COAL AGE

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Editor

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SAFETY—*A Major Consideration*

JUDGE GARY made an indelible impression on industrial organization. Called upon to occupy the center of the stage in the greatest industrial drama of all times, he immediately found himself out of tune with much of the tradition that had fastened itself not only upon the steel industry but upon American industry in general. It was the fashion of the era to crush competitors. Much of the literature of that period made gods of captains of industry whose success lay in their ruthlessness rather than in wholesome vision. It was the fashion, also, to hoard business secrets; to keep trade information from the public and thereby from competitors. The sentiment of the time seemed to dictate a philosophy of "suspect your competitor and distrust the public."

MR. GARY brought an entirely new viewpoint into this drama. His biographer, Miss Tarbell, tells at length of the difficulties he encountered in the early days of the Steel Corporation because of the differences between his viewpoint and that of men who belonged to the old school. He took the public into his confidence. He gave it facts about the financial operations of the Steel Corporation that amazed old steel men. Bankers, too, doubted the wisdom of this practice. Mr. Gary stood firm. Time soon justified his vision. Public opinion, formed during the political discussion from 1892 to 1900, changed from hostility to trusts to toleration and later to general approval of big business. The Steel Corporation prospered; the industry prospered. By common consent Judge Gary's was the guiding hand throughout this period. The intelligence and character that won for him his victory over tradition developed into leadership that kept the industry free from internal strife and thus free to grow strong in public favor.

IN SPITE of his numerous outstanding achievements many men will remember him best for his interest in and financial support of the safety movement. Thirty years ago industrial accidents were numerous. Industrial cripples were everywhere. Mill towns, particularly, abounded in them. Looked back upon in the light of modern safety technique and accomplishment we do well to record the fact that the first substantial impetus to improvement came from Judge Gary, who convinced his associates that support of the movement would be good for their business as well as good for humanity. His efforts were not confined to kind words. A genuine campaign to eliminate accidents was undertaken. A safety organization was created to function throughout the Corporation and its subsidiary companies. Money was spent in amounts previously unheard of for purposes of saving lives and preventing accidents. Hospitals and skilled surgical and medical service were made part of the program. Safety inside; better housing and living conditions outside became the slogan. This spread to those coal operations that are part of the Steel Corporation's activities.

IF THE safety movement has lost a friend it may well be said that he left a permanent organization to carry on with a genuine conviction that Safety should be a definite part of the operating program.

Courtesy Burton Holmes from Ewing Galloway

A Far Cry from Modern Transportation

Does LONGWALL *Save Lives and Dollars?*

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

TO remove the coal completely by longwall and let the roof fall over a long distance with only a few posts, cribs and jacks has always seemed likely to increase the dangers of mining. Everybody appeared to expect that it would, especially as the machine methods by which it was accompanied were noisy and continuous in operation and prevented the miners from hearing the sounds made by the movement of the roof. The speed of the operations, and the hazards believed to accompany mass production also seemed likely to cause accidents.

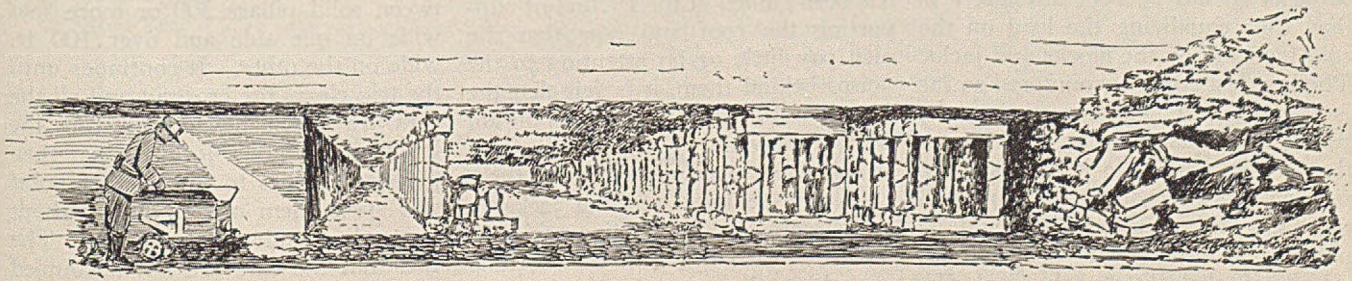
But after some wide experience it was found that dangers were fewer rather than greater with longwall mining, that the roof, coal and floor had less time to disintegrate and become dangerous, that by specialization the right men could be selected for every special and expert job, that supervision was easy and less expensive, that the tonnage per man increased, thus lowering the number exposed to the hazard and therefore the number of accidents per ton, that the explosives were used in lessened quantity, that the menace of an explosion of dust was less in the large open areas associated with longwall, for they gave ample opportunity for the expansion of inflamed gas or dust, thus decreasing the pressure of the explosion, and that there was less danger of gas accumulation where places were worked in some degree night and day and when they were ventilated with a more direct current.

Statistical evidence is restricted to a few companies but such as is available in regard to longwall and mechanical mining tends to show that modern methods will reduce hazards materially. The a priori reasoning of the mining fraternity was apparently all at fault. The miners who were at first fearful are gaining confidence in the new methods. Their fears were wholly natural and were shared by those who directed them, but experience is convincing them that the old methods were about as safe as the method of felling a tree by a girdling cut, such as novices in the art of tree felling quite frequently adopt when left to their unaided wisdom, believing that a cautious method of tackling the job such as that described will give opportunity for observation and safe retreat whereas it makes the hazard only the more imminent and precautions more difficult.

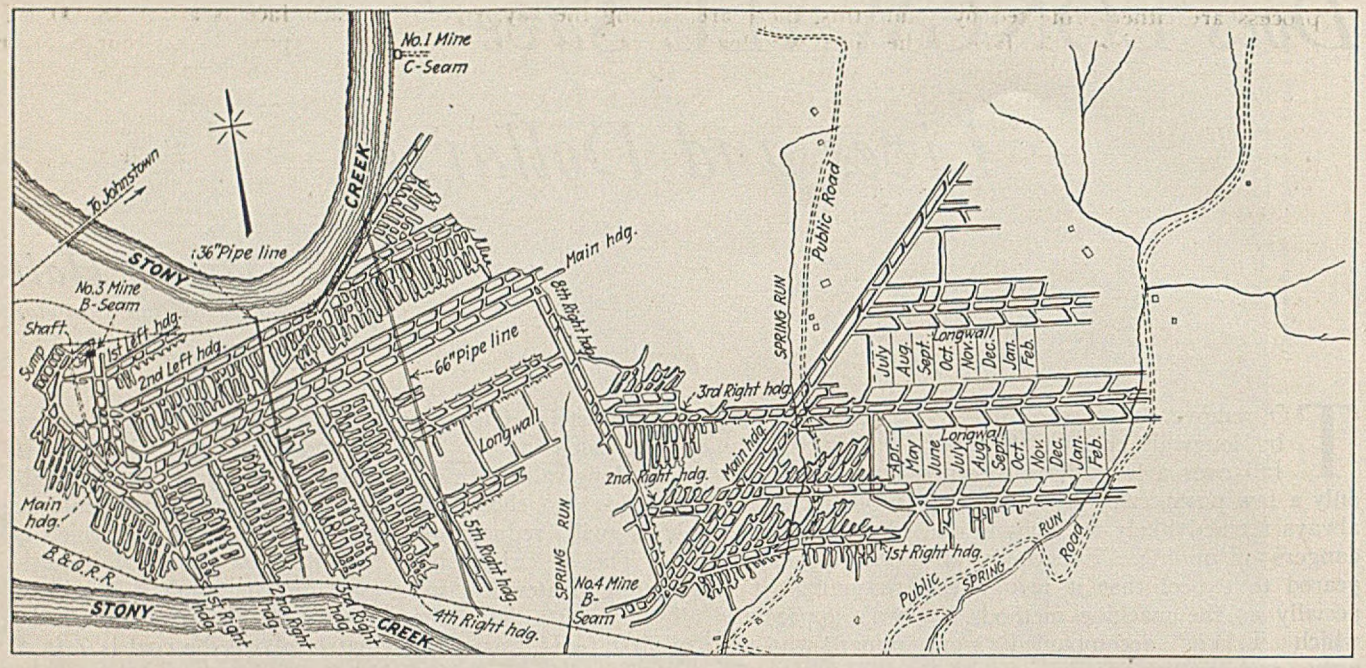
AT THE Valley Smokeless Coal Co.'s mine near Johnstown 187,827 tons of coal have been mined by longwall without any fatality. That is not a record, of course, in fact it is a little less than the normal tonnage per fatality, but it does show that safety can be attained by 300-ft. longwall faces when proper care is taken and adequate supervision afforded and all this though all timber is recovered. The company uses 1,500 jacks and not a jack has been lost. This recovery is probably the most dangerous part of the work. In it one man broke an arm and a leg. As similar recovery in room and pillar would be quite if not unduly hazardous, the methods and conditions at this mine should be described. The roof is one which is hard to handle by reason of its ultimate strength, the result it is said of the presence of thick sandstone beds. Immediately above the coal is 2 ft. 5 in. of slate, 13 ft. of sandstone, 9 ft. of clay, 9 in. of coal, 6 ft. of shale, 12 ft. of sandstone and 15 ft. of shale.

THE coal being mined is of low-volatile character and in the "B" seam, the Miller, as it is locally called. It has a large number of rolls. Its true thickness is between 36 and 44 in., but in places undulations of the floor locally reduce it to only 22 in. These rolls are so frequent and the coal was at best so thin that the cost of yardage in driving both rooms and entries was prohibitive.

Today the rolls have to be cut only in the entries. The longwall faces are handled without cutting into the clay for headroom, for the pan conveyors, which bring out the coal, accommodate themselves readily to the undulations of the floor and being low can readily be loaded to capacity no matter how thin the coal seam may be. To help support the roof where the men are working, a row of jacks is set 3 ft. clear of the face at 3-ft. centers. The jacks are suited for use in the thinnest of coal, compensation being made for the variation in the thickness of the seam by the use of hard maple or oak blocks above and



Sketch Section of Working Face Just Before Rear Jacks Are Moved Forward Into Space Behind Conveyor



Map of Valley Smokeless Mine Showing Two Panels of Longwall and the First Test Work Using That Method

below the jacks. The base block is laid on a thin bedding of slack.

Behind this line of jacks, of which there are about 100, is laid the conveyor in a space 3 ft. wide left between the afore-mentioned and a second line of jacks. The jacking back of the first row consists of four lines of jacks set in twos, each pair on maple or oak blocks 3 ft. 6 in. long. The blocks are set at 3-ft. centers and the center lines of the rows of blocks are 5 ft. apart. It is simpler, however, not to speak of the jacks as being in pairs, but to refer to them by row numbers. In the sketch the blocks near the caved area are ready to be moved up, for it is the fourth and fifth rows of props which are advanced whenever the first row of jacks and the conveyor have been shifted forward. The jacks in these two rear rows are loosened, and the blocks and jacks passed between the jacks in the second and third rows. They are then erected behind the conveyor.

IN ORDER to get best results the jacks should be kept absolutely in line, thus equalizing the load on the coal face and on the blocks and jacks. The heaviest cover encountered so far is about 530 ft., but nevertheless the roof has in places weak mud seams that sometimes make it necessary to put jacks between the front line and the face. If necessary it would be possible to do as was done at the mines of the Pittsburgh Coal Co. where 6-in. holes were drilled by a machine to a depth of 7 ft. in the face near the roof for the insertion of I-beams. These were set in the holes at one end and rested on posts in the line of the first row of jacks. These beams acted as forepoles and were used to support the "clod" over the coal. As the undermining was only 6 ft. deep, the I-beams, even after the coal was shot down, gave adequate support until new I-beams were placed at points intermediate between the old ones. Forepoling greatly reduces the hazard of mining in Europe, and it is well worthy of adoption in American mines.

THERE is question as to the need for, and advantage of, the fourth and fifth lines of jacks. They retain too much roof and consequently provide too much weight on the blocking which would last longer if subjected to less pressure. They were introduced as a means of giving assurance to the miners. When the mountain was tumbling in behind them it was comforting to feel that the rocks were falling no nearer than 12 or 14 ft., but now that confidence has been gained in the method of supporting the roof and now that the men pay little or no attention to the noises behind them, it is felt that the fourth and fifth lines of props do not add to safety and do increase the load, so it is likely that hereafter only three lines will be used and the jacks in the second and third lines will be moved up in pairs with the blocking on which they rest and with that which rests on them.

The safe feature of the system is the speed and ease with which the jacks are removed. A bar washer holds the jack up to its place. A blow on this washer releases it and the jack falls apart and the blocking on top of it falls. There is no delay, nor any difficulty. The man releasing the jack is at all times under the protection of two other jacks. The jack wedges slide easily both in erection and in demolition. At first it was thought that the faces of the jack should be smoothed and lubricated with graphite, but it has been found that they can be left as cast and that a little slack ground onto the rough surfaces will fill the interstices and give the best of sliding conditions.

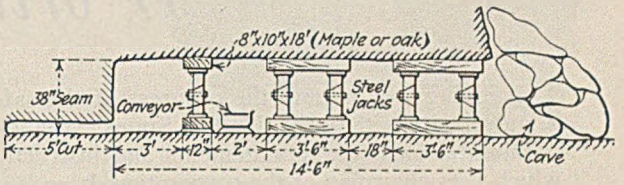
Safety in transportation has also been closely watched. An eight-car trip is pulled along the main panel entry of the solid panel which is left between each pair of working panels. (The solid panel will be worked on the retreat. The working panels are to be operated on the advance.) The locomotive turns into an inclined crosscut leading to the entry which skirts the longwall and passes on between solid pillars 300 or more feet wide on one side and over 100 ft. wide on the other. It continues until the trip clears the crosscut and all the cars are in the heading skirting the longwall. The locomotive then pushes the cars to the loading point and spots them one by one without uncoupling under the conveyor. The fact that the cars are not uncoupled adds to the safety by eliminating the hazards of uncoupling. The locomotive and crew during the whole

process are either protected by solid pillars or are so near the face of the longwall as to receive maximum protection. That done the locomotive pushes the cars along the edge of the gob to the nearest inclined crosscut. This takes only a minute or so. The roadway thus used by men and locomotive for so short a time is protected by 18-in. square cribs, a row of jacks and by the natural tendency of the roof to "shelf" over the rib.

By working half the force by night and half by day, or by dividing the force into three shifts the catastrophe risk is kept down. Therefore, it is worthy of note that at the Valley Smokeless Mine there are three gangs which follow one another in sequence. However, the number in each is not equal, the midnight shift consisting of two men who each labor in two longwall faces.

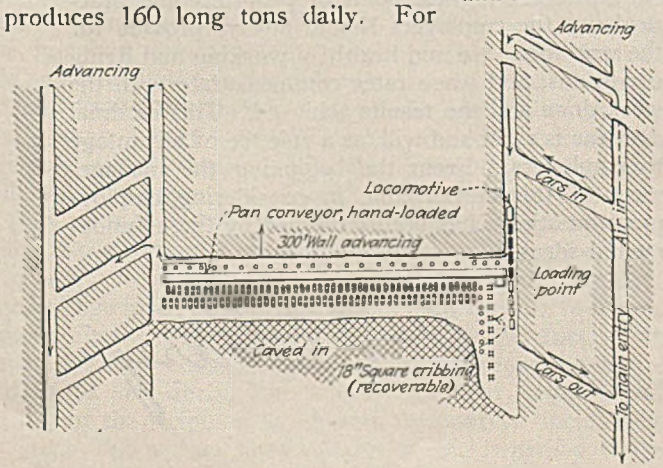
NEVERTHELESS approach is made toward dividing the force by three, and every advance in that direction, large or small, decreases the catastrophe hazard which increases as the square of the number of men in the mines at any one time. The operations of the men who load the coal at the Valley Smokeless mine do not endanger the men who at night advance the props nor do the operations of the latter prove a hazard to the men who handle the powder and shoot down the coal. The shooting also is not only handled throughout by men who are experienced in that work but is done when all the other men are out of the mine, and the operations of the other gangs are in charge of bosses—who work, it is true, but are employed mainly to promote the safety and efficiency of the men at the working face.

Thus much for safety. What are the economic features? Each face produces 160 long tons daily. For this, there are, during the day, eight men who load coal and move the conveyor and one shift boss who drills the face and moves the single or first line of face jacks. At night there are six men who move the other rows of jacks, two men who cut 300 ft. of face, one foreman who builds cribbing and in addition a shotloader and a shotfirer who in turn load and shoot the holes in two longwall faces. The coal is drilled with an electric drill and as the coal is "burned" to the roof the holes are made only 3 ft. deep. They are drilled at a slight angle near the roof. The shotloader and shotfirer come into the mine at 11 p.m., the other night men at 3 p.m. In all there are three shifts, in the aggregate of which nineteen men are employed which, at 179 net tons daily, gives an output per man of 9.4 tons, more than usual for thin coal. Great also is the advantage that whereas in ordinary room-and-pillar mines 21 per cent of the coal is recovered from narrow work, in this mine only about 6 per cent of the coal will thus be obtained. The cost for yardage at one time was 46c. per ton. It has been greatly reduced by the introduction of longwall.



Cross-Section of Face Showing Cave, Steel Jacks and Undercut

ANOTHER advantage of the system is the ease with which it can be started soon after a shaft is sunk or a drift has been extended far enough for entries to be developed. All that is needed for the starting of a longwall face is two panel entryways, each consisting of a roadway and airway, driven sufficiently far beyond the main entry to give a protective pillar, and also a room or development heading connecting the two parallel entryways.



A Longwall Face with Pan Conveyor at Valley Smokeless Mine

Nor is the equipment inordinately expensive. A single 300-ft. section of longwall such as that used at the mine of the Valley Smokeless Coal Co. can be equipped with conveyors, machines, jacks and gathering locomotive for about $25,000 and the cost of the preparatory work for each face is about $8,000. The latter expense, of course, would sooner or later have to be met with any form of mining.

It is fully realized that where time and capital are available it would be better before starting to work longwall to drive the panel entryways to the limit of their allotted territory, whether that be the boundary of the property or the protective pillar of a cross entry. In that case the driving of two entries would be saved and the longwall would be on the retreat instead of on the advance. Two panel entries forming a panel entryway are already being driven with the idea of working the coal into which they are entering on the retreat instead of on the advance, thus utilizing the economies and greater safety of this more favorable form of operation.

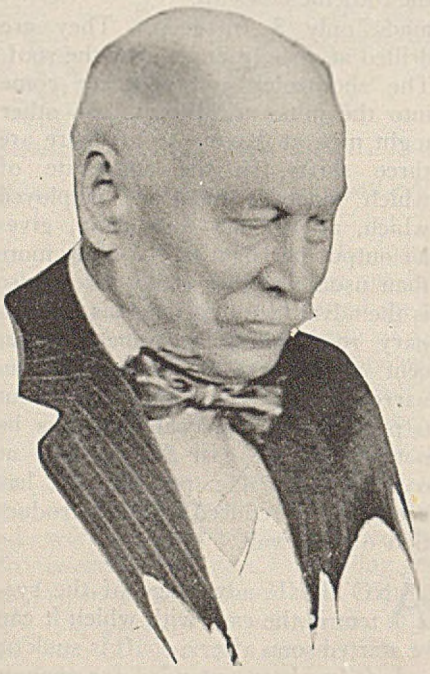
AT FIRST it was expected that the mine would be operated without rooms. All the coal was to come either from the longwall or from headings. When, however, a man failed to report for duty in the longwall face it was found necessary to cripple the heading force to make up the deficiency. In consequence, the entries seldom went forward as rapidly as the longwall face required. A cut is made every day in the longwall when it is in operation, advancing it 5 ft. In order to make sure of having a full quota of men at both the longwall faces and the entries it was necessary to keep ten rooms in operation at some additional cost, so as to have men on hand from which to draw should any of the heading or longwall men fail to report for work.

SO SUCCESSFUL from the point of view both of safety and economy has been the longwall work of the Valley Smokeless Coal Co. that C. M. Dodson & Co., subsidiary of the Weston Dodson & Co., Inc., has introduced it at its B. B. colliery in Audenried in the anthracite region. There the pitch of the measure up which the longwall face has been advanced is 12 per cent and undulating. A shaker conveyor accordingly will be used.

HUMAN LIFE—
Worth Saving

IN ORDER to picture the progress of the safety movement within the United States Steel Corporation, I shall quote statements and instructions which I, as chairman of the corporation, have issued from time to time. At one of the early meetings of casualty managers to discuss accident prevention, in May, 1906, I said:

"We should like to take a prominent part, a leading part, in any movement and in every movement that is practical to protect employees of the different corporations in which we are interested, and any requisition which is made for the expenditure of money to install equipment to protect our people will be honored, and I do not hesitate to say that we expect our legal department, and the gentlemen who are subject to their control and direction and advice to take such steps as are practicable to ascertain anything that can possibly be done at every locality and in every department to add to the safety of our equipment and to prevent accidents.



Judge Elbert H. Gary

"Upon the ascertainment of the facts which enable the heads of departments to form an intelligent judgment, we should be glad to have recommendations made so that we shall have opportunity of finally passing upon the question involved. We shall not hesitate to make the necessary appropriations of money to carry into effect every suggestion that seems to be practicable for the improvement of the conditions at our mills as far as our employees are concerned."

A little later, the following instructions were issued to the subsidiary companies:

"The United States Steel Corporation expects its subsidiary companies to make every effort practicable to prevent injury to employees.

"During the last fifteen years we have spent upward of $170,000,000 for safety, sanitation and employee welfare activities. These expenditures have been fully justified. They have been more than recovered in dollars and cents. But, of far more importance than the recovery of the expenditures, the happiness and gratification resulting to our many thousands of employees and their families, as well as to the management, through good health and safety of life and limb, have been beyond computation, beyond any measure in dollars and cents."

In addressing the stockholders at their annual meeting, April 18, 1921, I said:

"The United States Steel Corporation has been characterized as 'A Corporation with a Soul.' Whether or not the statement is literally true might depend upon your definition, or mine, of the word 'soul.' We might not agree. I volunteer one that you may be willing to accept, at least for the purposes of these remarks: A soul is a controlling influence, possessed by individuals, corporations or states, which recognizes as of equal importance the rights, interests and welfare of themselves with all others. It involves the practice of the rule promulgated by Confucius 500 years before Christ.

"Under this definition the United States Steel Corporation has striven to secure from all who are interested in its conduct the belief that it is possessed of a soul. To say it has often failed is to assert only that its managers are human. But when and in what respect it has failed in performance can be accurately and fairly determined only by those who are familiar with all the facts and motives applicable.

"Up to the highest point of propriety and practicability the employers should always provide for the workmen safe and healthful working and living conditions, and wage rates commensurate with the work done and the results achieved. This cardinal doctrine is right and will, as a rule, be of advantage to employers. From the beginning the management of this corporation, in considering employment questions, has been governed by these fundamental ideas."

E. H. Gary

POWER—

At the Working Face

By Frank H. Kneeland

Associate Editor, Coal Age, New York City

WITH growing mechanization of the coal mines the problem of maintaining normal power at the face becomes increasingly important. When machines such as locomotives, coal cutters and loaders designed to operate on 250 to 275 volts are supplied with current at only 180 volts or less much damage may result. Not only will such machines refuse to work properly but they are liable to expensive burnouts and other damage.

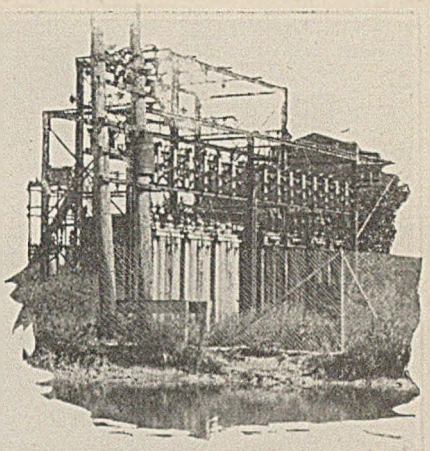
Means employed to keep the power at the face up to normal or nearly so vary widely with the circumstances and conditions encountered. Perhaps the simplest case is that of the strip pit. When steam shovels are employed this resolves itself into keeping them continuously supplied with fuel and water. Both of these processes are comparatively simple. In the case of the water, during severe weather, it sometimes becomes necessary to build fires at intervals along the supply pipe in order to prevent freezing. Another alternative is to periodically blow out such lines with live steam, while still another is to box them in and pack them with fresh horse manure, sawdust or some other insulating material.

ELECTRIFYING the strip pit shovels entirely obviates these difficulties but introduces others. These, however, are of far less magnitude and much more susceptible to a satisfactory solution than are those of fuel and water supply. Several companies operating strippings in the Middle West follow a procedure that has fully demonstrated its utility. Suppose that a certain area, say a section, of land is to be stripped. Current at high voltage is led to some convenient point on the edge of this area. Here an outdoor substation, so designed as to last during the anticipated life of the stripping, is erected. This steps down the line voltage (from 23,000 or 33,000 or whatever it may be) to say 440 volts or the potential at which it is to be utilized in the machine.

From this point several more or less permanent lines, radiating from the transformer station like the ribs of a fan or the outspread fingers of the hand, are built. These terminate at points a few hundred feet apart near the brink of the stripping or open cut. From junction boxes at the ends of these lines the current is transmitted through a triple-conductor cable covered with tough vulcanized rubber to the shovel. This cable is laid along the surface of the ground, and its length is somewhat more than half the distance between adjacent low-voltage line termini.

THE idea here involved is that as the shovel proceeds along the work it can be successively connected to the ends of the various low-tension lines. When it becomes necessary to change terminous connections it is an easy matter to hitch a team of horses or a tractor to the cable and drag it to its new position. The rubber covering of the cable is uninjured by this kind of treatment. This general method of procedure has been followed for years by the United Electric Coal Cos. at its strippings at both Cuba, Ill., and Farmersburg, Ind., and by the Sunlight Coal Co., at Boonville, Ind.

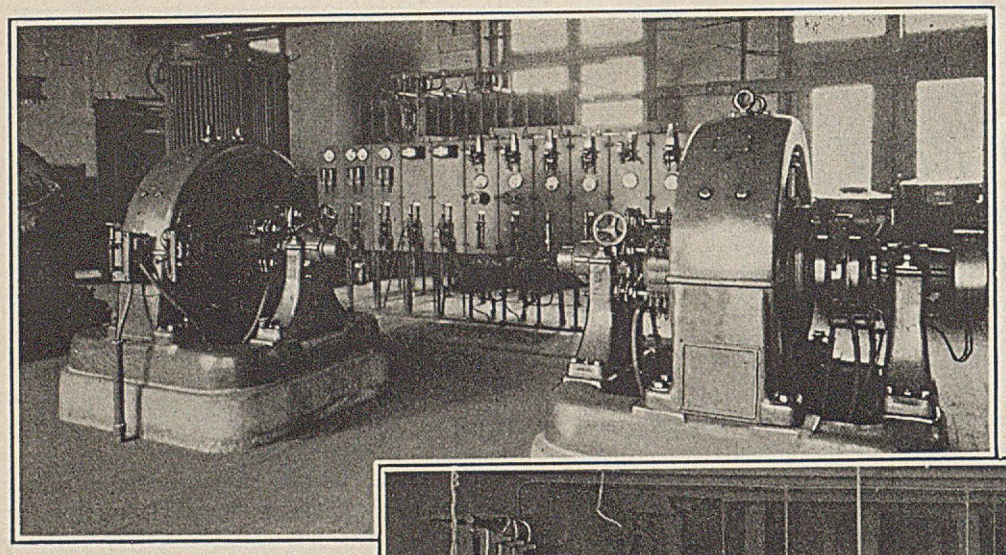
When electricity was introduced underground, because of the characteristics of the motors driven, direct current was adopted, and this form of electrical energy is still employed almost exclusively for driving practically all portable equipment. For years this current was generated on the surface and transmitted to the point of application in the mine. As the workings became more extensive, however, the amount of copper wire necessary in order to maintain voltage at the face at anywhere near a normal level became excessive to the point of being prohibitive. It was necessary, therefore, to find some means whereby the excessive transmission losses incurred with long direct-current lines might be avoided.



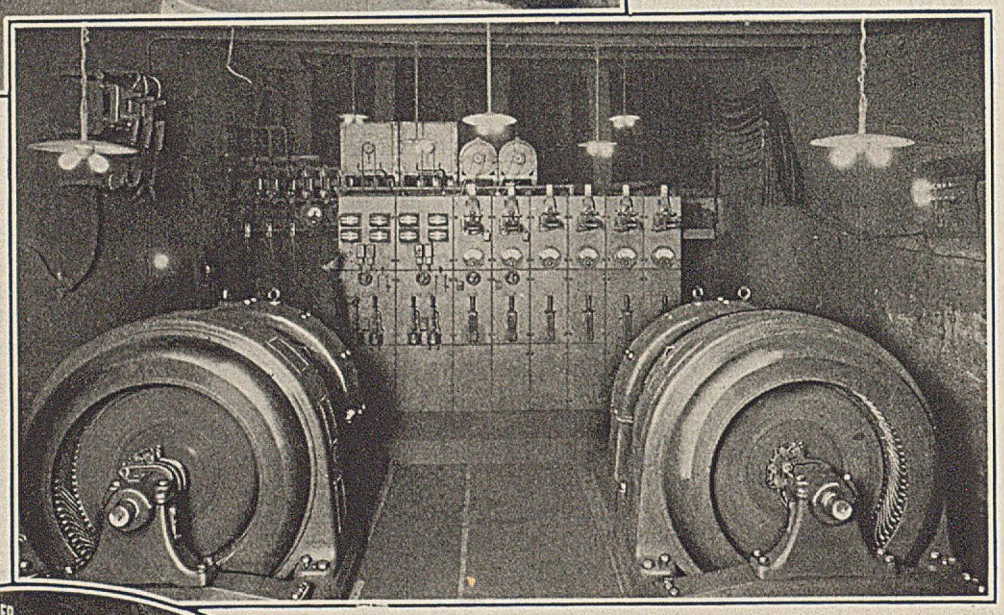
This has been accomplished in three separate and distinct ways, two of which resemble each other to a certain degree. The first of these is the practice of transmitting direct current down boreholes drilled from the surface over strategic points underground. In many instances the substations built at or near the top of such boreholes are made automatic in character thus almost entirely obviating the expense of attendance. This method of treating the problem has the advantage that all transformers and rotating machinery can be housed in a clean dry place on the surface where light conditions are excellent. It has the disadvantage that the direct current transmission lines are somewhat longer than would be necessary if this current were generated underground at the approximate center of load.

THE second and related method is to carry alternating current into the mine and there convert it into direct current at or near the load center or centers. The alternating current is led down cables in the main shaft, drift or slope, thence along a heading—usually one that is dead or not used as either haulage or manway—to the desired point where a suitable place is excavated for the installation of the necessary transformers and motor-generators or other equipment. From such a substation the direct current feeders are installed in a manner exactly similar to that employed in the case of passing them down a borehole from the surface. Of course, the alternating current may be led down boreholes above the desired point or points as readily as down the shaft. This method is preferred by many operators as it avoids alternating current cables in the headings.

