to competing stores to do her purchasing. This new type of customer is more discriminating in her choice and more critical in her purchases. Her problems must be more diligently studied and greater care should be exercised in meeting her wishes.

Ascertaining where to purchase, not from the whims and the wishes of the buyer, but from an understanding of what the customer really wants, is the new trend in buying. This is stated effectively in the words of a buyer: "Buying must be gaged from the customer-demand angle and not from that of the store manager's wishes and whims." The study of customer demand must be given more attention in the company store. Chain store systems follow very closely the trend of customer demand.

At a recent meeting of the executive committee of a prominent chain system the following problems were discussed: Why was the increase of sales in the ten cent articles greater than in the dollar merchandise?; what were the best selling items in the dollar class and in the dime group?; what articles should be eliminated from each group? If company stores compete with chain stores they must adopt chain store methods of carefully studying customer demand.

ACCURATE information of what has been sold, and in what quantities, may be secured through systematic records. It may be admitted that in a small store sales records may not be essential, yet they are most helpful to prevent either over-buying or buying lines that will not sell. If the stock is too large to allow the buyer to have an intimate knowledge of his stock, records must take the place of memory.

A trustworthy sales-record system demands that a record be kept of different factors as number, style, price, size and color. The information recorded will depend upon the type of merchandise. A record of the number of articles sold indicates the kind and quantity that has met with public favor and which is most acceptable to the customer. A record according to price lines or different selling prices indicates what the customers have been willing to pay for each kind of goods. A record of sizes indicates the size distribution of garments, shoes or articles where size is a factor in sales. A detailed sales record gives a buyer an account of past performance, which is invaluable in planning what and how much to buy. Much of the success of chain stores is due to their system of merchandise and accounting records.

AN AID in maintaining merchandise values and store service in line with the competing stores is comparative shopping. In large stores this function is the work of a special department under the direction of a manager assisted by a corps of assistants. In small stores the merchant employs special people to do the shopping. The manager of a company store found a decided decrease in sales of one of his best selling lines. He was competing with three other merchants. Once he asked a customer, who was accustomed to buy this particular article, if he wished to buy some of it that day. He answered: "No, I can get it fifty cents less at Smith's." It was learned that Smith was making a special of that particular article. The manager reduced his price and the sales returned. In the future he followed closely what his competitors were doing. It does not matter so much with an article where only a small amount is sold, but with a best seller comparative shopping becomes, in this age of keen competition, an absolute necessity.

Every store should have a definite place where all merchandise is received, unpacked, checked and distributed either to selling floors or to reserve stock rooms. In many stores merchandise is frequently delivered direct to the selling departments. This is not only a bad but a costly practice. It is impossible to insure that buyers or their assistants in their respective selling departments will keep a correct record of merchandise thus received and a careful count of it to ascertain that the amount corresponds to the amount charged on the shipper's bill.

Chain systems and progressive stores insist that orders be specifically made out, carefully checked with invoices, and goods on receipt checked with invoices. This practice should prevail in all company stores.

Quick turnover is the watchword in retailing and this may be accomplished chiefly by eliminating slow-selling merchandise. In order to detect this merchandise, every price ticket should be marked with a season letter or the date of receipt of goods. Whether this date indicates the exact day the goods were received or simply the month or season will depend upon the merchandising policy of the store. How the date is shown is not important so long as it is in some simple code. By means of the season letter every article that has been in the store more than a reasonable length of time may be discovered and removed from stock, either by special sales promotion or by reducing the retail price. The season letter is a most effective means of locating slow selling merchandise so as to make its disposal possible.

Wherever feasible, a price ticket should be placed upon every article. The three chief reasons for marking each article are: The price ticket acts as a silent salesman; it advertises the merchandise to the customer who is hesitant about asking the price; the price ticket avoids the misquoting of prices to the customer.

The price tickets should be printed or neatly hand printed in ink or by indelible pencil. A salesman in the Middle West through the use of a good erasure was able to defraud his store out of three thousand dollars

Dr. N. A. Brisco

before he was discovered. Untidy and unstandardized tickets are not good advertising. A typed ticket has an air of authority and this gives the customer confidence that she is paying the right price.

Stores are laying more and more stress on invoice control because of the desire to take advantage of cash discounts. Discounts earned in many stores nearly equal profits. If it were not for discounts many stores would not make profits.

TURNOVER has been declared to be the best possible guarantee of profits. The ideal turnover policy is a small stock selling rapidly and being constantly replaced by new merchandise. Turnover means the number of times during a certain period, usually a year, that the average stock of merchandise is bought and sold. The turnover varies for different kinds of stores and for different kinds of merchandise. Nevertheless, in each case an average turn may be ascertained and the aim should be to reach this or to increase it.

The chief benefits that arise from a rapid turnover are: Ability to operate on a smaller capital; the smaller the capital the less the interest charge; rapid replacement means fresher stock; handling expenses are proportionately less; mark-downs are less; ability to meet market changes and, therefore, less risk.

THE following is a good concrete example of effect of increased turnover. A shoe retailer was not satisfied with his turnover and made a careful study of his business. The following condition was found:

Classifications	Number of Styles	Number of Pairs	Annual Turn-over
(a) Rapid-moving styles	5	333	16
(b) Average-moving styles	40	2,300	5.1
(c) Slow-moving styles	105	7,050	1.6
(d) Non-moving styles	33	950	.....
Total	183	10,633	Av. 3.3

In a few months, he reduced his stock from 10,635 to 5,040 pairs and the number of styles from 183 to 84. What the shoe retailer did should be done by the manager of every company store provided, of course, that it is not operated on a good merchandise control system.

Company store managers should pay more attention to price lines. In a recent study the following facts were discovered: A merchant had 30 price lines in one of his departments, but he did 83 per cent of his business on 27 per cent of his stock, which represented 6 price lines and 20 lines were totally inactive. A second merchant had 77 price lines in one of his departments and did 78 per cent of the sales volume on 8 of these. Merchandising to definite price lines is feasible in nearly every department of a company store.

The model stock plan is attracting much attention and may be operated successfully in every company store. The purpose, as stated by Mr. Edward A. Filene, is to have the right goods, at the right time, in the right quantities and at the right prices. To do this it is necessary to determine, for any given class of merchandise, and for all classes carried, the three prices—low, medium, and high—at which the largest quantities of that merchandise can be sold. At these prices, complete stocks should be carried. In the average department fully 85 per cent of the stock may be concentrated at the three price lines, and the remainder at intervening levels.

Coal Age

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John M. Carmody, *Editor*

New York, December, 1927

Not Too Early to Plan Next Year's Safety Program

If there still be doubt about the possibility for immediately improving the mine accident rate in West Virginia, or elsewhere for that matter, encouragement may be drawn from the competent statements made by R. M. Lambie and W. H. Forbes in separate articles in this issue of Coal Age. Both men hold high rank in the field of safety. Both have demonstrated by heroic work and by genuine devotion to their chosen profession their right to speak authoritatively.

They point out clearly that lives may be conserved and money saved if operating officials, supported by top executives, will set up safety standards and enforce them rigidly. No two mines are exactly alike. Nevertheless each has its own peculiar hazards that should be understood by officials and men alike. It is not enough to recognize these hazards; definite steps must be taken to overcome them.

Intelligent timbering stands out as a constant need. United States Bureau of Mines statistics act as a reminder that accidents from roof falls exceed those from any other single cause. Why neglect necessary precautions? Why continue to take chances? Organization for safety at each mine, fostered by competent men, plus genuine cooperation throughout the industry, should be definitely planned to make the new year better than its predecessor.

Cost of Idleness in Terms of Rent

Deplorable as is the number of idle and irregularly-working mines, entailing loss of interest, depreciation and undue ventilating and drainage costs, such idleness is inevitable with the present overdevelopment. It is said that in the anthracite as well as in the bituminous region capacity has grown so fast that the loss in demand does not explain the greater part of the plant idleness. The important factor in the short operating time is not the dull market but rather the growth in capacity.

But even in mines that work steadily, there are heavy losses of a similar kind. Every roadway and room which is idle represents capital expended without return. Every room that is inadequately manned is using capital without proper remuneration. Every place that lies idle part of the day because shooting can be done only at night is rendering for the capital expended less than might be afforded if the coal were shot whenever the need arose. Every room that is driven up and the pillars allowed to stand is wasting the development that has been expended on it. On all this construction a rental charge may be made equivalent to the interest on the investment, the depreciation, the maintenance and, in some mines a hazard factor, for the seam comes and goes uncertainly.

All this, as one authority has suggested, may be designated rent. But some will urge that when the room is completed the rent must come to an end and what becomes of the capital charge and interest then? The cost should have been by that time amortized by the sale of the coal. If the price obtained for the coal has not paid for the expenditure, the interest and the maintenance, it has been expended in vain. If the room is driven slowly, irregularly, or lies idle or if the pillar is similarly treated, "rent loss" should be borne in mind, for if the room is not driven or drawn other places must be provided in its stead.

Only when superintendents and foremen know that there is a rental charge against each place will they persevere in their prompt completion of it as a means of saving expense. Setting up standards in terms of rent may be more effective as an urge for speed and economy of operation than capital return.

After Peace Has Been Restored in Colorado, What?

Developments in Colorado since the middle of August are a challenge to the advocates of the company union plan. The efficacy of state regulation of industrial relations also is involved. Although the situation is further complicated by the fact that the strike which has crippled production in the state has been conducted without the sanction of the labor organization recognized by operators who continue union affiliations, there can be no denying that by one means or another an organization that has few friends outside the ranks of radicalism has been able to induce hundreds of men to lay down their tools. Why? Empiric denunciation cannot explain away the situation. What is needed is a patient, sympathetic re-examination of all the facts and factors in the case so that out of present discord there may be distilled further understanding of the springs which move men to action.

Can Modern Methods Be Used by Company Stores?

So long as stores are operated by mining companies, either for profit or as a convenient service for employees, they should be efficiently managed. Elsewhere in this issue of Coal Age, Dr. Morris Brisco, Director of the School of Retailing, New York University, New York City, points out what the new competition offered by chain stores means to company store management.

Retailing has made great strides during the past decade. Scientific methods of merchandising, financial control, display and selling, have not only put the business on a sound basis, but have operated to give customers better merchandise at lesser cost than can be done through haphazard store-keeping. Mail order houses and chain stores, as aggressive competitors, are forcing company stores to adopt modern methods. Group buying has given many stores decided advantages.

Some company stores have kept pace with this new development in retail practice. Many, however, are not yet awake to the new day. In altogether too many such stores, inventories are still carelessly taken. Buying is done by whim of manager rather than by careful analysis of customer demand. Merchandise is carried on shelves and in stock for years. There are no turnover records. Clearance sales are not well organized. Literally, millions of dollars are today tied up in merchandise in company stores that is not worth fifty cents on the dollar cost. Where there is sufficient courage to face the facts and act on them, a thorough housecleaning would do many company stores a great deal of good if followed by the introduction of some modern merchandising thinking.

Who Won the War Now That It Is Won?

Time was when a burly, "hard-boiled" individual with loud voice and rough ways seemed the embodiment of what was desirable in a manager or a foreman. He depended on a "hunch" for all his methods. He improvised as he encountered his troubles. He went into his battle a barbarian without strategy. His only method of meeting his difficulties was working long and working hard—and he and his men did both.

But times have changed. Management is no longer noise and fury. Research and planning have displaced revelation and inspiration. No longer is the game won by long hours and hard conditions, by discomfort and actual suffering. Managers are looking forward and arranging the future, not looking back and correcting the past. The road of operation is all laid, ballasted and drained before the locomotive goes over it.

Some have termed the new technique scientific management, for it puts reason before action, thought before judgment, study before determination and uses, therefore, the scientific method. But to many the word "scientific" is offensive. Management, they say, must be hard business sense or it is nothing. But what is less visionary and more substantial than something scientifically determined?

Truth to tell, nearly all the science of management is being or has been accepted by the mining industry under the title of common sense. One by one, the ideas become the basis of common practice and cease to be regarded as scientific. The mining public persists in the belief that the only concepts that scientific management may continue to hold for its own are those which the public still deems false; all the rest, though formulated originally as scientific management, are so no longer. They are a part of business, which has obtained for them a squatter's title. Only by looking back can the ground gained by hard struggle be evaluated; but as it is surveyed a difference arises as to who won the war for better management.

Only by Knowing Exact Costs Can Managers Succeed

Too many managers are ready to list what they want—locomotives, rails, mining and loading machines and so forth—and forgetful to reckon and tabulate what they are losing by not having what they need. Budgeting of costs and savings is the basis of success in operation. The superintendent should be able to show himself and his manager just what expenditures would give the greatest return on an investment of capital.

For instance, back entries may be full of broken rock and crosscut stoppings may be leaking. What will it cost to put the airways in order and how much will the bill for ventilation be reduced by the change? Is it a mere whim that urges the superintendent to put track and a loading machine in his back entries or would it be a highly profitable expenditure of money? The rock will have to be dumped. Is he able to estimate just what it will cost to dispose of the spoil?

Most men do not know how many cubic feet of rock measured in the solid are actually loaded in an average car nor can they tell the relative cost of various methods of dumping. They have no way of adequately estimating the cost of rock disposal. They have not even the very elements of cost analysis under their command.

The BOSSES *Talk it Over*

Can Repair Costs Be Cut?

"SOMETHING has got to be done," observed Jim as he leaned forward over his desk, looking hard at Mac, Shorty and Tom, who were seated about his office.

"Our repair costs have kept going up and up and the Old Man is getting peeved. We can't blame him either," he continued. "Every month repairs go up."

"Not only that," cut in Mac, "but there is the indirect loss of breakdowns. They tie up the mine and interfere with production to beat the band. If it ain't cars, it's locomotives. Working this mine is getting to be just one darn breakdown after another and every blamed one of them means a loss both ways—repairs and lost output."

"Is there any way we can see the breakdowns and burnouts and other mishaps before they occur?"

"Yes, there is," spoke up Tom, the master mechanic. "There is a way that they can be anticipated and prevented—that is most of 'em. It's the same scheme that the railroads an' steamship companies an' other big concerns have used for years. As you all know every time a train stops at a big town men go along 'an bat every wheel with a hammer looking for cracked flanges and feel of every box to see if it is hot. Every time a ship comes into port her engines are gone over to see if everything is in shape for the next voyage. If a nut is loose or a bearing worn it is tightened and fixed up before she sails again. That sort of stuff is efficient but is expensive and that is probably the reason why the coal companies shy at it. But you can bet that it pays in the long run or the big companies wouldn't stick to it."

"What would it cost, Tom?" rejoined the super. "Do you mean that every time Old Ironsides came to the bottom that Shorty here should be on hand to give her an X-ray once-over and apply first aid? He wouldn't have time for anything else!"

"Not every time she came to the bottom, of course not," came back the master mechanic. "That would be crazy! But every once in so often, say once a week or so, somebody that knows locomotives should go over her from stem to stern and wherever he finds anything that is the least bit out of the way he should fix it right then. An' once in six months or a year she ought to have a thorough overhauling. 'A stitch in time saves nine' is just as true of locomotives and cars as it is of clothes."

"I've seen a lot of systems used by coal companies," said Jim, "and most of them call for a lot of reports. Like a new broom they sweep clean at first, but after a while they get to be just another piece of routine. Nobody looks at them and first thing you know they die out. What I'm looking for is something simple that will get results every day."

Have you had this problem at your mine?
How did you handle it?
Who makes the inspection? Is it done regularly?
Is a report made out showing condition of equipment?
Do copies go to foremen and superintendent?
What would you do if you were Mac or Tom or Jim?

All mining men are urged to discuss these questions.
Letters accepted will be paid for

Jim and Mac Advised To Modify

Standardization Is Desirable If Modified for Local Needs

STANDARDIZED mine layout is advisable for several reasons. The most important reasons are: Controlling the output by being able to foresee what to expect from that method; and, by being able to calculate the time of sections working out, to have the material for other sections. It also makes uniform pillars, thereby making it easier to keep a uniform pillar line; and it is less difficult to provide equipment to meet the conditions expected, since these conditions may be more accurately judged when worked on a standard system for a section.

It is easier to provide material for the proper working of a section if the whole section is worked on a standard system and thus, if everything is properly planned that comes under these headings, costs will be considerably reduced. Efficiency on the part of the workmen is also secured by standardization because they soon become acquainted with the system used.

But there are times when I would recommend a modification of the layout of a mine. Whenever a system has been adopted that does not permit the mine to be worked safely and efficiently it should be changed. It would be more efficient to bring the modifications on gradually unless the safety or efficiency of the section could be materially increased by making the change abruptly.

When the projections are made for a mining property, the superintendent's chief engineer and manager usually decide on the most desirable system for the mine and the property. As to the number of main entries, distance between butt entries, width and distance between rooms, and the angle the different workings are to be turned, various standards systems may be adopted; however, after a time when the mine is well under way, conditions are found that were either overlooked or that were not expected in the property, making these projections and methods inadequate.

If the property has been fairly well prospected by drifts around the crop line or by drill holes it gives a good approximate idea of the pitch heights thickness; kind of top covering; and the grade of coal; but these usually include a large boundary and often show up more favorable than are found in the boundary of the property.