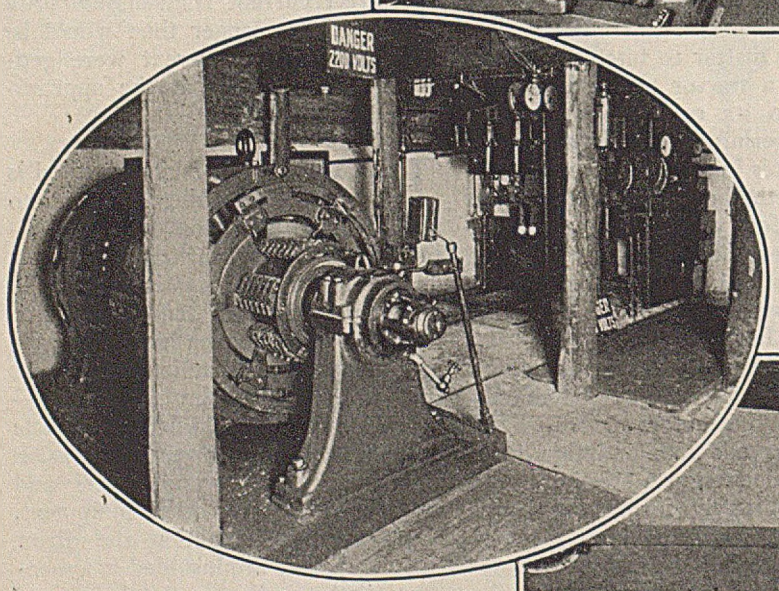
Any substation supplying power to



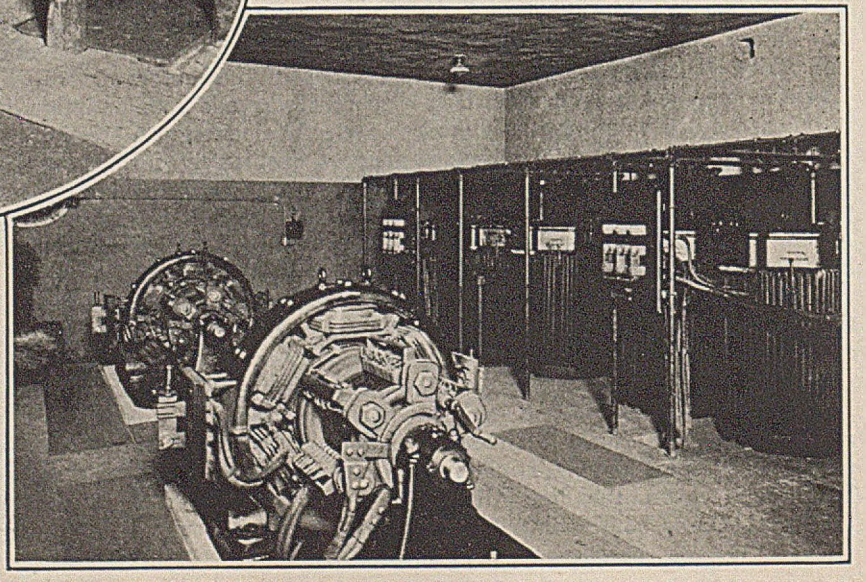
Typical Substation Above Ground



Underground Anthracite Substation

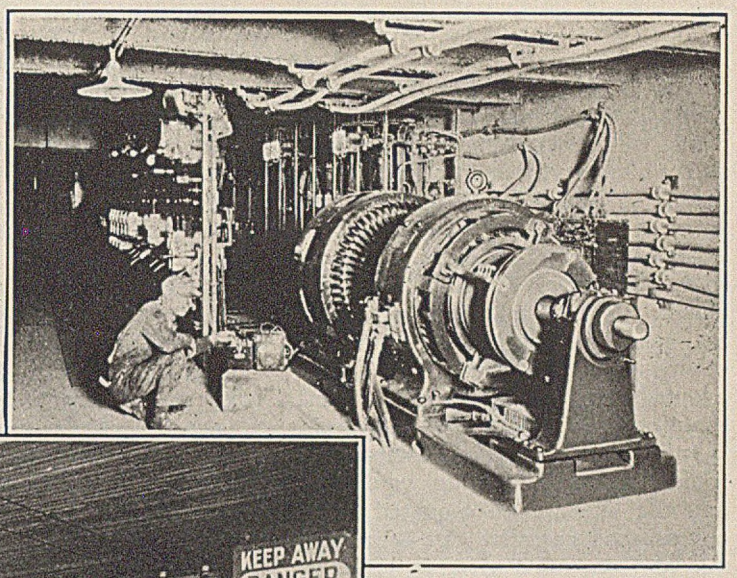


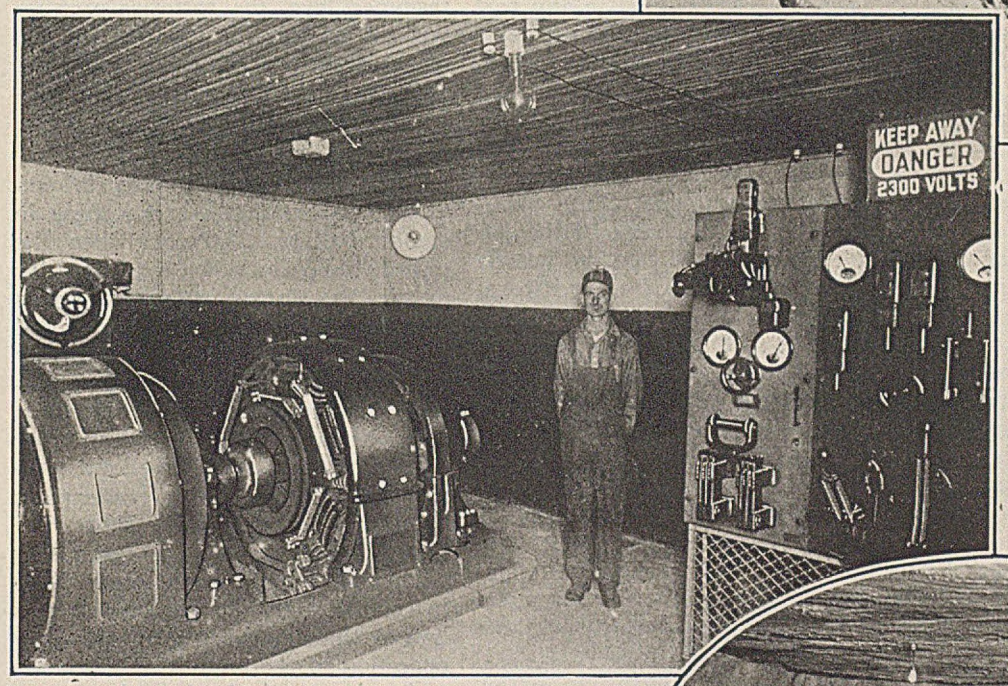
At Left— Western Pennsylvania Substation



Underground in Kentucky

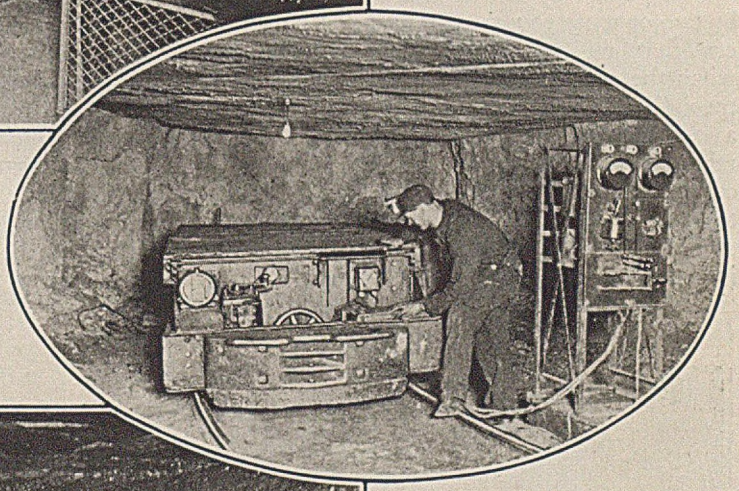
A Station in Illinois

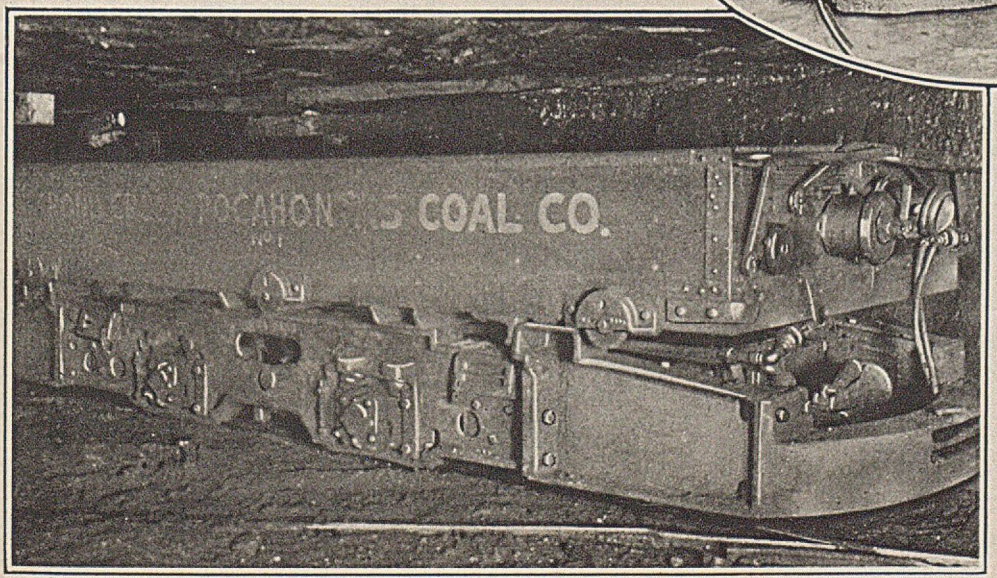




Another Illinois Substation

At Right— Charging a Locomotive





A Power Tank

any mine or portion thereof is of a more or less temporary nature inasmuch as when the mine or section served is worked out the electrical equipment supplying energy to it becomes of no particular value so long as it remains in that locality. When moved to a new location where new work is to be done its utility again becomes as great as ever. In order to make the movement of such machinery as easy as possible at least two firms, one in the East and the other in the Middle West, have adopted the idea of placing at least some of their substations on wheels.

In the case of the Eastern firm transformers, converting equipment and the like are all mounted in an old railroad car that can be readily moved from mine to mine as necessity or emergency may require. The company in the Middle West has mounted similar but smaller equipment on the truck of a mine car that can be moved from section to section underground.

With either of the two general systems described much can be accomplished in the way of better efficiency, especially in extensive workings, by sectionalizing the mine and tying the various feeders together so that current drawn from the trolley at some remote point may flow to that locality by two or more routes. Circuit breakers that will open when the current flow through them exceeds a certain volume and reclose again when the current flow has fallen to a predetermined safe level do much to improve voltage conditions at the working face.

The third method of keeping the voltage up to normal at the face is a problem in transportation rather than in transmission. It consists in storing electrical energy and then taking the storage battery to the point of power application. This method has certain obvious advantages and some equally self-evident disadvantages.

Among its advantages should be mentioned: The total absence of wiring and electrical conductors; all bonding of track is rendered unnecessary; locomotives and power tanks can proceed unhampered to any part of the mine over any kind of track, either steel or wood; power is delivered by the battery practically at the point of consumption and the voltage, therefore, is practically normal at all times, any changes in potential experienced being due to the condition and rate of discharge of the battery; the mine load may be largely equalized; because of its comparatively low voltage accumulator equipment of this kind—locomotives, power tanks and the machinery driven by them—can readily be made "permissible."

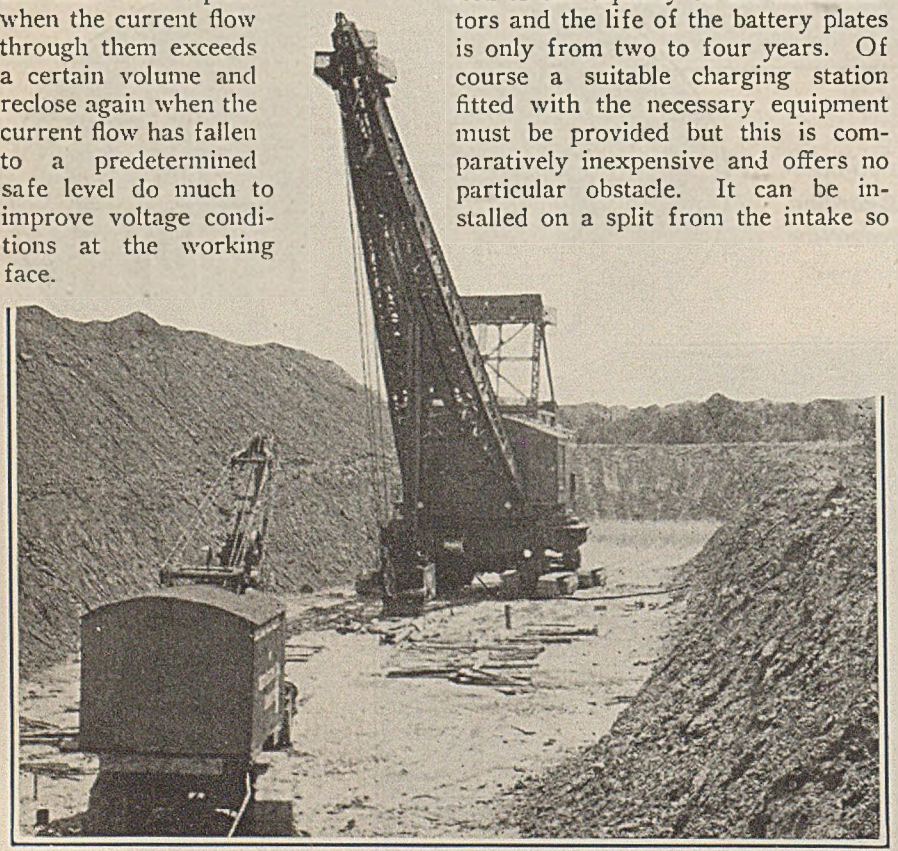
Among its disadvantages should be listed the fact that the efficiency of the storage battery is only about 80 per cent; the amount of energy that can be stored at any one time is limited to the capacity of the accumulators and the life of the battery plates is only from two to four years. Of course a suitable charging station fitted with the necessary equipment must be provided but this is comparatively inexpensive and offers no particular obstacle. It can be installed on a split from the intake so as to be perfectly safe even in a mine that is normally considered gassy.

A particularly interesting application of storage-battery power is found in some mines that use both batteries and wire or in at least one instance where batteries only were employed underground. In several mines where trolley locomotives are used for main haulage and storage batteries for gathering, spare batteries are installed at strategic points to "float on the line." By this means when the power demands are heavy and the voltage drops below a predetermined level the batteries give up current to the line; when, on the other hand, the power demands are light and the voltage rises the batteries automatically go on charge.

A variation of this plan is employed in at least one mine in southern Illinois. Here, when the mine is to be shut down for only a day or two, the storage-battery apparatus is assembled near the shaft bottom and connected with the line in such a way that equipment necessarily kept running during a temporary shutdown (such as fans and pumps), can draw their power from it. This allows shutting down the top works (power plant or substation) during the short time that the mine is idle. The generating equipment is, of course, started up in time to fully charge the batteries before the day shift goes on when operation of the mine is resumed.

Another method of cutting down peak loads and thus improving power conditions underground can be and is followed at some mines where the car supply is ample and the hoisting capacity exceeds the average rate of production. Valier in southern Illinois is a typical instance. In front of the hoistman is placed a meter that shows the entire load of the mine. When this approaches a certain amount that is below the "penalty peak," he shuts off power from his machine and does not resume hoisting until the total power requirements have fallen to another predetermined level. By this means not only is the power demand kept down below the peak mentioned in the contract but power conditions underground are improved.

This problem of keeping the voltage at the face up to normal or nearly so involves economic advantages of such magnitude as to warrant careful consideration. It is certain to demand much more attention in the future than it has received in the past.



Power for the Giants; Cables Lead Over the Bank

ANTHRACITE *Turns*

To Automatic Control

By J. T. Jennings

Power Engineer, Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.

WITH the increased application of electrically-operated machinery in anthracite mining, operating-labor problems and the maintenance and repair of electrically-driven equipment have become of vital importance to every mine manager. This is attributable, in part, to the class of labor that must be depended upon in mining operations. These problems have received serious consideration in recent years by the engineers in charge of this phase of mining.

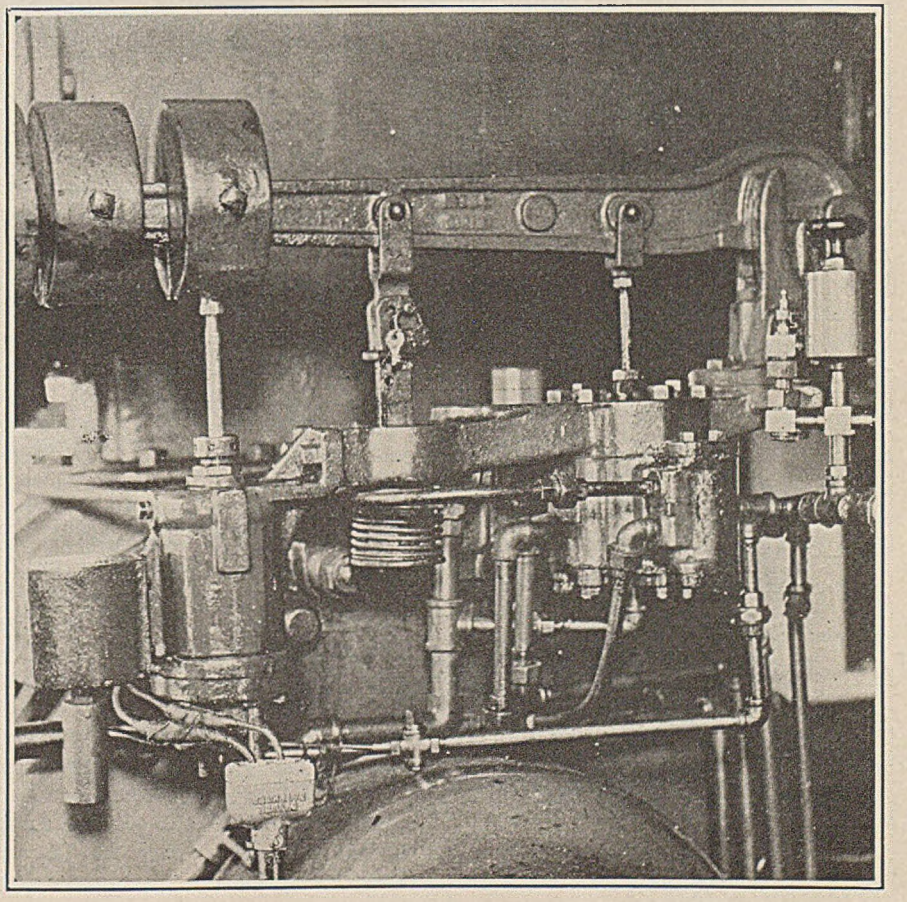
Prior to the introduction of alternating current, practically all electrically-driven plunger pumps in the mines were operated from 250-volt d.c. trolley circuits. The voltage varied widely because of the operation of mine locomotives. This condition placed a severe service on all constant-speed motors and resulted in high maintenance costs. To better meet these conditions, in 1904, automatic apparatus was applied to pump controls. This resulted in the elimination of practically all pump-runners and breakdowns were at once reduced to a minimum. All such d.c. drives are now protected by automatic apparatus at the time they are installed.

As early as 1905, remote or semi-automatic controls were placed in operation on mine fans. Operating from a distance, they eliminated the expense of fan-runners. This work received considerable attention and today has reached the stage where the automatic control is placed in the fan house near the motor. It is a reliable piece of apparatus and a recent survey shows that there are 200 automatically-controlled electric mine fans in service. These result in large savings in operating costs.

In 1922 the author originated, developed and put into successful operation the first full-automatic centrifugal-pump control on mine pumping plants. Because of the great saving in labor and maintenance costs, this has revolutionized pumping in the mining industry. Further improvements of much value have lately been made. These are termed "electrical supervisors" and are located outside the mines in the substations. They show the height of the water in the sumps and indicate which pumps are operating. In fact, the entire pumping conditions and pump performance at the pump house several hundred feet underground are indicated on the surface. A recent survey indicates that there are now approximately 150 automatic pumping plants in successful operation in the anthracite field. These represent annual savings in labor costs of about $500,000.

After the completion of his work on pumping-plant controls, the author turned his attention to outside machinery where his company has numerous stations in which are operating motor-generators and motor-compressors. Practically all motor-generator or converter sets are automatic in their operation. As the motor-driven compressors were not automatic, it was necessary to keep attendants at each substation.

Confronted with this problem, it was decided to experiment with a compressor unit in one of the typical substations to determine if it could be operated automatically. After experimenting for several months, it was determined that motor-driven



Magnet Operated Pilot Valve on Regulator

compressors could be made automatic if the manufacturers of such equipment would co-operate.

In 1923 the matter was discussed with three of the large manufacturers of compressors and in 1926 an agreement was reached as to the details which would insure successful operation through automatic control.

To construct such a control, the following difficulties were overcome: (1) A special regulator, which would automatically unload the compressor during starting or in event of power failure and which would start the compressor when power was restored, had to be developed; (2) protection against damage to the compressor through failure of the cooling-water supply had to be provided; as had (3) protection against overheated bearings; (4) protection against loss of direct-current excitation; (5) protection against motor troubles; and (6) protection of auxiliaries.

The first fully automatic substation where a motor-generator set and motor-driven compressor was put into operation without an attendant, and protected against the emergencies just mentioned, was at the Middle Creek colliery in the Tremont district. A second installation has been made at the Locust Gap colliery in the Mount Carmel district.

These installations consist of a 300-hp. motor-driven compressor having five-point step control and an air displacement of 1,721 cu.ft.; a 5-kw. motor-generator exciter set; and a 3-hp., 80-gal., circulating pump with its switchboard. A 220-volt control circuit is used for all a.c. apparatus.

The control features of the circulating pump and motor-generator exciter are alike, and these auxiliaries start up simultaneously. As shown in the wiring diagram, the circuits *A* and *B* are of the two-wire push-button type, energizing the coil of a magnetically-operated switch and thence through the contacts of a thermal-overload relay. When the motor-generator exciter starts and builds up its d.c. voltage, it operates a d.c. control relay on the main compressor panel. Unless this d.c. relay functions, the compressor will not start.

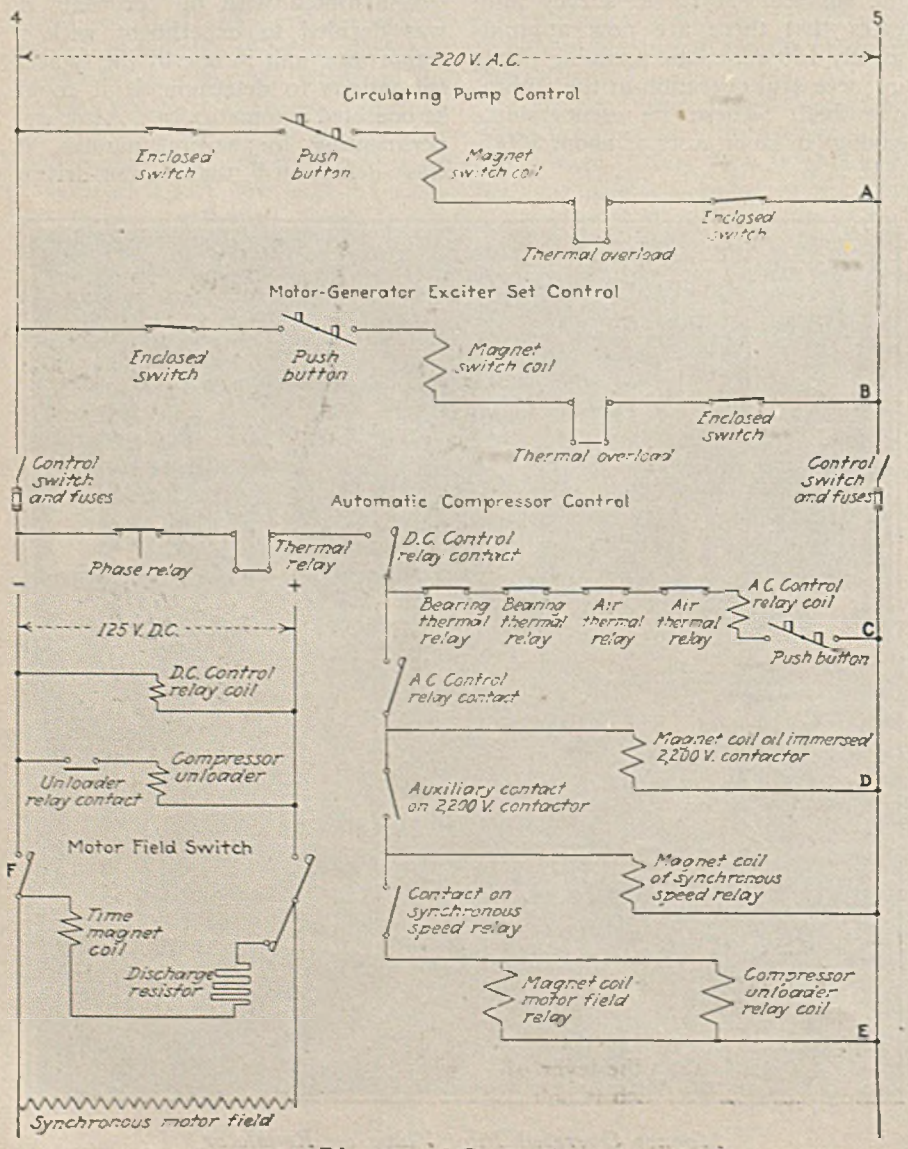


Diagram of Connections

Circuit *C* is the control circuit for the compressor panel. From the switch, the circuit is through a phase relay and thermal overload for motor-winding protection; a d.c. control relay which protects the motor from loss of excitation; bearing thermal relays to protect the machine from overheated bearings; thermostatic relays to protect the compressor from stoppage of circulating water; a.c. control relay actuating the main starting oil-contactor; and start- and stop-push button.

By energizing circuit *C*, the coil on on the 2,200-volt oil-immersed contactor (circuit *D*) is energized and applies line voltage to the synchronous motor. This starts the compressor, and as the compressor is unloaded, only starting load is imposed on the motor. As the motor approaches synchronous speed, the synchronous-speed timing relay closes and thus energizes the motor-field switch (Circuit *F*). This synchronizes the motor and, at the same time, energizes the coil of the unloader relay. Thus the compressor is placed under the operation of its own five-step clearance mechanical-regulator.

The compressor is put into operation by first closing the main oil switch at the switchboard, which energizes the bus- and control-transformers. The magnet switches on the auxiliary panel then close, starting the motor-generator set exciter and circulating pump. When the exciter builds up to a predetermined value, the d.c. control relay closes, thus establishing a circuit through the contacts of the overload relay, phase relay, bearing thermostat, air thermal relays and a.c. control relay. The closing of the latter causes the oil-immersed motor line-contactor to close and start the compressor motor. As the compressor is in an unloaded position, the motor will come up to full speed in about eight seconds. When it approaches full speed, the synchronizing relay closes, applying full d.c. voltage to the motor field and synchronizing the motor. At the same time, the unloader relay is energized, thus placing the compressor under the action of its own regulator.

It will thus be seen that the compressor can automatically stop and start without manual attendance.

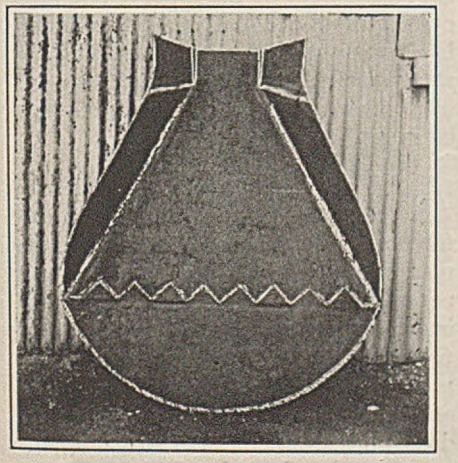
DUCKBILLS—

Demonstrate Their Practicability

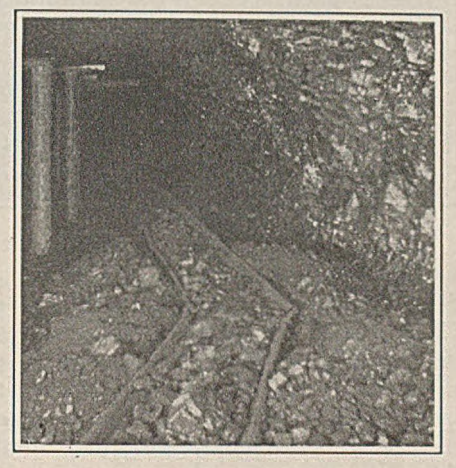
By J. H. Edwards
Associate Editor, Coal Age, Huntington, W. Va.

"EVEN under difficult conditions we have cut production cost by using duckbills in place of hand loading. Over a period of three years we expect to extend the use of these loaders to all of our mines. We have no conditions where duckbills cannot replace hand loading."

These statements made by an operating official of the Union Pacific Coal Co., in his office at Rock Springs, Wyo., rather surprised me. One of my chief reasons for visiting this town was to gain first hand, the latest information regarding this company's successes or failures with duckbills. Several details regarding the operation of these devices had never been clearly explained to me, and I was, therefore, not enthusisatic as to their possibilities. But seeing them in operation under varying conditions cleared up the doubtful points and convinced me that these loaders have a definite place in the present status of coal mine mechanization.



Duckbill of Welded Construction



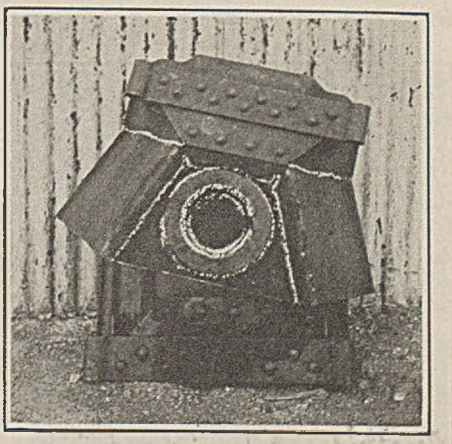
Jigging Conveyor Operating With Swivel Pan

THE duckbill has been described in some instances as "a scoop attached to the end of a jigging conveyor which automatically extends forward moving the scoop into the coal." This use of the word "automatic" is not exactly well chosen and has been the cause of some skepticism regarding the possibilities of the loader. It conveys the idea that the scoop advances into the coal gradually and at uniform speed. The many variables encountered in a pile of coal that has been shot from a face would hardly permit such an ideal arrangement.

Instead, the scoop is advanced only as conditions warrant. Its operation is automatic only in that power for its advancement is furnished by the oscillation of the conveyer itself. When a face man raises the lever of the short control pan, which is bolted to the end of the last standard pan, a brake or clamp is released and a ratchet device causes the rack pan and attached duckbill to move only with the forward stroke of the conveyer. One stroke advances the duckbill one stroke length, which may be as much as 8 or 9 in.

BECAUSE of this rapid advance, the lever is held up for only a second, or a fraction of a second at a time. When the lever is pushed down a brake clamps the ratchet pan and thus relieves the ratchet wheel pins and the pan racks of stress.

The standard duckbills of the Union Pacific company are 4 ft. 3 in. wide. They are made in the Rock Springs shop by welding together electrically four pieces of steel plate. The line of weld between the rounded-end nose plate and the bottom plate is saw-tooth shaped, and four of the teeth are lap, rather than butt, joints. This provides added stiffness



Swivel Pan—Electric Welds Indicated by Chalk Lines

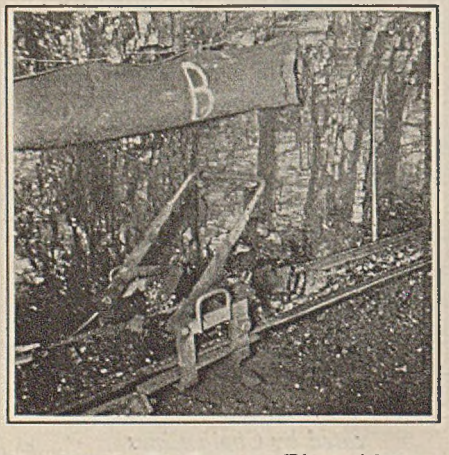
along the line of weld. The duckbill is bolted to a pan which has a rack piece fastened to each of its upper edges.

ACCORDING to latest plans the duckbill loaders will be confined, as at present, to entry and short-face working. It may be difficult for some to understand how a scoop of no greater width than the standard mentioned, can be used to advantage in loading faces up to 24 ft. wide. The secret lies in the fact that a jigging conveyer does not have to be kept in a straight line. One or two pan lengths back of the control mechanism there is inserted a swivel pan which allows the duckbill end of the conveyer to be swung as much as 27 deg. from straight alignment.

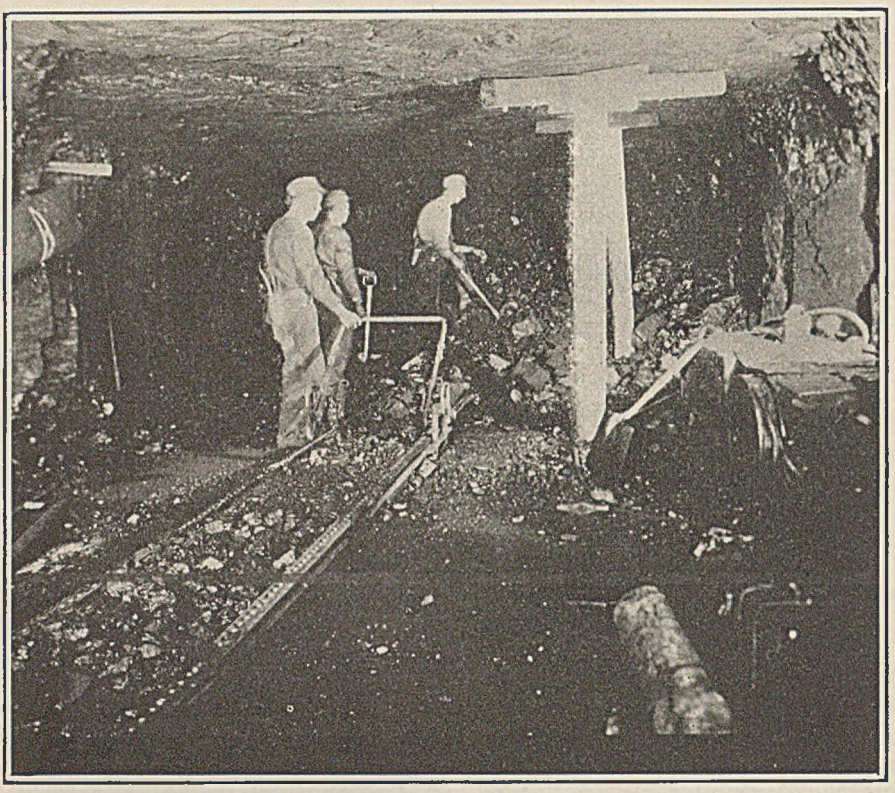
This means that the duckbill can be advanced to the face along several paths, and that as a result, only the coal at the corners must be missed. In driving a 16-ft. place three advances are made some coal being shoveled by hand during each advance, but the hand loaded coal need not exceed more than 10 per cent of the whole.

In clean coal where little timber is required, as in the No. 8 mine at Rock Springs, a duckbill crew consists of three or four men. One is stationed at the car-loading end, and the others at the face. It appeared to me that under good conditions two men should be sufficient at this latter point.

THE duckbill work in the Superior mine is the Union Pacific company's testimony that this loader can be used under adverse conditions. There is a 0 to 6-in. rock band in the coal bed, and the top is so weak that in 20-ft. rooms crossbars with four or five posts each have to be set on



Driving 16-Ft. Entry. First Advance Completed



Starting Second Advance in 16-Ft. Entry

5-ft. centers and lagging used in places. In order to swing the duckbill to new positions it is necessary to move the posts. This is accomplished by means of screw jacks.

Weekly production records of duck-bill narrow work in Superior mine, selected at random, show averages of 12.8, 12.9, 12.3, and 10.9 tons per man per shift including timbering, cutting, drilling, shooting and other work.

THE coal is from 6 to 7 ft. thick. In mines having better conditions correspondingly better figures are obtained. The men are on day rate at union scale.

The company uses but one width of conveyer pan in connection with the duckbill loaders—the Eickhoff No. 3, which is the 23½-in. size. The drives are electric and of two types. One is the "MT 15" equipped with a 15-hp. 250-volt direct-current motor and the other the "MRA" having a 25-hp. direct-current motor. For level entries the ordinary limits of conveyer length for these two drives are 250 ft. and 350 ft., respectively. I saw in operation one duckbill which was 435 ft. from its "MRA" drive. In this instance the average grade was possibly slightly in favor of the load, but there was a 3 to 4-ft. swag near the center of the conveyer length.

Starting several months ago all duckbill loaders were put on double shift. A mining machine is kept at each face and shooting is done during the shift. In some places boys are employed in the mine to pick refuse directly from the duckbill conveyor thus lightening the work of the car trimmers and lessening the transportation of waste.

AT PRESENT 16 duckbills are in use; eight of these are installed at Superior, three at Hanna, and five at Rock Springs. Thirteen more are going into the mines on the 1927 budget. Besides Frank L. McCarty, superintendent of the No. 8 mine and originator of the Union Pacific duckbill, most of this company's officials show marked enthusiasm for this type of loader especially when used for entry and room work.

AN IDEA of the progress that has been made by this company in the mechanical loading of coal at the face may be gained from the fact that the percentage of coal loaded by mechanical means in its mines has increased from 1.66 in 1920, to practically 40 per cent during the first six months of 1927. Naturally all of this increase does not result solely from duckbill operation but includes coal loaded by other mechanical means. It is probable that the latter half of this year will see still further increases in this ratio.

FIRST-AID TRAINING—

You Bet It Pays!

By Henry T. Bannister

Safety Engineer
Madison Coal Corporation

IN JULY, 1925, the author, in company with A. D. Lewis, director of the department of mines and minerals, Illinois, and Mr. A. U. Miller, assistant mining engineer, Vincennes station of the U. S. Bureau of Mines, held a conference as to whether it would be possible to train all of the employees of a mine in first aid in the organized field of Illinois. It was decided at this conference to make the attempt at mines 9 and 12 of the Madison Coal Corporation, located in Williamson County, Ill., and employing a total of 1,350 men.

Our first step was to "sell" the idea to the management of the mines that had been selected for the training. After this was done the idea had to be "sold" to the officials of the miners' union, as well as the miners themselves. We then began spreading propaganda and feeling out the men as to whether they would be willing to co-operate in the training. After more than a year had been spent in quietly working up favorable sentiment among the men, a meeting was held in September, 1926, at the Dewmaine office of the company. This was attended by the officials of Local Unions Nos. 1144 and 5050, U. M. W. of A., as well as the management of the two mines. After a lengthy discussion, in which everybody agreed that it was well worth while to put on the campaign, A. U. Miller, of the U. S. Bureau of Mines, and Thomas Rogers, superintendent of the state rescue station at Herrin, Ill., and the writer agreed to visit the local unions at their next regular meeting and lay the proposition before the men. These meetings were well advertised and well attended. Mr. Miller gave a talk as to the benefit the men would derive from the training. Mr. Rogers made a short talk on the same subject. The writer then informed the men that he would arrange to hold the training at the town in which they lived, instead of asking all the men to come to a central station. After making a very close check of the employees at the two different mines we found they were well scattered over three counties, Franklin, Williamson and Jackson, and that the classes would have to be held in eight different towns, with seven different nationalities to train as follows: American whites and Negroes, North and South Italians, Poles, Russians and Lithuanians. Some of the men had to be trained through an interpreter.

Our next problem was to get instructors from among our own employees. This necessitated another check to determine how many of our employees had been trained in first-aid work. After this was done we selected the men whom we thought would make the best instructors, and

First Aid for a Broken Back

Colored First Aid Instructors: Physician on Left

invited them to a meeting, asking them if they would be willing to cooperate in the work without being compensated for their time. They unanimously expressed their willingness to do this. The requisite number of competent instructors having been obtained, they were instructed at length as to how to present each lesson, the complete course having been outlined as follows:

Lesson No. 1: Show the course of the arteries on the subject and the pressure points. Application of tourniquet. Treatment and dressing of wounds.

Lesson No. 2: Shock: When does shock occur? Treatment. Explain the use of stimulants. Artificial respiration. Schaefer method. Practice in bandaging if time permits.

Lesson No. 3: Treatment for dislocation, including bandaging by the class. Transportation.

Lesson No. 4: Treatment for fracture, simple and compound. As much practice in bandaging by class as time permits. Transportation.

Lesson No. 5: Burns, treatment. Practice in bandaging. Review the above lessons if time permits.

A sufficient number of lessons were printed to furnish each instructor with a copy, and each instructor was also given a copy of the manual of first-aid instruction for miners, as furnished by the Bureau of Mines. At this meeting we tried to impress upon all instructors that the success of our campaign depended in no small part upon their efforts. The course was gone over several times and the instructors were thoroughly drilled as to its proper presentation to the men.

The next problem that confronted us was to find suitable places for holding the classes. This matter was taken up with the heads of the surrounding municipalities and school boards. Arrangements were made so that we could train in churches, schools, lodge halls, gymnasiums and City Halls. After these arrangements had been completed the instructors were called together and assigned to their respective posts. At this meeting score cards were prepared, spaced so as to allow twenty-five names on each card, and a place for each lesson. It was also decided at this meeting that it would be necessary to have a man to look after the cards and check them each night. This man's duty was to call the roll each night and note all absentees, after which he made a list of those absent and turned it over to the mine manager the next morning, with a copy to the face boss under whom the absent party worked, also telling the face boss where the man would be able to make up the lesson he had lost the previous night. It was then the duty of the face boss to see the absentee personally, and find out why he had missed the class.

The training work was under the direction of the U. S. Bureau of Mines, the state department of mines and minerals, and the safety department of the Madison Coal Corporation. The Bureau of Mines furnished two instructors; the state department of mines, eight; the Madison Coal Corporation, thirty-five; making a total of 45 instructors.

Each night the author, in company with a representative of the Bureau of Mines, and state department of mines and minerals, tried to visit each class, giving them a five- or ten-minute lecture on the work and the benefits they would derive from it. It was surprising to note the interest the men showed in the work, and how readily they would take instructions from men with whom they worked every day, and the freedom with which they would ask questions of the instructors. While they seemed timid in this respect the first night, when the Federal and state representatives were present, this soon wore off and they asked questions freely.

In fact, the interest displayed as soon as the work was well under way was remarkable, and it is surprising to know that some of the men who took this training spent as much as sixteen hours a day away from home.

The campaign started Oct. 4 and ended Oct. 23, 1926. During this three-week period there were trained 570 men, the entire force, at No. 9 mine and 676 men, 86 per cent of the force, at No. 12 mine, making a total number of employees trained of 1,246. The remaining men at No. 12 mine were all trained in special classes during the next few weeks, so that both mines stand 100 per cent trained.

By the experience gained in this campaign we were later enabled to train 522 employees at No. 2 mine, Glen Carbon, Ill., in much less time. At this place the training was not only given to every employee, but also to 79 housewives and girls, some of them belonging to miners' families

and others to different walks of life.

Our company believes that the effort required to bring about 100 per cent first-aid training is well worth while. As to whether it will actually reduce accidents, sufficient time has not elapsed to give reliable data. The training, however, undoubtedly tends to impress the men with the hazards of their occupation, and this in itself is notoriously difficult of accomplishment. It also teaches them how an accident can be prevented, and the author knows of no better way to impress it on the mind of a worker, nor of a more opportune time, than when he is demonstrating how to take care of a certain accident. A three-minute talk to a miner at that time will do more good than a long lecture when he is working below in the mine.

A very practical demonstration of the value of the training is given the men below on the occasions when a man is seriously injured. The efficient and workmanlike manner in which the first-aid men prepare him for removal, thereby insuring handling with minimum suffering and shock, and greatly enhancing his chances of recovery, forms an impressive exhibit in itself. Three cases in mind well illustrate this point.

The first was a machine runner who suffered a severe electrical shock and the men who were working with him, not being trained in first aid, thought the man was actually killed and so reported. There happened, however, to be two first-aid men in the immediate vicinity of the accident. They immediately began to apply artificial respiration, and worked with the man until he was revived sufficiently to walk out of the mine. This man lost only three days work and owes his life to the quick and efficient methods and prompt action of his first-aid trained associates.

The second case was a timberman who was lifting a heavy bar and in some way came in contact with a trolley wire carrying 250 volts. This man was also severely shocked and rendered unconscious, but the man with whom he worked happened to be trained in first aid. He immediately proceeded to give artificial respiration and continued at it until help arrived. Undoubtedly the timberman would have died had he not had the assistance of the man whose training enabled him to do the right thing without hesitation.

The third case was a trip-rider who was thrown under a trip of empty cars, having his hand and arm badly crushed. A first-aid man wiith ample supplies was close at hand. The injured man's wounds were bound up and he was made as comfortable as possible before he was removed from the place of accident. When he was brought out of the mine, the doctor was so well pleased with the bandaging that he ordered him taken to the hospital before giving any further treatment other than a hypodermic as a stimulant, because he was suffering intensely from shock. This boy is alive today, with no more than a twenty-five to fifty per cent loss of use of the arm.

In sad contrast, another boy was injured at almost the same hour at another mine in the same district, and by a strange coincidence the injury was to the same arm. Both boys were brought to the same hospital. Surgeons who saw both cases stated that our employee, if anything was the more severely injured. The other boy, however, did not have the advantage of a well-trained first-aid man at hand, was brought into the hospital suffering from severe shock and much loss of blood, from which he died within a few hours.

Such experiences as just related make us feel that it is well worth while, both from a humanitarian and financial standpoint, to train every man or boy who works in or around the mines in first-aid work. It also tends to create a better feeling between the employees and the management. They get a better understanding of each other, and the men come to realize that the company has their interest sincerely at heart, and is trying to make the hazardous occupation at which they work as safe for them as possible. Many of the employees say that they feel safer while working among men who are trained in first-aid work, and others have not hesitated to say that they feel themselves to be better miners for having received the training. Many assert that their jobs seem less dangerous.

One of the Proficient First Aid Teams

Underground Reservoir

Tapped Under Pressure

By Howard Howie
General Superintendent, Roane Iron Co.
Rockwood, Tenn.

THE Rockwood coal mine of the Roane Iron Co., at Rockwood in eastern Tennessee, has been operating continuously in the Sewanee bed since 1868. It produces a coal that is unusually low in sulphur and all of the output is used in the manufacture of blast furnace coke. The mine mouth lies at an approximate elevation of 1,085 ft. above sea level and is about half a mile from the coke ovens and blast furnaces.

The main working area of this mine is reached by a slope. This is about 5,000 ft. long with a difference in elevation between its ends of approximately 580 ft. It is driven in the coal and as this is highly irregular in contour its inclination varies from a maximum of 20 deg. to almost zero. Working entries are turned from either side of this passage and driven in the coal at such an inclination as to afford drainage to the slope and favor the loads. Inasmuch as the inclination of the bed varies between wide limits these entries are decidedly crooked and contain few stretches of straight track.

Recently, in order to decrease haulage costs and improve ventilation, a new slope was driven from a point on the No. 1 Right entry about 1½ miles from the main slope. This is called the Summers slope, being named after Orton Summers, the miner who drove most of it. It is about 2,800 ft. long and its extremities have a difference in elevation of 610 ft., its bottom being only 385 ft. above sea level. All machinery installed in this passage and its tributary workings is electrically driven whereas that used in the main slope and its territory is actuated by compressed air. Nearly all water made by the old workings was handled by one duplex pump.

Considerable water was encountered in driving the Summers slope and electric pumps were installed at three different points to handle it. These were arranged "in series," that is, each of the lower pumps discharged to the sump of the machine next higher up the slope, only the upper pump throwing water to the surface. This arrangement was, of course, only temporary and after an appreciable territory had been opened up and the water therefrom had increased in volume a permanent pumping station was installed. As originally planned this station was to contain a pump of sufficient capacity to meet not only the needs of Summers slope for a reasonable period but to handle the water then being pumped from the main slope by compressed air.

Although the old pumps were approximately 100 ft. higher than the new installation it was deemed economical to shift their load to the new machine. The old pumps were practically worn out and their pipe lines would soon have to be renewed. Under existing conditions an electric pump would be more efficient than those driven by compressed air and a cable was already installed in the new slope to provide power for coal cutting, haulage and the like. The future mining program contemplated the abandonment of the main slope for haulage purposes and its maintenance for pumping alone would have been expensive. A synchronous pump drive, also, would improve the power factor and when pumping from the old slope the new machine would operate under a pressure suction.

A dam protecting the new pump was accordingly built and an entry started through the old workings to tap an area containing about 90,000,000 gal. of water. This dam was located approximately 50 ft. below the surface of the water so that it was necessary to tap this reservoir under pressure. It was believed that this could be done safely so long as those supervising and doing this work acted with caution and used good judgment. Although the pressure against the face of the dam would be only about 20 lb. per square inch it was designed for a safe working pressure exceeding 100 lb. per square inch.

The entry was driven and the dam built 25 ft. in advance of the last break through which was the end of the air course, as otherwise it would have been necessary to build a second dam across the air course. Details of the dam's construction are shown in the accompanying illustrations. A 6-in. suction pipe was laid from the dam to the pump and a 12-in. pipe was inserted to provide for ventilation. A 6-in. pipe was also placed in the top of the dam to furnish an outlet for air and a passage for the wires used in firing shots.

At the point where the dam was located the coal was 3 ft. 4 in. thick with a slate top and bottom. As shown in the drawing, top, bottom and sides were carefully recessed by pick mining with the aid of occasional pop shots. The dam itself was constructed of concrete to within a foot of the top of the entry but as it was obviously impracticable to complete its construction in this manner a cement gun was used. As a further precaution to prevent the infiltration of water the entire surface of the entry on both sides of the dam was gunited for a distance of 20 ft.

A cast iron door and frame weighing over two tons was built into the dam to provide a means for driving the entry to the water. The door had to be made in two, and the frame in four pieces in order to get these parts into the mine. The joints in both door and frame were machined

and faced with red lead: that between the door and frame was made with a $\frac{1}{8}$-in. rubber-packing gasket.

After the dam had been completed and the concrete had set for two weeks water was pumped in behind it to a test pressure of 75 lb. per square inch. This developed a few seeps through the concrete. The red-leaded joints in the door and frame did not leak but the rubber gasket that had been made in four pieces let water through at its joints. The water behind the dam was released, the leaks in the concrete were stopped up and a one-piece gasket procured. The dam was then retested without developing leaks of any kind.

The dam having been made satisfactory, a ventilating system to serve the heading behind it was installed. For this purpose a direct-connected Sirocco blowing booster was used. This had a rated capacity of 1,000 cu. ft. of air per minute against a 4-in. water gage. Great care was exercised to make the brattice in the break through tight so as to prevent any possible recirculation of the return air. A sliding regulator was built as air in excess of the fan's capacity was provided in the air course. The methane that was constantly being given off from the face of the entry was thus properly diffused and rendered harmless.

With the exception of the 12-in. pipe through the dam a wooden box was employed to conduct the air to the face. This duct was made of 1 x 12-in. clear creosoted pine boards and built in sections 12 ft. long. Corner joints were made tight with two thicknesses of brattice cloth that had been saturated with graphite paint. The boards were held together with $2\frac{1}{2}$-in. wood screws. Sections were joined by means of cast iron collars so shaped as to leave a wedge-shaped space into which brattice cloth was calked. One of the accompanying illustrations clearly shows the construction and a piece of cloth protruding from one of the joints. This type of duct has proved to be durable, airtight and inexpensive.

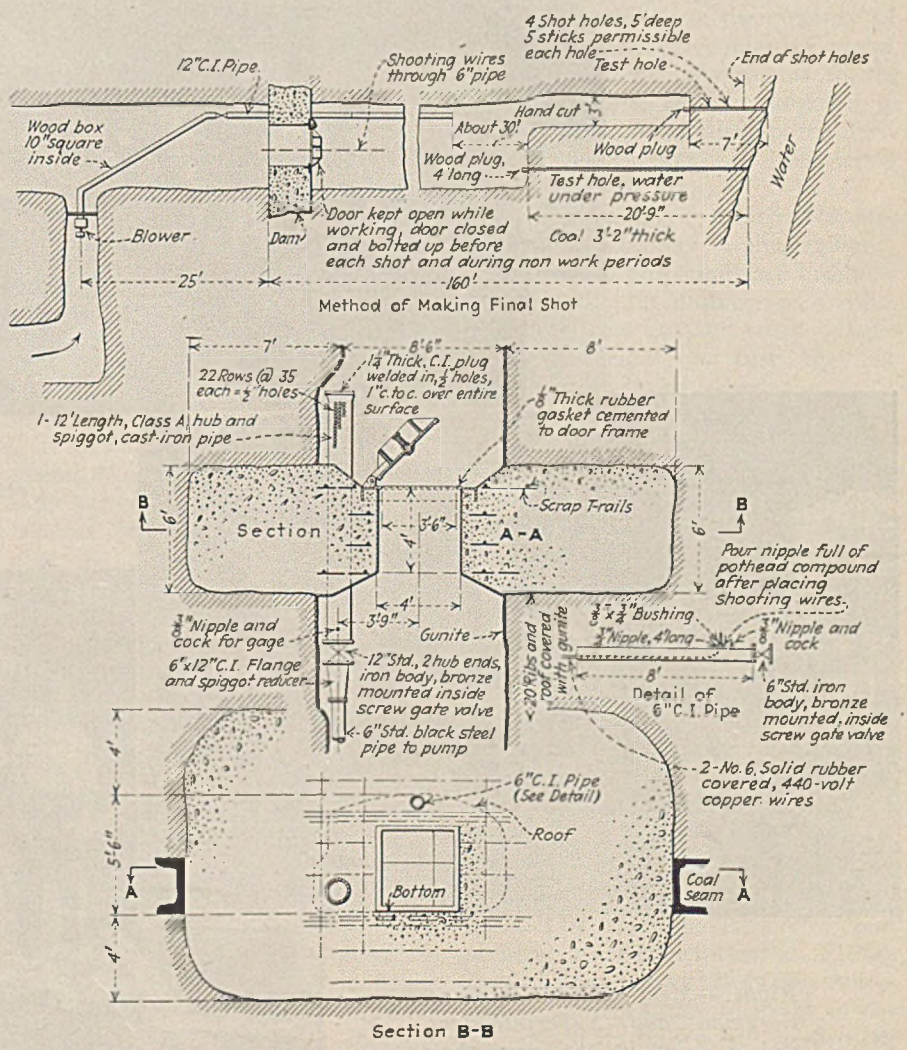
Had the water been tapped accidentally while the door in the dam was open it would have flooded many of the working faces and might have drowned some of the men. As a precautionary measure, therefore, the entry inby the dam was driven only at night. The cycle of operations was as follows: (1) Open the valves in the dam. (2) Start the ventilating fan. (3) Open the door in the dam. (4) Load out the coal and slate shot down during the previous night. This was brought out in wheel barrows and loaded into cars outby the dam. (5) Drill test holes for water 20 ft. ahead of the face; drill and load shot holes and wire them up for firing. (6) Shut door in dam and bolt it in place. (7) Open both valves in the pipes leading through the dam so as to release the explosive force of shooting. The shots were then fired with a battery and the valves reclosed.

Water was first encountered in a 20-ft. hole at the right of the heading. This hole was immediately closed with a long tapered wooden plug that had been previously turned up in a lathe and made ready for this contingency. It was decided to narrow the heading to 3 ft. advancing it by pick mining and only light shots carrying test holes 6 ft. in advance of the face until water was again tapped. This narrowing down of the face was done to prevent the possible shearing out of a block of coal by the pressure of the water.

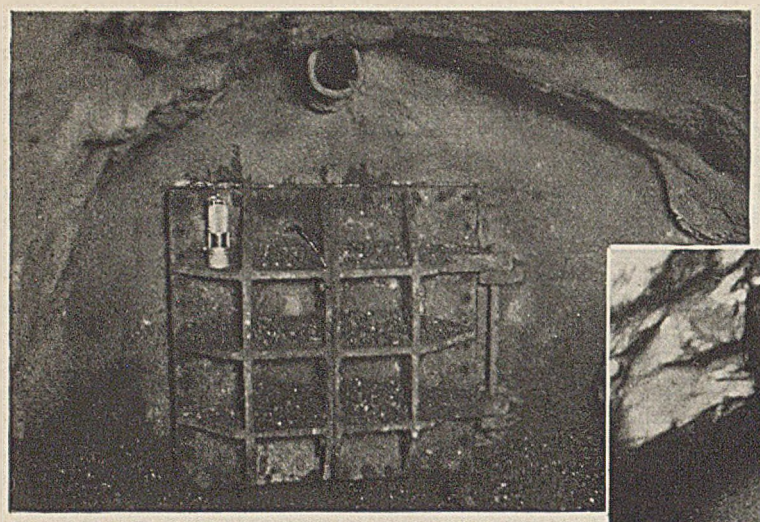
Water was again encountered in a 7-ft. test hole. Its flow was stopped with some difficulty by means of a wooden plug. While drilling the last 4 ft. of this hole the coal was so soft that the auger had to be "held back." It was then decided to drill two holes, one above and the other, below the test hole, and load them heavy enough so that they would shoot through to the water.

Each of these shot holes was accordingly loaded with five $\frac{1}{2}$-lb. sticks of Grasselli 6 L F permissible powder. Their detonation resulted in blowing out the coal and successfully tapping the water.

The pumping unit consists of a 7 x 10-in., vertical, triplex, single-acting, Worthington Deane, bronze-plunger pump, fitted with bronze-lined glands, and driven by a synchronous motor through a magnetic clutch. This machine operates at 60 r.p.m. with a piston displacement of 300 gal. per minute at a specified efficiency of 83 per cent. It actually delivers 287 gal. per minute at a discharge pressure at the pump of 285 lb. per square inch, this duty being established by weir measurement.



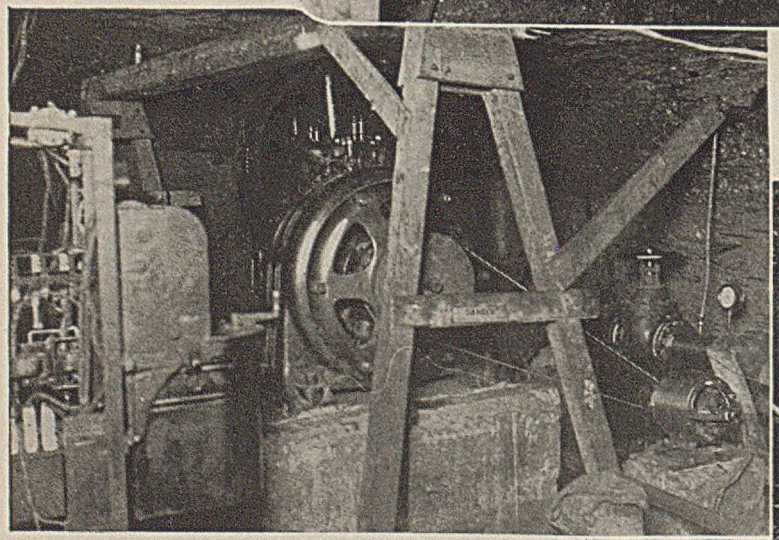
Plan of Heading and Design of Dam



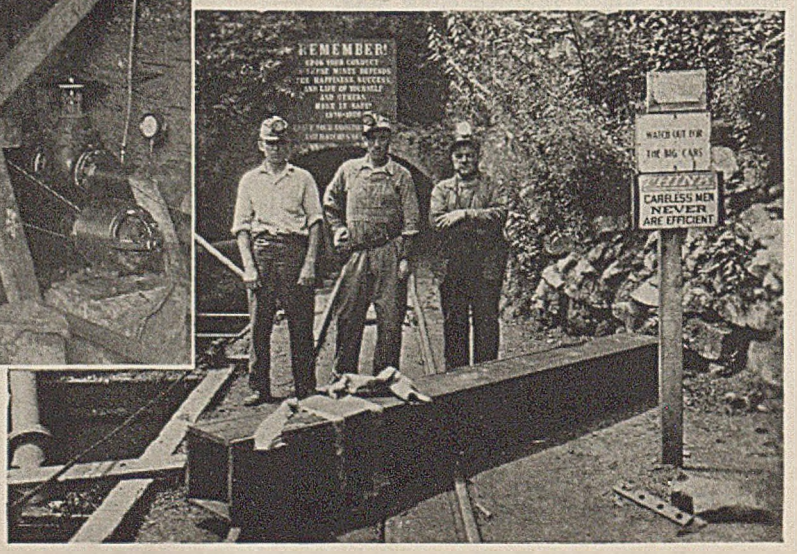
Left:—Door in Dam In Closed Position

Right:—Open Door in Dam from Outlby Side

Left:—The Men Who Did the Work



Left:—Completed Pumping Station



Right:—Mine Mouth Engineer, Foreman and Superintendent and a joint in the wind box

In order to get it into the mine the helical gear on the crank shaft had to be made in two pieces. It nevertheless operates smoothly and satisfactorily. Although requiring only 62 hp. at the capacity above stated, the pump is driven through a 16-in. Cutler-Hammer magnetic clutch by a 125-hp. 600-r.p.m., 3-phase, 60-cycle, 2,200-volt Fairbanks-Morse, synchronous, ball-bearing motor fitted with moisture-proof windings. This machine, when driving the pump, raises the power factor 3 per cent at the power plant. It is intended to operate it without connection to the pump during periods of maximum load in order partially to correct the power factor. This, however, has not as yet become necessary. The exciter is belt driven and of sufficient capacity to serve not only the motor but to provide current for the clutch as well. This latter piece of equipment consumes only 0.2 kw.

The suctions leading to this pump are so arranged that water can be drawn at will either from the sump or from behind the dam. The pump has operated daily since last January with entire satisfaction. The clutch has slipped occasionally but this has not proved objectionable as it prevents the attendant from screwing up the plunger packing glands too tight, thereby raising the load on the motor and clutch above normal operating requirements and running the risk of injuring the plunger surfaces through scoring.

In starting the machine for a run the motor is started without load, the valves on the pump are then so manipulated as to connect the suction and discharge lines through a 3-in. bypass. The clutch is next magnetized and the water gradually forced through the check valve on the discharge line as the bypass valve is closed by the attendant.

The design of this installation was made and its erection supervised by J. B. Ford, chief engineer of the company, and all erection was carried out by the company's own organization. Construction of the dam and the tapping of the water were ably accomplished by Riley Long and his gang under the general direction of N. D. Wilson, mine superintendent, the engineering direction being given by Mr. Ford. Much credit is due to these men for carrying to such a successful conclusion so hazardous an undertaking with all of its attendant difficulties.

Selling the Right Coal to the Right Buyer Urged as Beneficial to the Industry

Godfrey M. S. Tate
Consulting Engineer, Washington, D. C.

The coal industry should sell its product on a more scientific basis than heretofore, so that the right coal would be sold to the right users. If that were done much better prices could be paid, and the industry would be put on a more satisfactory basis. As it is now, certain coals such as, for example, those of the smokeless field enjoy a monopoly of prosperity, while other coals having quite as much value go begging on the market.

I do not wish to go into the question of union or non-union wages. This may have much to do with the depression in the Middle West, but it will not in the last analysis be the cause of the ultimate success or failure of that field. In any competitive business quality and quantity win, but the peculiar part of the coal industry seems to be that *quantity* has so far alone been considered. The millions of tons of low-volatile coal being used for locomotive firing and the thousands of tons of by-product coal being employed for domestic purposes and for steam boilers are evidence of a condition economically unsound.

If it were possible to get the coal operators of the United States to consider harmoniously their total ultimate benefits, it should be possible to so allot the coals of our country that each specific coal would be applied only to the field to which it is best adapted. In this regard I would point to the fact, that in both France and Germany the Government specifies that certain coals are to be used only for certain industries and not wasted on the general market.

We are entering into an era of tremendous expansion in the use of processed coal, and the rapidity of this growth and its extent depend almost wholly upon the recognition by the coal industry of the possibilities of selection. For example, in the last few years we have seen oil introduced most successfully for domestic heating, but, instead of meeting this competition on a rational scientific ground, we have attempted to deride and minimize its effectiveness. However, at the same time we have had at our command a much better domestic fuel, namely city gas, which can do everything that oil can do and do it better, but which is not available in most cities because of its cost.

By purchasing selected coal and by the installation of up-to-date properly designed plants, the cost of city or illuminating gas could readily be reduced to a point where it could meet and surpass oil competition, but little has been done in this direction.

After all, the coal operator is not so much interested in whether coal or oil is burned in American homes as he is in the selling of his coal to somebody at a good price. It seems to me that any effort to wrest from the oil people business which they have already obtained and to substitute solid coal is a step in the wrong direction. We could go further and induce gas companies to produce from coal a satisfactory gas comparable in cost to oil. To this end standards based on the agglutinating power of coal in coking, on the quantity of ulmins and the percentage of alpha, beta and gamma compounds in the coal have already been adpoted in some of our industries, particularly in the maufacture of illuminating gas.

The compounds to which reference has been made may be thus defined:

The alpha compounds are insoluble in pyridene; on destructive distillation they yield gas and small quantities of tar, but do not fuse; they are obtained as a brown powder.

The beta compounds are soluble in pyridene but are left as the insoluble residue from a subsequent chloroform extraction of the portion soluble in pyridene; they are distinguishable from the alpha compounds only by their solubility in pyridene.

The gamma compounds consist of the chloroform-soluble portion of the pyridene extraction; these compounds are obtained in the form of a resin or lac, and melt at about 212 deg. F. On destructive distillation they yield gas and tars (composed of olefines, paraffins, and naphthenes), and the residue is well fused and coked.

Though the expressions alpha, beta and gamma are clumsy and confusing and by no means as easy to comprehend as the expression British thermal units, nevertheless they represent certain qualities inherent in the coal which in future will have to be taken into consideration.