H. T. WALTON

Wolfpit, Ky.

Modification Should Follow Careful Engineering Survey

I AGREE with Mac that the mine projections should be changed at once down in the swamp section where the overlying strata is getting heavy. Evidently, Jim and Mac do not realize the amount of cover they have over the coal in the swamp section. In this case, if I were them, I would insist on a gradual modification of the present system until the barriers and chain pillars have sufficient thickness to control or stop the setting down of cuts on the pavement before they are shot and the action of draw slate and timbers becomes normal.

If they go into the modification abruptly it may disfigure their track layout and increase their entry work due to thicker chain pillars between heading and aircourse. Heading coal costs more than room coal and any increase in centers between heading and aircourse simply lengthens the crosscuts and builds up a higher rate per ton for development work. Therefore, by making the change gradually they will eliminate short curves in their trackwork and will not increase the thickness of the pillars over the amount that is necessary to control the weight of the over-cover strata.

Continuing on the present system may be the means of causing a squeeze and, if not, the extraction from this section will be very expensive due to excess timber and the handling of more gob than is customary under normal conditions. The modification of mine projections is essential in any mine operating an acreage that has not been core drilled and where the surface streams, swamps and contours have not been located.

I believe that one of the best investments any operating coal company can make is to have the acreage core drilled and a complete property survey made, locating the contours of the surface, elevations of the coal at the respective boreholes, property lines and other valuable detailed information before the mine is opened. By having this data, a mine can be planned so that a standardized mine layout may be adhered to with the exception of minor changes as the development work progresses.

If the mine in question had spent the money in engineering as outlined above, there would have been no cause for alarm of a squeeze in the swamp section or modification of mine layout as the mine would have been so planned that the weight in variation of cover would have had no ill effect on the workings below. The average coal company usually looks upon the money spent for reliable, accurate engineering work as something unnecessary, but the progressive operating executive of today knows the value of the mining engineer and does not consider his work as an expensive luxury but an asset.

C. T. GRIMM

Adrian, W. Va.

Topic for January

Who Should Be RESPONSIBLE *for electrical* Equipment?

Should electricians report to mine foreman?

If so, how much should mine foreman know about electrical work?

Does the size of the operation make any difference in organization?

Co-ordination Is Best Policy For Successful Operation

I HAVE become more and more impressed with the idea of the "Law of Co-ordination" in all the various branches of coal mining. Consider the position of the superintendent of a very large mine when he has from 6 to 8 mine foremen or —as is frequently the case—more than that number. Such must be at times a tremendous strain upon his nerves. To fulfill such a position calls for unusual character and energy. He must have a thorough understanding as to the uses of each piece of machinery to see that it is not taxed beyond its rated capacity; he must understand that the capacity rating of a man is not overtaxed—because the sudden breakdown will cause considerable loss due to too many breakdowns in the rank and file.

This item alone is one of the principal things the superintendent of a mine must cater to. He must keep plenty of good workmen on hand. To do so he has to umpire many cases of assumed mistreatment and, after careful study of the facts, make his decision so as to avoid illwill either upon one side or the other.

Then to avoid the aforesaid trouble there must be a system of periodical get-togethers of all officials to talk methods over and establish a permanent course to follow under the guidance of the superintendent.

The duties of mine foreman, assistant mine foreman and firebosses are all covered by acts of assembly. The superintendent must see that the law is being followed.

R. W. LIGHTBURN

Nemacolin, Pa.

"Standardization" Won't Work

JIM and Mac seem to have trouble working a mine that is run for them by a chief engineer from Fairmont, Baltimore or elsewhere. They are simply there to take orders from the chief. He had all the headings and rooms projected for that mine before any coal was taken out and it looked nice on the blue print. However, he did not take into consideration the roof conditions of the mine.

There are very few mines where the roof conditions are the same throughout and there are very few where the cover over the coal is of the same thickness. As the conditions of the mine change so should the headings and rooms be changed to avoid trouble such as squeezes or creeping or falls of roof, which require much timber and handling of rock.

This eats into the profits of the company. The men at the mine should run it to avoid these conditions. There are few mines where the standardization of mine layout is advisable and can be adhered to.

JOHN BOHN

Hooversville, Pa.

WORD *from the* FIELD

Colorado Governor Urges Strike Settlement

Governor W. H. Adams of Colorado has been working on plans during the last week to settle the strike called by the I.W.W. in the Colorado coal fields six weeks ago. Special efforts are being made to end the trouble since the clash of mine guards and state police with strikers at the Columbine mine of the Rocky Mountain Fuel Co., in Weld County, on Nov. 21, which resulted in the killing of five strikers and the wounding of more than a score of others as well as a number of the guards. The flare-up occurred when strikers attempted to invade the property in defiance of the orders of the state police.

Prospects of an early settlement are not particularly bright, as two of the largest operating companies in the state are opposed to meeting the strikers in a general conference to arrange an agreement. The Colorado Fuel & Iron Co. insists that there is no strike; that its miners who are not working are idle because of intimidation. Officials of the National Fuel Co. said they would meet their men direct if they had any grievances. Officials of the Rocky Mountain Fuel Co. are reported to be willing to agree to any plan suggested by Governor Adams.

Several minor disturbances have occurred in the southern Colorado field, where operations are approximately 60 per cent short in man power. In the Canon City and Crested Butte sections the mines are practically totally disabled, while Routt County is running about 50 per cent of normal. Hand-to-hand fights have resulted with the reappearance of pickets following the almost total cessation of activities by these agents.

Petitions bearing the signatures of nearly 6,000 miners have been presented to Governor Adams asking that he use his good offices in arranging a meeting between the strikers and the producers. The Governor said he would call the attention of the operators to the peace move and added that he was hopeful that the end of the walkout was not far off.

The State Federation of Labor also has offered to assist in bringing about a settlement of the difficulty. A statement issued by officers of this organization criticized the companies for their treatment of the miners, accused the State Industrial Commission of "playing politics" and charged that the I.W.W. leadership of the strike was not desirous of effecting a settlement for the benefit of the miners.

Mining Congress Plans Interesting Sessions

Officials of the American Mining Congress anticipate that the 30th annual convention of the organization, to be held in Washington, D. C., Dec. 1-3, will be the most interesting and successful held in recent years. A long list of prominent speakers are on the program for papers on vital questions in the mining industry and conferences with important government officials will be held.

Wm. H. Lindsey, Nashville, Tenn., president of the Congress, will sound the keynote of the meeting in his opening address, "Mining, the Keystone of Industry." Other topics to be considered are "Legislating for Natural Resources," "States' Rights, Individual Initiative and Centralized Government," "Modification of Anti-Trust Laws," "Mine Taxation" and "Progress in Mining."

Among the speakers will be Herbert Hoover, Secretary of Commerce; Scott Turner, Director, U. S. Bureau of Mines; Senator Oddie of Nevada; H. N. Taylor, president, U. S. Distributing Corporation; J. D. A. Morrow, president, Pittsburgh Coal Co.; E. A. Holbrook, dean, School of Mines, University of Pittsburgh.

L. P. Johnson Heads Harlan Operators

The Harlan County Coal Operators' Association held one of its most successful annual meetings Nov. 10 at Harlan, Ky., with a large attendance of producers as well as officials of fourteen railroads present as guests at the dinner. L. P. Johnson, general manager, Crummies Creek Coal Co., was elected president for the coming year, succeeding W. A. Ellison.

Harry L. Gandy, executive secretary of the National Coal Association, spoke at both the business meeting and the dinner. At the dinner E. C. Mahan, president, Southern Coal & Coke Co., and president of the National Coal Association, presided as toastmaster. The address of the evening was delivered by T. Russ Hill, president, Hill-Lawson Co., Middlesboro, Ky.

The newly elected vice-president is D. B. Cornett, president, Cornett-Lewis Coal Co., and the executive board is as follows: R. W. Creech, president, Creech Coal Co.; S. J. Dickenson, secretary-treasurer, Mary Helen Coal Corporation; A. F. Whitfield, Sr., president, Clover Fork Coal Co.; John Marland, general superintendent, King Harlan Co.; W. A. Ellison, vice-president, Mahan-Ellison Coal Corporation; J. C. Stras, president, Kentucky Cardinal Coal Corporation; J. B. Torbert, president, Harlan-Wallins Coal Corporation; R. C. Tway, president, R. C. Tway Coal Co., and B. W. Whitfield, president, Harlan Collieries Co.

Scant Hope Held of Coolidge Aid in Settling Coal Strike in Pennsylvania and Ohio

Economic changes being such that there is no urgent demand for coal, President Coolidge is of the opinion that one of the cures for the present troubles in the bituminous coal fields of Pennsylvania and Ohio may be the exodus of miners to other more lucrative industries. Therefore, there has been no development resulting from the suggestion that Mr. Coolidge call a conference of operators and miners to lift the suspension.

The President has made it evident that he thinks such a conference would avail little, but that the government would do all it could to help solve the problem, which he characterized as one of economic readjustment.

Headed by William Green, president of the American Federation of Labor, and John L. Lewis, president of the United Mine Workers, a delegation of labor leaders called on the President Nov. 21 and urged him to call a conference of operators and miners to effect a settlement of the strike in the affected areas. The labor men also asked Mr. Coolidge to recommend to Congress an investigation into an alleged conspiracy by railroads to depress coal prices and into the issuance of federal and state court injunctions against the strikers.

This action by the union men was taken as the result of a vote of 250 officers of national and international organizations affiliated with the American Federation of Labor, meeting in Pittsburgh, Pa., Nov. 15.

After a three-hour conference with the labor leaders the following day Governor Fisher announced that he would order a special investigation into the charges of abuses by coal and iron police against the strikers in Pennsylvania.

Shooting, Mechanical Loading and Dry Cleaning Discussed at Illinois Institute Meeting

ATTENDED by more than 100 members and guests, the annual meeting of the Illinois Mining Institute was held on Nov. 18 and 19. Business and technical sessions occupied the first day at Danville and a tour of various points of interest on the campus of the University of Illinois at Urbana, the second.

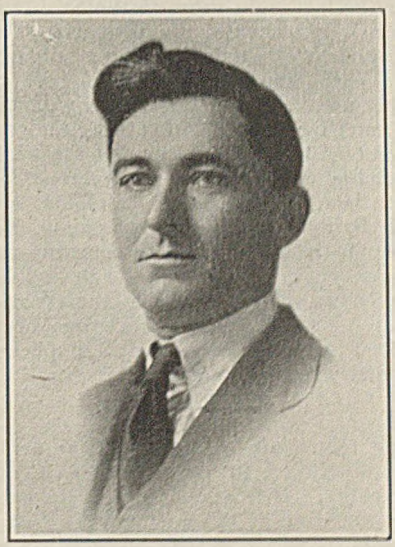
James S. Anderson, superintendent, Madison Coal Corporation, Divernon, was elected president of the Institute for the ensuing year; John E. Jones, Old Ben Coal Corporation, West Frankfort, first vice-president, and Prof. A. C. Callen, department of mining engineering, University of Illinois, second vice-president. Frank F. Tirre, St. Louis, was re-elected secretary and treasurer. Members elected to the executive board were: Thomas Back, Canton; J. W. Starks, Taylorville; A. D. Lewis, Springfield; J. A. Garcia, Chicago; J. A. Jefferis, St. Louis; B. F. Meyer, Staunton; S. T. Jenkins, St. Louis; Paul Weir, Zeigler; T. E. Coulehan; B. E. Schonthal, Chicago; J. F. Rodenbush, West Frankfort, and J. D. Zook, Chicago.

Following the election of officers, the balance of the first morning session was given over to a "free for all" discussion of various topics of general interest. Particular attention was paid to the shooting of coal with "Cardox" (liquid carbon dioxide cartridges), the discussion of which was led by E. Johnson, Chicago, and Lee Haskins, Terre Haute, Ind.

AFTER luncheon two papers were presented at the technical session presided over by James S. Anderson. The first, entitled "Experience in the Use of Mechanical Loading Machines," was read by Newton Bayliss, superintendent, Union Colliery Co. He stated that rapid progress has been made in mechanical loading since 1922 and it is reasonable to believe that this improvement will continue for some time to come. "Present practices will be discarded for new and better ways and means of performing different operations. A process of education for both labor and management is absolutely necessary before mechanical loading is to be made a success under any kind of natural conditions or with any special type of machine. It has been said that mechanical loading is 80 to 90 per cent mental attitude. Any operator who thinks he is successfully embarked upon a system of mechanical loading when he has purchased the necessary equipment and placed it in his mine may be rudely awakened by his own organization or by the labor."

Mr. Bayliss then went on to briefly describe the various classes, types and manufacture of loading machines and detailed the introduction of such machinery at the Kathleen mine of his company, which, including all necessary changes in the top works, cost approximately $250,000. In June, 1924, a rehnilt rock loader was introduced as the first step in the mechanization of loading. This was soon discarded in favor of standard equipment, and in August, 1925, six mechanical loading units of various types and manufacture were loading 22 per cent of the daily output of the mine. In February, 1926, there were nine units loading 38.4 per cent of the production; in June, 1926, twenty units had been installed and were loading 92.5 per cent of the coal produced, and by December of the same year, 22 mechanical loading devices (two being kept in reserve as emergency "spares") were loading practically 100 per cent of the daily output of 5,000 tons.

THE complete mechanization of loading necessitated several changes in surface and underground arrangements. Picking tables were lengthened; more pit cars were purchased; under-



Newton Bayliss

ground substations, near the base of operations, were installed; an aerial tramway was erected to dispose of the refuse, and a new underground repair shop, about a mile from the bottom of the shaft, was built. Shearing machines were introduced with considerable success and the tons per man per parting was increased from 15 to 21; the tons of coal per pound of powder was increased from 7 to 14; labor costs at the face were reduced 11c. per ton; and there was much less wear and tear on the loading machines.

By better preparation of coal and the elimination of unnecessary delays the capacity of the loading machines has been increased until in March, 1927, six Goodman loaders averaged 273 tons per day per machine, and ten Joys with three of them double-shifting (the equivalent of thirteen machines) averaged 176.6 tons per shift per loader. The Joys are worked in entries and places where conditions are not suitable to the Goodman loader.

In concluding, Mr. Bayliss stated that to date his company has not changed the system of mining to any great extent as the management did not wish to introduce two unknown factors at the same time. "What success we have had with mechanical loading has been obtained by continuously hunting the faults and devising ways and means of eliminating each weakness as it is discovered."

The animated discussion which followed the reading of Mr. Bayliss' paper was led by Harry Treadwell, superintendent, Orient Mine No. 1, who said, in part: "When a company decides to mechanicalize, the personal or human problems generally are of as great importance as the machines themselves. I have never known a successful mechanical loading installation except where the men in charge were completely sold on the idea. Lukewarm or half-hearted support will only result in trouble. The thing that makes mechanical loading successful is organization, management and perseverance. The average good machine will work if it has a chance."

IN THE unavoidable absence of Ray W. Arms, his paper, "Dry Cleaning of Coal," was presented by J. E. Machamer, engineer, Roberts & Schaefer, Chicago. Touching upon the subject of mechanical loading, Mr. Arms said that it was inevitable that machinery should eventually entirely replace hand loading of coal in the mine. Such machinery, however, will be completely successful only when mechanical cleaning plants are a part of the mining equipment, since it is practically impossible to discriminate between coal and refuse when loading mechanically.

Mr. Arms then briefly discussed the principles involved in pneumatic cleaning of coal and, by means of slides, described the dry-cleaning plant of the Algoma Coal & Coke Co., Northfork, W. Va.

"The air cleaning process is limited in the size of coal it can handle advantageously," said Mr. Arms. "Although plants have been built to clean up to 3/4 in., the volumes of air for coal above 1 in. are excessive, dust collection is difficult and power requirements are high. The best judgment in the matter seems to favor cleaning by a combination wet and dry process, using washing for the coarse sizes from perhaps 1 in. up to 4 or 5 in. and dry cleaning for coal under 1 in."

Citing the Menzies Hydro-Separator as perhaps the simplest and most economical washing device on the market, Mr. Arms described its construction and operation in detail. He concluded with the statement that probably the most comprehensive solution of the cleaning problem yet offered was wet washing of coarse coal with the Hydro-Separator and air cleaning of the finer sizes.

The discussion which followed the presentation of this paper was led by George E. Lyman, general superintendent, Madison Coal Corporation, Glen Carbon, Ill., and was joined by others.

Washington Letter

By Paul Wooton
Special Correspondent

APPARENTLY the American Federation of Labor has scored some advantage as a result of its recent gathering in Pittsburgh. The immediate effect was to strengthen the morale of the strikers and to increase contributions from other unions to the strike fund. The chief result, however, is the effect it has had on public opinion.

The meeting has interposed no barrier against the tide of non-unionism sweeping up from the South. To all intents and purposes Pennsylvania at present is 100 per cent non-union. Ohio may patch up a truce if the market should improve, but the power of the union in that state appears to have been definitely broken. In the Pittsburgh district the steady and more capable element in the union appears to have gone back to work. About one-half of the employees now working in the mines of that district are old employees. The other half is being brought in from the outside.

The Federation of Labor meeting seems to have been intended to save something out of the wreck, if anything can be saved in the way of wage contracts for the United Mine Workers. There was, at least, an opportunity to obtain front-page publicity throughout the country in an appeal for public sympathy. President Green is taking full advantage of the human tendency to sympathize with the loser in a fight. This is particularly true in a coal strike. When the union succeeds in putting great economic pressure on consumers it creates in the public mind an impression of arrogance and intolerance. The United Mine Workers stood in that position in 1922 and paid as a price of victory the designation by none less than the President of the United States of being an agency that had the country at its mercy.

TODAY the country no longer fears the union. Its power to injure the public is gone. Everyone can see that the settlement in Illinois and Indiana makes this struggle in Pittsburgh a local one which cannot possibly create a shortage of coal this winter. The country, therefore, is in a position where it is likely to look on the pathetic side of the picture. It was for that reason that the Federation of Labor is emphasizing the hardships of unemployment, with tent and barrick colonies, its eviction from homes and the destitution of women and children.

The mine workers' position is now one of pleading for recognition against those who would destroy the machine of collective bargaining. In Pittsburgh it is not a question of refusing to compromise and accept lower wages, as was the case in Illinois. It is a question of the open shop as against collective bargaining. For the first time in years the employers are in a position that is difficult to explain to the public, whereas the miners are in a position to exploit sympathy. Independent observers predict that coming developments in Pittsburgh are certain to have an influence in the political campaign of 1928.

IN Illinois and Indiana it is recognized that success in the future is going to depend largely upon mechanical equipment. Coal operators there are now in a position where they must figure on machine production. This does not mean the use of undercutting machines alone but of loaders and of highly efficient transportation. Out of this situation, therefore, is certain to grow a more intense competition.

Many coal mines, as a result of the competition between producers who can afford to put in mechanical aids, are going to be forced to close down. The higher cost mines close down only temporarily, however, and are not put out of physical existence. They can come back like the snowbird and in that way the industry continues to run along with 50 per cent overcapacity. Since it is the existing practice in car distribution that makes it possible for high-cost mines to come back into production, it is fully expected that an effort to effect a change in those rules again will become an issue.

Wilson E. Bridges

Bridges Promoted

Wilson E. Bridges, sales manager for the last eight years in the St. Louis (Mo.) district for the Chicago, Wilmington & Franklin Coal Co., Chicago, has been chosen to fill the post of sales manager of the company, made vacant by the election of Andrew Maloney to the presidency of the Philadelphia & Reading Coal & Iron Co., with headquarters at Philadelphia, Pa. Mr. Bridges, who is 40 years old, has been in the employ of the company for fifteen years except for the period he served in France during the World War. The St. Louis office has been placed in charge of Clyde H. Stephens, formerly Omaha manager.

Personal Notes

James H. Pierce, formerly operating and engineering executive of the Thorne, Neale interests, has become a partner in the firm of Stuart, James & Cooke, Inc., New York City.

F. R. Bell has been promoted from general superintendent to manager of mines of the Alabama Fuel & Iron Co., Birmingham, Ala. Charles F. DeBardeleben, Jr., recently resigned as manager to look after the operation of a mine which he purchased.

L. J. Flanagan, assistant to the late "Ernie" C. Howe, district manager at Cincinnati of the Pocahontas Fuel Co., has been appointed acting district manager until a permanent successor to Mr. Howe shall have been chosen. Mr. Howe died Oct. 28 after an extended illness.

E. B. Worthington has been promoted to the position of chief engineer in charge of the mechanical and electrical departments of the Susquehanna Collieries Co., Wilkes-Barre, Pa. C. H. Matthews has been appointed to succeed H. L. Reese as electrical engineer of the company.

W. E. Guller has resigned as chief engineer for the Donk Bros. Coal & Coke Co., St. Louis, Mo., to accept a position with the Peabody Coal Co., Chicago, which operates 22 mines in Illinois.

P. J. Conahan has resigned as inside superintendent of the Dodson Coal Co., Hazleton, Pa., after 25 years' service. Ill-health was the reason of his retirement.

Clarence R. Goldmann has been elected executive secretary of the Coal Merchants' Educational Bureau of St. Louis, Mo. Mr. Goldmann was for ten years a wholesale and retail coal merchant in Galveston, Texas, and for the last seventeen years has been a retailer in Dallas, having just completed eleven years' service as secretary of the Retail Coal Dealers' Association of Texas.

George B. Harrington, president, Chicago, Wilmington & Franklin Coal Co., Chicago, has been appointed an additional member of the government relations committee of the National Coal Association by President E. C. Mahan.

Christmas Seals Ready

The annual sale of Christmas seals has been announced by the National Tuberculosis Association. This is the twentieth year for these drives, which have been instrumental in cutting down the toll of deaths from tuberculosis from 200 in every 100,000 living persons 20 years ago to less than 90 last year. Continued help is needed.

Bituminous Coal Stocks on Oct. 1 Showed Slight Decline in Three Months

STOCKS of bituminous coal in storage on Oct. 1, according to figures by F. G. Tryon and H. O. Rogers, of the U. S. Bureau of Mines, are estimated at 61,900,000 net tons. From 63,400,000 tons, the revised figure for July 1, stocks declined to 60,100,000 tons on Aug. 1, a decrease of 3,300,000 tons in 31 days. During August and September production exceeded consumption and 1,800,000 tons was added to stocks. The net decrease from July 1 to Oct. 1 was thus 1,500,000 tons.

Exports were normal during the period from July 1 to Oct. 1, averaging 351,000 tons per week. Home consumption averaged 8,360,000 tons as against 9,050,000 in the corresponding months of 1926, the decrease of 7.6 per cent reflecting diminished activity in the steel, automobile and other industries.

In addition to the stocks of consumers there were 9,905,547 tons of bituminous coal and 1,108,310 tons of anthracite on the docks of Lakes Superior and Michigan. In comparison with Oct. 1, 1926, this is an increase of 32 per cent for bituminous coal and a decrease of 3 per cent for anthracite.

Retail coal yards were well stocked with anthracite on Oct. 1. The dealers reporting had a supply sufficient to last 60 days.

Reports were received from all by-product coke plants, all steel works, all large railroads, from 573 electric utility plants, 240 coal-gas works, 2,092 general industrial plants and 887 retail dealers handling bituminous coal. These large firms, although a small part of the total number of consumers, use a very large part of the coal, and furnish an adequate basis for estimate. On Oct. 1 the tonnage actually reported in this way amounted to 43,237,808 tons, or 70 per cent of the estimated total.

The geographical changes in stocks during the last quarter reflect the abnormalities in supply caused by the suspension of mining. In the area normally dependent on the mines of Illinois, Indiana and adjacent fields which had been closed by the suspension, the decrease in stocks was much greater than in the country as a whole. From July 1 to Oct. 1 the average decrease in the stocks of all the industrial plants reporting was only 4 per cent, but in Kansas there was a decrease of 22 per cent, in Missouri 17 per cent, in Indiana 26 per cent, and in Illinois 28 per cent. In the Middle Atlantic States the decrease was much smaller, and in still other areas there was an actual increase. In New England, for example, industrial stocks increased 12 per cent, and in southern Michigan they increased 23 per cent.

In spite of the decrease, the stocks remaining on Oct. 1 appear considerable even in the Middle West. Though the reserves of individual consumers varied widely, the average held by industrial plants reporting from Illinois was sufficient for 36 days. In Indiana the average was 38 days; in Iowa it was 35, and in Ohio, 59. Pennsylvania industrials had an average of 56 days' supply; New England, 111 days, and for the country as a whole the average of all industrial plants reporting Oct. 1 amounted to 62 days.

Large reserves are still in the hands of the public utilities. Reports of the American Railway Association indicate that stocks declined during July but increased during August and September. Stocks as of Oct. 1 were 16,510,000 tons. This compares with the following figures for other recent dates: Jan. 1, 13,499,000 tons; April 1, 22,806,000 tons; July 1, 17,780,000 tons. On Nov. 1, according to figures furnished *Coal Age News* by the American Railway Association, the total had declined to 15,839,313 tons.

No estimate is made in the survey of the amount of coal in transit on Oct. 1, but it is noted that the unbilled tonnage at mines and in railroad classification yards dropped from 1,081,000 tons on July 1 to 441,000 tons. Ground storage at the mines and intermediate points increased from 179,000 to 209,000 tons.

Besides the transit, unbilled and ground storage coal there also was a total of 9,905,547 tons of bituminous on the Lake Michigan and Lake Superior docks, as against 7,487,598 tons on Oct. 1, 1926.

Good sized stocks were reported in the yards of retail anthracite dealers on Oct. 1. At the rate of deliveries in August and September the stocks of reporting dealers were sufficient for 60 days.

Stocks of domestic coke at byproduct plants continued to increase, as usual at this season. A group of 21 plants supplying gas for city use and producing coke suitable for domestic fuel had 799,000 tons of unsold coke on hand Oct. 1, as against 584,000 tons on July 1 and 628,000 tons on Oct. 1 a year ago.

DAYS' SUPPLY OF BITUMINOUS COAL IN HANDS OF VARIOUS CLASSES OF CONSUMERS IN THE UNITED STATES, JAN. 1, 1919, TO OCT. 1, 1927

	Jan. 1, 1919	Sept. 1, 1922	Sept. 1, 1925	Oct. 1, 1926	July 1, 1927	Aug. 1, 1927	Oct. 1, 1927*a*
Byproduct coke plants	52	11	22	26	40	39	40
Steel plants	42	12	30	37	59	63	58
Other industrials	65	32	38	37	64	63	62
Coal-gas plants	81	34	67	70	87	91	93
Electric utilities	49	26	43	45	76	69	69
Coal dealers (bituminous)	39	11	27	32	48	41	43
Railroads	32	13	28	33	54	50	48
Total bituminous	42	17	32	35	54	53	53

(*a*) Calculated at average rate of consumption during August and September, 1927.

RATE OF CONSUMPTION IN AUGUST AND SEPTEMBER COMPARED WITH THAT IN AUGUST AND SEPTEMBER, 1926, AT REPRESENTATIVE INDUSTRIAL PLANTS, BY REGIONS

(Only firms reporting both periods included)

	Number of Plants	Per Cent of Change
New England	383	+ 2.7%
New York, New Jersey and Pennsylvania	321	— 5.5%
Maryland, Delaware, D.C., and West Virginia	72	+ 4.1%
Ohio, Indiana, and Illinois	285	— 3.3%
Southern Michigan	78	—24.7%
Lake Dock States (*a*)	163	+ 3.4%
Southeast	213	+ 0.6%
Trans-Mississippi (except Lake Dock States)	191	—12.6%
Total	1,706	— 4.9%

(*a*) Includes, northern Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa and Nebraska.

AVERAGE WEEKLY EXPORTS AND CALCULATED UNITED STATES CONSUMPTION OF BITUMINOUS COAL ALLOWING FOR CHANGES IN COMMERCIAL STOCKS

(In Net Tons)

Period	Net U. S. Consumption (*a*)	Exports	Total Consumption and Exports
1921—Aug. 1 to Oct. 31	7,298,000	361,000	7,659,000
1922—Sept. 1 to Sept. 30	8,190,000	307,000	8,497,000
1923—July 1 to Sept. 30	9,190,000	(*b*)524,000	9,714,000
1924—June 1 to Aug. 31	7,310,000	380,000	7,690,000
1925—June 1 to Aug. 31	8,040,000	416,000	8,456,000
1926—July 1 to Sept. 30	9,050,000	(*b*)897,000	9,947,000
1926—Oct. 1 to Dec. 31	11,200,000	(*b*)1,116,000	12,316,000
1927—Jan. 1 to Mar. 31	11,430,000	387,000	11,817,000
1927—April 1 to April 30	10,050,000	323,000	10,373,000
1927—May 1 to June 30	8,316,000	394,000	8,710,000
1927—July 1 to Sept. 30 (*c*)	8,360,000	351,000	8,711,000

(*a*) Production plus imports and minus exports plus or minus charges in stocks. Allowance is made for stocks at the mines, coal in transit, including unbilled loads, coal in cars en route to destination and coal on the Lake docks and stocks of commercial consumers. Consumption of retail purchasers is represented by deliveries of retail coal dealers to their customers. (*b*) Unusual demand for export overseas. (*c*) Subject to revision.

Plans Central Washery

First details of the central preparation plant to be erected by the Pittsburgh Coal Company recently were released by officers of that organization. The unit, to be known as the Champion Preparation Plant, will be located on the Montour R.R. near Imperial, Pa. Coal from five mines will be prepared here, the total capacity of the plant being 650 tons of run-of-mine coal per hour. The washery, which will treat 500 tons of coal per hour, will prepare all sizes under 4 in.

Allen & Garcia are to be the consulting engineers representing the owners; the Wellman-Seaver-Morgan Company will install the rotary railroad car dump, and the American Rheolaveur Corporation will design the washery and wet-process phases of the plant.

Community Move to Aid Hard Coal Reaches Climax In Mt. Carmel Co-operative Conference

A TWO-DAY meeting at Mt. Carmel, Pa., Nov. 9 and 10, marked the climax in the movement to widen the markets for anthracite. The co-operative conference was held under the auspices of the Mt. Carmel Chamber of Commerce.

Ralph E. Weeks, president, International Textbook Co., Scranton, who delivered the keynote speech as permanent chairman of the congress, declared the purpose of the meeting to be "to sound the merits of anthracite and to create an atmosphere which will help those who produce and sell coal to give the public what it is entitled to receive from the industry—that is, a steady supply of clean coal at reasonable prices."

One of the great principles involved in the co-operative movement to aid the anthracite industry, according to Dr. W. R. Buckley, president of the Mt. Carmel organization, is the possibility it offers to the public to provide that intelligent leadership which will eliminate all strife in industry.

In discussing the possibilities of co-operative advertising and the effect the publicity used by competitive fuels already has had on the sale of anthracite Henry Coolidge Parlin, director of commercial research, *Saturday Evening Post,* pointed out that advertising makes boosters of the consumers. National advertising, he said, would strengthen hard coal in the markets it now has.

Secretary Hoover stressed the fact that the anthracite industry has no monopoly which will enable it to impose its will and prices upon the country. It must compete with other fuels in both the domestic and steam trades. But anthracite, he declared, has great advantages which, properly exploited, promise stability of employment and markets.

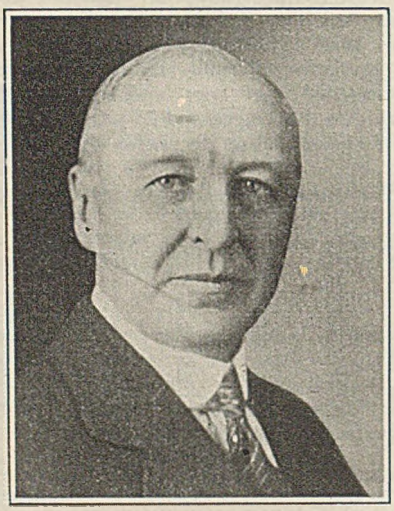
COMPETITION has disturbed the autocratic position of anthracite among fuels, said Governor Fisher, so that it is compelled, figuratively, "to roll up its sleeves and enter the hurly-burly of trade along with bituminous coals and their manufactured product, coke, as well as oil, gas and the latest and most gigantic power of all—electricity."

Admitting the justice of some resentment against the hard-coal tonnage tax because it singled anthracite out from all the natural resources of the state, Governor Fisher defended the impost on the ground that it was passed at a time when the revenue was needed to finance an expansion of public improvements. He added, however, that he would be willing to give his sanction to the repeal of this tax whenever it can be done without impairing the budget.

S. D. Warriner, chairman, Anthracite Operators' Conference, and president of the Lehigh Coal & Navigation Co., warned that the success of whatever plan of campaign that might be devised rested upon recognition of the competition that faced the hard-coal industry. "It is obvious that, as merchants, we must study the changing desires of our customers and endeavor with our product to meet their wants. Otherwise it is equally obvious that we do no business with them.

"The knowledge that the industry is faced with severe competition," Mr. Warriner added, "should act as a challenge to these communities to meet this competition by stronger support, to labor to give a full day's work for a full day's pay, to our transportation interests to do as well for anthracite as other railroads do for other fuels. In other words, the customer's demand for fuel is our greatest trade asset. We must meet him face to face, make him fully acquainted with our wares, satisfy his reasonable desires as to quality of product, comfort, safety and convenience in its use, and convince him that the cost of this service is not unreasonable.

"The mine workers of the anthracite region are glad to participate in any plan of practical co-operation designed to aid the industry or improve the quality of its public service," said John L. Lewis, president of the United Mine Workers.



Governor John S. Fisher

MR. LEWIS pleaded with his hearers, however, against any attempt to reduce wages or interfere with the "fundamentals of wage agreements." He added the suggestion that an undertaking now by producers and mine workers to assure the public that there would be no suspension when the present contract expires in 1930 would not only strengthen public confidence in the industry but also would enable the managers of the collieries to enter upon long-term projects which would cut production costs and raise the output per man.

Thomas Kennedy, international secretary-treasurer, U. M. W., also bespoke the willingness of labor to co-operate.