THE COST OF NEGLECT

A Fable

By Donald D. Long

Woodward, Ala.

WE were six mighty proud mine cars when the last rivet had been driven and we stood on the rails, spic and span, ready for active service. I was in hopes that we might all go to the same place, but the fates decreed otherwise and three of us were sent to the ore mines and the other three to the coal mines.

We hadn't cost much to build—only about $150 each—but the six of us represented an investment of $900. We little dreamed then that each one of us would soon be worth much more than our original cost.

With two of my brothers I was

"Me and My Five Brothers"

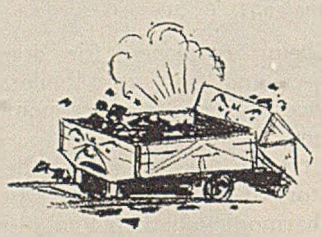
loaded into a flat car and taken to a coal mine. Here we were unloaded, pushed into the tipple and switched to the slope track. I had the honor of being the chain car on our maiden trip.

Down we went faster and faster into the mine, our new wheels singing and our bearings humming in sheer delight. Then came a sudden jerk and we stopped. Eager hands uncoupled us and I was separated from my brothers. It was rather lonesome at first but in my eagerness to see more of the mine I didn't miss them so much.

Days and weeks passed. I was rushed into and out of the mine. It was a great satisfaction to know that I was really aiding in the production of coal and helping some miner earn his wages. But my joy was short lived. One man who had me was careless and evidently did not appreciate the service I was giving him, for he failed to couple me securely into a trip. The pin wasn't thrust entirely through the coupling hole, and try as I might I couldn't tell him of his error (for mine cars are entirely at the mercy of the men who handle them).

Off we went, the motorman driving his locomotive as fast as he could and the cars in front of and behind me pulling and straining at my poorly-secured coupling. The pin started working, but I was helpless. Little by little it pulled out and finally let go completely. I had a sensation of sharp pain when the cars behind me jolted and hoarse cries from the men in the heading told me that something was radically wrong. I knew that something was wrong too, for I had an odd sensation in my front trucks—a feeling of helplessness. After the debris had been cleared away it was found that I had lost both of my front wheels, while one wheel had been torn completely off the car behind me.

Immediately my stock went up! I

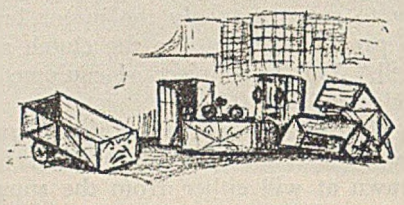


"It Was Found That I Had Lost My Front Trucks"

was taken out of the mine and sent to the shop for repairs. My original cost of $150 was raised to $225. In addition I had been the unwilling cause of an equal repair expense to the car behind me.

In the shop I saw with mingled delight and dismay my five brothers lying about in various stages of repair. That night after the men had gone home we talked over all that happened since we had separated. And this is about the net result of our experiences:

Brother No. 1, who had been in the mine with me, had had his drawbar bent by rough handling. That threw his coupling-pin holes out of line. The miner who had him was in a hurry to get the trip out, so instead of reporting him, he grabbed a heavy



"Lying Around in Various Stages of Repair"

hammer or rock and drove the pin through. This cracked the drawbar and when the mouth of the mine was reached it let go and the trip ran away to the bottom. Luckily the slope was well sprinkled and an explosion did not occur, but the entire trip was wrecked and the cost of fixing Brother up was $110 (bringing his stock to $260), not to mention the expense of the mine delay while the wreckage was being removed.

BROTHER No. 2 had also been in the mine with me. His tale of woe was similar. He had been handled somewhat roughly and one of his wheels had been chipped. This didn't bother him much at first and he thought surely someone would dis-

A Cracked Drawbar

cover it and have a new wheel put on. But time went by and those who saw his predicament took no action. The wheel became worse and worse until one day when he was hooked into a long trip and was rounding a curve it threw him off the track and the cars behind piled up on top of him. His

body was shattered and the cost of a new wheel (which would have raised his stock to $160) was increased to $75, making him worth $225.

Brother No. 3 had been in the ore mines. He said that he really enjoyed being there for the first week or so, but as soon as the novelty had worn off he noticed that the men had no respect for him whatever. He was wrecked several times on account of dirty track and each time he hurt himself somewhere. None of the individual injuries were big enough to send him to the shop but col-

A Chipped Wheel

lectively they soon told on him. "Shop car" was at last marked in big letters on his side and he was sent out for repairs. He figured his total present worth as $225 or 50 per cent more than his original cost.

Brother No. 4 also went to the ore mines and had a good time while it lasted. He said that after about a month he had a feeling that something was wrong with him but he couldn't quite locate it. The symptoms were strange—he couldn't get his wheels to turn freely and his boxes would get hot. One day came the finale. He made a trip to the tipple but there his wheels refused to turn at all. With much cursing the men pushed and pinched him onto the dump track where the belated oiler administered first aid with a grease gun. But it was too late! The deadly heat and friction had gotten in their work and his bearings were burned out. He cost $39 for repairs, which raised his worth to $189, while the wages of the crew that sweat and cursed in getting him through the tipple raised this to $210.

Brother No. 5 had the saddest tale of all. He had been treated very nicely and had nothing to complain of so far as handling was concerned. He had been greased at regular intervals and his miners always looked him over before loading to see if he

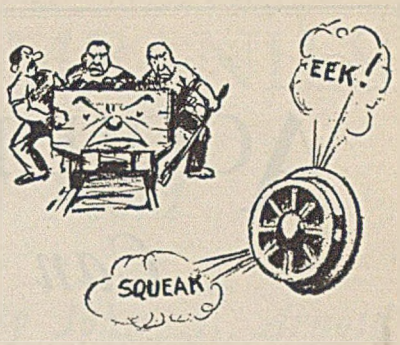
MORAL:
A Dollar's Worth of
INSPECTION
Is Worth More than a
100-DOLLAR REPAIR BILL

was in shape to be trusted. All in all he had been treated royally.

But one day when he had come merrily up into the tipple with several of his buddies and he and the car be-

Marked Shop Car

hind him were getting into the dump somebody became careless and the dump started to revolve. He said that he tried to call out to someone on the tipple but nobody there could understand his language so all he could do was hold his breath and wait. There was a sharp cracking of

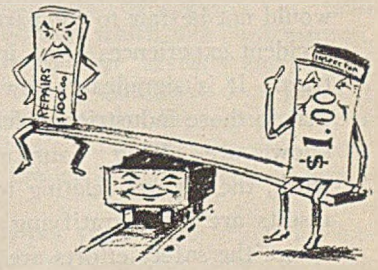


Burned-Out Bearings

wood, the heart-rending groan of twisting steel and then darkness.

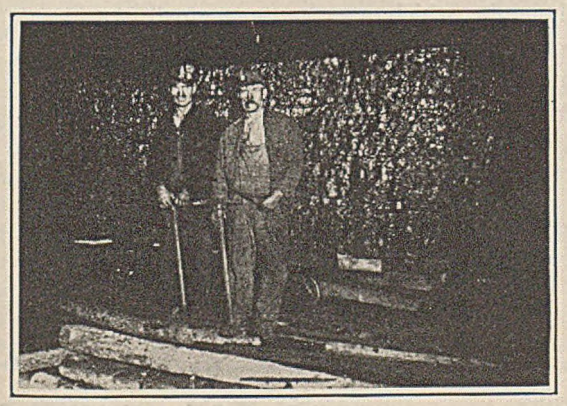
He woke up on the ground and noticed to his dismay that the other cars of the trip had fared as badly as himself. It had been several hours since the accident and the mine had not yet started. The cost of that delay was tremendous and the expense of getting Brother fixed up was $110. He said that he couldn't figure the delay and dump-repair cost, but he thought that it would be greater than his. We agreed that he was right.

The six of us represented an investment of $900 when we started out in life. But now after two months we were all back in the shop

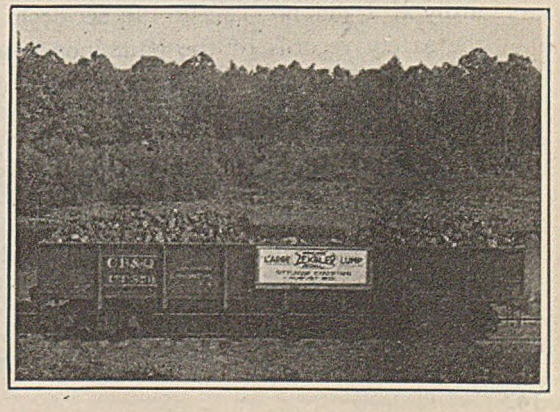


A Dollar's Worth of Inspection

representing an aggregate expense to our owner of $1,405—an increase of $505, or 56 per cent, all caused by carelessness.

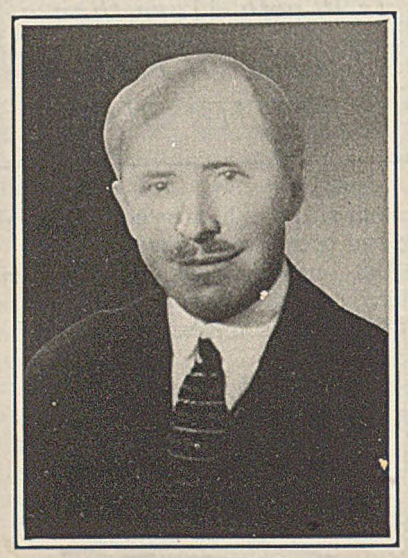


A Big Lump Mined for Exhibition Purposes



ACCIDENTS—
Can They Be Prevented?

THAT accidents can be prevented has been demonstrated conclusively by every industry where a real determined effort has been made for the conservation of lives and limbs and property. This statement is supported by statistics presented in a pamphlet just published, entitled, "The Annual Industrial Accident Experience of Members of the National Safety Council," showing how both accident frequency and severity rates of all plants have been reduced, figures which become more significant when a comparison is made of the 1925 and 1926 records of the plants which reported for both years.



W. H. Cameron
Managing Director
National Safety Council

Because of the obviously different conditions that prevail throughout various industries, it would not be fair to compare the accident experiences of all industries. It is significant, however, that in those industries which we know are doing constructive work, the reports relating to the results are most gratifying while in those groups where the safety efforts are not whole hearted, the decreases are not remarkable.

If there is any industry whose safety record is not under control, the explanation is usually due to a lack of real co-operation within the industry and I would suggest a study of the mental attitude taken by employers and employees toward the accident problem.

I would be ignorant if I did not know and cowardly if I did not lament the accidents that mar the safety records of the bituminous coal mining industry. Everyone familiar with the situation in that field appreciates that there is room for marked improvement. In the interests of the safety movement, I cannot help but deplore the apparent lack of real enthusiasm for accident prevention in this particular industry. When I was abroad I had an opportunity to study the records made by European countries and while the United States is ahead in accident prevention work in most industries, this is not true in the mining industry.

It is not my intention to be critical of the safety situation in this field but I am inclined to wonder if we have been successful in really selling the safety idea to the principals. I am sure that no informed person who has studied the accident problem will deny that safety pays big dividends. I am afraid that we have not yet impressed upon the minds of mine owners the real expense attendant upon accidents. For instance, a statistician who has made a study of the subject, estimates that the so-called "incidental" cost of accidents to be *FOUR* times the compensation and medical payments. A realization of these facts should make every employer appreciate that from a purely selfish viewpoint, accident prevention is good business, to say nothing of the humanitarian angle of the problem.

LET all of us give this matter the consideration it deserves. Let us be frank about the matter, Let us have light on the true facts in the case. With this object in view, we have invited some well known men in the mining industry to speak fully and freely at our Sixteenth Annual Safety Congress which will be held at Chicago, Sept. 26-30. It is possible that there may be an explosion of verbal dynamite which may cause a small sensation among the mining people. However, I am sure that everyone who is sincerely interested in the welfare of the industry will rejoice if something happens that will clarify the situation.

W. H. Cameron

THE ASSOCIATED COMPANIES

Why They Left the Coal Field

By John A. Arnold

General Manager
The Associated Companies
Hartford, Conn.

NEVER have insurance companies been desirous of issuing compensation insurance to coal-mine risks. In the course of time a dozen or more old-line stock companies have issued such insurance, and the losses have been so heavy that today only one is left which is writing freely, and possibly two or three others which are writing in limited areas on a restricted basis.

In order to divide up the hazard so that no one company would be subjected to too large a loss in a single catastrophe and to provide a safety engineering organization which would function at maximum efficiency, ten of the leading stock concerns organized in 1915 the Associated Companies for the express purpose of issuing workmen's compensation policies for coal mines. From then on till 1919 it carried a large amount of this insurance at a small profit. Thereafter, the abnormal conditions caused by the World War gradually came to a close and the high rate of employment ceased. At the same time rates for this insurance were reduced on the indications of the experience which had been accumulated during the war years and from that time on coal-mine compensation insurance has been written at a substantial loss.

IN ADDITION to the ten original members of the Associated Companies one or two other stock companies had taken up the writing of coal-mine insurance and when some of the original members of the Associated Companies resigned, other companies took their places, so that all together there have been at one time or another, perhaps sixteen stock companies interested in the writing of this insurance.

One by one, the Members of the Associated Companies gave up the attempt to put coal-mining insurance on a profitable basis and resigned, until by 1925 only four companies remained. One by one the companies outside the Associated Companies lost their interest in coal mines, and in 1926 it ceased issuing policies on coal risks, after having spent seven years in an unsuccessful attempt to put the business on a profitable basis, losing, in the meantime, many hundreds of thousands of dollars on its coal-mine business.

At first thought it may seem strange to the coal operator that the insurance companies whose business has been insurance for many years and who are trained in the art of computing rates should be unable over a period of seven years to establish schedules at which the insurance could be written profitably.

THE coal operator finds it comparatively easy to determine quickly the cost of producing his coal. As a general rule he knows when he sells it whether he is making a profit or taking a loss on it. That is not true of the insurance business. When an insurance company sells a policy, it sells protection against future losses. There is no way of knowing in any individual mine how much the losses are going to be. Even after the accidents have occurred it is sometimes three and four years before it is known how much money will have to be paid out as a result of the accident.

Not so long ago we had a case where the injured man had been paid his compensation and the case was closed by order of the Industrial Commission; yet seven years after it was reopened and the Associated Companies had to pay large additional sums to the injured man. In other words, it has to prophesy what the ratio of compensation cost to payroll will be in the future, basing its prophecy on the ratios which have been experienced in the past.

With life insurance that is comparatively easy. First, because of the enormous number of individual cases on which the tabulations are based; second, because each insured life involves the payment of a specific amount of money and third, because constant improvement in medical knowledge is gradually extending the average duration of life. But in compensation insurance we have much fewer data and it is affected by a number of factors which are far from being perfectly understood.

In a majority of the states there is an Industrial Accident Commission or other supervisory body to which has been delegated, by the laws of the state, the duty of passing upon the adequacy and reasonableness of the compensation rates. No insurance carrier may charge any rate except one which has been approved by that commission. These commissions are answerable to the citizens of their respective states, and they will not permit any so-called judgment factors to be used which will tend to increase the cost of insurance to their citizens.

The first step in the making of a compensation rate is the collection of data showing what the cost has been in the past. These data consist of the amounts of payroll in each classification which has been insured, and the number, severity and cost of the accidents that have occurred. It is usual to take the figures for a period of from three to five years using the latest years which are available.

It is not possible to bring this experience down to the date on which rates are being made. In the first place, not by any means all the accidents are reported promptly. Often the first knowledge the insurance company has of the accident comes three, four or five months after it has occurred, and in many cases it is months before the amount of the loss is known. For that reason it is not as a rule possible to use payrolls and accidents for the year immediately preceding the date of making the rates.

THESE figures show the amount of the payroll insured during the past and the amount of losses which have been occurring, but in each of those years there have been factors operating to change the cost, so that the actual figures which are gathered are obsolete when they are used. The compensation laws of most states are amended at every session of the Legislature. The theoretical effect of

these amendments can be computed with reasonable accuracy and all the supervising authorities have permitted the inclusion of factors to correct the amount of loss to make it agree with what the loss would have been under the amended law.

In addition to the changes in the actual wording of the law there are also constant changes in the manner in which it is interpreted by the industrial commission or other body which supervises the settlement of compensation cases. Invariably these changes in interpretation increase the cost. It is not the custom of the Industrial Commissions to approve the use of any factor which will reflect the change in cost due to change in interpretation, perhaps because of the difficulty of determining accurately what this effect is. Therefore, in the majority of cases the actual losses used for computing rates for a period in the future are lower than the losses to be expected during the time for which rates are being made.

BUT there are other beside legal factors which may have a material effect on the ratio of cost of workmen's compensation to payroll. When wages are steadily increasing the compensation loss ratio tends to decrease, particularly when there are bonuses and overtime payments. Every workmen's compensation law has a maximum amount which the injured man can collect as a weekly payment. As wages rise above the point where the normal percentage of wage exceeds the maximum the ratio of loss to payroll naturally goes down.

In addition, when wages are high and men are working full time, the temptation to draw compensation instead of wages is small because of the amount of money they have to sacrifice to get it. When wages are going down the tendency is the reverse, because then the ratio of compensation in weekly benefits on the payroll is increasing and there arises an increased temptation to draw compensation without working.

WHEN reduction in wage comes because of one- or two-day operation, it is even more serious to the insurance company, because of the method provided by the laws of a number of states for computing average wages. In many of these the average weekly wages are determined in such a way that the injured workman gets credit for having worked a full week even though he only worked one day a week, which permits him to draw compensation based on the full week's wages. Under this system the amount of compensation may exceed the amount of his wages. Yet the insurance company can only collect premium on the actual wages paid. This, of course, makes it extremely unprofitable for any insurance company to insure a coal mine working only part time.

The increased use of power almost inevitably increases the number of accidents compared to the number of men employed, even though it may mean a decrease as compared to the number of units of production. In some sections of the country where I have seen the figures, the cost of producing coal at the mine mouth is approximately one-half of what it was at the peak of prices. This has resulted partly perhaps from improved discipline and partly from increased efficiency, but also from increase in the use of power-driven machinery.

MR. ARNOLD shows why rates based on experience must, under present conditions, almost always be too low unless they be tempered with judgment—or should it be with prophetic instinct.

THE introduction of such equipment has introduced new hazards and has eliminated to a considerable degree the employments which were relatively non-hazardous. The net effect has been that, although the cost of compensation has remained the same, or at most increased a relatively small amount, the cost of compensation has increased enormously when computed on the basis of payroll expended.

Part-time operation does more than reduce the payroll on which the insurance company collects its premium. It also affects the safety conditions in the mine. When an operator is running at a loss it is hard to interest him in any safety measure which involves spending money. When men are working only one or two days a week, they are much less apt to be careful in the elimination of accidents than when they are working full time. A miner, for instance, is likely to neglect the timbering in his eagerness to produce a large tonnage.

During a strike, particularly, the mines are allowed to get into bad condition, which sometimes takes months to repair.

None of these factors, other than those arising from law amendment, though they affect the cost of compensation on a coal mine, are given any consideration by the supervising authorities in determining what is an adequate rate for coal-mine compensation insurance. The figures for from three to five consecutive years brought down to the level of the current law are combined, the losses are divided by the payroll to find the cost per hundred dollars of payroll for the period which is used, and that figure is adopted as the compensation part of the rate. Usually it does not become effective for three or four months after it is approved and then only on new and renewal business. The policies which are in force are always permitted to run to expiration at the inadequate rate except in one or two states where the laws on the subject are such that the rate can be endorsed on the policy and collected as soon as it is approved by the state.

Having determined the compensation part of the rate, how much shall be allowed for expenses? At the present time the standard allowance is 34½c. out of each dollar of rate. There seems to be much misunderstanding over the subject of expenses in insurance rates. I have seen many articles in print, some even by people who knew better, giving the public the impression that all of that part of the premium over and above the actual losses paid out was profit, ignoring the fact that it costs money to administer the insurance business.

DURING the recent anthracite strike I was compelled here in Hartford to pay $14 per ton for soft coal, the labor cost of which was less than $2. In other words, I paid seven times the cost of the raw material to have the coal delivered to my cellar. The coal operator pays approximately one and one-half times the cost of the raw materials for insurance delivered as compared with my seven times. The services which enter into that 34½ per cent are just as complex as those which enter into the 85-per cent expense which I paid for the coal.

To begin with, the total sales cost of that insurance, including the retailer, the wholesaler and the sales expense in the company office is limited to 10 per cent of the premium. There are very few lines of business which to my knowledge can sell from the manufacturer to the consumer for 10 per cent of the final price; and

both the retailer and the wholesaler perform, for the assured, services which are worth their cost. In the majority of states 2 per cent of the premium must be paid to the state treasurer as a direct tax. In some states the percentage is higher. In addition to that the agent must be licensed and pay a license fee and in some cases the claim adjuster must also obtain a license for which he must pay. There are local taxes also which, added to those stated, bring the tax charge up to approximately 2½ per cent of the premium.

IN COMMON with the majority of the larger insurance carriers the Associated Companies has maintained a large staff of engineers and inspectors to assist the operator in reducing hazards. In the case of the coal-mine business, this has cost from 8 to 12 per cent of the premium collected, and it has been for the direct benefit of the assured, not the insurance company, for the net effect is to reduce the rate, thereby reducing the income of the insurance company.

In addition to these expenses we have those of issuing the policies, keeping track of them, investigating every accident and seeing that the injured workman gets the compensation to which he is entitled, making payments periodically, once, twice or four times a month. We have the expense of preparing the figures showing what the results have been and submitting these figures to various insurance departments.

All of these things must be done, and they cost money. Only by the most careful management have the companies been able to do business on the allowance which is made, and in many cases the allowance has been inadequate. Even if this expense allowance were increased to 40 or 45 per cent, the insurance company would still be transacting its business at a very small margin, lower than that between the cost of raw material and retail price in other lines of business.

THERE is not and has not been included in the rate for compensation insurance either for coal mines or for other lines any loading for profit. In the past the insurance companies have not asked for a profit, having been content to serve the public treating the workmen's compensation coverage as an accommodation to the public, being content to make their profit on other lines of insurance.

Though no allowance has been made for the steadily increasing cost of compensation insurance, though the expense loading has been kept to the lowest possible point and there is no loading at all for profit it has taken the Associated Companies sometimes as much as two years to get an increased rate approved and before the approval had come, later statistics showed that a much higher rate was needed. In the state of Kentucky alone the Associated Companies was out of pocket more than a million dollars on its compensation insurance. This includes its entire period of operation in the state on coal-mine business.

Every year for the past seven years the Associated Companies has used red ink to mark its year's operation on coal-mine compensation insurance and this has not been the result of catastrophes, although it has had its share of them, but it has been the result of the ordinary everyday casualties, falls of roof, haulage accidents, electrical accidents, etc. The catastrophe, it has provided for and can stand, but when every single year for seven years showed a heavy loss there was nothing left to do but drop the line.

THE CONDUCT of the insurance business like that of any other industry costs money. In addition most industrialists seek to make a profit. The workmen's compensation insurance rates are not set with any provision for profit but solely with the idea of breaking even.

Business men the country over are of the opinion that any organization engaged in a legitimate business is entitled to 6 per cent profit on its turnover. Why should not an insurance company be entitled to that profit? Yet no industrial commission has ever been induced to believe that insurance companies were so entitled. There has not been any profit-loading in the rates and not only have there been no profits, but there have been losses year after year.

Until the coal operator recognizes the justice of establishing coal-mine compensation rates on such a basis that the company can collect enough premium to pay the losses and legitimate expenses and 6 per cent profit on the turnover, it will, in my estimation, be impossible to increase the number of insurance companies engaged in the business.

At the same time I do not believe that any serious emergency exists. In Ohio, Washington, West Virginia and Wyoming, the State Fund is monopolistic, and the insurance business has been taken over by the state, much as the coal mines might be taken over if what many people have advocated should be accomplished. In Colorado, Maryland, Michigan, Montana, Pennsylvania and Utah, there are competitive State Funds which are entirely willing to and do insure coal mines.

The number of carriers which are writing in the remaining coal-mining states is limited, but I do not think there is any coal-mining state where no company will write. Operators cannot expect insurance companies to welcome the business at inadequate rates. They cannot expect any carrier to seek to carry the liabilities at a mine which is in bad physical condition or incompetently operated. If the insurance company does write such mines, sooner or later the resulting losses will get into the experience, and the mines which are properly operated will have to help pay for the incompetence of other operators. Neither the coal industry nor the insurance companies want that.

I have no way of knowing whether the coal operators in general want more companies in the field writing workmen's compensation insurance. If they do, they can get them, although it will not be easy after the discouraging results which the liability companies have had in the past in this direction. The way to do it is for the coal operators to go to the insurance commissioner and tell him that they want to see the insurance companies enter the coal-mine field, and that they are willing to pay a price which will enable the insurance companies to make a small profit in the writing of this business.

WHEN the insurance companies, the coal operators and the insurance commissioners get together and agree upon some plan for making rates which shall take into account the conditions which have changed, the expectation of losses in the future; which shall include an expense loading adequate to pay the expenses and which will allow a 6 per cent profit on turnover to the insurance company which conducts its business economically, the insurance companies, or at least some of them, will once more enter the field of coal-mine workmen's compensation insurance.

ANTHRACITE PREPARATION

Crushing Roll Tendencies

By Frank J. G. Duck

Assistant Editor, Coal Age
New York City

IMPRESSIVE advances have been made in recent years in anthracite crushing-roll design and practice. Although little has been said regarding this phase of preparation, the improvements made have resulted in securing a greatly increased yield of prepared or domestic sizes. A survey just completed indicates that the best-designed of present-day rolls, whether No. 1 (main) or No. 2 (secondary), produce, on the average, 90 per cent of nut and larger—and that consistent yields of 95 or 96 per cent are not uncommon. Even on soft, friable anthracite, the quantity of prepared sizes varies from 80 to 90 per cent—No. 1 rolls averaging 85 to 90 per cent and No. 2 rolls from 80 to 85 per cent.

The results shown in Table I were obtained by a large independent company operating more than a dozen collieries in various parts of the anthracite field. This company makes it a practice to test all of its rolls at least once a month and more frequently if the yield of prepared sizes appears to be below standard. Collieries "A" and "B" are near each other but are preparing coal from different seams. In each colliery, manganese-steel segmented rolls having hawk-bill teeth are used. The rolls are 42-in. in diameter and 36-in. long, operate at a tooth speed of 250 lineal ft. per min. and the teeth of the No. 2 rolls are spaced 4¼ in. from each other. The distance between roll centers varies with the quantity of the different sizes desired but approximates 45 in. In all tests, 100 lb. of steamboat and 100 lb. of broken coal are mixed and fed to the rolls. The resulting product is hand screened for the yield of various sizes. The sizing standards adopted on April 1, 1925, are used in all cases.

The figures in Table I present many points of interest. For instance, they not only show the consistent yield of prepared and small sizes obtained but they also indicate the flexibility of the modern rolls. Thus from colliery "A," by changing the distance between rolls, the quantity of broken coal made varied nearly 11 per cent. Yet, excluding the month of June when a large amount of pea coal was made (because of the increased demand for this product at that time), the yield of prepared sizes was always more than 94 per cent. Results from colliery "B" are equally good and perhaps even more consistent. Probably the most remarkable feature of Table I is the uniform yield of the small sizes (pea and under). Not only is the total quantity of steam sizes unusually constant but the amount of each of the small sizes produced (with the exception at colliery "A" previously noted) is just as uniform.

The month of June at both collieries "A" and "B" is worthy of note. As has been indicated, this month brought an improved demand for pea coal. It also resulted in a falling off in orders for all of the domestic sizes excepting nut. At colliery "A" the rolls were set to produce about 7 per cent more pea than normally—largely at the expense of egg coal. As there was a fair demand for nut, the rolls at colliery "B" were adjusted to yield approximately 10 per cent more of this size than was customary. The decrease in the quantity of broken and egg coal produced was nearly equal to the increased percentage of nut and the total quantity of prepared sizes obtained remained practically constant.

That these high yields of prepared sizes are not exceptional or unusual is

TABLE I—TEST DATA ON NO. 2 CRUSHING ROLLS MARCH-JUNE, 1927

Per Cent Each Size	Colliery "A"					Colliery "B"				
	March	April	May	June	Average	March	April	May	June	Average
Broken	16.50	12.56	5.88	15.94	12.72	17.00	13.88	20.25	16.32	16.86
Egg	50.00	45.25	53.37	38.62	46.81	48.70	46.87	48.13	42.06	46.44
Stove	20.75	28.00	26.75	24.50	25.00	20.50	25.50	19.50	19.62	21.28
Nut	7.25	8.50	8.50	7.56	7.95	7.50	7.88	7.12	16.80	9.83
Total prepared	94.50	94.31	94.50	86.62	92.48	93.70	94.13	95.00	94.80	94.41
Pea	1.25	1.50	1.00	8.25	3.00	2.25	1.50	1.25	1.33	1.58
No. 1 buckwheat	1.50	1.63	1.63	1.43	1.55	1.50	1.50	1.25	1.37	1.41
No. 2 buckwheat	1.25	1.31	1.37	1.50	1.36	1.25	1.50	1.37	1.32	1.36
No. 3 buckwheat	0.50	0.50	0.38	0.88	0.56	0.50	0.50	0.38	0.43	0.45
Dirt*	1.00	0.75	1.12	1.32	1.05	0.80	0.87	0.75	0.75	0.79
Total small	5.50	5.69	5.50	13.38	7.52	6.30	5.87	5.00	5.20	5.59

*Includes No. 4 buckwheat.

TABLE II—PERFORMANCE OF NO. 1 AND NO. 2 CRUSHING ROLLS COLLIERY "C," JANUARY-JUNE, 1927

Per Cent Each Size	No. 1 Rolls						No. 2 Rolls					
	Jan.	Feb.	April	May	June	Average	Jan.	Feb.	April	May	June	Average
Steamboat	31.13	34.88	39.13	36.75	37.50	35.88	.....	.....	.....	.....	.....	.....
Broken	21.63	19.25	21.50	20.63	19.63	20.52	1.25	1.50	0.75	1.13	1.25	1.17
Egg	14.63	14.25	12.63	13.50	13.38	13.68	27.38	26.25	31.50	29.38	30.25	28.95
Stove	13.38	11.63	8.25	9.63	9.50	10.48	35.25	33.75	33.13	33.63	32.88	33.73
Nut	8.63	9.50	8.25	8.88	9.00	8.85	18.25	19.25	17.88	18.75	18.00	18.43
Total prepared	89.40	89.51	89.76	89.39	89.01	89.41	82.13	80.75	83.26	82.89	82.38	82.28
Pea	2.60	2.36	2.00	2.23	2.13	2.27	4.38	4.75	4.38	4.50	4.87	4.58
No. 1 buckwheat	2.24	2.50	2.75	2.50	2.86	2.57	4.50	4.75	4.25	4.35	4.50	4.47
No. 2 buckwheat	2.38	2.25	2.11	2.38	2.25	2.27	3.86	4.00	3.11	3.38	3.50	3.57
No. 3 buckwheat	1.63	1.75	1.63	1.75	2.00	1.75	2.88	3.25	2.75	2.88	2.75	2.90
Dirt*	1.75	1.63	1.75	1.75	1.75	1.73	2.25	2.50	2.25	2.00	2.00	2.20
Total small	10.60	10.49	10.24	10.61	10.99	10.59	17.87	19.25	16.74	17.11	17.62	17.72

*Includes No. 4 buckwheat.

proven by the results obtained at these collieries during the past two years. In 1926 at colliery "A" the total quantity of domestic sizes obtained (as indicated by monthly tests) varied between 96.30 and 91.22 per cent; in 1925 the same colliery produced a maximum of 96.50 and a minimum of 94.00 per cent of prepared sizes. Colliery "B" in 1926 showed a maximum percentage of 96.41 and a minimum of 91.26 per cent of large sizes; in 1925 the limits were 97.37 and 92.50 per cent.