Retail coal men as well as leaders in other industries had their inning on the second day of the conference. Among the speakers were Joseph E. O'Toole, resident vice-president, National Retail Coal Merchants' Association; Major C. B. Staats, president, New York State Coal Merchants' Association; Hiram Blauvelt, vice-president, Comfort Coal-Lumber Co., Inc., Hackensack, N. J.; Wellington M. Bertolet, secretary, Pennsylvania Retail Coal Merchants' Association; W. A. Clark, president, New England Retail Coal Dealers' Association; F. J. Moran, executive vice-president, Coal Credits Bureau, Hartford, Conn., and Roderick Stephens, vice-president, Stephens Fuel Co., New York.

The dealers freely offered their co-operation in extending the markets for anthracite, emphasizing the need for clean, well-prepared coal. Inferior preparation in the past, it was stated, had done more injury to the industry than any other single factor. There also were expressions of dissatisfaction over the tonnage tax.

Pleas for harmony were made by A. R. MacDonald, director of development, A. W. Shaw Co., Chicago; Dr. D. F. Garland, welfare director, National Cash Register Co., Dayton, Ohio; Floyd Allen, assistant to the president, General Motors Corporation, Detroit, Mich.; Henry T. Myers, director of sales, Chrysler Sales Corporation, Detroit, and Mayor Thompson of Chicago.

A committee of fifteen appointed by Chairman Weeks as the first step toward making the congress a permanent body met in Wilkes-Barre, Pa., Nov. 23 and named a permanent committee of 21 to work out remedies for the ills that affect the anthracite industry. The permanent committee, which is composed of operators, miners, retailers and representatives of the public from the anthracite fields, is as follows:

Daniel T. Pierce, vice-chairman, Anthracite Operators' Conference, New York; E. H. Suender, general manager of anthracite operations, Madeira, Hill & Co., Frackville, Pa.; Alan C. Dodson, president, Chas. M. Dodson & Co., Bethlehem, Pa., and R. H. Buchanan, president, South Penn Collieries Co., Scranton, for the operators; Rinaldo Cappellini, president, district 1, United Mine Workers, Plains, Pa.; C. J. Golden, president, district 9, Shamokin; Andrew Mattey, president, district 7, Hazleton, and Thomas Kennedy, international secretary-treasurer, for the miners; James C. Tattersall, Trenton, N. J., and Wellington M. Bertolet, Reading, Pa., for the retailers.

The representatives of the public on the committee are Raymond Gibbs, Scranton, Pa.; C. W. Laycock, Wilkes-Barre; J. H. Paul, Carbondale; W. A. Dyatt, Hazleton; O. L. Underwood, Pottsville; W. K. Armstrong, Shamokin; J. C. Noonan, Mahanoy City; W. H. Blanning, Lykens; Ralph E. Weeks, Scranton; Dr. J. C. Buckley, Mt. Carmel, and Roy C. Haines, Mt. Carmel.

It was decided to postpone all discussion until rules are drafted.

I. C. White Dies at 79; Was Noted Geologist

Dr. Israel C. White, of Morgantown, W. Va., State Geologist of West Virginia for the last 30 years, died in the Johns Hopkins Hospital, Baltimore, Md., Nov. 24, following a minor operation. He was 79 years old.

Dr. White, who specialized in coal, petroleum and natural-gas studies, took a deep interest in the development of Pennsylvania and West Virginia oil and gas fields, which were located in part by the anticlinal theory, which he advanced in 1882. He was assistant geologist of the second geological survey of Pennsylvania, 1875-84, and of the U. S. Geological Survey from 1884 to 1888. He was professor of geology at West Virginia University from 1877 to 1892 and became State Geologist of West Virginia in 1897, without salary.

Israel C. White

Fair Prices and Efficient Methods Hold Interest Of Southern Appalachian Operators

MANY prominent railroad officials as well as producer members turned out for the sixteenth annual meeting of the Southern Appalachian Coal Operators' Association, held Nov. 11 and 12 in Knoxville, Tenn. Officers for the ensuing year are:

President, V. N. Hacker, president, Pruden Coal & Coke Co., Knoxville, Tenn.; first vice-president, C. M. Moore, president, Moore Coal Co., Knoxville; second vice-president, C. W. Rhodes, vice-president and general manager, Fork Ridge Coal & Coke Co., Middleboro, Ky.

In his address summarizing the activities of the association during the past year, President J. E. Butler stated that $7,000 had been added to the surplus in spite of increased activities on the part of the group. Warning the members that prices seemed to be stabilized by those from whom coal operators purchased and definitely set for coal by buyers, he urged operators to give more attention to their association and make a greater effort to get a fair price for their coal. He deplored mining ahead of sales and price cutting to move tonnage unwisely mined.

The sixteenth annual banquet and "fun feat" of the association, held Friday night at the Whittle Springs Hotel, was attended by more than 200 operators and prominent mine and railroad officials. Judge H. B. Lindsay presided as toastmaster.

Harry L. Gandy, executive secretary of the National Coal Association, in a more serious vein, advocated two policies for coal operators: (1) That no coal be mined until sold and, (2) no coal be sold below the cost of production.

W. J. GERMAN, technical representative, DuPont Powder Co., Huntington, W. Va., gave a series of character sketches.

Officials representing the Southern, Louisville & Nashville, Big Four, Monon and Baltimore & Ohio railroads were presented by Judge Lindsay. H. R. Kurrie, president of the Monon; Archibald Fries, vice-president, B. & O.; G. E. Evans, vice-president, L. & N., and R. E. Simpson, general manager, Southern Ry., emphasized their desire to keep service abreast of the industrial needs of this expanding region.

On Saturday morning, Nov. 12, in Whittle Springs Pavilion, the Southern Appalachian Efficiency Association drew 100 mine managers, superintendents, mine foremen, mechanical and electrical men to discuss mine mechanization. H. Foster Bain, secretary, American Institute of Mining and Metallurgical Engineers, was the principal speaker.

"SUCCESS of shooting for mechanical loading lies in dividing the shots; double the number of holes and the results will be better," was the advice of W. J. German. He said the chief trouble is the tendency to want to shoot all of the face down with one shot.

In calling attention to Tennessee's record of a higher tonnage mined per fatality than the other principal coal-mining states, O. P. Pile, the chief inspector, credited the Southern Appalachian Efficiency Association with being the biggest factor in attaining this record. Speaking of the workmen's compensation law, he expressed the opinion that Tennessee has a less effective law than neighboring states. He does not favor a compensation law because it deprives the workmen of jury trial.

In an excellent general discussion of mechanical loaders, William Whaley emphasized the point that in mines where considerable rock must be handled, there is opportunity to show even greater earnings on a loading machine by using it to load rock.

He explained that because of the low wage scale in this territory, 15c. per ton or $20 to $25 per day is about the maximum possible saving in handling coal, while $40 to $50 per day saving is the possible maximum in handling rock.

Dr. Bain explained that the coal-mine mechanization conference came about as a result of the American Society of Mechanical Engineers learning from a survey made in 1924 that coal loading in mines represents the biggest single operation still being done by hand labor. He outlined the broader aspects of the introduction of loading machines and sketched the progress of the informal conference.

Safety was the principal theme of J. E. Davidson. From falls of roof and coal in Alabama, 81 mines have a record of no fatalities in six years and 141 mines the same record for two years.

The only description of a specific application of mechanical loading was an impromptu discussion by Howard, Howie, manager of the Roane I on Co., Rockwood, Tenn. In spite of the difficult conditions in the Rockwood coal mine, a scraper loader is now being used. The V-system retreating with a 1,500-lb. scoop working two 80-ft. faces is employed. The hoist is the two-drum type.

Coming Meetings

American Mining Congress, Thirtieth Annual Convention, Washington, D. C., Dec. 1, 2 and 3. Secretary, J. F. Callbreath, Munsey Building, Washington, D. C.

American Society of Mechanical Engineers. Annual meeting week of Dec. 5, at Engineering Societies Building, 29 West 39th St., New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

New River Coal Operators' Association. Annual meeting at the White Oak Country Club, Mt. Hope, W. Va., Dec. 6, 1927. Secretary, S. C. Higgins, Mt. Hope, W. Va.

Coal Mining Institute of America. 41st annual meeting, Dec. 7, 8 and 9 at Pittsburgh, Pa. Secretary, H. D. Mason, Jr., Box 334, Ebensburg, Pa.

Sixth Annual Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 5 to 10.

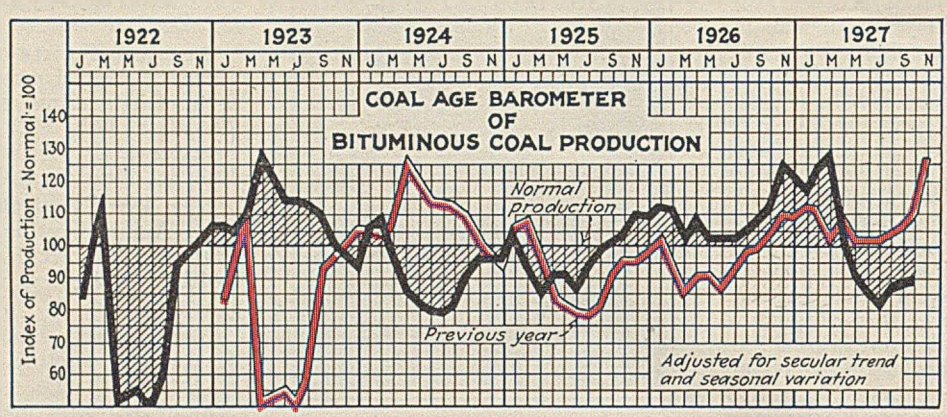
West Virginia Coal Mining Institute. Annual meeting, Jan. 3 and 4, 1928, at Wheeling, W. Va. Secretary, R. E. Sherwood, Charleston, W. Va.

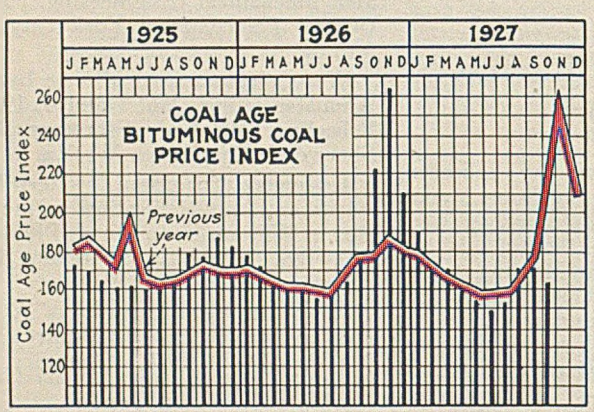
Engineers' Society of Western Pennsylvania. Annual meeting in the Blue Room, William Penn Hotel, Pittsburgh, Pa., Jan. 17, 1928. Secretary, K. F. Treschow, Pittsburgh, Pa.

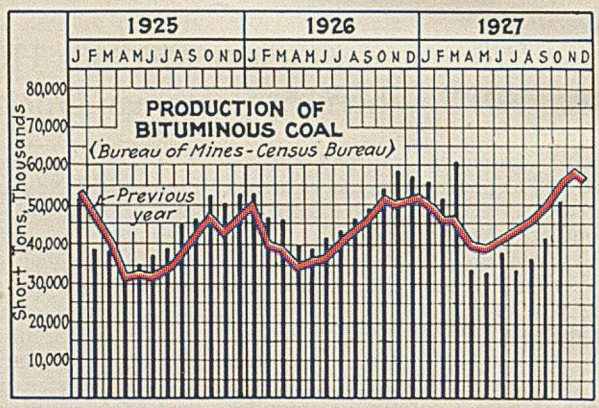
American Wood Preservers' Association. Annual meeting at Montreal, Canada, Jan. 24-26, 1928. Secretary, E. J. Stocking, Chicago, Ill.

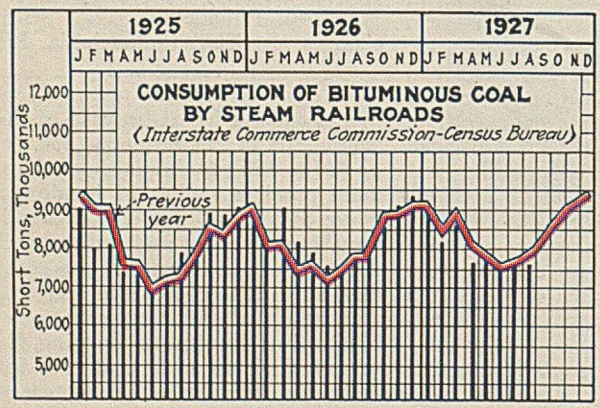
Coal Club of Philadelphia. Annual meeting and dinner at the Bellevue-Stratford, Philadelphia, Pa. Secretary, Charles H. Scull, Philadelphia, Pa.

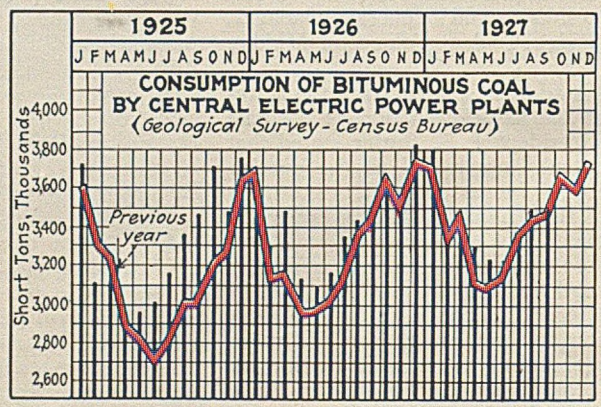
Indicators of Activities in the Coal Industry

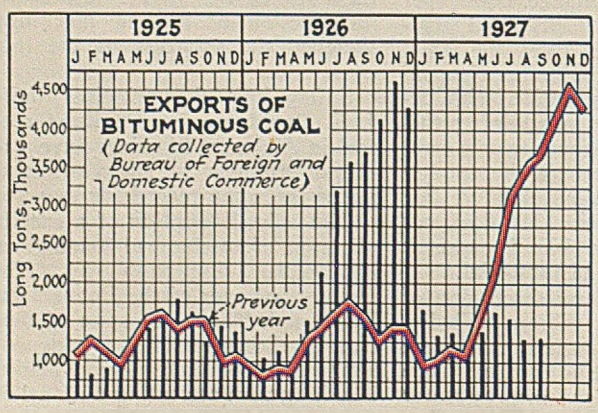


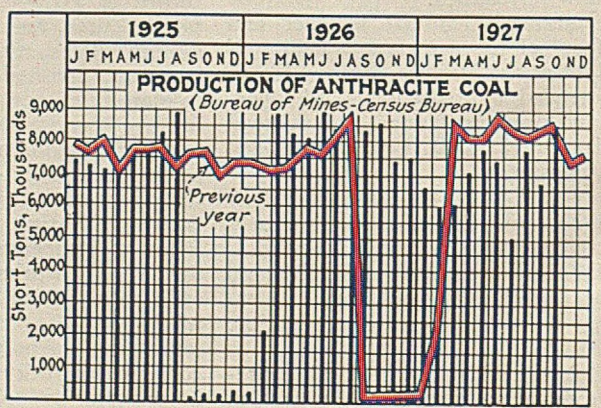












MARKETS *in Review*

DEVELOPMENTS in the bituminous coal markets of the United States last month lacked sufficient breadth to effect any major change in trends. The process of readjustment of production schedules which started in October with the labor truce in Illinois, Indiana, Iowa and the Southwest continued. Some progress also was made in curtailment of total output. The movement in that direction, however, was not drastic enough and its influence was buried under the stockpiles in the hands of the consumers.

These storage reserves, according to the latest estimates of the U. S. Bureau of Mines, approximated 61,900,000 net tons on Oct. 1. With production during that month about 44,000,000 tons, it is patent that the withdrawals from stockpiles were not heavy. Undoubtedly more coal was taken out of storage in November, but the total draft was too small to cause any apprehension as to the future upon the part of the larger users of fuel.

THE FACT that every important bituminous-producing district also was burdened with "no bills" and that, in many cases, there was distress tonnage at intermediate and terminal points acted as additional checks upon any upward swing to the spot market. Weather, once the standby of the producer, was largely ineffective as a stimulus to buying by either industrial consumers or retail distributors.

Under these circumstances the best that the industry could hope for was to prevent any further general slump. This appears to have been accomplished last month. Fluctuations in spot quotations became less violent and the price ranges narrowed. *Coal Age News* Index of spot prices, which opened at 159, slipped back to 157 and held at that level through the third week of November. The corresponding weighted average price was $1.90.

WHETHER this steadiness can be maintained will depend in part upon the rapidity with which tonnage released from the lake trade is absorbed by all-rail buyers or is definitely withdrawn from the market by further curtailment in weekly output. Dumpings at the lower ports during recent weeks have averaged over 8 per cent of the total production. In the present delicate state of the market such a tonnage forced into spot channels easily might wreck the price structure.

Lake trade this year has shattered all previous records. Up to Nov. 28 there had been a total of 32,475,023 tons of cargo coal and 1,432,994 tons of vessel fuel dumped at the lower ports. Last year total shipments of cargo coal for the season were 28,162,499 tons. In 1923, the season's total was 29,839,918 tons. In other words, the 1927 dumpings to Nov. 28 were 4,312,524 tons ahead of the total for the preceding year and 2,635,105 tons greater than in 1923.

NORTHWESTERN demand has been helped materially by the weather in the last few weeks. Dock operators are confident that November totals will exceed October shipments of 32,178 cars and fears that the heavy movement uplake would lead to congestion have vanished. In the Southwest the situation has been uneven. The strike in Colorado has widened the market for Utah and Wyoming coals.

Midwestern coals have been struggling to recover ground lost during the long suspension. In Illinois much of the production activity has centered in the southern part of the state where demand for lump and egg increased the difficulties surrounding the sale of steam sizes. In other fields and in Indiana unevenness in demand as between different sizes has complicated the production problems facing the operators. Illinois output the first two weeks of November was running about 79 per cent of the November, 1923, average; Indiana, about 62½ per cent.

KENTUCKY suffered severely both from the standpoint of production and of prices in November—if the comparison be made with figures prevailing during the crest of the strike period in Illinois and Indiana. On the production side, however, both the eastern and the western sections of the state still are doing better than they did during November, 1923, and the margin of gain has been substantial. In common with other fields, Kentucky is held back by unbilled loads the total of which exceeded 2,500 cars early in the month.

West Virginia low-volatile shippers made no change in circular prices on Nov. 1, holding lump and egg at $3.75; nut at $2.50 and mine-run at $2.25, but spot tonnage moved at lower figures. As the month progressed high-volatile fluctuations became less marked, but the undercurrent was none too strong. Interchange of coal loads through the Cincinnati gateway dropped from 10,748 cars the week ended Nov. 5 to 9,257 cars the week ended Nov. 12, rising to 10,562 cars the following week and to 11,050 cars the week ended Nov. 26.

Ohio was too busy throughout the month with labor troubles to pay much attention to the development of the market and the situation generally at both Columbus and Cleveland was soft. Western Pennsylvania found its sales difficulties multiplying although standard gas and industrial grades, aside from steam slack, held their nominal quotations. Domestic sizes weakened 25c. toward the end of the month. Central Pennsylvania output gained.

Conditions along the Atlantic seaboard have been disappointing to the coal trade fraternity. New England spot business has been a picture of unrelieved gloom. Indifference has ruled Philadelphia. New York had a brief glimpse of increased activity, but the upswing did not hold. Baltimore has been marking time. The situation in the Birmingham district has been little better. Spot inquiries for steam tonnage have been few. There was some weather pick-up in domestic movement but the increase was not material.

DOMESTIC anthracite showed a gradual improvement throughout the month—particularly in the New York area. Chestnut led in popularity with stove a fairly close second. Egg and pea still lagged, but not to the extent which they did earlier in the season. On the whole the Philadelphia market was behind New York in activity. Elsewhere the market was a weather proposition pure and simple. Lake business in anthracite has been distinctly backward.

The position of the steam sizes, although less strong than that of the domestic coals, gained somewhat in the fluctuating movement which characterized November operations. One significant development in this direction was the growing unwillingness on the part of independents to make substantial concessions in price to place tonnage. No. 1 buckwheat, of course, was subject to greater sales pressure than either rice or barley. The last-named size was in the strongest position of all.

BEEHIVE COKE in the Connellsville region had hard sledding last month. Despite a steady curtailment in operations, prices weakened under the strain of inadequate demand. Furnace coke broke from $2.85@$3 to $2.75@$2.90; domestic slid down to $2.50. Birmingham prices also gave way towards the end of the month, with furnace coke declining from $5.50@$6 to $5 and domestic sizes easing off 10 to 15c. per net ton.

OPERATING IDEAS *from* Production, Electrical *and* Mechanical Men

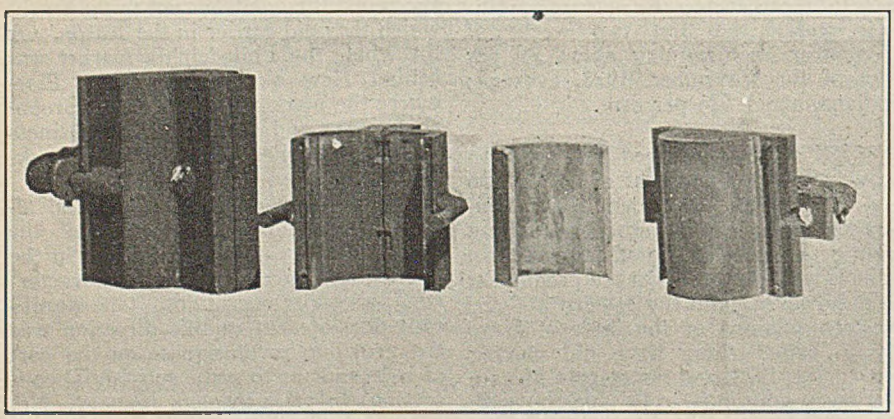
Casting Locomotive Journal Brasses in Shop Decreases Replacement Costs

ONE of the locomotive parts requiring frequent renewal, as all mining men know, is the journal-box brass. For the past seven years the Pittsburgh Coal Co. has been casting these parts in its shop. These are not made from brass but from a special-alloy white metal composed of copper, zinc and lead. The brasses are cast in carefully-finished molds or jigs.

The illustration shows two such molds as well as a finished casting made in one of them. Three principle parts comprise each mold. When in use these are fastened together with keys, gibs or cotters. The part on the extreme left is a complete mold fastened together and placed in casting position. Next are shown two side pieces of another mold. Then follows a finished brass and, lastly, another part of the second mold.

After the assembled mold has been fastened together, it is placed on end on a smooth plain surface of iron or steel. The metal, which has been melted and thoroughly mixed, is then poured into the upper end of the opening until the mold is completely filled. Each brass carries two lugs on its upper surface. It will be noted that the distance from one of these lugs to the extremity of the mold is greater on one end than it is on the other. This longer end is placed uppermost so that any dross or other impurity will rise to the top of the casting. After pouring, it is removed by loosening up the jig keys. When cooled, the brass is placed in another jig and the long end sawed off. This removes all dross, oxidized metal and other impurities. The sawings from these brasses, as well as old worn ones, are remelted and the metal used over again. This avoids waste and gives as satisfactory results as would be obtained by using all new metal.

By fitting these jigs or molds with care and polishing their surfaces, it is unnecessary to either bore, grind or polish the finished casting. As soon as it can be sawed off it is ready to be placed in the locomotive. As may be seen, the molds are extremely simple in construction and, if made accurately, will give satisfactory results indefinitely.



Reduce Maintenance Charges With This Outfit

Electrical Heating Is Applied to Baths

The Valier Coal Co., Valier, Ill., recently installed electricity to heat bath water for such of its employees as work on holidays or at times when most of the force is idle. This method resulted in a substantial saving.

The steam-heating system, still used for work days, provides for the needs of about 600 men. Its operation requires about five tons of coal per day and the services of three firemen. Employment of maintenance and construction men made it necessary to keep this system in readiness on idle days as well as on working days. During such times, there was no reduction in cost over the expense of operation on working days.

The initial electric-heating installation now meets all requirements for idle

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PROGRESS is made step by step through the exchange of ideas. Every man learns from others. Production men, electrical men and mechanical men are constantly trying out new methods for increasing efficiency and reducing costs. One idea suggests another.

COAL AGE has been for years the medium through which operating men have traded ideas. Underground methods, shop kinks, haulage devices, tipple arrangements, electrical and mechanical pointers and safety methods all have a place in this picture.

IDEAS are worth money. *Coal Age* will pay from $5 up for those that are accepted and published in these columns. Here's your opportunity to win recognition for yourself and get paid for it. Can you use a few extra dollars? Practically everybody can.

LET'S GO! Short stories are best. We'll help you edit them. Simple sketches will do, too, or good snapshots. Our drafting room and illustration department will do the rest. Some of the most simple devices are the very things another fellow is looking for.

days and shut-down periods at a substantial decrease in operating cost. It is considered to be sufficient for 50 or more men, but normally is used by about 15 only. The water reaches bath temperature three minutes after the current is turned on. Thereafter, all demands are met without delay.

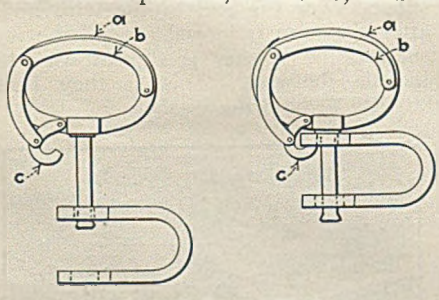
The equipment consists of seven hot-and-cold showers. The water is heated, in a 235-gal., heat-insulated, hot-water tank, by six 5,000-watt, 220-volt, helicoil sheath-wire immersion heating units manufactured by the General Electric Co. Heating is governed by complete thermostatic control, and the installation is so arranged that it will not interfere with steam operation.

It has been found that the cost of steam operation on either work days or idle periods is $34.25 per day, while that of electric heat, used on idle days, is only $7.64—a saving of $26.61. These figures are based on raising the temperature of 25 gallons of water, for each of 15 men, from 60 deg. to 105 deg. F. Cost of electrical operation is calculated at 1.3 cents per kw.-hr. The expense of steam includes the cost of the coal and the wages of the firemen.

Safety Rope Clevis Is One-Hand Device

The fitting for hitching the end of a hoist rope to the end of a trip of cars on a haulage slope should, above all, be one that will not accidently come loose. Other important requirements are that the hitching be light in weight and take but one hand for attaching or detaching.

A safety rope clevis used by the Union Pacific Coal Co., Rock Springs, Wyo., is shown herewith. When in the hitched position, a catch *c*, held in



Saves Life and Limb

place by gravity and a spring concealed between *a* and *b*, prevents rising of the pin. The clevis is unhitched with one hand by grasping the handle and squeezing *a* and *b* closer together. The hole in the bottom of the clevis is larger than that in the top so that the enlarged end of the pin slips easily through the bottom but not the top.

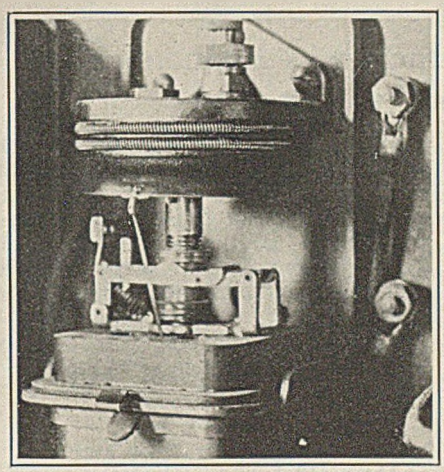
The first clevis of this type put into use by this company was designed and made by Swan Swanson, master mechanic at the Winton mine, Megeath, Wyo.

Starter Reset Prevented By Simple Lockout

Under certain conditions it may become desirable to replace an automatic-reset overload relay with one of the lockout type. The accompanying photograph, made in a pumping station in western Kentucky, indicates that instead of replacing the relay it may be possible to make a simple change which will convert it to the lockout type.

The relay pictured is a widely-used type of inverse time-limit overload relay. To prevent reset there was attached, to the edge of the convex disk below the bellows, a bow mounting and part of the bow from a pair of rimless spectacles.

Normally, the end of the short length



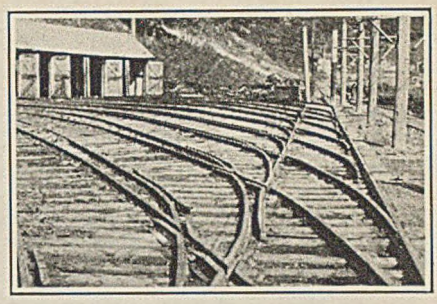
A New Use for Spectacles

of bow sticks down into the hole accommodating the relay stem. When the bellows is compressed the end is pulled out of the hole, after which the bow hangs vertically and acts as a prop to prevent the stem from going down after the circuit has been broken. The bow mounting and bow being gold filled, there is no danger of corrosion and sticking of the hinge. This attachment has been giving satisfactory service for some time.

Motor Barn Track Layout For Individual Stalls

Convenience considered, the motor barn to be preferred is one with an individual lateral track for each locomotive. But difficulty of track arrangement is one of the reasons why this type of outside motor barn is not commonly used.

The accompanying photograph shows the double-frog layout leading to the motor barn at the Nellis mine of the American Rolling Mill Co., Boone County, W. Va. According to William Jayne, general mine foreman, the idea for this layout came from his copy of



Not So Complicated as It Looks

the *Coal Age* "Kink Book" which was published some years ago.

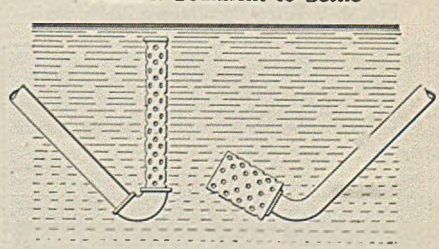
The motor barn has ten single stalls. The track gage is 42 in., yet the ten turnouts are arranged within a length of 90 ft. of straight track. In other words, it is but 90 ft. from the first switch point to the last frog.

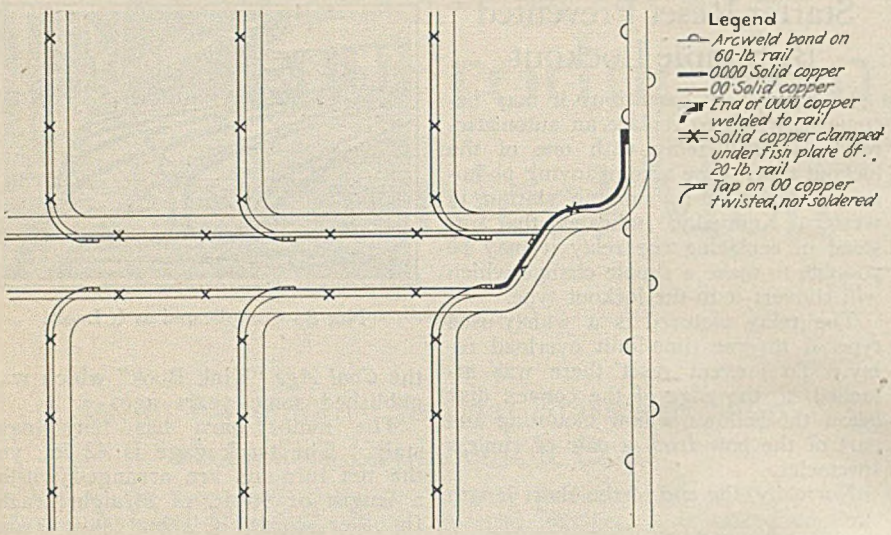
T. W. Blake, the local chief electrician, likes the track arrangement. "Each locomotive has a regular stall so we know just where to find it when we want to repair it. A motorman has no excuse for not putting his locomotive in the barn at the end of the shift."

Use of Vertical Strainers Saves Wear on Pumps

Most foremen when arranging to draw water from a sump provide, at the end of the suction line, a strainer consisting of a sloping pipe perforated with holes. This draws water entirely from a point near the bottom of the sump keeping that part of the reservoir in continual turmoil and preventing the mud from settling. Some mud and fine coal, therefore, is drawn into the pipe line to the detriment of the pumps and pipes. It would be better to let it settle and to shovel it out at intervals. William G. Fletcher, general superintendent, Inland Collieries Co., Indianola, Pa., prefers to use a vertical pipe drilled with fine holes, most of which are well above the level of the sediment. It need not be feared that the pipe will draw air so long as the water covers enough of these holes to provide for a sufficient flow to satisfy the pump. In this way the water is always clean and free from grit, there is no danger of comparatively large particles being kept in suspension and small likelihood of the strainer becoming clogged.

Permits Sediment to Settle





Lack of Bonding Characterizes Economical D.-C. Distribution System

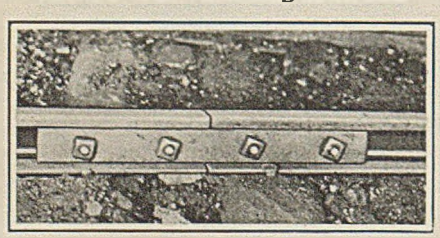
IN THE No. 9 mine of the Peabody Coal Co., Taylorville, Ill., all coal is undercut, gathered, and hauled by direct-current. Although producing 6,000 tons of coal per day, the total consumption of direct current averages but 0.83 kw.-hr. per ton. Consequently, there cannot be much energy lost in transmission and the average voltage at the working faces must be high.

Excepting possibly the generous size of the positive and negative feeders, there is nothing unusual about the circuits on the main haulways. The unusual feature of the d.-c. distribution system is the lack of bonding, as the term is commonly used, in rooms and room entries.

Instead of bonding, a continuous solid-copper conductor is carried parallel to one rail of the 20-lb. track and this conductor is clamped tightly under the fish-plates. The main negative feeder to each panel of 38 rooms is a 4/0 round wire, which is arcwelded to the 60-lb. track. Depending upon the grades encountered, wire of this size is carried to the first room, or possibly farther along the room entry. Number 2/0 wire is used for the remainder of the distance. At each room a 2/0 negative conductor is tapped to the wire on the room entry and likewise clamped under the fish-plates of one rail of the room track.