To illustrate what can be accomplished under difficult operating conditions, Table II is included. Colliery "C" is located in the southern field and the anthracite prepared there is noted for its softness and friability. Both the No. 1 and No. 2 rolls have manganese-steel segments and hawk-bill teeth. They both are 42-in. in diameter and 36 in. long and are compound-gear driven. The No. 1 rolls run at a speed of 245 lineal ft. per min., are spaced 48⅜ in. between roll centers and the teeth are 5¼ in. apart. The No. 2 rolls also operate at 245 ft. per min., are 44⅝ in. between center lines and carry teeth spaced 4¼ in. apart. As at collieries "A" and "B", the rolls at colliery "C"

TABLE III—DATA ON OLD-STYLE NO. 1 AND NO. 2 CRUSHING ROLLS

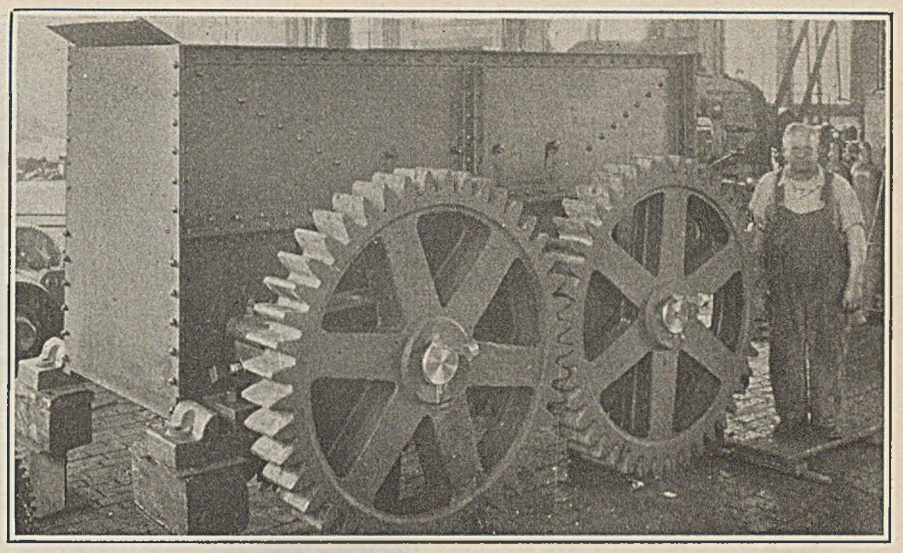
Colliery "D," May, 1908

Per Cent Each Size	No. 1 Rolls	No. 2 Rolls	Second Breaking Based on Original Lump Broken	Obtained from Both Breakings
Steamboat	72.75	.....	.....	.....
Broken	8.88	53.00	38.56	47.44
Egg	6.87	17.75	12.91	19.78
Stove	2.75	8.75	6.38	9.13
Nut	3.00	7.25	5.27	8.27
Total prepared	94.25	86.75	63.12	84.62
Pea	1.50	3.62	2.63	4.13
No. 1 buckwheat	1.62	3.00	2.18	3.80
No. 2 buckwheat	0.63	2.75	2.00	2.63
No. 3 buckwheat	0.88	1.00	0.73	1.61
Dirt*	1.12	2.88	2.09	3.21
Total small	5.75	13.25	72.75	15.38

*Includes No. 4 buckwheat.

are tested at least once a month—all tests are made with a mixture of 100 lb. of steamboat and 100 lb. of broken coal.

Beyond calling attention to the uniform yields of the various sizes, and the relatively high percentage of prepared sizes, Table II requires no comment. The No. 1 rolls at colliery "C" in 1926 produced a maximum of 90.13 per cent and a minimum of 87.75 per cent of large sizes; in 1925, the upper and lower limits were 86.50 and 80.50 per cent respectively. In 1926 the No. 2 rolls gave a maximum percentage of 85.13 and a minimum of 79.25 per cent of prepared sizes; in 1925 the figures were 81.63 and 80.38 per cent. Attention is called to the improvements in results made since 1925.



Takes an Entire Car at One Time

At another colliery of the same company, where No. 1 and No. 2 rolls of the same characteristics (except for speed and spacing) as at colliery "C" are used, the following results were obtained from January to June of this year: No. 1 rolls, operating at a tooth speed of 379 lineal ft. per min., gave a maximum of 96.84 and a minimum of 94.81 per cent of prepared sizes; the No. 2 rolls, running at 333 lineal ft. per min., gave 95.93 and 92.69 per cent as the upper and lower limits respectively.

At a fourth colliery, where the coal also is soft and friable, the No. 1 rolls are driven at 289 lineal ft. per min. and there is 49¼ in. between the center lines of the roll shells. The No. 2 rolls also run at 289 ft. per min. and are set on 46⅛ in. centers. Other caracteristics, including size, are the same as those of the rolls already mentioned. From January to June of this year, tests of the No. 1 rolls indicated a maximum of 90.00 per cent and a minimum of 86.38 per cent of prepared sizes; the No. 2 rolls showed upper and lower limits of 83.50 and 79.88 per cent respectively. These data are given merely in further support of the statements made in the opening paragraph.

A comparison of the foregoing results with those obtained from the old-style, small diameter, high-speed rolls is instructive. As shown, the contrast is not always unfavorable to the old rolls. But it must be remembered that such results as given in Table III were the exception rather than the rule. In fact, the high yield of prepared sizes indicated in that table was obtained only after elaborate preparation and minute attention to all details. Therefore, the figures in this table represent the best results obtained under ideal conditions. Such records as given in Table III were not made in daily operation—Table V more nearly presents the case of the old-style rolls under usual conditions.

It should not be forgotten, however, that periodic testing of crushing rolls by the anthracite producers is a comparatively recent development. Therefore, except for isolated instances such as given in Table III and those that follow, no records of the consistent performance of the old-style rolls over long periods of time are available. As a result, it is difficult to state what was a fair average day-by-day performance of the high-speed rolls. However, a consistent yield of 75 per cent prepared sizes is probably a liberal estimate. Certainly, an average of 80 per cent over a period of months would represent unusually good results. The author is indebted to Frank B. Davenport, consulting mining and mechanical engineer of Scranton, Pa. for the information and data contained in Tables III to VI.

Both the No. 1 and No. 2 rolls in

TABLE IV—SIZING STANDARDS IN GENERAL USE PRIOR TO APRIL 1, 1925

Trade Name	Screen Mesh, Circular Opening, Diameter, In. Through	Over
Broken	4	3½
Egg	3½	2½
Stove	2½	1⅞
Nut	1⅞	¾
Pea	¾	⅜
No. 1 buckwheat	⅜	⅛
No. 2 buckwheat	⅛	⅜
No. 3 buckwheat	⅜	⅛
No. 4 buckwheat	⅛	⅛
Culm or silt	⅛	....

Table III were 32 in. in diameter by 36 in. long and were fitted with old-style elliptical-base teeth $3\frac{1}{2}$ in. long and $1\frac{3}{4}$ in. wide. The No. 1 rolls were set on $41\frac{3}{4}$ in. centers, operated at 850 lineal ft. per min., and had 198 teeth in each shell. The No. 2 rolls were on $39\frac{5}{16}$ in. centers, ran at 900 ft. per min., and carried 308 teeth per shell. Two hundred pounds of hard and firm honey lump coal was fed to the No. 1 rolls and the steamboat size resulting from this operation was crushed in the No. 2 rolls. The fourth column in Table III is obtained by multiplying each of the figures in the third column by 0.7275—the percentage of steamboat coal resulting from the original crushing. The percentages in the fifth column are the result of adding the corresponding values in the second and fourth columns.

The various sizes given in Tables III, V and VI are those that were in general use prior to the new standards adopted on April 1, 1925, and are shown in detail in Table IV. Pea coal, under the new standards, is $\frac{1}{8}$ in. smaller than it was in 1908, and the range of this size in that year was $\frac{5}{16}$ in. Consequently, if pea coal graduated evenly in quantity from the upper to the lower size limits, two-fifths of it or 1.66 per cent should be included with the prepared sizes in Table III. This would indicate an ultimate yield of large sizes of 86.28 per cent and of course excludes from consideration the coal that was not of prepared size on arrival at the dump.

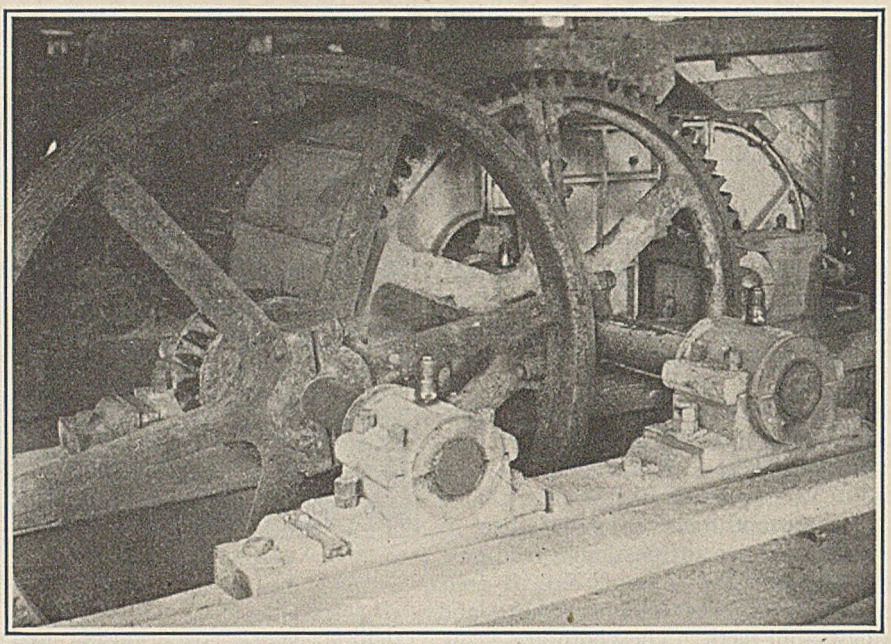
It is the author's opinion that Table III represents the best of the early efforts at conservation and the beginning of the reduction of waste from crushing rolls. However, as previously indicated, these results were exceptional and are by no means typical.

Table V is given not only to show the average performance of the old-style rolls but also to contrast their operation with the early results obtained from compound rolls. The rolls at colliery "E" were 32 in. in diameter, 36 in. long, set $38\frac{5}{8}$ in. between center lines of shells and ran at 1,000 ft. per min. The teeth were old-style, had square bases and 300 of them were staggered in each shell. Approximately 600 lb. of lump anthracite from the northern field were fed to the rolls at a uniform rate and the resulting product screened to the meshes given in Table IV.

Table V—Early Tests on High-Speed and Compound No. 1 Rolls

Per Cent Each Size	Colliery "E" October, 1912 High-Speed Rolls	Colliery "F" January, 1913 High-Speed Rolls	Colliery "F" January, 1913 Compound Rolls
Broken	10.43	37.00	54.00
Egg	25.80	12.00	12.67
Stove	25.90	14.83	8.67
Nut	15.35	16.00	11.67
Total prepared	77.48	79.83	87.01
Pea	7.01	6.84	4.66
No. 1 buckwheat	6.23	2.17	1.17
No. 2 and 3 buckwheat	5.80	8.66	5.50
Dirt*	3.48	2.50	1.66
Total small	22.52	20.17	12.99

*Includes No. 4 buckwheat.



Rope Drive on No. 2 Compound Rolls

Colliery "F" was in the Wyoming region and the tests given in Table V were made to compare a recently-installed set of compound rolls (practically identical with those of today) with the old rolls which they replaced

The object in giving Table VI is to show the improved operation of the earlier compound rolls that resulted from their readjustment—principally with respect to the distance between the shells. The rolls at colliery "G" were 36 in. in diameter, 34 in. long and had manganese-steel segments carrying patented hawk-bill teeth $4\frac{1}{2}$ in. high. They operated at 377 lineal ft. per min. and each test was made on 500 lb. of hard, clean and firm lump coal from the same seam uniformly fed to the rolls. During the test made in October, 1912, the rolls were set on $42\frac{1}{4}$ in. centers—subsequent data on the spacing is lacking but it is evident that the distance between the roll shells was considerably increased on September 2, 1920, and slightly reduced for the test on the following day.

Although the yields of prepared sizes given in Table VI are much higher than those generally obtained from the high-speed rolls, when contrasted with the present-day results they show that even as late as 1920 the great importance of crushing rolls was not fully realized. Of course, allowance must be made for the fact that the sizing standards in vogue prior to 1925 made the toal yield of prepared sizes more difficult to attain then than now. Even so, however, there can be no question but that present crushing-roll design and practice is much further advanced than it was five or six years ago.

Table VI—Early Comparative Tests on No. 1 (or Crusher) Compound Rolls Colliery "G," 1912 and 1920

Per Cent Each Size	Oct., 1912	Sept. 2, 1920	Sept. 3, 1920
Broken	4.11	51.43	48.13
Egg	43.41	14.54	19.73
Stove	26.40	12.28	11.39
Nut	11.75	9.00	8.24
Total prepared	85.67	87.25	87.49
Pea	5.52	3.48	3.29
No. 1 buckwheat	4.21	4.41	4.61
No. 2 and 3 buckwheat	3.36	3.38	3.14
Dirt*	1.24	1.48	1.47
Total small	14.33	12.75	12.51

*Includes No. 4 buckwheat.

Despite the great improvement, it must not be assumed that perfection has yet been attained, or that all crushing rolls at all collieries give the excellent results shown in Tables I and II. There yet are companies who pay little or no attention to the operation and condition of their rolls, and there are others who maintain that frequent periodic testing of such equipment not only has no practical value or significance but also that it is a waste of time. The matter of roll tests and testing will be treated in a subsequent article.

DEPLETION—

How to Figure It

By Thos. F. Kennedy
Scranton, Pa.

DEPLETION seems to be the most confusing and perplexing of the problems of mining investments. I have found that the average coal company official, accountant, lawyer and engineer as well as other so-called experts have only a faint idea of what this term really means.

Broadly speaking, coal mining investments are divided into five general classes, namely: Coal, plant and equipment, development, surface, and other assets. Depletion is used in connection with the value of coal and is one of the important factors in coal mining costs.

Before discussing this subject, it is interesting to know how the problem of depletion developed in the various income tax acts from 1913 to 1926, inclusive.

The Act of 1913, G(b) (3) (c) uses the following words:

> In the case of mines a reasonable allowance for depletion of ores and all natural deposits, not to exceed 5 per cent of the gross value at the mine of the output for the year for which the computation is made.

There is nothing to show how the factor of 5 per cent was determined. It was probably an arbitrary figure that looked reasonable.

The Act of 1916: Section 12(a) Second (3) (b) provides that:

> In the case of mines a reasonable allowance for depletion thereof not to exceed the market value in the mine of the product thereof which has been mined and sold during the year for which the return and computation are made, such reasonable allowance to be made under rules and regulations to be prescribed by the Secretary of the Treasury. Provided, that the allowance authorized in (b) shall equal the capital originally invested, or in the case of purchase made prior to March 1, 1913, the fair market value as of that date, no further allowance shall be made.

This new provision defined depletion within fairly close limits in comparison to the depletion allowed by the 5 per cent factor which would fluctuate annually according to the selling price at the mine. In the subsequent income tax acts, there were no material changes in depletion as applied to coal mines.

From a study of the Act of 1916, it can be seen that depletion depended upon the original cost after March 1, 1913, or the fair market value of the coal on that date.

For determining the valuation of mineral deposits or rights, three general present value methods are in practical use. These are known as the annuity investment, diminishing investment, and sinking fund or permanent investment methods respectively.

For practical purposes as well as for the sake of simplicity in the development of the various formulas, it is considered that the mine produces equal annual incomes from which its present value must be returned.

According to the annuity investment method $V = (R^{n-1}) \div (R^n rn)$. In this and subsequent formulas the following nomenclature is used:

V = present value of n yearly incomes,
P_1 = present value of first year's income,
P_n = present value of income to be received, at end of n years,
A = annual income,
n = number of years = life of mine,
r = rate of interest, and
$R = 1 + r$.

To determine V, then,

$$P_1 (1 + r) = A \text{ or } P_1 = A \div (1 + r)$$
$$P_2 = A \div (1 + r)^2$$
$$P_3 = A \div (1 + r)^3$$
$$P_n = A \div (1 + r)^n$$

And,

$$P_1 + P_2 + P_3 \ldots P_n =$$
$$A \div (1 + r) + A \div (1 + r)^2 + A \div (1 + r)^3 \ldots + A \div (1 + r)^n = (a)$$
$$V = [A \div (1 + r)] (1 + [1 \div (1 + r)] + [1 \div (1 + r)^2] \ldots [1 \div (1 + r)^{n-1}])$$

Substituting,

$$R = 1 + r, \; V = (A \div R) [1 + (1 \div R) + (1 \div R^2) \ldots (1 \div R^{n-1})] = (b)$$

Multiply (b) by R,

$$RV = (AR \div R) [1 + (1 \div R) + (1 \div R^2) \ldots (1 \div R^{n-1})] = (c)$$

Substracting (b) from (c),

$$V = (R^n - 1) \div R^n rn$$

In the derivation of the above annuity formula (which is also known as the Inwood formula), each year's income includes the present value of that year's income at the basic date of valuation plus the interest compounded from the basic date to the date when the income is received. In other words, the annual income contains a separate and distinct investment and the present value returned each year is considered the capital which is immediately liquidated. The compounded interest is considered the return on the investment and may also be distributed. This method is the simplest one and can be applied readily to unequal annual incomes. Below is shown the application of the formula to a typical practical problem. Given:

Coal marketable	100,000 tons
Estimated annual production	20,000 tons
Estimated life	5 years
Estimated royalty per ton	10c.
Estimated annual income	$2,000
Estimated total income	$10,000
Investment rate (risk)	6 per cent

Determine V or present value of total expected royalties.

By substituting the various values in the formula derived above, V for one dollar is found to be $0.84247, which, applied to the total expected income of $10,000 determines V to be $8,424.70, the present value of the total expected royalties. The interest or return on this investment for five years is $1,575.30. The average depletion rate for practical purposes is determined by dividing the present value, $8,424.70, by the total marketable tonnage of 100,000 and is found to be 8.4247c. per ton.

The detail of this problem is shown in Table I and Chart 1.

TABLE I—CAPITAL AND INTEREST

Year	Annuity	Discount Factor 6 Per Cent	Annual Capital Liquidation	Interest
1st...	$2,000.00	.943396	$1,886.79	$113.21
2nd...	2,000.00	.889996	1,779.99	220.01
3rd...	2,000.00	.839619	1,679.24	320.76
4th...	2,000.00	.792095	1,584.19	415.81
5th...	2,000.00	.747258	1,494.52	505.48
Totals			$8,424.73	$1,575.27

LIGNITES

Of Saskatchewan

By John Galloway
Estevan, Saskatchewan

ACCORDING to estimates of the Dominion government an area of 6,000 square miles of rolling prairie overlies 50 billion tons of lignite in the Province of Saskatchewan. Within this area are some 60 mines, but the principal producers center around Bienfait, Estevan and Shand. Practically all coal shipped in the province originates at these three towns.

Of the 60 mines mentioned, only nine are on the railroad. Some of the others, when not too far from a shipping point, haul from the mines with teams or trucks and are thus able to ship a few carloads when the demand is brisk. Others, again, are content with local trade and work only in the winter.

Two of the nine shipping mines are worked by slopes, five have shafts with self-dumping cages, and the other two run their cars off the cages and dump by hand. The shafts are from 80 to 110 ft. deep, and the bed which lies horizontal is about 12 ft. thick. With the exception of a band of clay 4½ to 6 in. thick, occurring about 30 in. from the floor, and some blackjack near the roof, the bed is free from impurities. Some of the mines work on top of this clay and thus save handling it, but they loose the bottom coal. When this is done undercutting machines have to be used for there is no natural parting between the coal and the clay seam. The clay roof takes a lot of timber to support it and for that reason some mines work to the bottom. Running the coal cutters in the clay and leaving a foot or two of coal to support the roof, is undoubtedly the most practical and economical method of working. For by this means not only is a considerable saving made in timber costs but much of the roof coal is recovered when the rooms are worked back. As will be gathered from the foregoing, most of the mines use coal cutters although some still stick to the ancient practice of shooting off the solid.

The double entry system is used in most cases, the entries being driven 7 to 9 ft. wide and from 35 to 50 ft. apart. Rooms are turned on 30-ft. centers and driven 15 to 20 ft. wide and 150 to 200 ft. deep. A 10-ft. slice along the rib is taken in coming back, which gives an excellent percentage of extraction. Much depends, however, on the state of the market, for rooms stand much better if they are kept moving. If a room has to remain idle over the summer it usually gives trouble when started up again the following winter and often the roof breaks at the point where working was stopped. It has been found advisable therefore to regulate the length of the rooms according to the winter's output. During the quiet summer months, entries are driven and the necks of new rooms turned.

COMPRESSED air is not used, but nearly all the mines employ electricity which they generate themselves. Electric haulage locomotives are installed at one mine, whereas others use various systems of rope haulage. Some stick to the old horse. No gas is encountered underground, so ventilation is simple.

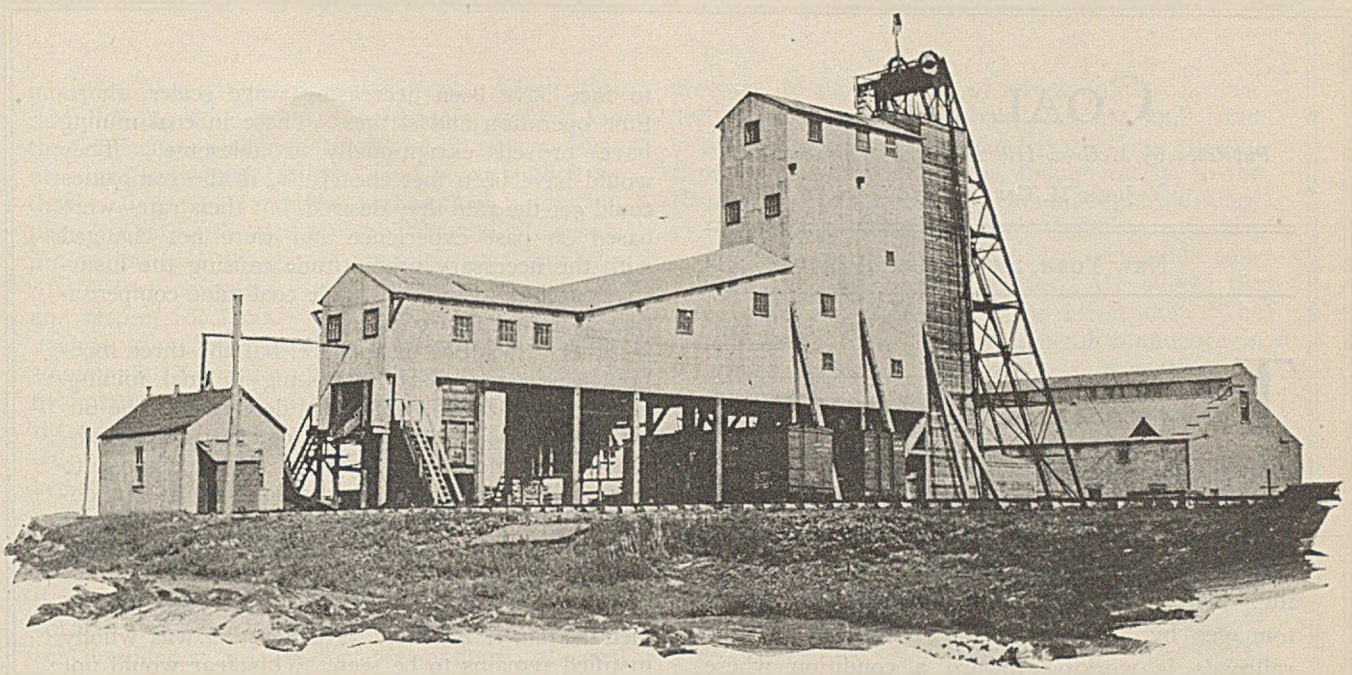
Faults and hitches are practically unknown, and with the exception of melted snow entering the workings through cave-ins during the spring little trouble is experienced with water. Fires of spontaneous origin have, however, given considerable trouble in several of the mines. Two methods have been successfully used in combating them—flooding and sealing.

An average analysis of this lignite is about as follows: Moisture, 33 per cent; volatile matter, 27 per cent; fixed carbon, 33 per cent; ash, 7 per cent; and thermal content, 7,400 B.t.u. The ash fuses at approximately 2,170 deg. F. Its analysis is about as follows: Silica, 53.0 per cent; iron oxide, 4.4 per cent; alumina, 22.4 per cent; lime, 10.1; magnesia, 2.1; potassium oxide, 0.8; sodium oxide, 4.6; phosphoric acid anhydride, 0.2; and sulphur trioxide, 1.7 per cent.

The output of this field for 1925 was 478,668 tons and for 1926, 435,841 tons. This does not seem much when divided up among so many mines, but it must be remembered that the season is short, the keeping qualities of the coal are poor, and the population of the district served is scanty. Two of the mines are capable of producing 1,000 tons per 10-hr. day if necessary.

THE market served extends from Moose Jaw on the West to Winnipeg in the East. Beyond Moose Jaw competition with Alberta coal is severe, and the scope of the Eastern market is limited by the freight rates. A village usually surrounds a mine. The houses are owned by the coal company and rents are nominal. Coal, water and electric light are provided at a slight charge to cover the cost. Two of the largest mines run general stores for the benefit of their employees. Schools are provided, as well as amusement halls, community clubs and pool rooms. Some employees have been with the same firm for 20 years. Each householder has his own garden plot which is usually plowed, free of charge, by the company every spring.

IN 1923 the Saskatchewan Coal Operators' Association was formed. By means of this organization it was hoped to stabilize the market and prevent the price cutting which became manifest every season as soon as the market slackened. The association did not survive the following winter, but its effects were not altogether in vain, for one of the dealers succeeded in obtaining control of the output of several mines. From that beginning eight mines eventually got going in a co-operative selling scheme under the name of the Souris Coal Distributors, Ltd., with an office and a salesman in each of the principal towns who covers the surrounding territory as well.



CUSTOMERS and dealers may order coal from whichever mine they fancy, but should that operation have more orders than it can fill promptly, an endeavor is made to have the customer accept a car of coal from another mine. The operators maintain an office in Bienfait which acts as a distributing center by collecting the orders from the salesmen and allocating them to the mines on a predetermined ratio agreed to by the operators themselves. The output ratio between the mines in the pool is not based on grades of coal but on tonnage.

The operators made an arrangement nearly a year ago by which two of the mines producing the poorest coal were closed, their allocated output being taken and paid for by some of the others. This arrangement has evidently been a success, for it has recently been agreed to continue it for another two years.

Of the recent developments in this field, by far the most interesting was the experiment carried out by the Dominion Government in conjunction with the provincial governments of Manitoba and Saskatchewan, in briquetting this lignite. To accomplish this, the Lignite Utilization Board was formed consisting of representatives of all three governments.

The Lignite Utilization Board started work in October, 1918, and spent a year and a half in investigating previous work in order to insure that it would have complete information as to the development of the process, and the scope of fundamental research made necessary by the discovery that no lignite carbonizers had been developed on this continent. An arrangement was made with the Department of Mines whereby the board used the latter's laboratory at Ottawa. From here the chemists and engineers employed purchased the equipment to carry out the necessary tests. Here it was, also, that the first carbonizer model was built, and although this device worked perfectly as a model, it proved quite useless when operated on a commercial scale.

The next year was spent in constructing and equipping a plant near Bienfait. It was an unfortunate time in which to build such a plant for everything was at the peak of after-the-war prices, construction was slow, labor high, and the special materials required were hard to obtain.

TROUBLE first developed in the drying equipment, but this was corrected. Carbonizers with floors of carbofrax tiles, however, developed such bad cracks in the floors that relining with both a high grade fire-clay brick and carbofrax hollow tiles was tried. The tiles again cracked and the carbonizer fitted with fire-clay tile had such a low capacity that it was considered impracticable from a commercial standpoint.

Further work on these carbonizers was abandoned and investigation started on a shaft-type of carbonizer that had been built at Grand Forks, North Dakota. Eventually, 100 tons of Saskatchewan lignite was shipped to Grand Forks and there carbonized. The next move was to build a similar retort at Bienfait. When completed it was operated practically continuously for six months, recovering 1,300 tons of char from 3,000 tons of lignite put into it. This retort, although certainly more satisfactory than the Ottawa carbonizer, had to be carefully handled owing to clinker troubles and the burning out of the baffle plates. One hundred and fifty tons of char from this oven were shipped to Hebron, North Dakota, and successfully briquetted, the product being returned to Canada. The briquets thus made stood up well under all weather conditions, held together nicely in the fire, but contained far too much ash. This is accounted for from the fact that over two tons of lignite were used in making one ton of char. Had some method of dry cleaning the char so as to remove the surplus ash been employed, a wonderful briquet would have resulted.

BY GOVERNMENT instructions the plant was shut down at the end of 1923, and has stood idle ever since. It cost over a million dollars to prove that lignite could not be briquetted commercially by the methods followed. At the moment of writing there is some possibility of one of the mines—with the help of British capital—taking over the plant and trying out a German method of briquetting. The Germans have doubtless carried the art of briquetting farther than anyone else and it is quite possible that some of their practices can be successfully transplanted.

COAL AGE

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JOHN M. CARMODY, *Editor*

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Time to Guard Against Runaway Market

The bituminous coal market has reached that stage of sensitiveness where it will bear close watching. The steady draft made upon their reserve tonnages by large industrial consumers and the railroads is working toward a condition where duplication of orders by buyers who have not kept careful check upon their stockpiles might readily lead to market inflation and skyrocketing prices. On top of this the longer hauls made necessary by the placement of orders from Midwestern buyers at mines further removed from the point of consumption puts an added strain on the transportation machine.

So far the market seems to have been able to meet the new demands without any great advance in the general level of spot prices. There is no reason why it cannot continue upon that plane if buyers will use discretion and sellers sound judgment in the prices they ask for their product. But unless this is done, there is more than an even chance that a runaway market will be capitalized both by politicians hungry for an issue and by union sympathizers desperate for something which will extricate them from their present position.

Wise physicians do not permit starving men to kill themselves with gorging. The coal industry would do well to cling to moderation.

Not Risk but Rate Makes Companies Withdraw

Nothing in the excellent article by John A. Arnold appearing in this issue suggests that it was the great hazard of coal mining, as has been alleged, that made the liability companies unwilling to continue to write coal-mine workmen's compensation. There are employments more hazardous, but they are not so undesirable as risks.

The difficulties the liability companies have had to face have been decreasing wage scales, short-time operation and strikes. These in coal mining have proved exceptionally troublesome. They would have been met cheerfully, if the companies could get the rate they desired, but their rates were based on past experience and were not changed with the necessary promptitude causing the insurance carriers losses that made coal-mine compensation insurance unprofitable.

Other difficulties there were, but the three mentioned were peculiarly harassing in coal mining. Hazard as hazard is not a real deterrent. The uncertainty as to the sums to be collected, the conditions that deter the injured from returning to work and the fact that compensation does not decrease in proportion to the decrease in the insurance collected were the principal reasons for discontinuing operations.

Fear of an increase in hazard had some part in their action, it is true. Whether this was wholly justified remains to be seen. This fear would not have discouraged the companies had they known that the rate would change with conditions. Realizing, however, that there was always a lag in correcting the schedules made the situation grave. In Pennsylvania, some of the companies are still writing risks, perhaps because in that state the rate has been found less out of line with the immediate conditions.

Statistics When Properly Used Can Aid Stabilization

All science, all industry is characterized by a close approach to exact measurement. It is difficult to imagine progress without units of this nature. To determine whether a boiler is working within its limits of safety, we consult a gage. In business and industry, however, we have ever steered a course, not by a compass based upon an exact knowledge of operations, but upon the basis of each man's opinion and guess. As a result, the past history of business and industry has been one of ups and downs, prosperity or panic, a condition of almost continual uncertainty and turmoil.

Industry has determined that its days of walking in the dark without guideposts and beacons to light the way are over. In the future accuracy must be substituted for guesswork. Business and industry through strict accounting methods have met their problems internally; now, through statistics and fact analysis, business has determined to meet them in the broad field of commercial enterprise. Industry has aimed to be intelligent as to past operations; now it has determined upon a scientific study of policy and future activity.

The basis for this scientific study is the recognition of the value of facts, followed by the establishment of plans or policies based on correct

interpretation. It means, as Professor Secrist has said, "taking note of small differences, seeking for the similarities and basic truths which govern business and industrial relations, and being guided by them. It means foresight, rather than hindsight; planning rather than customary behavior. It means innovation and change, if an impersonal analysis of the facts suggests them. It means fearlessness and respect for facts."

Coal Age recognizes and subscribes to these statements. Operators and distributors must cease to isolate themselves from the larger problems of their industry, the solutions of which are possible only through the fullest co-operation of every member of the industry.

The application of the scientific method to the problems of the coal industry is possible only if facts are made available for study and interpretation. Such facts can be obtained only with the cordial support of the entire industry. The recent tendency of many associations of coal operators to broaden their statistical work and to utilize the facts thus developed for the benefit of the industry indicates coal men have a new appreciation of the value of facts in business.