Joints necessary in extending the wires, and the taps to room negatives, are tight mechanical connections which are not soldered. These joints consist of twists or wraps such as are commonly used with small solid wires. In addition to leaving practically no chance for one or more high-resistance connections in the negative circuit, the system has the further advantage of low installation cost and high recovery—the wire is used again when the tracks are torn up and moved to new panels.

No. 4/0 Wire Paralleling 20-lb. Rail



How to Prevent Squeezes In Pillar Workings

In many coal mines, squeezes frequently cut off the tonnage of the pillar sections from which a large part of the production of the mine comes, says W. L. German, technical representative, E. I. du Pont de Nemours & Co., Inc., Huntington, W. Va. To stop these squeezes much expensive timber is often used and the lives of many men endangered. Even when the squeeze is stopped, it is still a difficult problem to bring the pillar section affected back into shape, to establish a breakline and to get the men back to work so that the daily tonnage may be brought to normal.

Most of the trouble in pillar work is brought on by section bosses who mark the mine maps to show blocks of coal completely removed when in reality several stumps have been left scattered along the pillar line. These prevent the roof from breaking. Some of the weight is, therefore, thrown onto active working places causing the pillars that are nearing removal to crack and snap. This arouses fear of an immediate caving of the roof. In consequence, the company men quickly lift the track to save it from burial under a fall.

Later, if the squeeze subsides, the miners resume the mining of the pillars but, being unable to put the tracks close to the pillar line, they have to leave goodly stumps behind them which prevent the roof from falling. Thus the pillars again become overweighted. The section bosses to save their reputations mark the maps as if the coal had been removed, and thus there is no investigation made or remedy applied, and a costly squeeze results.

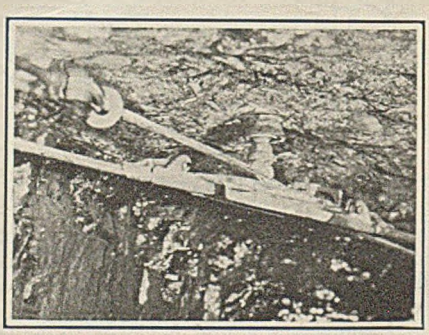
All stumps should be removed along the pillar line and if they cannot be extracted they should be broken down by blasting. Holes, drilled near the bottom of the stump at a proper distance apart, charged with whatever explosive is used in the mine and shot in a safe way, will break up the stump and will permit of a clean break.

Temporary Wiring Is Firmly Erected

Because of the rapid-advance panel mining in the No. 9 mine of the Peabody Coal Co., at Taylorville, Ill., all trolley lines (excepting those on the main entries) serve but a short time before they are taken down and moved to new panels. However, these lines are not put up in temporary fashion. They are erected so as to give the minimum of trouble during the time of mining.

An idea of the rugged construction employed may be gathered from the accompanying photograph of a trolley frog on a room entry. Both the main and branch wires are carried straight through the frog and the branch wire is dead-ended at a roof anchor. This anchor relieves the frog of side strain.

Another feature of the construction is the use of a steel washer to fasten the end of the trolley wire to the dead-end insulator. The washer is first slipped over the end of the wire and, after the wire is looped around the insulator, the washer is slipped back to include the end. This is then bent slightly to hold the washer.



Rugged Though Temporary

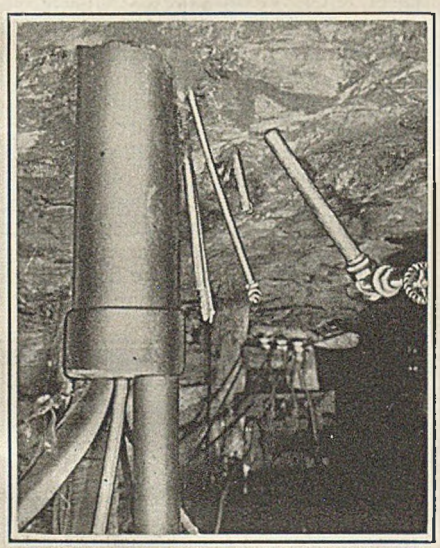
Before this method was adopted, the practice was to fasten the end of the loop by wrapping with about 30 in. of No. 4 copper wire. In recovering the trolley wire, the wrapped section at the end was cut off and scrapped.

Deep Boreholes Are Cased By Unique Method

Unless submarine cable is used, a wet borehole is a menace to the electric feeders where they leave the hole at the bottom. Further, in most mines the influx of water is objectionable from the standpoint of drainage. If the hole is cased for the entire length, the flow of water can be stopped by sealing between the casing and the hole at the bottom.

If the hole is of such depth that the water accumulation after sealing rapidly builds up a high pressure, the sealing process may require considerable ingenuity. The accompanying photograph and sketch show the method which F. B. Thomas, electrical engineer of the Victor-American Fuel Co., Denver, Col., has used with complete success on several boreholes.

A small hole is first drilled at an

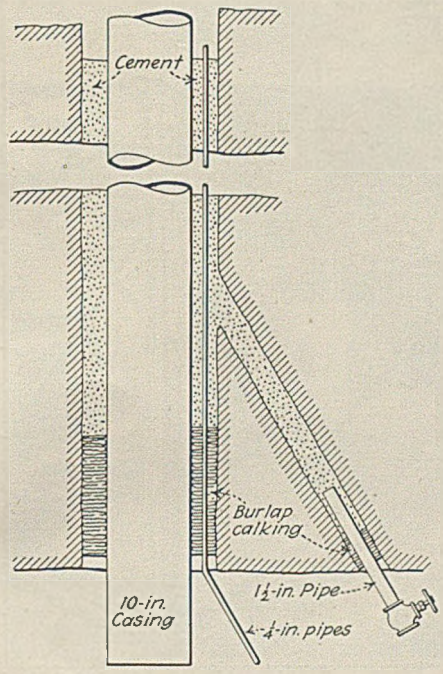


Bottom of 770-ft. Borehole

angle to intersect the borehole a few feet from the bottom. A short length of 1½-in. pipe with a valve on the end is then calked into this hole. Next, several 20-ft. lengths of ¼-in. pipe are shoved up into the space between the casing and borehole. The number of pipes to be used depends upon the amount of water made by the borehole.

Calking around the casing with burlap, brattice cloth or like material, is the next job. While this is being completed, the water is draining through the 1½-in. pipe. As a preliminary to the injection of cement through the 1½-in. pipe by means of a piston-type hand pump, careful preparation is necessary. So that there will be no interruptions during the injection, two men are required for mixing the cement and water in tubs. Because of the danger of its beginning to set, the cement should be mixed only a short time before entering the pump.

Two men are required to work the

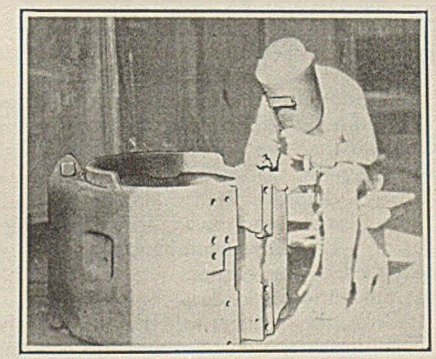


Details of Seal

pump, and two extra men are on hand for relief and emergency. When the pump has been operated until cement begins to appear through the ¼-in. pipes, the work is done. The 1½-in. valve is then closed, the pump disconnected, the ¼-in. pipes capped and the job is done.

Motor Housing Rings Are Welded Into Place

Housing rings on the motors of ordinary mine locomotives occasionally wear out and must be replaced. Ordinarily, these rings are merely dovetailed into their housings, but it has become the standard practice of the Pittsburgh Coal Co. to electrically weld these rings into position. This assures that the ring will be firmly held in place.



Making a Good Job of It

The housing ring is a steel casting. It is first partially cut through with a hacksaw at a point corresponding to the joint in the motor housing. It is then chipped with a chisel along the edge where the weld will be made as is also the housing itself. This is done to assure a proper weld, as dirty metal at this point would render such a union out of the question.

After being welded in position, the complete housing and ring is mounted on a mandrel and the ring turned up to proper size in a lathe. The cut through the ring at the housing joint is then carried to completion so that the two halves in the housing may be separated.

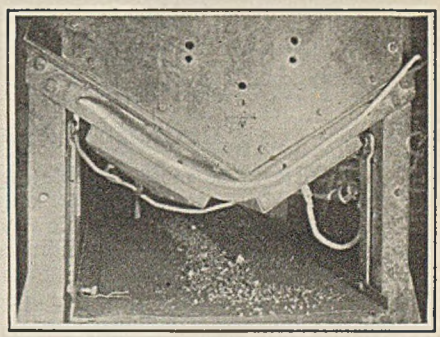
Mounting housing rings in this manner assures that they will be held firmly in place. Should it ever become necessary, because of wear or for other reasons, to remove a ring that has been fastened in this manner, it can be done by means of the oxy-acetylene torch.

Electric Sand Drier Is Labor Economizer

According to C. N. Orr, superintendent of the King No. 1 mine, United States Fuel Co., Hiawatha, Utah, the use of an electric sand drier at that mine saves the wage of a day man. Countering this saving, however, is the difference between the cost of electric power and the fuel cost for drying the same amount of sand with a stove.

The power demand of the drier is approximately 5 kw. In winter it must be operated about 16 hr. per day but during the summer, when the sand is received relatively dry, 3 hr. is usually sufficient. The energy consumption of 80 kw.-hr. during the winter represents an expense of about 85c. per day.

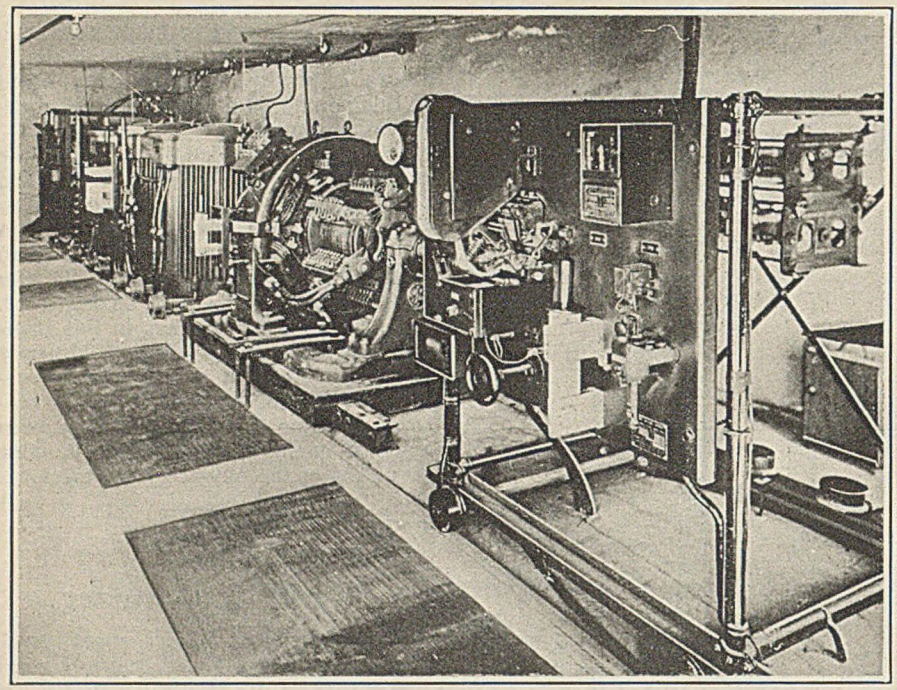
The heating units, four in number and attached to the underside of the drier bottom, each consist of four elements made by wrapping No. 12 galvanized steel wire (four turns per inch) over a 30-in. length of ¾-in. pipe. This pipe



Saves Wage of Day Man

previously has been insulated by wrapping with wet sheet asbestos to obtain a thickness of ¼ in.

The drier is located in a small concrete room on the main haulway about 400 ft. inside of the drift mouth. Turning the power on and off, and occasional shoveling of sand into the drier, is done by a main-line motorman.



Underground Converter Equipment on Wheels

Portable Mine Substation Delivers Power At Working Face When Needed

A PORTABLE mine substation which can be moved to a new location in approximately eight hours has been installed by the Union Colliery Co., Dowell, Ill. Operation of this mine necessitates frequent moving of the converter substation to maintain the desired d.-c. voltage at the working face. It is estimated that it will be necessary to move the substation every three to six months and it is, of course, undesirable to interrupt the production of coal during the moving. To meet the situation, a unique substation has been installed in the mine. It is equipped with a General Electric, semi-automatic, 200-kw. synchronous converter with transformer and control equipment.

The transformer, switchboard and control panels are mounted on trucks which are of the same gage as the mine tracks. The converter base has structural steel projections from which trucks are detached after the set has been moved. The unit is then bolted down.

In designing this substation low headroom was an important factor, it being necessary to keep within a limit of 4 ft. 6 in. Ventilation is also important and the substation rooms are so arranged that they always will be ventilated by air from the intake.

Preservation and Filing of Shop Drawings Effected by Mounting in Frames

IN ORDER to be most valuable and effective, shop drawings not only should be immediately available but should also be kept in good condition. To accomplish these results, the Pittsburgh Coal Co. has adopted a unique system of mounting such blueprints.

Ordinary shop drawings are made 8⅝ x 11⅛ in. They are mounted in tin frames behind a thin sheet of transparent celluloid so that the surface of the drawing or blueprint is thoroughly protected yet always visible. The tin blanks are made ½ in. larger each way than the blueprint. To allow bending over ¼ in. on each edge, the corners are trimmed off at an angle of 45 deg.

Both the cutting of the sheets, the beveling of the corners and the bending of the edges are done by means of jigs. The bending jigs are each made of two 2 x 2-in. angles planed to give a true surface and doweled together. The dowels form the depth gage for the plate in bending. In use, the bending jig is placed in a vise. The edge of the plate inserted between the two angles, the vise drawn up tight and the plate bent over by means of a special "hammer" made of 1½ x 1½-in. steel, planed true and provided with a handle at each end. One bending jig serves for the sides and one for the ends of the plate.

When the edges have been bent up at right angles to the plate, the blueprint is placed in the pan thus formed. A sheet of transparent celluloid cut to proper size is placed over it and the edges of the pan bent over lightly with a small hammer. These edges are then inserted between the angles of the bending jig and squeezed to place.

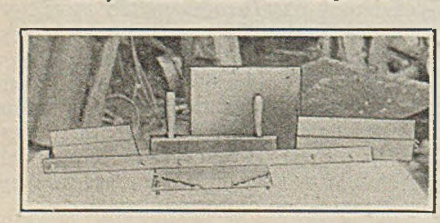
Whenever a piece of work comes into the shop for repairs, or when a new type of machine is purchased, its component parts are detailed on these drawings which are then filed away. If another part of the same kind is needed, it can then be made immediately. In many cases three such prints are made. This is particularly true of large parts or machine elements composed of several parts, such as locomotive wheels and axles, armatures and shafts and the like. Thus three men may simultaneously be put to work on the one job. Of the smaller work, only two prints are made.

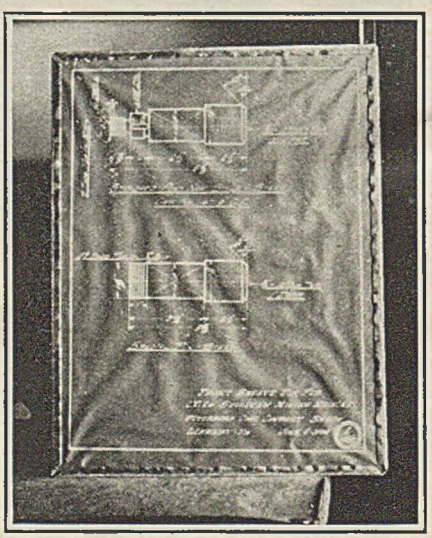
Frequently, when a part is ordered by one of the mines, the old part arrives at the shop after the new one has been made up from these drawings. In other words, the trucks that bring the broken or defective parts to the shop, often return to the mine with the finished new ones. No delay other than that occasioned by loading and unloading the trucks, is experienced.

The dimensions given are for standard drawings. Some larger drawings have been made but most of these have been pencil sketches. They are, however, handled in the same manner as the standard-size blueprint.

By treating blueprints in this manner, they are preserved indefinitely and are always clean, neat and ready for use.

Only These Tools Are Required





Always Neat and Handy

Among the Manufacturers

THE CONSOLIDATION of the Minneapolis Heat Regulator Co., Minneapolis, Minn., with the Honeywell Heating Specialties Co., Wabash, Ind., to form the Minneapolis-Honeywell Regulator Co., brings together two important units in the heat regulating business. W. R. Sweatt, president of the Minneapolis Heat Regulator Co., is now chairman of the board of the consolidated company.

* * *

THE NEW YORK OFFICE of the Hazard Manufacturing Co., Wilkes-Barre, Pa., manufacturer of electrical wires and cables, has been moved to rooms 3008 and 3010 Transportation Bldg., 225 Broadway. The New York office and warehouse of the Hazard Wire Rope Co., manufacturer of wire rope and wire rope fittings, now separate and distinct from the Hazard Manufacturing Co., will be retained at 533 Canal Street.

* * *

THE MORSE CHAIN CO., Ithaca, N. Y., announces the appointment of Harry E. Matthews as manager of its Charlotte (N. C.), office, succeeding George W. Pritchett, deceased.

* * *

THE MINE SAFETY APPLIANCES CO., Pittsburgh, Pa., furnished fourteen continuous carbon monoxide recorders for the new Holland Tunnels which connect New York City with Jersey City, N. J. The CO recorders will show as low as two parts in a million of carbon monoxide and will indicate the condition of the air in the tubes at all times, thereby serving as a guide to proper ventilation.

* * *

STOCKHOLDERS of the Safety Cable Co., Dudlo Manufacturing Corporation, Rome Wire Co., Standard Underground Cable Co. and the Sheet & Wire Mills of the Baltimore Copper, Smelting & Rolling Co. have ratified a consolidation plan whereby they are all merged into the General Cable Corporation. The new company has authorized capital consisting of $16,000,000 of first mortgage 5½ per cent bonds, $30,000,000 of par value 7 per cent cumulative preferred stock, 750,000 shares of no par class A stock and 3,000,000 shares of no par common stock.

DR. W. D. COOLIDGE, assistant director of the research laboratory of the General Electric Co., has been awarded the Hughes medal by the Royal Society for "distinguished work on X-rays and the development of highly efficient apparatus for their production." The Hughes medal was first presented in 1913 to Dr. Alexander Graham Bell. Dr. Irving Langmuir, also of the General Electric research laboratory, received it in 1918.

* * *

THE LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the transfer of R. P. Nick from the Baltimore (Md.) office to the Lancaster (Pa.) office, where he will be in charge of sales. R. M. Plympton has been appointed salesman in charge of consumer motor business in Chicago. He will work under the direction of R. D. Malm, Chicago district manager.

* * *

THE ROLLWAY BEARING CO., Syracuse, N. Y., has opened a Cleveland (Ohio) office in the Leader Building, with R. D. Faris in charge.

* * *

THE AMERICAN-LA FRANCE FIRE ENGINE CO., INC., of Elmira, N. Y., has acquired the assets and good will of the Foamite-Childs Corporation, of Utica, N. Y., and the business of the two companies has been combined under the name of the America-La France and Foamite Corporation.

* * *

EDWIN H. LUNDGREN, for the last four years general sales manager of the Combustion Engineering Corporation, New York City, has been elected vice-president and director as well as general sales manager.

* * *

THE HAZARD WIRE ROPE CO., Wilkes-Barre, Pa., has acquired the wire and wire rope division of the Waterbury Co., Brooklyn, N. Y.

* * *

THE AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill., has purchased the iron foundry of the American Brake Shoe & Foundry Co. at Burnside, on the South Side of Chicago, making the seventh in the chain of plants producing AMSCO castings.

IN RECOGNITION of the steady growth of the utility and industrial interests concentrated in the Eastern states, the Ohio Brass Co. has decided to create an executive branch in New York City, covering New England and the territories served by its present New York and Philadelphia sales offices. This change will be made effective about Jan. 1 with Frederic Attwood in charge. Mr. Attwood is well known in the electrical industry, both here and abroad, having directed the interests of the Ohio Brass Co. in Europe for several years, and recently returned to this country to undertake the organization and direction of the New York executive office of that company.

* * *

THE FALK CORPORATION, Milwaukee, Wis., has made arrangements with William Kennedy & Sons, Ltd., Owen Sound, Ontario, whereby the latter company will manufacture and sell Falk gears, speed reducers and flexible couplings in Canada.

* * *

THE MANUFACTURING PLANT and entire business of the Davenport Locomotive Works has been acquired and will hereafter be conduced by the Davenport Locomotive & Manufacturing Corporation, Davenport, Iowa.

* * *

THE ROBERTS & SCHAEFER CO., Chicago, recently acquired the sole bituminous rights to the Menzies Hydro-Separator, which for some years has been manufactured by the Wilmot Engineering Co., Hazelton, Pa., for use in the anthracite field.

* * *

G. W. DULANY, JR., chairman of the board of the Dulany Trust, Chicago, has announced the election of E. B. Mallory as vice-president and member of the board of directors of the Climax Engineering Co., Clinton, Iowa, a subsidiary of the Dulany Trust.

* * *

The OHIO CARBON CO., Cleveland, Ohio, announces the appointment of James H. Parks, 403 Hines Avenue, Princeton, W. Va., as district representative, handling industrial brushes in the coal fields. Mr. Parks has had 25 years' experience with electrical work in mines.

WHAT'S NEW

In Coal-Mining  *Equipment*

Coal Loaded at Low Cost By Underground Shovel

An underground shovel loader that has been installed in several mines in the West and is said to effect substantial savings, even under adverse conditions, is now being manufactured by the Nordberg Mfg. Co., Milwaukee, Wis.

The mechanical loader, known as the Nordberg-Butler shovel, operates on compressed air and functions in many ways similar to the steam shovel. It is of the full-revolving type, loading cars at either side and at the rear as may be desired. Even where double trackage is impossible the Butler shovel may be effectively used, according to the manufacturers, because of the long reach of the dipper arms.

Its compact design permits its use in areas 5½ ft. wide and 7 ft. high, while its wide clean up of 18 ft. makes it advantageous for large rooms. It is claimed that it will dig about 8 inches below grade in any direction and load into cars 48 in. or higher.

The air consumption is from 135 to 150 cu.ft. per minute. The one-quarter-yard dipper operating at a speed of 3½ passes a minute gives the shovel a large capacity. Under ordinary conditions this is said to vary from 15 to 30 tons an hour.

All castings used in the equipment are given severe tests. Renewable bushings are provided at all points subject to hard usage. The total weight of the shovel is 4,600 lb., which permits it being easily transported from the mine on its roller-bearing wheels.

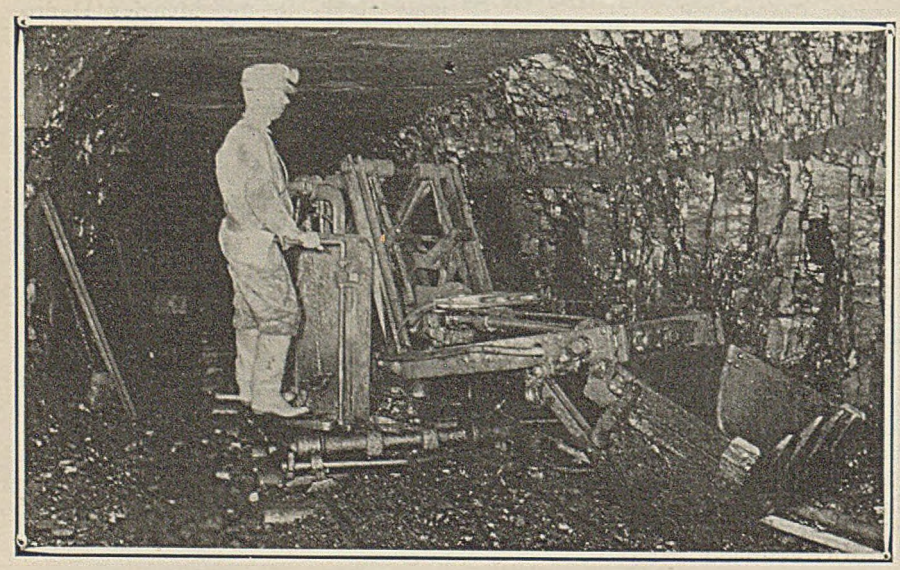
In operating the shovel, one hand is on the lever controlling the rotation, the movement of the lever being always in the same direction as the revolving member is to move. The other hand is on the lever of the operating valve which controls the movements of the dipper. When finished in one location, the shovel can be pushed to another without difficulty. It can be rolled on a mine cage 36 in. x 54 in.

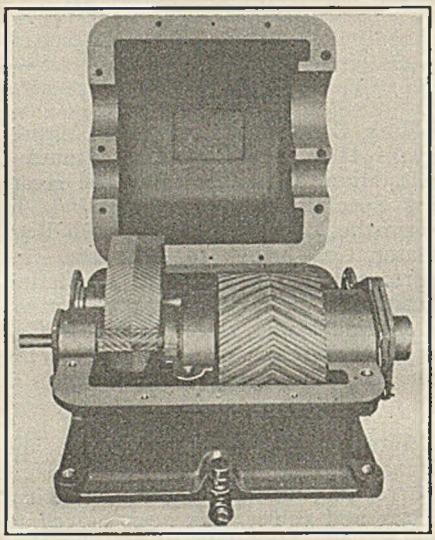
The "Shoveloader" consists of three principle parts—base, operating cylinder and the dipper assembly. The base casting is of steel, to which is attached the clamping device for securing the machine to the rails. This base also serves as a support for the rotating portion of the shovel which revolves on a row of steel balls. The power required for rotating the machine is supplied by a small four-cylinder air engine attached to the base.

In the operating cylinder are two pistons which act as one when imparting the crowding or lifting motions to the dipper. For the digging and dumping motions, air is introduced between the pistons which forces them apart and then by means of cables and links, gives a positive and effective dipper action.

The side arms of the dipper are of heavy bar steel but the design of the machine is such that strains encountered in the digging action are borne by the dipper instead of the arms.

Helping the Operator Solve the Loading Problem





Works Efficiently Without Noise

Quiet Speed Reducer for Multi-Service Work

A speed reducer has been developed that is said to have distinct advantages in quietness of operation, high efficiency and ability to withstand shocks. This announcement has been made by the Link-Belt Co., Chicago, which is manufacturing the new Link-Belt Sykes herringbone speed reducer shown in the photograph above.

The company claims that the reducer may be applied economically to all classes of service no matter how light or heavy it may be. Three standard units have been developed to cover a wide range of ratios and capacities. A single reduction unit, type "S," covers ratios up to 10 to 1. Types "D" and "DV" are double reduction units. Type "D" is designed for heavy duty and ratios are from 10 to 1 up to 80 to 1. The third standard unit, "DV," is for light duty. Ratios range from 10 to 1 to 130 to 1.

The units are rated according to the r.p.m. of the prime mover, ratio required and the nature of the service. For continuous duty allowance is made for 50 per cent momentary overload.

The manufacturer has endeavored to use a minimum number of parts. Oversize Timken bearings are used. Gears rotate within a large oil reservoir and bearings are splash lubricated. Special oil baffles at shaft projections keep dust out and oil in. Link-Belt Sykes herringbone gears are the backbone of the unit.

Mine Hoist Brake Control Regulated by Pressure

A new form of brake control for power-operated mine hoists which has been under development for the past several years has now been perfected, and the manufacturer, the Ottumwa Iron Works, Ottumwa, Iowa, claims that it has marked advantages over the type of control now in general use.

The Ottumwa control was designed to eliminate grabbing and uneven braking that has occurred with the positioning method of control in which the brake weight corresponds with a specific position of the operating lever. In the new device each position of the operating lever corresponds to a different pressure in the thrust cylinder of the hoist. If the pressure is less than the amount sufficient to lift the brake weight, the brake settles to the drum and rests against it with a pressure corresponding to the deficiency of thrust pressure.

Another feature is that each position of the operating lever requires a different pressure by the operator's hand. Hoisting engineers—accustomed to a hand brake—will handle this mechanism unconscious of the fact that it is a power-operated brake. The harder the pull on the lever the greater the braking effect.

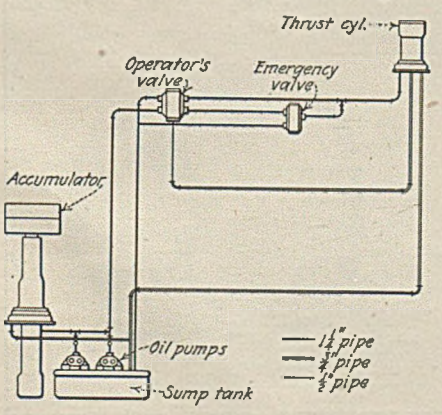
As may be seen in the accompanying drawing the bottom part of the operator's valve is connected to the source of pressure. The two middle ports are connected to the thrust cylinder, the lower admitting oil and the upper exhausting it. The top part is connected to a sump tank. The bottom of the valve is attached by a separate pressure pipe to the thrust cylinder.

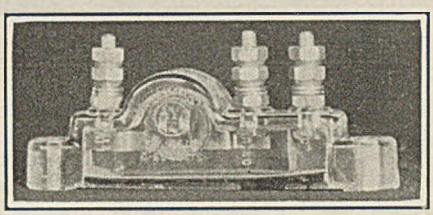
The weight of the vertical rod from the operator's lever to the spring casing over the valve gives a pressure on the valve stem. If the pressure in the thrust cylinder is less than this, the valve lowers and admits oil to the thrust cylinder. When the pressure in the thrust cylinder is such that it gives a pressure on the bottom of the valve slightly greater than that corresponding to the weight on the valve stem, the valve raises and closes the admission.

With reduced pressure on the stem, oil is forced out until thrust-cylinder pressure balances valve stem pressure. The spring over the valve stem cares for an adjusting dancing motion and enables the operator's lever to stand motionless. A movement of the lever decreases spring tension and effects a corresponding amount of braking.

The adjustable emergency trip mechanism gives a predetermined amount of braking at a predetermined rate of speed in case of interruption of power. The slowing down and stopping of the hoist in mid-positions of the cage is said to be very evenly effected.

Provides for Intermediate Braking





Discharges High Currents

Low-Voltage Arrester Is Encased in Glass

To guard low voltage systems against insulation breakdowns, including failures of relays, transformers and other apparatus, resulting in interruption of service, a low voltage auto-valve lightning arrester recently has been announced by the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. This apparatus is claimed to be exceptionally fast in operation and capable of discharging high currents without failure.

It is said that this arrester may be applied to a.c. systems which operate at 65 volts or less as well as to d.c. systems which operate at 45 volts or lower. Some of the circuits to which this arrester may be applied advantageously include signal and fire alarm systems, remote metering circuits and current transformer primaries.

Simplicity in design, speed of operation and ease of maintenance are other features claimed for this arrester. Because it is retarded by air resistance only, the speed of operation is said to be unusually high. The arrester is encased with clear moisture-proof glass, making every part of the arrester visible without removing the seal in the bottom and reducing leakage currents to a minimum.

Due to a low discharge voltage and minimum delay in operation, it is claimed that maximum protection is provided by this arrester against high voltages. It is further asserted that low resistance makes it possible for discharge currents of 1,000 amperes to flow through the arrester without causing a dangerous voltage across it.

Spun Glass Mat Features Storage Battery Design

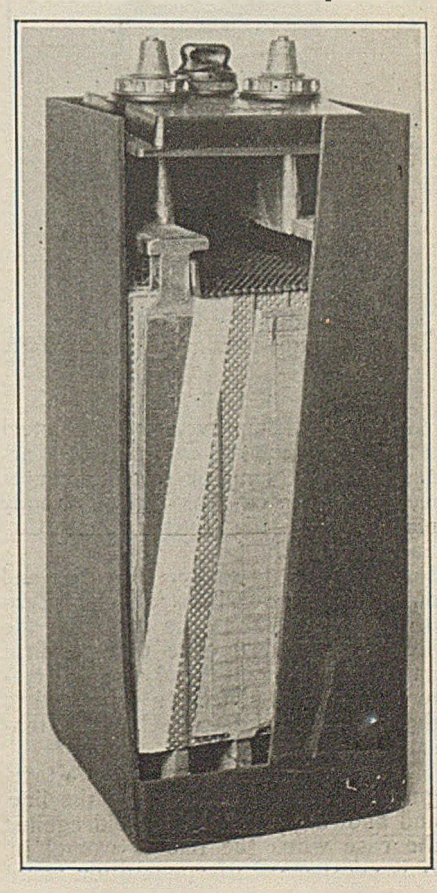
The storage battery finds many uses in the coal mining industry. An announcement that treats of developments in this field leading toward greater efficiency and reliability comes from the Gould Storage Battery Co., Inc., New York City.

This organization has designed the new Gould Kathanode battery on what is said to be an entirely new principle. A highly porous mat of many layers of spun glass placed against the surface of the positive plate is used. This permits free supply of the electrolyte to the surface of the plate. It is resistant to acid action and is of small resistance to the passage of current. Combined with this special mat is a wood veneer and a ribbed and perforated rubber separator with its ribs against the negative plate.

The spun glass retainer is said to have the property of permitting a free supply of the acid to the positive plate under the most severe conditions of electrical and mechanical abuse. Use of this development also permits the use of a high capacity positive plate and increases the life of the cell.

Due to the reduced loss of active material from the plates, the Gould Kathanode battery is said to maintain its rated capacity, a valuable consideration for the user of locomotives, practically throughout its useful life.

Produced After 25 Years Experience

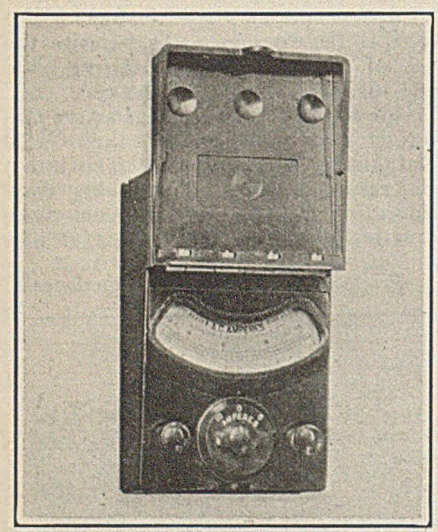


Portable A.-C. *Instrument Construction Modified*

A new type of portable a.-c. instrument designed for general testing and inspection work in industrial plants and power stations has been announced by the General Electric Co., Schenectady, N. Y. It is of the repulsion type and while intended for use on a.-c. circuits, can also be used to advantage on direct current.