Says We Are Tardy In Censure. Well—

Some time ago Harry Phythyon published a book entitled "The Rock Dust Remedy" and now a New York paper "The Nation" says that "It is significant that since the appearance of Mr. Phythyon's book neither the Bureau of Mines nor the mining journals that were preaching the coal-dust theory and rock-dust remedy have taken issue with him."

Probably the reason why no one has replied to Mr. Phythyon is because everyone believes that the case of rock dust is so well proved that it is not open to serious question. The danger of coal dust with and without explosive gas has been proved so conclusively by the Bureau of Mines in its experimental mine, in explosion galleries, temporary and permanent, large and small, and in other places, that it would seem that no doubt can continue to exist, Mr. Phythyon to the contrary notwithstanding.

One can always say, rightly or wrongly, with Mr. Phythyon that in any ordinary mine where an explosion occurred, gas was probably present, but in the Bureau of Mines' experimental mine and in experimental galleries there is adequate evidence that there is no gas and that dust can be and is the agent. There the flame if not controlled by rock dust sweeps out of the mine mouth and does not die in the presence of fresh air. Explosions often fail to sweep certain sections of coal mines due to one or more of, at least, three causes: To an increased area for expansion which decreases the pressure, to the presence of adventitious rock dust derived from clay and shale shooting and from locomotive sand ground under the wheels of passing trips and sometimes perhaps, though rarely, to the formation of a barricade of cars and rubbish raised by the action of the explosion.

The reviewer believes *Coal Age* a possible convert to Mr. Phythyon's theories. He quotes the issue of Nov. 11, 1926 to the effect that "The change of attitude shows a general confidence in improved equipment and methods of ventilation, in permissible explosives and in the last line of defense—rock dust." The reviewer adds: "Mr. Phythyon would certainly not relegate rock dusting to a less important position than the last line of defense." It would seem to *Coal Age* that he does. He would make it no defense whatsoever.

And moreover, what else can a curative measure be but a last line of defense? Rock dust used in the roadways is not a preventive measure. It does not remove the explosive gas like ventilation or prevent gas ignition as do permissible devices. Instead it permits the explosion to occur and then smothers it when the opportunity affords. What is that but a last line of defense? To be the last in defense is not to be negligible or even relatively unimportant as American soldiers amply proved during a recent conflict. A last defense may not be the most effective of any, but it may be the most certain and dependable when the evil it corrects has had time to develop.

Still no one can deny, and the Bureau of Mines will not deny it, that good ventilation though not a cure-all for explosions is one of the best provisions against them. Both rock dust and ventilation are needed.

Country Uses Less Lumber So Will Mine More Coal

Despite the activity in building in 1926 the production of lumber fell 3.7 per cent and lath, 2.5 per cent, according to the Department of Commerce, all of which shows that the fireproofing of buildings is making steady progress, partly because of the declining supplies and increasing costs of lumber and partly because of the greater appreciation of the value of permanent construction.

All this bids fair to increase the demand for coal. Almost every permanent building material is, or has been, made by fire. No durable artificial material is made without that agency. Consequently the drift from lumber is one that will aid in consumption of coal. More tile, brick, cement, steel, iron, copper, lead, zinc, cement and lime will be used and the consumption of coal will increase. Accordingly the demand for coal in the future as in the past is bound to increase more rapidly than the population.

The BOSSES *Talk it Over*

Does Safety Pay?

THE WHOLE official force at the mine was visibly "up in the air." Another fatal accident had occurred that morning, the second for the week. The latest victim, a timberman, had been killed by a fall of rock while he and his buddy were working on a stretch of bad roof near the North Main intersection. Two days before a trip-rider lost his life coupling up in a tight place. The Old Gent telephoned from the city that he would be out at the mine in the afternoon and expected to hold a safety meeting of bosses at four o'clock. The boys had gathered in the super's office waiting for the arrival of the big boss. All were grave and looked silently in the direction of Jim, the super, as if expecting him to speak. But Jim sat for a long time in deep meditation, his eyes fixed on the floor, puffing steadily on his pipe. Finally he said:

"Mac, how long has it been since we had our last safety meeting? That's right—seven months. It seems to take a couple of fatals to bring us to our senses. We've been going in the wrong direction, fellows! We act after instead of before. Something has got to be done. The Old Man will be here pretty soon but before he comes we ought to sort of decide on something. What have you got to say, Mac?"

"Jim, I don't want to sidestep responsibility or lay blame on anybody else's shoulders, but maybe the Old Man and the rest of them in the city office have the wrong slant on safety. They want it, of course, but they forget that it costs money. It takes more than talk to make mine operation safe. If the company won't spend to keep up safety, how in Sam Hill can it expect the men to practice it?"

Jim nodded approval. "That's right, Mac!" he said. "Going a little bit further along your line of thought, money invested for increasing efficiency of plant operation helps safety. It works the other way, too! Money spent on safety peps up plant efficiency. You have to approach safety from both sides. And the best part of it is the money spent on this work really earns good dividends."

The resident engineer, scraped his chair forward and, at a sign from Jim, cut in: "I wonder how straight the city office is on that last statement of yours, Jim! At the last institute meeting the Old Man made a speech. He repeated what he said he heard at an association conference, something about fixing it so every company would be more evenly burdened with the cost of safety and passing that cost on to the consumer. Looks like a whole bunch of the big fellows have the wrong slant on safety."

"Now you're talking," piped up Shorty, the electrician. "Safety must work from the top down. It hurts when we work our fool heads off to protect our men and get no particular encouragement from the main office. I don't believe"—

But at this point the door opened and the Old Man entered. This was a sign that the fireworks would soon start.

As a rule, does safety improve efficiency?

What part should each division of management, from top to bottom, play in carrying out a safety program? What should be the attitude of each?

Should safety work be budgeted?
Should it be guided by a committee or by a safety engineer?

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

What Other Macs and Shortys Think

Development Can Be Balanced

THE best regulated mines and mining operations, those that can produce coal at a low cost and continue to operate when there is a depression in the market, are mines in which the groundwork was well laid before the production of coal began.

First, the mine territory should be well tested and an accurate map made showing the property lines of the surface owned, also the acreage of mining rights. The test wells should also be accurately shown with the elevations of the floor of the coal seam. It then becomes possible to prepare a projected drawing or map which should be followed as closely as local conditions will permit for development of the principal entries of the mine.

The plan of development to be adopted will depend upon the size and extent of the mining rights and the proposed daily tonnage of coal to be produced; the depth of the coal below the surface and the character of the slate or rock over it; and the character of the fire clay or rock below the coal.

The question of safety should not be forgotten in the projected plan of development. Should the territory to be mined be located in a gaseous section it will require sufficient air courses in the mine to insure a large volume of air distributed to each heading at a low water gage.

Before producing the desired daily tonnage of coal, the main entries and sufficient panel entries should be developed to accommodate the number of workmen necessary to get this tonnage. However, there is only a small percentage of mining operations that follow the above plan probably either because of eagerness to secure immediate returns from the capital invested, or the lack of sufficient capital to finance the development of the mine to the proper stage.

It probably does not pay to spread development for the sake of immediate cheap coal, although there are exceptions to this rule. When the development for future operation is stopped it becomes necessary to follow this plan as otherwise a good contract for the sale of the coal might be lost.

There are periods in the life of all mines when the price for which the coal is sold does not give the executives of the company much to go on. At such times it would be better to produce cheap coal rather than to mine at a loss. Some headings might be developed at the same time for future operation, to compensate the error in neglecting proper development.

If the general manager, in the case depicted in *Coal Age* for August was in error, in order to save misunderstandings later, it would be well to have the chief engineer prepare data necessary for the use of the general manager so he would be acquainted with the facts and change his order if agreeable. On the other hand the general manager may have had sufficient cost data at hand unknown to the superintendent, to justify his apparent mistake and the plan finally decided upon would then be agreeable to both him and the superintendent.

A balance between entries of working areas and those being driven for future use can be maintained, providing the coal bed that is being mined is not interrupted by faults or horsebacks. However, with a large tonnage production this is difficult to maintain while the mine is young, unless a system of mining is used that develops sufficient panel entries in advance before the desired daily tonnage is reached.

F. F. GREEN

Christopher, Ill.

Topic for October

Loading of Dirty Coal —How to Prevent it

Should the section bosses watch out for dirty coal?

What are the effects of a bonus or a penalty system?

Is a face-coal inspector necessary?

Up to the Big Boss

AS A COAL mine is a business proposition, and the owners expect a fair return for the money they have invested in the properties, the Big Boss must know exactly what the mines under his charge can do, before he can risk signing a contract to deliver a large tonnage. Therefore, it is up to Jim and Mac to work out their own salvation, at their own particular mine, get the coal, and show the Big Boss a fair profit from their plant.

If the physical characteristics of a mine will permit, it is well to maintain enough reserve entries to take care of emergencies of this nature. In mines where it is necessary to brush the roof for headroom and pay yardage or maintain expensive timbering, that must be periodically renewed because of decay and breakage, it is possible to get enough money tied up so that a legal interest charge on it for a considerable length of time, would absorb the profits that may be made on this block of coal when mined.

It is a good plan to develop the main entries, so that room entries can be turned when needed and developed rapidly by double shift work or mechanical loaders. An emergency of the nature facing Jim and Mac could then be met by driving twin entries, working the rooms on the return side as the entries advance, and those on the intake side by the full-retreat method.

The West Main entries may have been stopped to take care of a situation of this nature. The Big Boss may have known that the market price of coal was going to drop in the near future and that it would be necessary to produce a large tonnage, at a small profit per ton. The super should recognize the authority of the Big Boss, and go ahead as directed, but this should not stop him from discussing the question with him.

Yes, a balance between entries of working areas and reserve entries can be maintained, provided the cost of maintaining these reserve entries does not offset the other advantages.

WM. J. WALKER

Sagamore, Armstrong County, Pa.

Development Ahead Is Necessary

DEVELOPMENT of a mine should be given careful consideration if the cost of the coal is to be kept at a minimum throughout the life of the mine. A mine properly developed will pay fair profits to the end while one that is not will operate at small profit or even at a loss at times, thus making the long time investment probably a failure. A survey of coal mines will show some producing good results, yet probably not far away may be a mine that is operating at a loss, or at best only small profit. Usually this can be traced to improper development. It is a well-known fact that all mining properties have their good and bad periods but if a mine is properly developed it has more good profits than poor. In order to be properly developed a mine should be in such shape that it can produce the largest or the required tonnage from the smallest area with the least expense for operating and maintenance. The older a mine gets, the higher these expenses run, but if it is properly developed so that the required tonnage is taken from a small area, these expenses are a minimum.

In speaking of producing the required tonnage from a small area, I mean the major part of that tonnage. The main entries and cross or butt entries should be driven far enough ahead at all times to insure the tonnage in case of some accidental failure of the part being worked. In such a case, however, I would only recommend using this development as a reserve. I don't believe that it is necessary to mine where the coal is the cheapest when the price realized is low. But if the mine has been worked as Mac says, dug all over, it becomes necessary at times to mine where the coal is the cheapest.

The operations that are well developed are about the only ones which can work through the dull periods. It is time that development and operation should be given first consideration by mining companies if their investment is to prove a success. Idleness of a mining property means a great increased cost, that eventually will be charged to the coal. I am a firm believer in concentrated mining, and know that it will produce cheaper coal from the same investment than any other method. If a time comes when more coal is wanted.

it can be gotten more cheaply, and probably quickly enough, by using the double or triple shift method until development is provided for the increase in tonnage. I would rather look to that method than to "hogging" as it is sometimes called. Good results can be secured for a short time by digging all over the patch, but a poor period is sure to come from that method. The time has come when if a mining company is to operate successfully and reap fair profits, the costs of operation must be considered from every angle.

H. T. WALTON

Wolfpit, Ky.

Let the Super Have the Last Word

IT is not only possible to keep the development of a mine well up to the capacity of the equipment installed, but it is the only feasible thing to do. Development should be planned and the most economical projection should be made so as to afford the shortest hauls and the greatest concentration of working, whether the mine is operated mechanically or by hand loading.

Jim was foreman in a mine in the Upper Freeport seam. Everyone marvelled at the low cost of his coal. He paid the highest yardage in his vicinity for that bed and yet his coal costs were lower than at other mines. He worked his rooms advance- and-retreat, i.e., bringing back the room pillar immediately upon the completion of the room. Still he always had enough development so that at any time he could produce a tonnage up to the capacity of his equipment.

Pete was always considered a very good foreman, so good in fact that a neighboring company weaned him away by giving him a substantial raise in salary. Just before he left he was producing 200 tons more per day than the mine has ever produced, before or since. Yet his successor, who inherited a highly developed mine, saw his tonnage drop. He stopped development work to impress his employees with his tonnage costs. The result was that the extra development was eaten up.

When coal commanded a high price Pete was asked to produce a tonnage equal to the equipment capacity of the mine. But he was caught without development and was unable to give the tonnage demanded. The company lost a chance to reap profits because of short-sightedness on the part of the management.

I would recommend that more time be spent on development work because several conditions are to be considered. (1) Better haulage conditions may be secured by the correct analysis of grades, curves and concentration; (2) ventilation can be improved; (3) a greater extraction may be possible and the development yardage may be reduced; (4) more coal may be taken out per yard of entry developed; (5) territory may be developed to such a degree that the equipment capacity can be secured either on short notice or continuously.

The projections should be in the hands of the mining engineer, who should know his conditions and who should take into consideration the above facts. The final decision should be in the hands of the superintendent.

SAMUEL LAW

Adena, Ohio. *Engineer.*

Organization Means Much

MINE management functions best only when the mine superintendent gives his orders covering underground work to the mine boss who in turn relays them to his assistants. The mine boss is entitled to absolute authority underground. If every Tom, Dick and Harry issues conflicting orders, the men will not know whose instructions to obey and the pit boss will soon come to be regarded as a "dud."

The superintendent should meet daily with the pit boss and his assistants to discuss their problems. Together, they should decide plans and the best ways of carrying them out. Harmony is thus assured and these men are encouraged to put forth a greater effort to produce more coal at less cost, with conservation of both effort and property. The superintendent has a big job and does not have the time to personally run any one particular department.

J.A.R.

System is Lacking

HAVING had twenty-six years' experience in coal mines, holding a number of positions among them electrician and mine foreman, I would say that the trouble between Mac and Shorty as set forth in *Coal Age* for July arises from a lack of system. For this the superintendent is responsible.

Shorty does the repair work and the inside line work. This should not be if the mine is large. If I were the superintendent I would instruct Mac and Shorty that Mac was not over Shorty but that they should co-operate in matters pertaining to production. I would further instruct Mac that the inside line work and bonding was to be done by a man under him.

I would then instruct both of them that the motor repair work would be done at the shop, also the machines when it was reasonable to take them there. I would instruct Shorty to inspect every motor each evening and do any necessary repair work on them before the beginning of the next shift. If it was necessary for him to leave the shop to do any work he should leave word where he could be found so as to enable the foreman to get word to him in the event of a breakdown.

I would then instruct the outside foreman that he had no authority over Shorty but to notify him if he had trouble with the machinery. As superintendent I would hire my chief electrician and he could select his own helpers or assistants.

C. E. LIVELY.

Vivian, W. Va.

R.M.C.M.I. Has Interesting Program

EACH year the Rocky Mountain Coal Mining Institute holds an interesting meeting in the West, at which problems of both general and local interest are discussed. This season this meeting was held at Trinidad, Colo., on Aug. 29, 30 and 31.

The program included papers on the following subjects: "Modern Mine Cars," by W. C. Holman, chief engineer of the Phelps Dodge Corp., Dawson, N. M.; "The Rheolaveur Washery at Cokedale," by Chas. Spahr, superintendent of washeries, American Smelting & Refining Co., Cokedale, Colo.; "Safety Methods at No. 5 Mine of the Gallup American Coal Co.," by L. M. Kuhns, safety engineer of that firm; "Coal Geology," by J. Q. McNatt, division engineer, Colorado Fuel & Iron Co., Canon City, Colo.; and "Underground Substations," by C. H. Matthews, engineer of the Mining Section, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Inspection trips to the Cokedale washery and to the Morley, Swastika and Dawson mines, a banquet and dance and an evening at the vaudeville show were likewise on the program.

IN HIS paper on mine cars Mr. Holman drew attention to the fact that "transportation from the working face to the tipple offers a fertile field for engineering study." During the last few years improvements in the design and construction of cars have been confined largely to changes in the size and shape of the body rather than to improvements in mechanical features. "Pit car capacities are being continually increased. The use of smaller wheels, longer wheel base, wider, higher and longer bodies all tend to reach the highest ratio between the dead weight of the car and its gross weight."

The author pointed out that the many types of devices now employed in mechanical loading must be given consideration when designing a present-day car. He stated that "the consensus of opinion seems to be that the composite type of car is the best both from a practical and economical standpoint. The cost of the composite car is from 10 to 15 per cent higher than that of a wooden car of the same general dimensions and the weights of the two are about the same. Capacities are from 15 to 20 per cent in favor of the composite car."

Steel cars, unless entirely demolished by wrecks or falls can be repaired at the mine shop, whereas wooden car bodies under similar conditions would be an utter and entire loss. It is almost impossible to es-

tablish a definite comparison between the lives of pit cars of various types. It is usually conceded that the life of steel cars exceeds that of wooden cars. Copper bearing steel used in the side and end plates as well as paint protection will asure longer service. The longer life, greater capacity and lesser upkeep of the steel car more than offset its greater cost.

CARS of high capacity have many advantages. These include fewer cars per trip, fewer transportation delays, a larger tonnage per man and at the tipple, fewer dumping operations and lower running and repair cost.

Experience has shown that the cast steel wheel has an advantage over the cast iron wheel especially if it is equipped with anti-friction bearings. A set of cast steel wheels weighs about 175 lb. less than a set of cast iron wheels of the same size. Their cost is somewhat higher and if not properly designed the steel wheel has a tendency to flatten between spokes under severe loading. If properly proportioned, however, this tendency is avoided. Wheels that have been in use for two years at high speeds and over steep grades show no wear.

DURING recent years anti-friction bearings have been largely adopted on mine cars. Several types have been tried and all have given satisfaction. It is conservatively estimated that the cars on which they are used travel from 3,000 to 4,000 miles per year. The bearings are greased every four months but it is believed that they would run satisfactorily for a year without relubrication. In two years of severe service no car has been out of running because of bearing trouble.

In his paper on safety methods followed by the Gallup American Coal Co., Mr. Kuhns stated that "although explosive gas has never been detected in the Gallup district, the mine is operated with closed lights, no matches or smoking materials are permitted in the mine and every precaution that is generally used in gaseous mines is taken in order that the risk from gas, which is inherent in all coal mines, may be reduced to a minimum."

Tests have shown that coal from this district when reduced to dust is highly inflammable. Sprinkling and air humidification were at first relied upon to allay this hazard. This was not only expensive and difficult to maintain but did not yield the desired degree of safety. Accordingly a rock dusting machine was procured and the entire mine rock dusted.

Gypsum, quarried at Laguna, N. M. is the rock employed in preparing this dust. Yearly the company sends a man to the quarry who with the aid of Indian laborers quarries and loads enough of this material to last for a year. This rock is first put through a jaw crusher and then a hammer pulverizer. This so reduces this material that 90 per cent of it will pass through a 100-mesh screen and 60 per cent through a 200-mesh screen. The dust thus prepared is 100 per cent incombustible and contains less than 6 per cent of silica or quartz.

AIR courses not containing tracks are dusted by blowing this pulverized gypsum through a nozzle into the air current, at intervals of 500 ft. No specific amount is applied per foot of entry, but redusting is performed whenever volumetric analysis shows less than 70 per cent of incombustible matter in the total dust of the passage, or when a coating of coal dust forms over the gypsum. Where electric current is available dust samples are collected by means of a vacuum sweeper; in other places by brushing.

V-trough rock-dust barriers are installed at the mouths of all cross entries and air courses and at strategic points elsewhere about the mine. These are regularly inspected to make sure that they will function properly and promptly should the need therefor ever arise.

ALL working places and enterable gobs are inspected nightly. All blasting is done by shot firers when no one else is in the mine. Only these shot firers are allowed to have detonators or firing machines. Non-conducting fibre cases are used by the men for carrying powder into the mines. Only enough explosive for the day's requirements is allowed any one man.

The mine is divided into five districts each in charge of a foreman who must visit each working place at least twice a day, and who is held personally responsible for the condition of his district. All timbering is systematic with a maximum of 5 ft. between timbers or between timber and rib. This distance may be and frequently is decreased if in the judgment of the foreman this is necessary.

Safety committees, organized from among both the men and the officials, have proved themselves highly valuable in the prevention of accidents. Fire protection is afforded by foaming extinguishers at each parting and carbon tetrachloride extinguishers on each locomotive and at each hoist. No one is allowed to carry tools on any cage carrying men. Dull tools are checked in at night, sent to the shop and sharpened, returned to the shaft bottom and issued to the proper men in the morning.

It is the desire and intention of the company that all employees shall eventually be trained in first aid. At present about one half of the men have completed training and have been issued certificates. First aid outfits are kept on each parting underground. A mine safety station is also maintained on the surface fitted with oxygen helmets, self rescuers and other apparatus necessary for mine recovery and fire fighting. All workmen are checked into and out of the mine in the usual manner and any visitors, after signing a card releasing the company from liability in case of accident, are checked in a similar manner. All miners and others whose work involves an eye hazard must wear goggles.

AN EFFORT is being made to induce men to wear safe clothing and several articles of wearing apparel of this nature have been put on sale at the company store. As yet it is too early to judge of the results of this effort.

Trips are handled within the mine by a dispatcher and their movements controlled by means of an electric block system. Tail lights and drags are also used, as well as special rail clamps and cast steel frogs.

Careful records of accidents are kept and every three months a special cash bonus is given the foreman having the best record. This is figured on the basis of the number of full shifts worked per day lost. Every foreman is given a bonus if no time is lost in his department or section because of accident for a three-month period.

ONE section of the mine is used as a place for training new men. They here work under the instruction of a special foreman until they become competent to take care of themselves.

Although accidents are being reduced the results thus far obtained are not deemed satisfactory. It is believed that the entire personnel of the mine is now earnestly endeavoring to decrease accidents and a marked improvement is hoped for during the current year.

WORD *from the* FIELD

Suspends Lake Rate Cut On Southern Roads

Tariffs filed by the Southern carriers to meet the reductions in rates on lake cargo coal from the Pittsburgh, Cambridge and Ohio No. 8 fields were suspended by the Interstate Commerce Commission on July 16. This action, which holds up the 20c. cut from the South until March 28, 1928, pending a hearing on the rates, was taken a few days after Pittsburgh interests had filed formal protest against the Southern reductions.

In their protest, the Pittsburgh operators charged that the tariffs filed by the Southern carriers to become effective Aug. 28 would upset the adjustment contemplated in the Commission's second decision in *Lake Cargo Coal Rates 1925* by restoring the same differential relationship which the Commission itself destroyed by directing the reduction of 20c. in the Northern rates.

Southern operators and carriers vigorously opposed the petition for suspension. They were supported in their fight by the public service commissions of a number of Northwestern states.

Orders Illinois-Kentucky Rates Revised

The Interstate Commerce Commission in a decision in *Illinois-Indiana Coal Cases,* 128 I.C.C. 265, made public Aug. 2, ordered an increase of 10c. per net ton in the differential which western Kentucky coal must pay over southern Illinois to Chicago and destinations in the Northwest. The present differential is 25c. The new rates under the terms of the Commission's order, go into effect Oct. 20.

In addition to passing upon this differential adjustment the Commission also directed the railroads to reduce the interstate rates from the Danville, Illinois district to Chicago 22c. per ton in order to bring these rates in line with the charges in effect on intrastate traffic. A reduction of 5c. in the rates to Chicago from the Brazil-Clinton and Sullivan-Linton groups in Indiana also was ordered.

The complainants in this case, operating interests of Illinois and Indiana also asked for increased rates from the Crescent fields, but the Commission refused to grant this request.

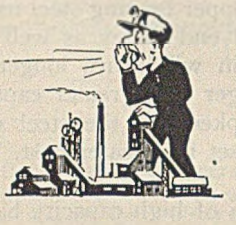
Dr. Frederich Bergius

Standard Oil Co. Buys Bergius Rights

Rights to the use in this country of the Bergius process for making synthetic gasoline from the liquification of coal have been purchased by the Standard Oil Co. of New Jersey. The agreement was reached by Walter C. Teagle, president of the Standard company, and officials of the I. C. Ferbenindustrie Atkiengesellschaft—the German Dye Trust—by which the two companies will mutually share in the utilization of the Bergius patents. A corporation to be known as the Deutsche Gasoline Co. will be formed to market the synthetic fuel. "I.G." will hold 50 per cent of the shares and the remainder will be divided equally between the Standard Oil Co. of New Jersey and the selling agency, it is reported.

The Bergius process directly liquifies coal by treating it with hydrogen in the presence of a catalyst. Finely-pulverized bituminous coal or lignite is mixed with oil or tar (obtainable from the process once the reaction has started) to form a thick paste. This mixture is then placed in a cylinder where it is subjected to the action of hydrogen gas at high temperatures and pressures. The length of time required to completely liquify the coal varies with the temperature and pressure and with the nature of the coal being treated.

When reaction is complete the mixture is withdrawn from the reactor, cooled and the gases separated from the solid and liquid products. The gasoline and other substances are then fractionally distilled. German scientists estimate that the Bergius process will cut the cost of motor fuel 50 per cent.



Coming Meetings

Tenth Annual Conference on Human Relations in Industry, under the auspices of the industrial department of the Young Men's Christian Association, at Silver Bay, Lake George, N. Y., Sept., 1-4. Executive secretary, Fred H. Rindge, Jr., 347 Madison Ave., New York City.

Smokeless Coal Operators' Association of West Virginia. Annual business meeting at the Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 14-17. Secretary, E. J. McVann, 907 15th St., N., Washington, D. C.

American Refractories Institute. Fall meeting at Clifton Hotel, Niagara Falls, Canada, Sept. 15. Secretary, Miss D. A. Texter, Oliver Building, Pittsburgh, Pa.

Second Annual State Safety Meet of West Virginia at University Stadium, Morgantown, W. Va., Sept. 17. Secretary, D. H. Pape, Monongahela Valley Bank Building, Morgantown, W. Va.

American Welding Society. Fall meeting Sept. 1923, at Book-Cadillac Hotel, Detroit, Mich. Secretary, M. M. Kelly, 33 W. 39th St., New York City.

Fourteenth Annual Tennessee Miners' First Aid Contest will be held Sept. 24 at the East Tennessee Division Fair Grounds, Chilhowee Park, Knoxville, Tenn.

National Safety Council. Sixteenth Annual Congress at Chicago, Sept. 26-30. Managing director, W. H. Cameron, 108 East Ohio St., Chicago.

National Fuels Meeting, under the auspices of the Fuels Division of the American Society of Mechanical Engineers, will be held at St. Louis, Mo., Oct. 10-13. Chairman Publicity Committee, Edwin C. Moody, 1932 No. Broadway, St. Louis, Mo.

Coal Age News

Readers desiring to keep in touch with the coal industry week by week between the appearances of *Coal Age,* will find up-to-the-minute developments covered in *Coal Age News.* Complete reports of progress in all phases of the industry, including the latest news and market activities, received by mail, telegraph and cable, appear each week. *Coal Age News* is published every Thursday.

Stocks Off 13,000,000 Tons First Quarter But Beat All Past July Records

Bituminous coal reserves in the hands of the railroads, industrial consumers and retail dealers approximated 62,000,000 net tons on July 1, according to the quarterly stock canvass of the U. S. Bureau of Mines and the Bureau of the Census. Compared with the figures for April 1, this was a decline of 13,000,000 tons. In terms of days' supply, however, stocks on July 1 were estimated to be one day greater than on April 1.

The July figure also broke all previous records for totals at the beginning of the second quarter of the coal year. On July 1, 1926, the total was 30,000,000 tons. July 1, 1923 it was 46,000,000 tons. The estimates, based upon signed reports from representative consumers and coal merchants throughout the country, are subject to a possible variation of 3 to 7 per cent.

Reports were received from all by-product coke plants, all steel works, all large railroads, from 585 electric utility plants, 254 coal gas works, 2,152 general industrial plants, and 943 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 July 1, the tonnage actually reported in this way amounted to 45,859,831 tons or 74 per cent of the estimated total.

The decline of stocks from April 1 to July 1 was most marked in the Middle West in the area normally dependent on the mines of Indiana, Illinois, Iowa, Missouri and Kansas, which have been closed to a great extent by the suspension. Industrial consumers in Illinois (other than steel and coke works) reported 38 per cent less coal on hand July 1 than on April 1. In Indiana, the decline was 44 per cent; in Missouri, Kansas, Iowa and Nebraska it ranged from 35 to over 50 per cent. On the other hand there were areas where industrial stocks increased, particularly in the South and the Lake Dock territory.

In spite of the decline, industrial consumers in Illinois had 46 days' supply on hand July 1; those in Indiana had 45 days; in Iowa 32 days; in Missouri 63 days; in Southern Michigan 78 days. For New England, the average on July 1 was 93 days.

The public utilities continue to be heavily stocked with coal. Reports of the American Railway Association indicate that there was a decrease of about 5,000,000 tons in stocks of railroad fuel from April 1 to July 1. Stocks as of July 1 were 17,780,000 tons. This compares with stocks for recent months as follows: Jan. 1, 13,499,000 tons; April 1, 22,806,000 tons; May 1, 20,800,000 tons. On July 15, according to figures furnished *Coal Age News* by the American Railway Association, the total had declined to 16,521,421 tons.

The survey makes no statistical estimate of the amount of coal in transit on July 1, but calls attention to the fact that the unbilled tonnage at mines and in railroad classification yards has dropped from 1,809,000 tons on April 1 to 1,081,000 tons. Ground storage at the mines and intermediate points declined from 431,000 to 179,000 tons.

In addition to the transit, unbilled and ground storage coal there also was a total of 6,840,554 tons of bituminous on the Lake Michigan and Lake Superior docks, as against 5,450,000 tons on July 1, 1926.

Retail coal yards were well stocked with anthracite on July 1. At the rate their customers were calling for hard coal in May and June the stocks of the dealers reporting were sufficient to last 50 days. In New England the supply on hand was equivalent to 59 days' deliveries.

Stocks of domestic coke at by-product plants have increased since April 1, as in usual at this season of the year. A group of 21 plants supplying gas for city use and producing coke suitable for household fuel had 584,000 tons of unsold coke on hand July 1, as against 470,000 tons on April 1, and 334,000 tons on July 1 a year ago.

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

	Jan. 1 1919	Aug. 1 1921	Sept. 1 1922	July 1 1923	June 1 1924	June 1 1925	July 1 1926	Oct. 1 1926	Jan. 1 1927	Apr. 1 1927	July 1 1927*a*
By-product coke plants	32	31	11	26	34	20	23	26	34	38	40
Steel plants	42	46	12	35	56	27	26	37	50	73	59
Other industrials	65	56	32	46	53	32	35	37	41	62	64
Coal-gas plants	81	79	34	89	88	68	72	70	69	77	87
Electric utilities	49	44	26	48	63	48	52	45	47	70	76
Coal dealers, (bituminous)	39	42	11	39	40	31	43	32	23	24	48
Railroads	32	(*b*)	13	28	50	32	27	33	33	59	54
Total bituminous	42	39	17	37	49	32	34	35	37	53	54

(*a*) Calculated at average rate of consumption during May and June, 1927. (*b*) No data.

AVERAGE WEEKLY REPORTS 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—Apr. 1 to July 31	6,260,000	*b* 637,000	6,897,000
1922—Mar. 1 to Aug. 31	7,480,000	155,000	7,635,000
1923—June 1 to June 30	8,870,000	*b* 632,000	9,502,000
1924—June 1 to Aug. 31	7,320,000	380,000	7,700,000
1925—Mar. 1 to May 31	8,300,000	269,000	8,569,000
1926—May 1 to June 30	8,030,000	*b* 470,000	8,500,000
1926—Aug. 1 to Sept. 30	9,440,000	*b* 936,000	10,376,000
1927—Jan. 1 to Mar. 31*c*	11,430,000	387,000	11,817,000
1927—Apr. 1 to June 30*c*	8,920,000	385,000	9,305,000

(*a*) Production plus imports and minus exports plus or minus changes in stocks. Allowance is made for stocks at the mines; coal in transit, including unbilled loads, coal in cars enroute to destination, and coal on the Lake docks; and stocks of commercial consumers. (*b*) Unusual demand for export overseas.
(*c*) Subject to revision.

RATE OF CONSUMPTION IN MAY AND JUNE COMPARED WITH THAT IN FEBRUARY AND MARCH AT REPRESENTATIVE INDUSTRIAL PLANTS AND RETAIL COAL YARDS

(Only firms reporting both periods included)

Region	Industrial Plants (Other Than Steel and Coke) Number of Plants	Industrial Plants (Other Than Steel and Coke) Per Cent of Change	Retail Dealers' Deliveries of Bituminous Coal Number of Dealers	Retail Dealers' Deliveries of Bituminous Coal Per Cent of Change
New England	437	—27.1	130	—43.1
New York, New Jersey and Pennsylvania	383	—13.7	75	—44.3
Maryland, Delaware, D. C., and West Virginia	87	— 7.5	29	—53.2
Ohio, Indiana and Illinois	348	—11.3	183	—22.2
Southern Michigan	90	—13.5	50	—45.6
Lake Dock States *a*	191	— 5.9	118	—63.0
South East	269	—13.5	118	—18.3
Trans-Mississippi (except Lake Dock States)	239	—11.0	102	—71.0
Total	2,044	—13.1	805	—40.0

(*a*) Included Northern Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa and Nebraska.

Mining Congress Defers Planning for 1927

The American Mining Congress has deferred plans for its 1928 convention of operating officials until the manufacturers' division of the organization meets in December. At that time, it is announced, decision will be reached as to the time, place and program of next year's meeting. The division will have under consideration at its December meeting suggestions to expand the program to take in a large number of subjects other than the major themes of mechanization, underground loading and preparation.

Although the last four conventions have been held at Cincinnati, Ohio, several other cities have been proposed for the 1928 convention. Among the cities suggested are Chicago, Pittsburgh, Cleveland, Atlantic City, Washington, Louisville and Columbus.

In some quarters the suggestion has been made that there be fewer papers presented at the next convention and that more time be given to a discussion of the papers included in the program. One proposal is that each state represented call upon its delegates to discuss specific papers. A suggestion that evening sessions of the convention be held also will be considered.

Empire Mining and Metallurgical Congress Opens Second Triennial Sessions

The Second Triennial British Empire Mining and Metallurgical Congress began its "grand tour" of the Dominion of Canada Aug. 22 with a two-day session at Montreal, P. Q. Development and expansion of the mineral resources of the British Empire for the purpose of attaining as nearly as possible economic independence in the matter of mineral and metal supplies sounded the keynote of the meeting.

Sir Thomas Horne, G.E.B., K.C. M.P. who is honorary president of the Congress and Secretary of the Board of Trade in the Baldwin government, in addressing the meeting made it clear that in his opinion no other group of workers had it in their power to do so much to advance these causes as the mining and metallurgical engineers, represented in the audience of 400 gathered from all parts of the globe. He stressed also the point that aside from the advantages accruing to the Empire, every discovery and advance in the arts of exploiting and beneficiating ores was a contribution to the progress of mankind.

Nothing just like this convention probably ever has happened before in the mining world. Other gatherings may have been as large, but they did not compare with this in the large number of countries represented, the long distances traveled to get to Montreal. Besides visiting members from the various constituent organizations, ten in number, official delegates from many countries are present. The registration list includes names from Germany, Belgium, France, Russia, Korea, Tanganyika, Federated Malay States, South Africa, Rhodesia, India, Australia, Burma, the Gold Coast and the United States.

Scott Turner, director, U. S. Bureau of Mines, is the official representative of the United States.

J. S. Haldane, professor and director of the Mining Research Laboratory, Birmingham University, and president of the Institution of Mining Engineers, and R. V. Wheeler, professor of fuel technology. Sheffield University, and Director of the Safety in Mines Research Board of Great Britain, delivered a paper entitled "Progress in Researches on Health and Safety in Coal Mining—1924-27" at the Montreal sessions. Among other interesting observations the paper contained were the following:

"The influence of refrigerating plants underground, of ice distributed locally and of purely local arrangements for increasing the velocity of air currents are, of course, being studied. The further these investigations have been carried, however, the more clearly does it seem to emerge that, as a general rule, it is extremely difficult to control temperature and moisture by any other means than abundant ventilation directed on the parts of a mine which are being worked."

As regards rock-dusting, the authors say that though there was a fear that the use of an excess of shale dust (which may contain about 35 per cent of free silica) might prove harmful, this fear seems to have been groundless. The paper says that ankylostomiasis or miners' anaemia has not invaded British coal mines but that spirochaetal jaundice from underground infection has been found in one or two shallow Scottish collieries. Septic cellulitis, or bursitis, known to coal miners as "beat knee," "beat hand" and "beat elbow," has also been found. Nystagmus, a disease of the eyes which entails much suffering and puts a heavy economic burden on the coal-mining industry, is

Scott Turner

due, say the authors, to defective illumination and not to carbon-monoxide poisoning or to the disturbance of the nervous system by some toxin.

After discussing the "lag on ignition" of methane that makes it difficult and with proper conditions impossible to ignite that gas through the gauze of a safety lamp and renders it safe from explosion even when exposed to flame provided the flame is of sufficiently short duration, the paper says that flame is not essential for the ignition of a flammable gaseous mixture.

"A firedamp-air mixture can be ignited by pressure alone, and this fact may have an important bearing on the question of the ignition of pockets of gas in crevices by the pressure produced when a shot is fired, even where it is possible to suppress the flame of the explosive entirely. A matter which does not appear to have been investigated hitherto is the extent to which flame can be projected beyond the region in which a flammable mixture originally existed. Experiments have shown that the projection of the flame of a firedamp explosion into air is between five and six times the length of the original column of explosive mixture."

The paper also states that the flame of a detonator never comes in contact with the external atmosphere, being always surrounded by a "blanket" of incombustible gases (the products of detonation), a fact which explains the inability of the flame of a detonator to ignite mixtures of firedamp and air.

After two days at Montreal the Congress moved on to Ottawa and then to Toronto. Last Saturday (Aug. 27) was spent at Niagara Falls, Sunday at Sudbury and the rest of the week in visiting various metal mines and mills in Ontario, with a split in the party on Thursday, when one group went East.

Coal greets the party continuing westward on Sept. 8 with their arrival at Bienfait. The Bienfait and Taylor coal tipples and mines of the Manitoba & Saskatchewan Coal Co. and of the Western Dominion Collieries respectively will be visited. Two days, Sept. 6 and 7, will be spent at Banff, where the coal-cleaning plants at Lethbridge and Coleman are within reasonable distance. Friday should see the party at Fernie, where the mines, tipples and coke ovens of the Crows Nest Pass Coal Co. will be viewed.

Sterco is reached on Sept. 19. Here are the coal strippings of the Sterling Collieries Co. and the Coal Valley Mining Co. Cadomin follows in the same afternoon with the mines and tipple of the Cadomin Coal Co. From Sept. 20 till Sept. 26 is to be spent on the return to Quebec, through Edmonton, Winnipeg, Fort William, Taschereau and Noranda (Rouyn) with some entertainment by the way and visits to the University of Saskatoon and the Noranda Mines, Ltd. On Sept. 27 the trippers leave for Sherbrooke, where they view the asbestos mines, returning to Quebec.

The second party reaches Minto, N. B., and the collieries of the Minto Coal Co. on Sept. 7. Sept. 8 is spent at Moncton. Friday and Saturday, Sept. 9 and 10, are to be devoted to Sydney with the works of the British Empire Steel Corporation and its submarine coal mines. On Sept. 12 the train arrives at St. Johns, N. F., and the submarine iron mines of the British Empire Steel Corporation. On Wednesday noon, Sept. 14, the party doubles straight back to Quebec, arriving Sept. 17.

Erie Railroad Buys More Oil-Electric Engines

The Erie R. R. has ordered two 100-ton oil-electric locomotives for yard switching service at Akron, Ohio. A 60-ton engine of similar type was purchased over a year ago for use in New York City. The locomotives are the joint product of the General Electric Co., the American Locomotive Co. and the Ingersoll-Rand Co.

Central Pennsylvania Joins Open-Shop Ranks While Union Gains in Indiana

A definite start on an open-ship basis by central Pennsylvania operations heretofore strongly union, disorders in eastern Ohio as mines there begin non-union operations and important gains by the United Mine Workers in Indiana marked the high spots in the development in the bituminous labor situation in the old organized fields during August.

A few of the smaller commercial operations in Illinois have accepted the Jacksonville scale on the so-called interim agreement plan of the union; the deadlock in Iowa and in the Southwest is unbroken and non-union production in western Pennsylvania has increased. In the non-union fields the event of the month was a 20 per cent increase voted western Kentucky miners by the operators of that section on Aug. 15.

Early in the month central Pennsylvania operators posted notices at their mines that operations on the basis of the terms offered by the producers at the Philadelphia conference would be undertaken as soon as enough men indicated a willingness to accept those terms. Late in the month a number of leading operations, including the Clearfield Bituminous Coal Corporation, Pennsylvania Coal & Coke Corporation, the Madeira-Hill interests and Peale, Peacock & Kerr began work at a few mines. Among the operations reopened are Clymer No. 1 and the Barr mine of the Clearfield and the Pennsylvania Coal & Coke Arcadia plants.

The efforts to reopen mines in eastern Ohio have been attended with such interference on the part of union sympathizers that some of the operators appealed to the federal courts for relief and on Aug. 15 U. S. District Judge Benson W. Hough issued a restraining order against the union. A temporary order curtailing union activities in the southern part of the state was later modified by Judge Worstell of the Court of Common Pleas of Athens County to permit the union to maintain six pickets near the Lick Run mine.

The larger producing interests of Illinois continue to insist that the international policy committee of the union waive its demand for a renewal of the Jacksonville scale as a condition precedent of a new contract. Indiana producers who have not signed up voice the same demand. The operations in Indiana reported to have made peace with the union during August include the Ayrshire Coal Co., the Vigo Mining Co., McClelland Coal Co.; Hymera Coal Mining Co., and the Ebbw Vale. Most of the mines in Gibson and Pike County have resumed. Current Indiana output is about 67 per cent of what it was a year ago.

The Pittsburgh Terminal Coal Corporation is now operating five out of seven mines. The Valley Camp Coal Co. is running two mines. Vesta Coal Co. also has two mines going. The Inland Collieries Co., the Consumers Mining Co. and the Union Collieries Co. have been added to the open-shop list. The Pittsburgh Coal Co. during the week ended Aug. 6 produced 152,195 tons—a new record in its open-shop operations.

The Pittsburgh Terminal company went into the federal court during the third week of the month and asked a sweeping injunction against the union and its sympathizers. If granted, it would compel the strikers to abandon company houses at the Terminal camps —something the corporation has been unable to do through ordinary eviction proceedings because of appeals filed by the union. Hearing on the petition has been set for Sept. 9.

Early in the month Governor Donahey attempted to bring the warring factions together by inviting a resumption of Central Competitive Field conferences at Toledo on Aug. 15. Operators informed the Governor that the Central Competitive Field was a thing of the past and that no producer had authority to call such a conference. Union officials indicated their eagerness to attend such a parley. The operators of Indiana and Illinois further stated that just as soon as the union policy commission abandoned its position on the Jacksonville scale they would be glad to meet with the district scale committees in state conferences.

Governor John Hammill of Iowa, at a meeting with representatives of the operators, union officials and the civil authorities of Appanoose County at Des Moines on Aug. 26, denied the request of the producers to send troops into the Iowa mining fields. He specifically directed the sheriff of the county, however, to protect men who have accepted the operators' offer of work at $5 per day. He also urged operators and miners to settle their differences.

Personnel Changes

THOMAS G. FEAR, formerly production manager of the Consolidation Coal Co., has been appointed general manager of operations of the company, with headquarters at Fairmont, W. Va., effective Sept. 1. He succeeds R. L. Melendy, who resigned.

A. M. AYERS has joined the staff of the Consolidation Coal Co. as district engineer at Caretta, W. Va.

JAMES B. PAULEY, who recently resigned as president of the J. K. Dering Coal Co., Chicago, was appointed chairman of the board of the Miami Coal Co., Chicago, early last month. The Miami Coal Co., controlled by the Connery interests, operates seven mines in Vigo County, Indiana.

H. A. GLOVER has been appointed chairman of the marketing committee of the National Coal Association and Walter Barnum named as head of the membership committee.

W. H. GRADY, for several years general manager of the West Virginia Coal & Coke Co., Fairmont, W. Va., has resigned to become president of the Empire Anthracite Collieries Co., Pulaski, Va.

T. L. OLIVER has succeeded John R. James as superintendent of the Baker Colliery of the Glen Alden Coal Co., Scranton, Pa. Mr. James recently resigned to become Deputy Secretary of Mines of Pennsylvania.

MAJOR W. W. INGLIS, president of the Glan Alden Coal Co., has been elected to succeed W. J. Richards, former president of the Philadelphia & Reading Coal and Iron Co., as chairman of the Pennsylvania Anthracite Board of Conciliation.

GEORGE B. HADESTY, general manager of the Philadelphia & Reading Coal and Iron Co., has been elected by the anthracite operators to represent the lower end of the Pennsylvania hard-coal region on the Anthracite Board of Conciliation.

FRANK L. PARSLOE has been appointed general manager of stores, warehouses and manufacturing plants, in charge of merchandising and operation, of the Consolidation Coal Co., vice C. S. Moss, assigned to other duties.

FRANK HAAS, consulting engineer, connected with the Consolidation Coal Co. for the last 26 years, has resigned, effective Sept. 1.

Industrial Notes

THE CUTLER-HAMMER MFG. CO. has moved its Cleveland (Ohio) office from the Guardian Trust to the Guarantee Title Building.

THE AKRON BARROW CO. of Arkon, Ohio, organized in 1840, has changed its name to the General Wheelbarrow Co. The change became effective Sept. 1.

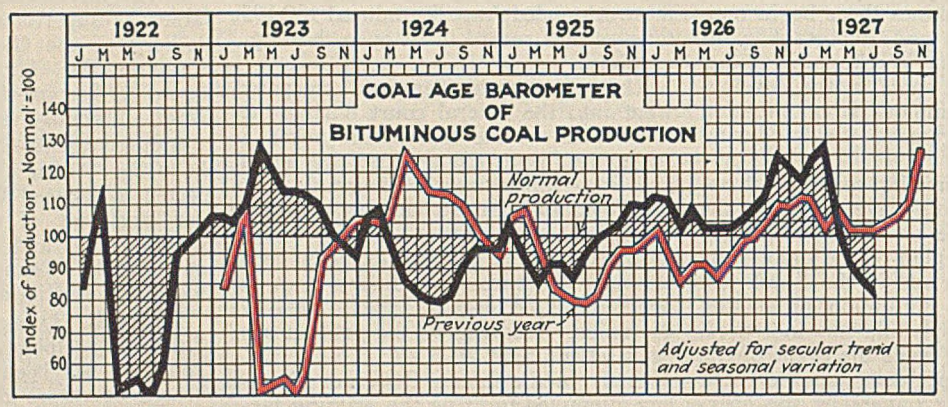
THE ATLAS CONVEYOR CO., recently organized to build conveyors, skip hoists, coal weigh larries, drag scrapers, elevator and kindred products for handling coal and ashes, has opened offices at 20 South Fifteenth Street, Philadelphia, Pa. Percival K. Reed, L. G. Weygandt and E. A. Thumlert formerly connected with the R. H. Beaumont Co., are associated with the new organization.

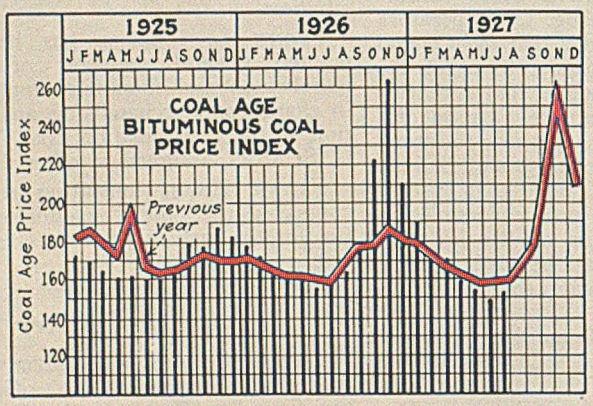
THE AMERICAN RHEOLAVEUR CORPORATION, Wilkes-Barre, Pa., recently completed an arrangement with H. B. Carpenter, Pueblo, Colo., whereby it will design, manufacture and market the Carpenter centrifugal drier. Mr. Carpenter is the patentee of this equipment, which is used at the Minnequa works of the Colorado Fuel & Iron Co.

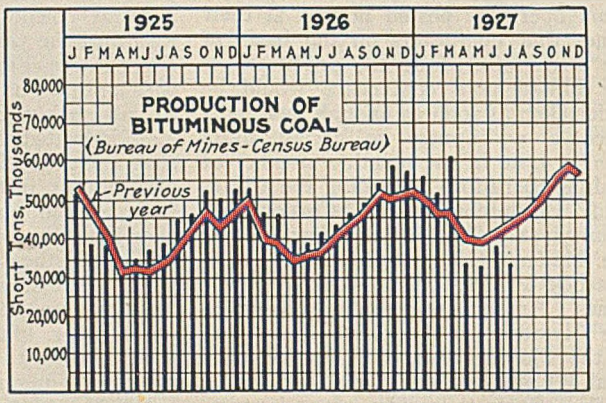
A DEPARTMENT OF RESEARCH AND TECHNOLOGY for the United States Steel Corporation was organized by Judge Elbert H. Gary shortly before his death last month. Dr. John Johnson was appointed director, assisted by Robert A. Milliken and Frank P. Jewett.

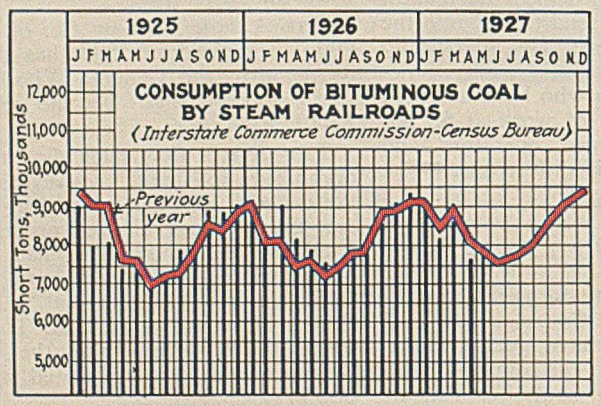
(Other manufacturers' notes will be found on page 173.)

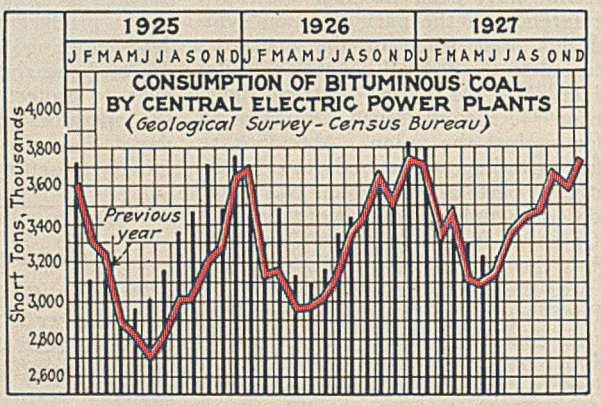
Indicators of Activities in the Coal Industry

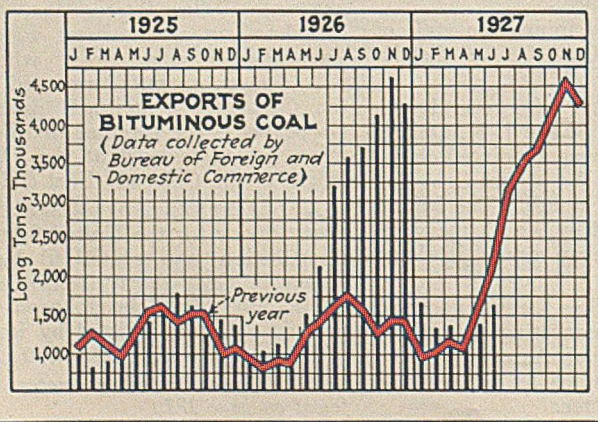


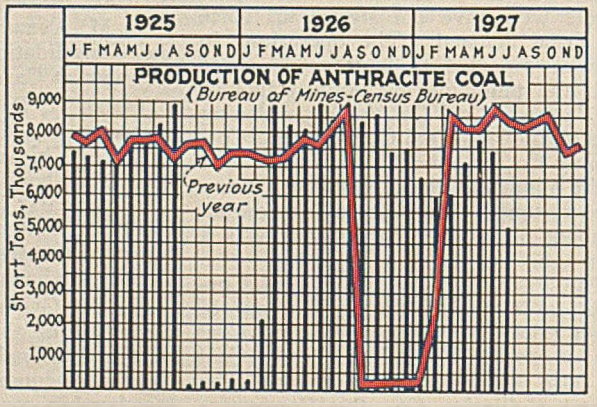












MARKETS *in Review*

FURTHER broadening of demand and rising prices—particularly in the Middle Western markets—featured bituminous coal trade developments in the United States during August. The expansion forecast late in July when railroad buying lifted up western Kentucky coals was augmented last month by off-line buying which sent Middle Western railroads into northern West Virginia and eastern Kentucky for fuel supplies.

Railroad fuel stocks, like the reserves of the industrials, have been diminishing. Between July 1 and Aug. 1, carriers reporting to the American Railway Association, decreased their stockpiles about 1,600,000 tons. In one or two cases, according to a survey made late in August by *Coal Age News*, Middle Western railroads are deliberately reducing storage reserves. In some others, carriers have built up stocks heavily since Aug. 15. The principal Northwestern systems are reported to be in particularly good shape.

COAL STOCKS generally, the latest joint canvass of the U. S. Bureau of Mines and the Bureau of the Census shows, decreased 13,000,000 tons during the first quarter of the present coal year. Curtailment in industrial consumption, however, made the stocks as of July 1 one day greater in terms of days' supplies than was the case on April 1. Nevertheless the drafts which have been made upon reserves in the last few weeks have been considered serious enough to call for a special warning from the National Association of Purchasing Agents.

Production during the first week in August was nearly 8,500,000 tons. For both of the weeks following the 9,000,000-ton mark was passed. Cumulative output to Aug. 20 was less than 10 per cent behind the cumulative total for the corresponding period in 1926. At that mines in many parts of the country are working far below capacity — even where there are no labor troubles to hamper operations.

MOST of the developments in the labor situation the past month have been against the United Mine Workers. More mines have reopened under open-shop conditions in western Pennsylvania; eastern Ohio, despite considerable disorder, is starting up again with union sanction; a group of central Pennsylvania operations for years strongly union has begun non-union production; Iowa producing interests are challenging the union power and there have been few important breaks in Illinois. In Indiana, on the other hand, the union has made some notable gains.

Average prices on spot bituminous coal moved upward throughout the month, with the advance more rapid during the last half. *Coal Age* Index on spot bituminous prices was 164 on Aug. 3 and Aug. 10, 169 on Aug. 17 and 174 on Aug. 24. The corresponding weighted average prices were $1.98, $1.99, $2.04 and $2.10. Increases in Kentucky coals and in high-volatiles from West Virginia played the biggest part in this price movement.

MARKET activity was more marked in the Middle West than in the East. Along the seaboard demand for the most part was moderate. This was particularly true at Philadelphia and, until the last few days of the month, at Baltimore, New England was inclined to be sluggish. Western railroad buying of Southern coals had a sentimental reaction on the New York market, but prices were not affected. Greater interest, however, is forecast for September and most shippers anticipate rising prices.

The Pittsburgh market began to gather momentum as the month progressed. Western railroad buying of Fairmont coal and the shifting of some business normally going to central Pennsylvania were factors in the strengthening of the Pittsburgh market. Buffalo was more optimistic. There were gains, too, in northern and central Ohio, particularly in the demand for coal for domestic consumption.

SOUTHEASTERN markets also improved. Louisville, as the center of trading for western Kentucky coals, showed the greatest gains. Cincinnati stepped forward, but the advances there were more uneven. Prepared sizes of low-volatile coal were pegged at higher figures for spot shipment but the situation with respect to mine-run was disappointing to many who looked for sharp advances in quotations. As the month progressed there was a stronger tone to the Birmingham district.

Lake shipments for the four weeks ended Aug. 29 were somewhat ahead of total cargo dumpings for the corresponding period last year—3,505,136 net tons as against 3,497,579 tons. Shipments earlier in the season, however, were so far ahead of those during 1926 that the cumulative totals on Aug. 29 were 4,262,041 tons above the figures for the corresponding period last year.

MIDWESTERN trade expanded throughout the month. Railroad and industrial buying absorbed heavier offerings of steam coals and retailers bought more liberally of Eastern fuels as they abandoned hope of an early resumption of production in southern Illinois. The Illinois and Indiana operations which have started up since April 1 experienced less difficulty in disposing of their product. "No bills" shrank sharply and ground storage at the mines diminished. West of the Missouri River the situation was more spotty.

July exports—the latest month for which figures are available—were less than half of the quantity shipped to foreign buyers in July, 1926, when the movement created by the British strike was in full swing. During July of this year there were 1,530,524 gross tons of bituminous coal exported; of this quantity Canada took 1,366,923 tons. Anthracite exports were 228,472 gross tons; coke, 58,039 tons.

ANTHRACITE domestic sizes enjoyed a wider market last month, with most of the expansion coming in the last fortnight. The stimulus to buying, of course, was the advance of 25c. per gross ton in mine prices which went into effect on Sept. 1. Stove moved readily in all Eastern markets; there was a surplus of nut, but rising interest in this size as the month progressed. Pea coal was sluggish. Buckwheats continued in brick demand throughout the month and the increasing output robbed them of none of their strength.

Production showed a distinct improvement during August, climbing from 1,371,000 net tons the first week to 1,577,000 tons the week ended Aug. 20. This latter figure was higher than any other week except the one immediately preceding since June. Cumulative production to Aug. 20 was 50,480,000 net tons, as compared with 50,236,000 tons a year ago. Lake dumpings to Aug. 21 were 1,057,904 net tons, as compared with 1,767,784 tons for the corresponding period in 1926.

BEEHIVE COKE in the Connellsville region strengthened about the middle of the month with the disappearance of accumulations which had been holding back the market. Production is being regulated closely so that any unexpected rush of spot orders—even if minor in quantity—probably would result in a sharp reaction. The byproduct markets throughout the country are in a comfortable position, with demand for household coke growing.

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

If you have a practical idea, a short cut method, or a new wrinkle in operating or maintaining a machine, here's the place to shout about it! *Coal Age* will pay you for your time and trouble and for the help it will be to other coal operators.

* * *

Depending on its possible value to the shop or operating departments (which look to *Coal Age* for new ideas from the field), and upon our ability to publish it in these columns, we will pay from $5 up for each idea.

* * *

Here's your opportunity not only to win the recognition of your own officials for using your wits to lick a job, and to cash in on it, but also to exchange your ideas with others. For through this department of *Coal Age* others will contribute ideas which will be worth a lot to you.

* * *

So go to it and give this clearing house of ideas a chance to record your progressiveness.

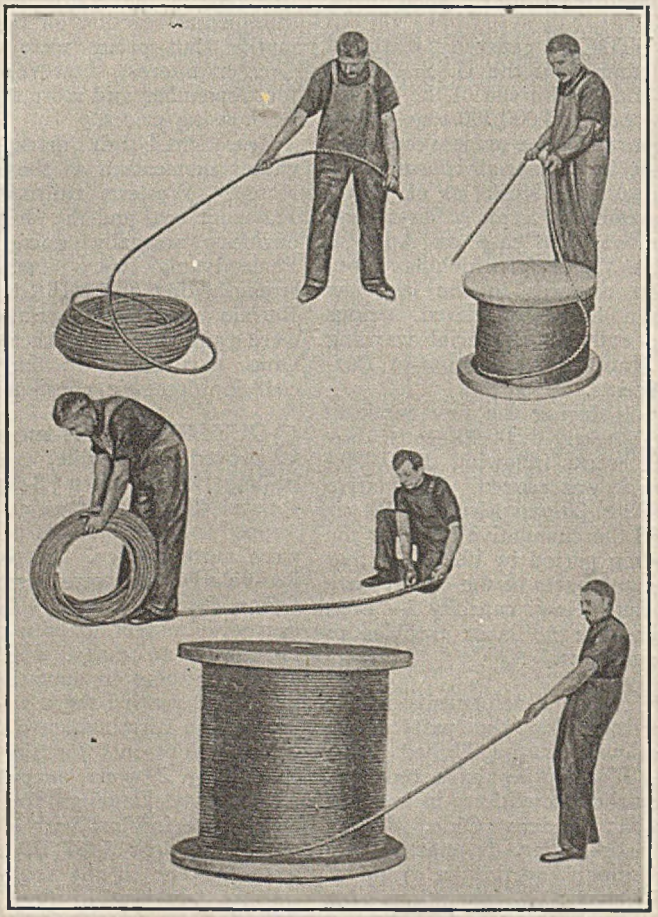
* * *

Make your story short and snappy. We'll edit it if necessary. Don't stop to make finished drawings if illustrations are needed. Simple sketches will do. Our draftsmen will follow your ideas.

Correct Unreeling of Wire Rope Prevents Kinking And Promotes Safety

WHEN uncoiling or unreeling a wire rope it is important that no kinks be formed, says Walter Voightlander of Chicago, Ill. Once a kink is made, no amount of twisting or stressing can take it out and the rope is unsafe for work. Never uncoil a wire rope as might be done with a rubber hose or manila or hemp rope. Lift the coil to its edge and unroll it allowing the rope to lie flat until used. This serves to prevent kinking.

When wire rope is received on a reel it should never be taken off as shown, for such a method will invariably develop kinks. If a jackbracket for the coil is not available, turn the reel on edge and roll along the ground.



Kinks Ruin a Rope

A. C. Operation of Signal System Enabled By Home-Made Transformers

ENDLESS worry over the uncertainty of the source of electrical supply has been caused in certain Canadian mines using 6- and 10-in. "Faraday" bells on 6 volt d.c. circuits operated by dry cells, according to Edward Hughes of Cumberland, B. C. This was due to the fact that the rope riders and others were never sure that their signals were transmitted to the hoist rooms.

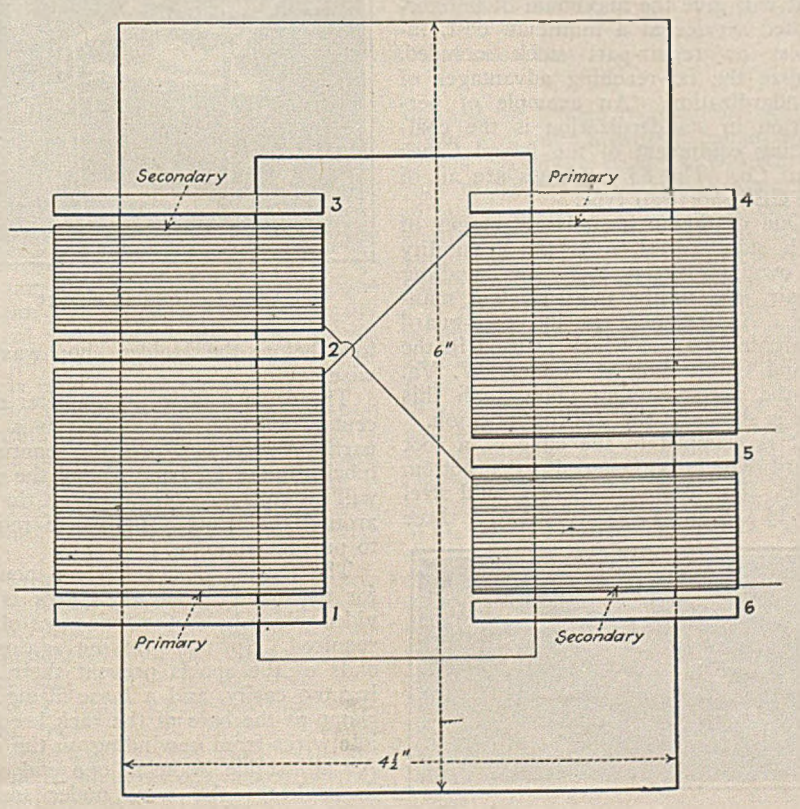
Much time has been lost in the past by the rope riders being obliged to walk to the hoist room to find out the cause of the delay only to learn, in the majority of cases, that the dry cells had run down. Different types of dry batteries had been tried without success.