Ammeters are supplied self-contained in ratings not exceeding 20 amperes. Voltmeters are supplied self-contained in ratings not exceeding 300 volts. For higher ampere and volt readings transformers and multipliers are supplied.

The scale length of 3 in. is clearly visible. The case and cover are of moulded bakelite. Each instrument is equipped with a well protected but accessible adjusting device. The instrument weighs 18 ounces. It is designed to fit in the coat pocket, measuring 5¼ x 3½ x 1⅞ in.



Handy to Carry and Use

Improved Steel Tape Hook Convenient to Use

A new and improved hook for steel tapes that enables one man to accurately take long or short measurements unassisted has been recently marketed by the Lufkin Rule Co., Saginaw, Mich.

Although it is easily slipped on and off the tape it cannot fall off. Zero of the tape falls at the inside of the hook. A toothed edge takes a firm and square grip on metal or other materials the instant tension is applied to the line and releases itself when tension is released.

It swings with the ring of the tape, guarding against breakage of the line, and allowing the hook to fold against the case when the line is wound in. It is constructed of composition metal

A One-Man Device

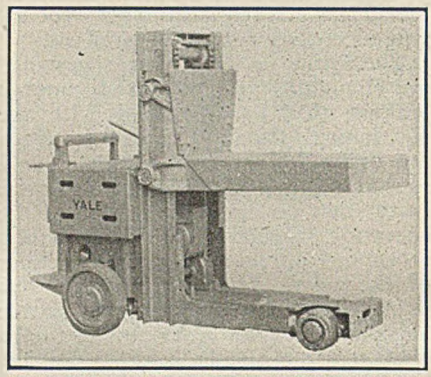
and is of light weight and is 2 in. long. It is suitable for standard steel tapes ⅜ in. wide and is known as No. 252.

High-Lift Electric Truck Has Large Capacity

A 3-ton high-lift elevating truck, known as model K 25, has been produced by the Yale and Towne Mfg. Co., Stamford, Conn., to meet the requirements for larger capacity electric industrial trucks. The platform has an overall width of 27 in., a height of 11 in. and a length of 54 in. It is raised and lowered by a 1½-in. diamond roller chain which passes over a power-driven sprocket at the bottom and an idler sprocket at the top. The ends of the roller chain are attached to the platform through a spring take-up device which, it is said, will automatically adjust itself as the chain wears.

The hoisting motor is connected to a spur-gear pinion through a spring ratchet, so arranged that a positive drive is obtained when raising the elevating platform. If, however, the platform was checked in its downward travel, it is claimed that the ratchet would merely release and, therefore, cause no injury to the mechanism of the truck. Due to the high efficiency of the roller chain and the spur-gear reduction in the hoist unit, a speed of 7½ ft. per min. is said to be obtained when lifting a full load, and a speed of 19 ft. per min. when raising the empty platform. The lowering speed is 19 ft. per min. loaded or empty.

A four-wheel steering feature allows a turning radius of 96 inches to the outside edge of the truck. To reduce the physical effort necessary to steer a machine of this heavy capacity, the steering knuckle kingpins have been fitted with ball and roller thrust bearings. Thus the entire weight of the machine is carried on anti-friction bearings as they are used in all moving parts. Tests made with this machine carrying the capacity load of 6,000 pounds, show that the pressure required at the operator's handle to steer the wheels is less than was formerly required on the 2-ton machines which were equipped with hardened pins and ground bushings.



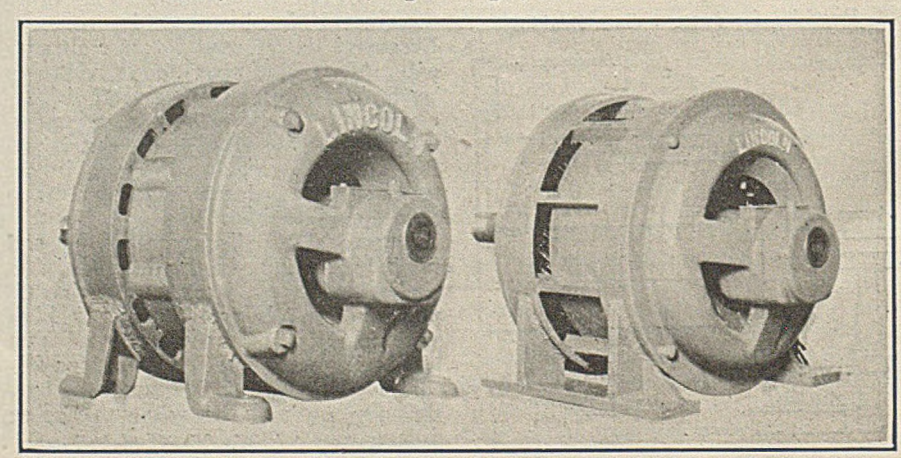
Handy Around the Shop

Motor Frames Are Made From Welded Steel

Recent patents covering the construction of welded steel motor frames to replace castings, have been granted to the Lincoln Electric Co., Cleveland, Ohio. As shown in the illustration, the construction is an assembly of hot-rolled steel parts welded into the equivalent of a casting. The claims allowed for the method of construction cover its use only to dynamo-electric machines. According to engineers of the Lincoln Electric Co., it is claimed that the welded steel method of construction gives a practically unbreakable frame, light weight and better ventilation.

Steel is six times as strong, and two and one-half times as stiff, as an iron casting. Therefore, less weight is required in a machine made of steel. Steel also costs only about one-third as much per pound as a casting. Consequently, materially lower production costs are said to be secured.

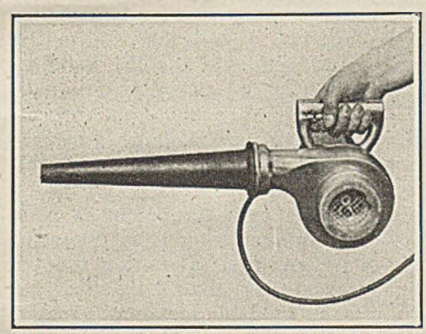
Sturdy Construction, Light Weight, Low Production Cost



Portable Electric Blower Keeps Machinery Clean

Insurance underwriters state that a considerable percentage of all motor trouble is due to the presence of foreign matter in windings and insulation. A device that removes dust from motors and other machinery; that prevents dust explosions; that may be used as a suction cleaner, a blower or as a spraying apparatus; is now being manufactured by the Clements Mfg. Co., Chicago.

There are two models of the ball bearing blower, both of which are known as the "Clements-Cadillac." Model "F," equipped with a ¼-hp. motor, is recommended for motors up to 20 hp. and for all ordinary cleaning. It will deliver 47 cu.ft. of air per minute at a velocity of 225 ft. per second, with a pressure of 17 inches of water.



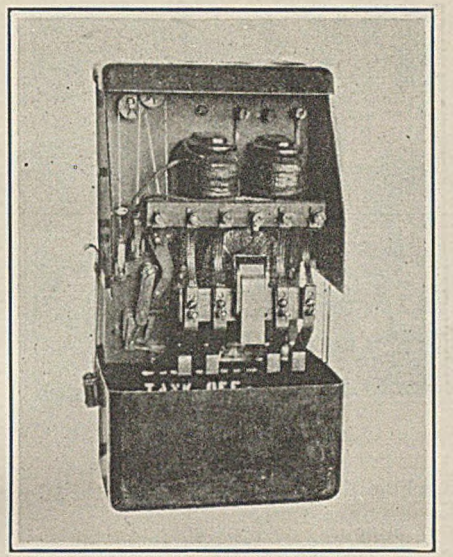
Blows Out the Dust

Model "G," is designed for large motors and places where dust is difficult to remove. It delivers 55 cu.ft. of air per minute at a velocity of 276 ft. per second at a pressure of 21½ in. of water. The motors are mounted upon Norma ball bearings which require no oiling.

Push-Button Control for Small Motors

Type "ZO," a push-button-operated, across-the-line type of starting switch, with oil-immersed contacts having inverse time element overload protection, is the latest offering of the Electric Controller & Mfg. Co., Cleveland, Ohio.

It is designed for the control of 10 hp., or smaller a.-c. motors. It is a self-contained unit enclosed in a pressed steel case. It is said to have all the advantages of the contactor type of starter and the safety feature of having all the main contacts, and also the contacts of the over-load device, immersed in oil. Its construction eliminates all arc barriers and blow-out details, and at the same time insures a quick rupture of the current when the contacts open.



Prevents Burning Out of Motors

Lubrication is by capillary action and a slight splashing when the magnet surfaces engage, which cleans the parts of the mechanism and prevents corrosion.

As shown in the accompanying photograph the design of the box is sturdy and compact. All machines may be furnished to give either no-voltage protection or no-voltage release. This is specially advantageous where continuous service is necessary.

Power-Driven Handsaw Is Rapid and Safe

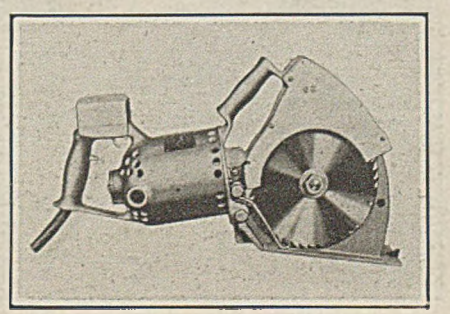
A portable power-driven handsaw that, it is said, can be used for practically all sawing operations, recently has been developed. Known as the Crowe safety saw, it is manufactured by the Crowe Manufacturing Corporation, 229 East Third Street, Cincinnati, Ohio, for operation by electricity or air and by the Ingersoll-Rand Co., 11 Broadway, New York City, for air-drive only. It is claimed that the saw will cut practically any size timber used in coal mines, construction work, ship yards, railroad yards, shipping rooms and factories.

The body of the saw is aluminum which makes it light in weight and easy to handle. Every part is machined and is interchangeable. It is made in four sizes for electricity and in three sizes for air. Model C-12 is equipped with a 12-in. blade, weighs but 35 lb. and can be adjusted to cut any thickness of lumber up to 4⅛ in. It is said to cut 80 per cent faster than two men with a crosscut saw.

The saw blade is tempered crucible steel, carefully machined and treated to assure long life. The entire blade is hardened, permitting it to retain a cutting edge even when the saw has been filed down to the revolving hub.

Equipped with a trigger switch, both for economy and to insure safety, the saw is easily operated. Motor fan and shafts are dynamically balanced to eliminate vibration while in operation, and the saw is provided throughout with heavy-duty ball bearings. The motor is of the universal type, especially designed for the tool, and can be used on either alternating or direct current. The saw can be supplied for either 110 or 220 volts.

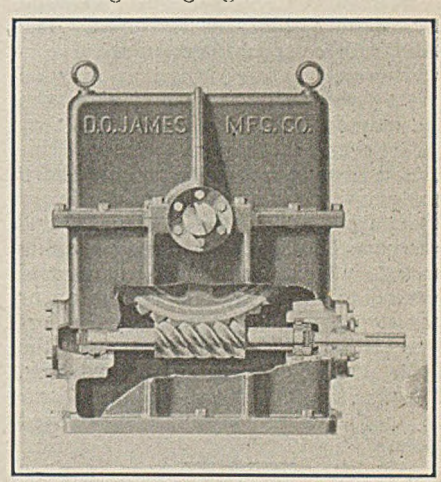
Does Work of Two Men



Worm Gear Speed Reducer Made Practical Device

Guaranteeing smooth frictionless action of worm and gear, a new heavy-duty worm gear speed reducer has made its appearance. The device has a large oil cooling chamber that is said to prevent all overheating.

When the worm is at the top of the unit, sight feed oil cups are used for furnishing a high grade of oil to the roller bearings on the worm shaft. A level cock is fitted to the side of the housing, and a drain plug is located in the bottom of the casing.

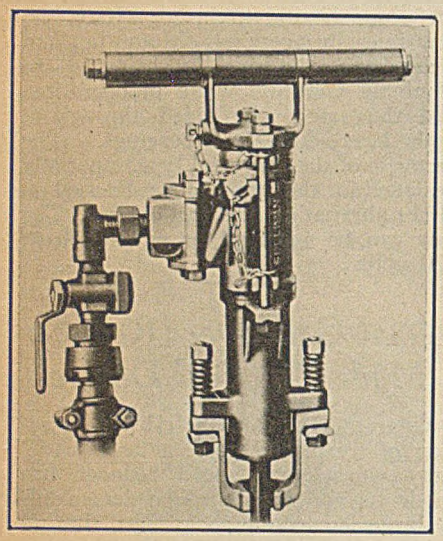


Withstands Severe Tests

The construction of the unit is as follows: Gears of phosphor bronze; worms of chrome nickel steel (S.A.E. 3140); Timken and Norma-Hoffman roller bearings; interchangeable bushings. The housing is made of high-grade gray iron, designed for maximum cooling space. The unit is built by the D. O. James Mfg. Co., Chicago.

Drill Sticking Eliminated By Rear-End Rotation

Specially designed for soft-ore drilling, a tool that weighs only 39 lb., that may be held horizontal or on upward holes by an operator without undue fatigue, has been announced by the Sullivan Machinery Co., Chicago, Ill. It employs a twisted or spiral drill steel and its rear-end rotation takes effect on the forward stroke of the piston, so that the bit, which is ordinarily of the fish-tail pattern, turns as it cuts.



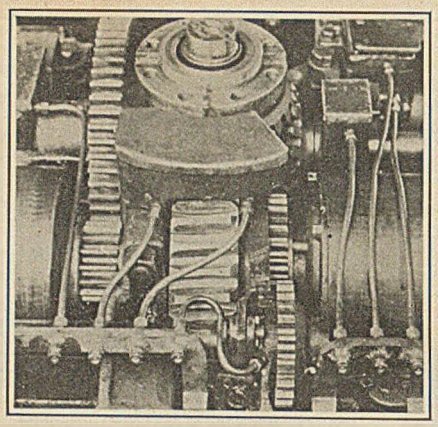
It Turns as It Drills

This prevents the bit from sticking as it advances so that the maximum hole-cleaning ability is developed. The Sullivan three-spool differential valve is incorporated in the design as may be seen by the accompanying illustration. The manufacturer claims that this feature guarantees positive action and insures a lively powerful blow and sharp recovery.

The front end of the piston is fluted to engage lugs in the retaining bushing through which the rotation is carried forward to the drill steel on the up or back stroke of the piston. On the forward stroke or blow, the action of the piston is unimpeded. The cylinder, chuck housing and rear head of the drill are machined from solid drop-forged billets.

Bearing Lubrication Made Easy and Effective

To insure lubrication of bearings in comparatively inaccessible positions, the Hulbert Oil & Grease Co., Philadelphia, Pa., has developed and is selling the Hulbert spring oiler lubricating system. The accompanying photograph shows the top view of a mining machine where the system has been applied. Brass or copper pipes are attached to the bearings to be oiled and are led to a suitable block at some point on the



Keeps Dust and Dirt Out

machine that can be readily reached by the machine runner.

An oil gun is used to force lubrication. On waste-packed bearings the lubricant is discharged into the sides of the waste packing rather than onto the top. This practice eliminates the necessity of the lubricant passing through the layer of dust that is usually found collected on the waste. Patents have been applied for.

Atomic Hydrogen Welds Open New Field

By the use of equipment recently announced by the General Electric Co., atomic hydrogen welding—through which it is claimed that hitherto unweldable metals can be melted and fused without the slightest trace of oxidation, and welding can be performed in some cases on metals as thin as paper—is now made practicable. This process, which also makes possible the welding of many special alloys and the production of ductile welds in iron and steel, is the result of research work conducted by Dr. Irving Langmuir of the General Electric research laboratory.

Briefly, this method utilizes the passage of a stream of hydrogen through the arc between two electrodes. The heat of the arc breaks up the hydrogen molecules into atoms. These combine again a short distance beyond the arc into molecules of the gas and, in so doing, liberate an enormous amount of heat. Therefore, it is said, more effective welding temperatures can be obtained than with the usual welding methods.

Since atomic hydrogen is a powerful reducing agent, it reduces any oxides which might otherwise form on the surface of the metal. Alloys containing chromium, aluminum, silicon or manganese can thus be welded without fluxes and without surface oxidation.

The welding outfit consists of: (1) A single-phase transformer for converting the voltage of a 60-cycle source of power to one suitable for the welding equipment; (2) a specially designed, variable reactor to provide the proper welding current and voltage for different classes of work; and (3) the welding torch.

To date, the new equipment is produced only for operation from 60-cycle, single-phase circuits. It is for use on ordinary metals less than ¼ in. thick, or on hitherto unweldable metals of greater thickness. It is claimed that metals having a thickness of but 10 mils can easily be welded. Little doubt is expressed that, in some cases, material as thin as 2 mils (about the thickness of ordinary writing paper) can be welded.

Welding With Atomic Hydrogen Has Many Advantages