In these mines the hoists are driven by a.c. motors. Therefore, the management determined to try to operate the signaling systems on alternating current. Having facilities for designing and fabricating equipment of various types it was decided to design and build transformers for this work. The transformer was designed to deliver a maximum of 100 watts at 20 volts reduced to this voltage from 440 volts at 25 cycles.

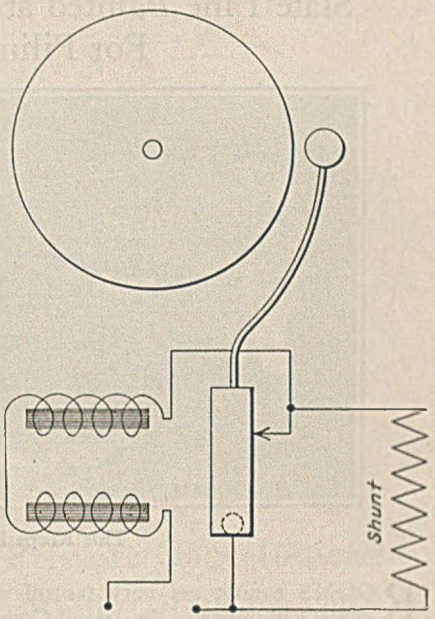
Two points were kept in mind: First, the equipment must be entirely free from breakdown over a period of many years; and, secondly, there must be no possibility of the primary current getting into the secondary circuit and thereby endangering the lives of the signal men or animals that might come into contact with the bell lines.

To attain the first requirement, the iron was worked at a low density, the copper was given liberal dimension and the windings were well insulated and impregnated to repel moisture. To attain the second requirement, the windings were composed of two primary coils. One primary and one secondary coil were placed on each core leg. Fibre washers, ⅛ in. thick, were placed between the primary and secondary coils and between the coils and the yoke of the transformer. These are indicated by the numerals 1 to 6 in. the accompanying illustration below.

The core of the transformer, 1 in. square, was made of laminated steel, the primary windings were made up of 5,200 turns of No. 28 (B. & S. gage) d.s.c. wire and the secondary winding of 240 turns of No. 16 d.c.c. wire. The whole was placed in a 100-amp. 600-volt fuse box, a number of which had been discarded for circuit breakers. Two 600-volt, one-ampere, fuses in standard fuse blocks were also placed in the box to protect the primary circuit. The 30-ampere, 250-volt, double pole indicating snap switch, connected to operate as a single pole switch, was placed on the cover so that the transformer could be disconnected from the line when the hoist men went off duty.



Sketch of Transformer Construction



Details of Connections

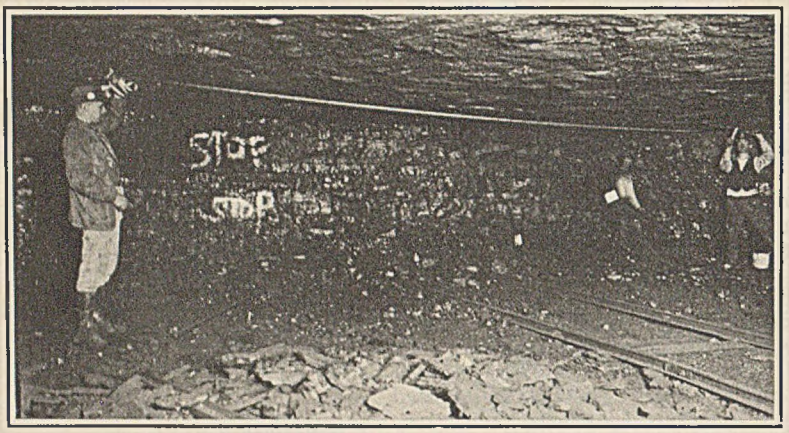
To eliminate, so far as possible, the erosion of the bell contacts from sparking, a shunt was made by winding about 15 ft. of No. 28 iron wire upon a fibre base 5x4 in. and ⅛ in. thick. This was insulated and impregnated to keep out moisture. The shunt was mounted at the back of the bell and connected across the contacts, as shown in the illustration. The transformers have been operating for six years on two-wire circuits ranging in length from a few hundred feet to a mile and a half. Fifteen transformers were built and placed in use at a cost of about $30 each. These displaced a barrel and a half of dry cells per month. At the time of installing these transformers the dry cells cost approximately fifty cents apiece in barrel lots of 125. A barrel and a half per month, therefore, represented a cost of approximately $94.

In less than six months the savings on batteries alone had paid for the transformers. The saving in time, through the signal apparatus being in operating condition at all times, was also an asset as it materially aided in speeding up the output of the mines.

Endeavoring to eliminate the troubles ensuing from the use of a make-and-break type of bell, polarized bells were tried using 10 volts a.c. In dry places these were successful with circuits 2,000 ft. long, but in wet places the bells, being sensitive, rang continually.

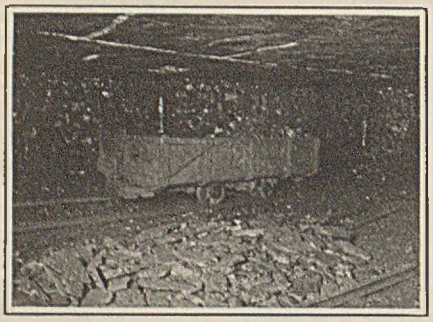
That the polarized type of bell can be used for long periods without adjustment or attention is shown by the use of such a bell as a warning at the entrance to a main slope. Here the bell operates from 7 a.m. to 10 p.m. on an average of once every 10 minutes for 20 seconds. This bell was not touched once in eight months and then was removed only to have its hammer replaced.

Slate Line Painted at Face Establishes Limits For Piling of Refuse



This Keeps Rooms on Center

ROOMS cannot get very far off of centers in mines of the Island Creek Coal Co. Near the close of each shift a section foreman and centerman visit each place with a tape measure and a bucket of whitewash. First they measure the width of the room, then extend the center line to the face. After that they



Lines Prevent Alibis

paint on the roof what is termed a "slate line," at a point 20 ft. from the cleaned-up face. The line is made several feet in length and is drawn at right angles to the room center line.

One of the accompanying photographs shows W. E. Eynon, section foreman, at the left and Glen Savage, centerman, at the right. They are marking the center for a butt-off cut at the end of the pillar. The room, 26 ft. wide, has been driven to the limit as indicated by the word "stop" marked on the face. The other illustration shows two slate lines—indicated by the white markings—extending to the right of the room center line. Because a new slate line is painted for each cut and inasmuch as the mining machines are equipped with 7 ft. cutter bars, the lines are about 6½ ft. apart. In the shadow, at the left of the car, the loader is tamping a shot to loosen bottom coal in a cross-cut.

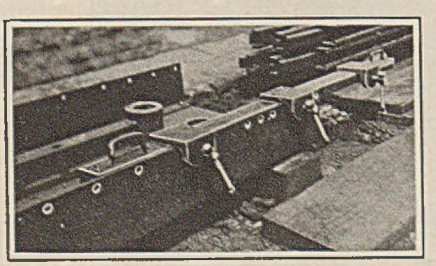
The object of the slate line is to have a definite mark back of which the loader must throw all refuse. This leaves no chance for argument as to whether sufficient clear space has been left for the undercutter. Since all refuse is thrown to the center of the room between tracks, the size of the pile serves as a rough indication to foremen and inspectors as to how thoroughly the loader is picking out the thin parting which occurs in the seam.

Foot-guard Rectifier Saves Labor

Men who are held to account for equipment maintenance in a manner that will give the maximum of uninterrupted service at a minimum cost, interest on repair-part stock included, realize the far-reaching advantages of standardization. An example of perfection in standardization is the coal-cutting equipment of the Island Creek Coal Co. The 85 machines are all of the CE7 shortwall type.

One of the incidental advantages of such standardization is the feasibility of owning special tools for handling repair jobs in the most efficient manner. An example is the foot-guard straightening tool which is used in the Island Creek shop at Holden, W. Va. In the accompanying photograph this tool is shown in the working position.

It is clamped to the edge of a foot guard which is fastened to a bottom plate. The tool consists of a mild steel bar 1½ x 3 in. having welded to it three



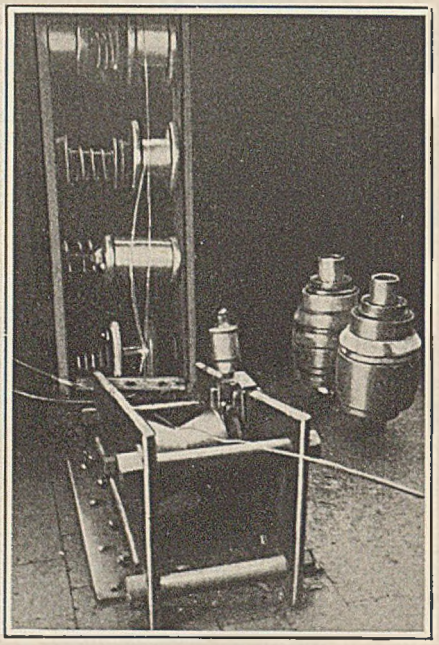
A One-Man Machine

screw clamps and two handles. The edge of the plate is straightened by clamping the bar on the inside or outside, as desired, and then hammering the high places. The tool acts as a straight edge and as an anvil.

By the old method it took two men to straighten a guard. One held it in position on an anvil while the other did the hammering. By using the special tool, one man does the work.

Drum-and-Brake Device Best for Banding

Experience had convinced the men in the Island Creek shop at Holden, W. Va., that a fiber clamp is far from the ideal tension device for applying armature bands. Therefore, after one of the men read in *Coal Age* (p. 552, Vol. 27) about the tension device used by the Raleigh Coal & Coke Co., it was not



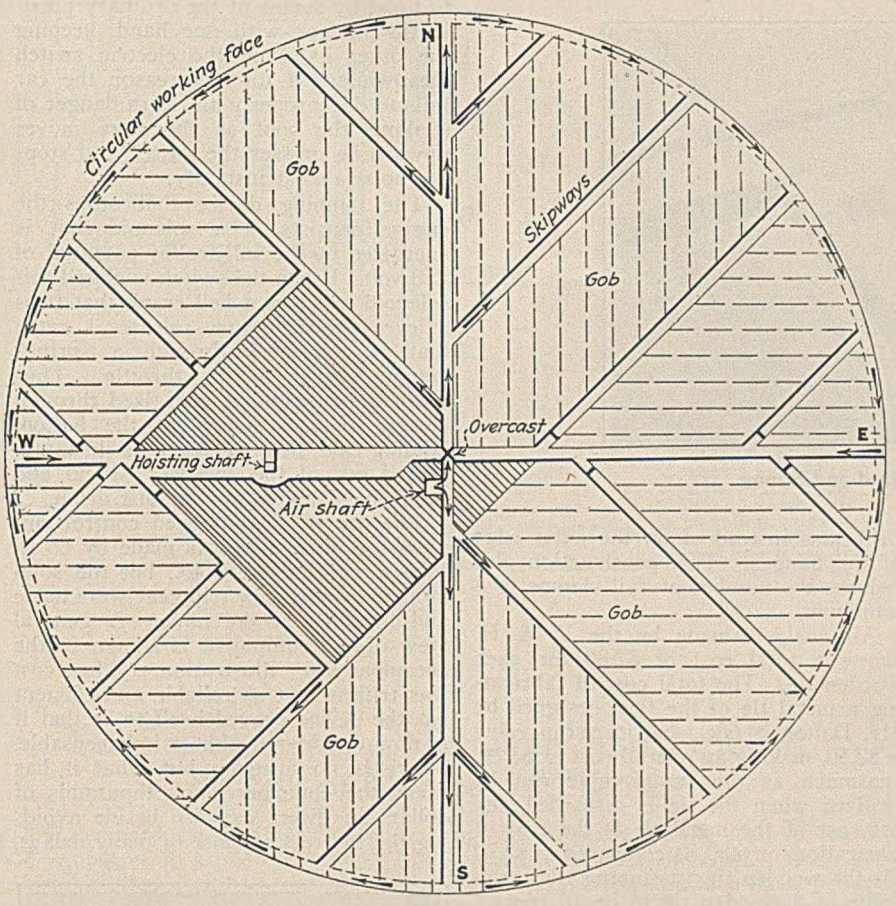
Gleaned from *Coal Age*

long before the Holden shop was likewise equipped.

The drum is 4 in. in diameter at the center, and the brake band is a Ford part. An oil cup provides continuous lubrication of the band so that the action will be uniform. Six turns of the wire around the drum usually are required to prevent slipping.

The tension device has no mounting for the spool. Instead, a rack is provided which holds the four sizes of wire required. Springs pressing against the ends of the spools prevent their turning too easily, and a loose-fitting fiber clamp at the base of the rack keeps the idle wires from unwinding on the spool. An adjustable brake at one end of the drum keeps the wire under uniform tension.

Air Should Be Split Even in Longwall Mines To Insure Proper Ventilation



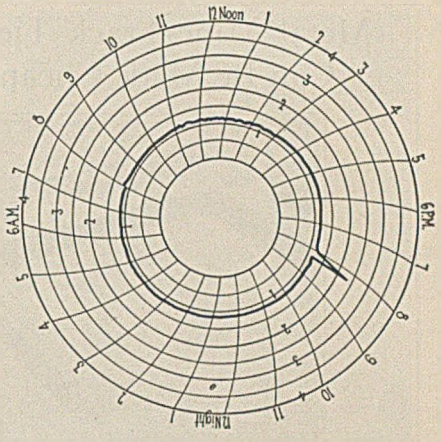
Sketch of Improved Ventilation Plan

A MINE operated by longwall methods is more easily, efficiently and economically ventilated than one in which any other system of mining is provided, says W. E. Holland, state mine inspector, Centerville, Iowa. Once the air reaches the working face in an almost unobstructed course to its destination, the path of the air has practically none of the many right-angle bends, with their consequent resistance, that beset it in other mine workings.

If, in the longwall mine, ventilation is insufficient, it is either from a neglect to place the necessary curtains where needed, or because an attempt is made to conduct the air in a single continuous current throughout the entire mine.

In large mines the use of a single current of air is impracticable because so much of it inevitably passes through the curtains in both the main and skip entries and returns to the shaft with its work only partly accomplished, leaving only a small portion to complete the circuit of the face. This air being deficient in quantity becomes after its lengthy travel depleted of oxygen and has a high percentage of carbon dioxide. For this reason it is entirely unfitted for human respiration, and the miner who must breathe it cannot work at his maximum capacity without injury to his health. Hence the practice of using a single continuous current should be discontinued at all mines which subsequently will be made large enough to produce a big tonnage.

A more practical and beneficial plan is shown in the accompanying sketch. At the opening of such a mine, preparations should be made to split the air at the bottom of the downcast shaft and both currents should be carried to the working face at points diametrically opposite each other. Here the air should be split right and left along the face. With this arrangement, more fresh air reaches the miners along the face than when a single continuous current is provided, and all the air that leaks through the curtains in the skip entries ultimately reaches the face and there meets and helps to refresh the original face current. This is vital to the health of the miner and is especially desirable in mines generating and giving off large quantities of carbon dioxide. These results are absolutely impossible in mines where the continuous method of ventilation is put into practice.



Water Gage Showed Rock Fall

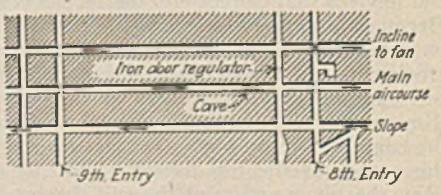
Pressure Gage Indicated Main Aircourse Cave

Every mine fan of the Union Pacific Coal Co., Rock Springs, Wyo., has a pressure gage or clock chart which records the pressure or vacuum continuously night and day. The charts are sent daily to the general office for inspection, says M. W. Medill, Reliance, Wyo.

"On May 20, the chart for the previous day at mine No. 2 Reliance showed an irregularity quite unlike the even run which marks the fan pressure. The mine is standing idle, on account of insufficient demand for coal, and the irregularity occurred a few minutes after 8 p. m., and was concluded abruptly at 8.15 p. m. The gage increased from 1.15 to 2.35 in., and when I received the chart I noted on it—"It looks like a cave in aircourse." I telephoned the foreman, R. J. Buxton, and when he reported, he had found a cave in the main airway, 2,600 ft. from the fan, closing that passage so completely that there was barely space for a man to pass.

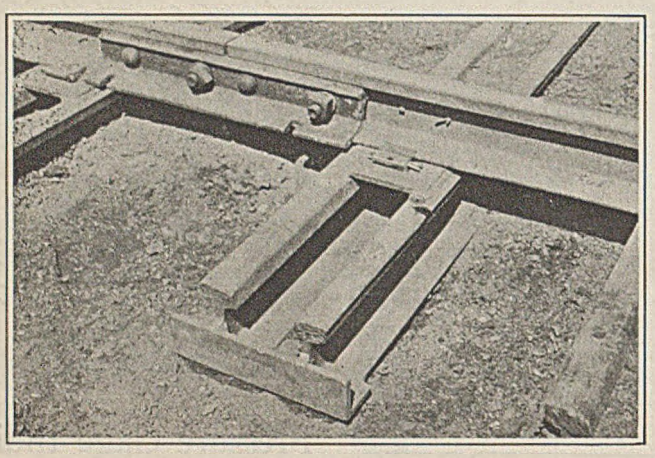
There are two aircourses communicating with each other so, when the cave occurred in the main airway, the air came partially to a standstill for a space of fifteen minutes, causing the irregularity noted on the chart. Later, the air took the other aircourse and the pressure came back to normal.

This cave would not have been found for at least a week if it had not been for the chart reading, and the air would have been cut off if there had not been a double aircourse.



Where Fall Was Found

Metal Mine-Track Ties of Great Durability Can Be Made Cheaply from Scrap Rails



Inexpensive, Long-Lived and Strong

METAL railroad ties, constructed by electrically arc-welding worn rails together, are not only ten times as strong as the ordinary wooden tie, but can be made at an unusually low cost, according to William Dalton of the manufacturing department of the General Electric Co. Mr. Dalton, in collaboration with H. S. Clarke, engineer, maintenance of way, Delaware & Hudson R.R., recently completed a series of tests extending over a period of a year.

A number of sample ties were installed by the Delaware & Hudson about a year ago in its Glenville yards. These have been so successful that President Loree has decided to undertake the substitution of metal for wooden ties in all yards and sidings. Arrangements are now being made by the railroad to install equipment in its shops for the construction of the ties.

The tie design, as worked out by Mr. Dalton, involves the use of two pieces of rail for each tie. The rail used is that which has been removed from the roadbed as worn and has no value except as scrap. The two lengths are fastened together at each end by metal plates welded in position. The L-shaped angle bars used in ordinary rail joints can be utilized for this purpose. When two rails are fastened together in this manner, movement of the tie in any direction in the ballast is said to be eliminated.

To hold the track in position metal plates are welded to the tie and the rails clamped to gage by means of special devices that cannot slip out of place. Because any holes punched in the tie bars for rail clamps would destroy the efficient use of the bar material, the use of separate plates fastened to the tie eliminates trouble in this connection. As the edges of the tie plate are placed over the center of the top flange of the tie bars, the wave action of the rail throws the load directly over the webs of the tie beams instead of on the outer edge of the flanges. This construction also reduces the number of rail clamps to a minimum.

An analysis made by the D. & H. shows a total cost of $2.80 for each wooden tie. The total cost of fabricating a metal tie of the type designed by Mr. Dalton is 60c., and its scrap value is $2.50, making an overall cost of $3.10. Inasmuch as the scrap value can be realized when the tie is discarded, the net cost of the metal tie is the cost of fabrication, or 60c., as compared to $2.70 for the wooden tie (assuming the scrap value of a wooden tie to be 10 cents.)

Present applications have been confined to railroad-yard and siding service. This field, however, alone requires over 30,000,000 ties a year for replacements. An insulator between the tie and the rail will be required on main lines using automatic signaling.

In order to facilitate the easy and inexpensive construction of these metal ties, the General Electric Co. has designed a new type of automatic electric arc-welding equipment. One of these machines is to be installed within a short time in the D. & H. shops.

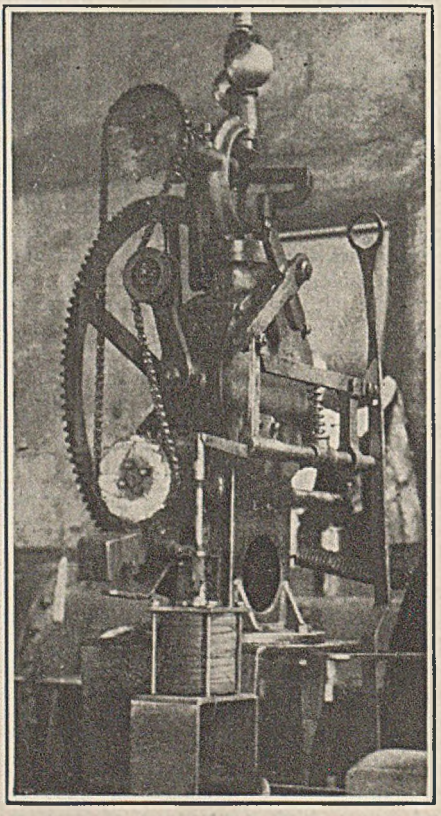
Remote Hoist Control Speeds Caging

They hoist cars rapidly at Zeigler No. 2. This statement applies not only to the speed of the cages within the shaft but to the dead period at top and bottom or the time required in caging. In order to get the desired output this lost time between hoists must be kept to a minimum.

In order to shorten this dead or caging period a switch is installed on the bottom under the ready control of the bottom cager, that controls or connects with a home-made attachment to the overwind and overspeed device attached to the hoisting engine. When a car is caged the bottom cager gives the signal to hoist by means of the ordinary pneumatic plunger with one hand, keeping the other hand on the electric switch meanwhile. If for any reason the car fails to dog properly and is in danger of striking the roof as the cage moves upward he presses the switch and stops the hoist almost instantly.

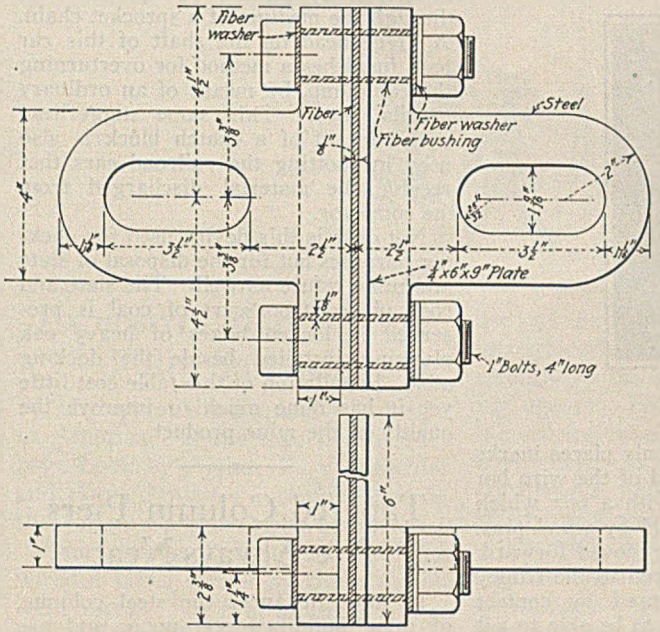
The tripping device that stops the engine consists of a solenoid that is energized by the full trolley potential of 250 volts. When the switch is closed this solenoid operates a bell crank that trips a lever which in turn releases a catch that is connected through a spring-actuated lever to the throttle. Thus when the solenoid is energized through closure of the switch at the bottom landing the throttle lever is instantly jerked out of the engineer's hand and the brakes applied to the hoist drum.

The overwind and speed control employed at this mine was made by C. R. Welch, of Denver, Colo., but the solenoid and emergency trip gear were made and installed at the mine. A general view of the equipment is shown in the accompanying illustration. The cost was trifling yet so reliable and efficient has the device proved itself to be that it is now considered almost indispensable. There is no question but what it has saved the company many thousands of dollars in direct expense beside avoiding the indirect expense of many delays.

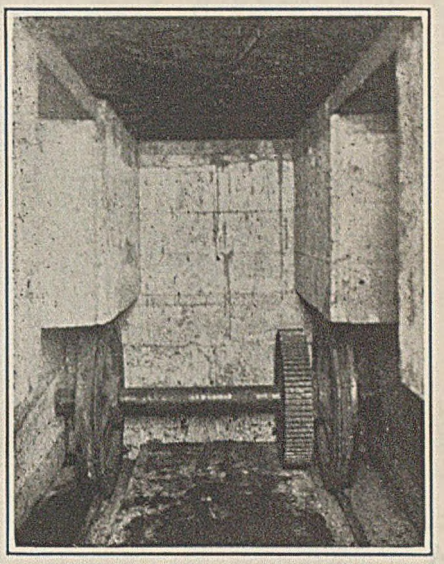


An Output Booster

Insulating Mine-Car Couplings Prevents Passage of Current Through Trip



As described by J. J. Forbes, a sheet of fibre, ½ in. thick and 6x9 in. in size, is interposed between the coupling ring — the boltheads rest on fibre. Although shown applied to a particular type and size of coupling, the method of insulation is readily adaptable to practically all styles of couplings.



Makes Repairs Easy

Re-trucking Facilitated By Pit-bottom Track

Track appears to be out of place in the bottom of a locomotive repair pit, and for that reason the accompanying photograph, taken from the inside of the new pit in No. 1 mine of the Island Creek Coal Co., requires explanation. The mine roof, on which the trolley wire shows indistinctly, is actually 7 or 8 ft. above the top of the pit instead of the short distance it appears.

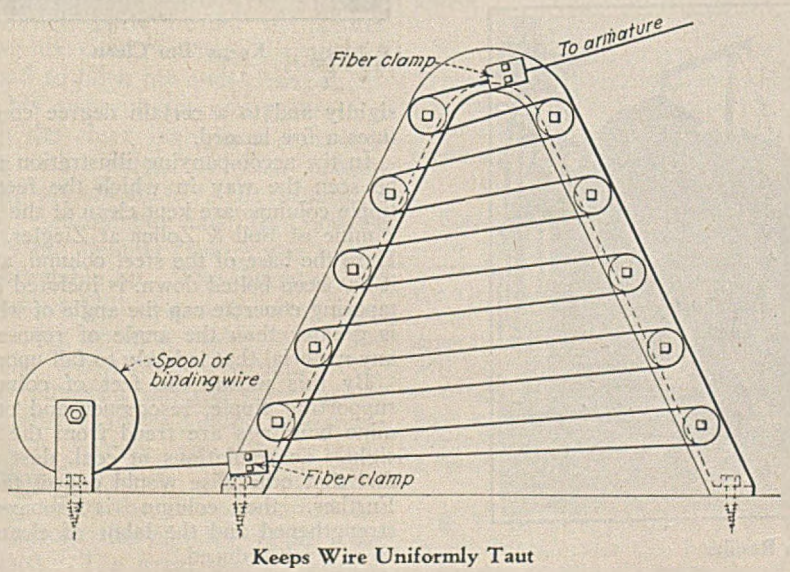
The pit is designed to give maximum ease and speed in changing trucks on outside-frame main-haulage locomotives. An extra truck is stored in one end of the pit. When a locomotive is to be retrucked, the frame is blocked and short sections of the mine track rails removed. The old truck is lowered through the wide space into the pit and onto the rails in the bottom where it is rolled to one side. The new truck is then rolled to the wide place and hoisted to the locomotive.

Tension on Armature Binding Wire Applied By Use of Number of Sheaves

OF the many types of tension devices employed in armature banding, the adjustable fiber clamp is the one most commonly used. Ease of construction rather than efficiency is the principal reason, for a fiber clamp will not maintain a uniform tension on the wire.

The accompanying sketch shows a tension device that is used in some shops. The frame consists of a 2½-in. angle bent to shape and the ends turned over and welded to form feet.

On the flat side of the angle iron a number of plain-bearing steel rollers or sheave wheels are mounted. These are 2½ in. in diameter and each has a groove of ¼-in. radius. The desired tension of the armature band is secured by doubling the wire back and forth around the necessary number of sheaves. Small fiber clamps prevent the wire from "going wild" when not under tension. As usually built the angle-iron frame stands 28 in. high. The rack which holds the spool should have a spring friction to prevent unwinding too easily.



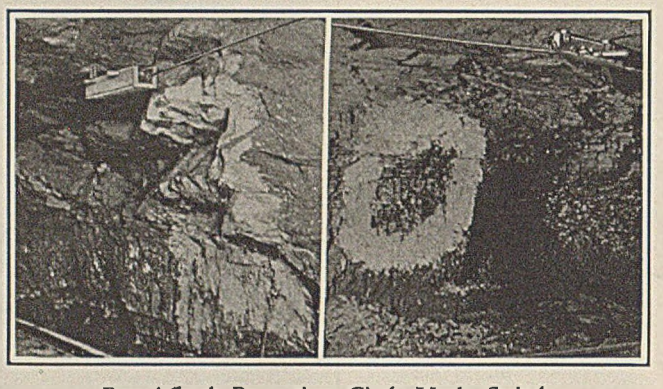
Keeps Wire Uniformly Taut

Much Armature Trouble Due to Carelessness

Extreme care should be exercised in noting all details when stripping a factory-wound armature for rewinding. An example of difficulty due to lack of such precaution was seen recently at a bituminous mine.

After being rewound, certain armatures having heavy rectangular conductors gave repeated trouble due to loosening of leads at the commutator. It was finally learned from a factory representative that the bottom conductors which were being brought straight from the slots to the bars should have been given slight kinks to allow for expansion.

How Trolley Wire Mishaps Are Prevented By Simple, Inexpensive Means



Box Affords Protection; Circle Marks Switch

AT THE mines of the Colonial Colliery Co., at Natalie, Keiser and Parsons, Pa., a guard made of 4-in. pressed-fiber insulating pipe cut in half is used instead of board guards to protect the trolley wire in gangways at turnouts and loading chutes. According to J. J. Forbes, it has the merit of standing away from the wire so as to make it readily possible to replace the wheel on the line in case the direction of the trolley pole is reversed or the trolley wheel is derailed.

The end of a trolley wire that protrudes beyond the last hanger is a source of danger. The Consolidation Coal Co., of West Virginia not only places marks on the rib near the end of the wire but also covers that end with a box which is open on top and held by wood pins. The box can be readily moved forward.

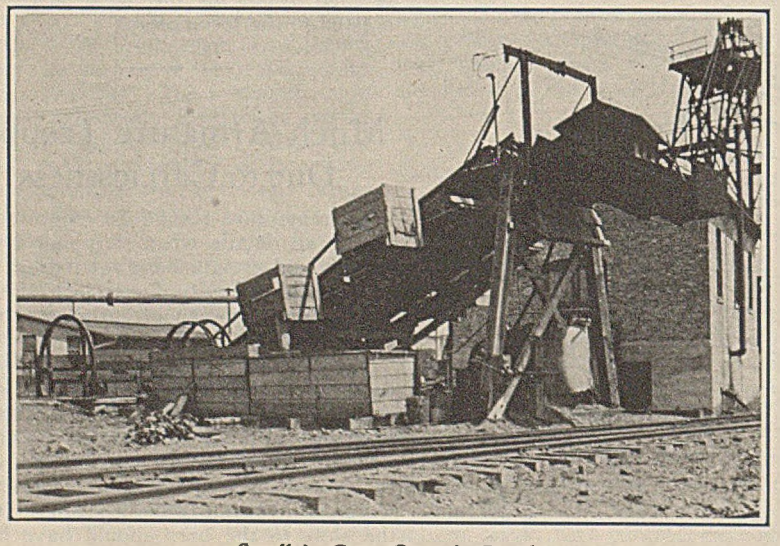
When accidents happen to the trolley wire or men are injured by contact with it, it is important to be able to cut off the current promptly, but often workmen do not know where the cutoff switch is. So in the mines of the Consolidation Coal Co. the place is marked by a large white circle on the rib. Those switches that are to be pulled out at night for fire protection have an X painted inside the circle.

Installation of Docking Table Costs But Little Yet Greatly Improves Mine's Product

NO MEANS of inspecting individual carloads of coal was available at Zeigler No. 1 mine. In other words there was no docking table. Such a device was needed, however, and accordingly one was built. This is shown in the accompanying illustration.

First a rotary dump was constructed, the bin or hopper beneath which feeds to the table proper. This consists of a discarded conveyor set on an incline, beside which boxes are arranged to receive the slate and rock. The conveyor is driven by an old 15 hp. car haul through the medium of a sprocket chain. A niggerhead on the shaft of this car haul furnishes a method for overturning the car dump, by means of an ordinary manila rope. This same niggerhead with the aid of a snatch block is also used in spotting the railroad cars that receive the material discharged from the conveyor.

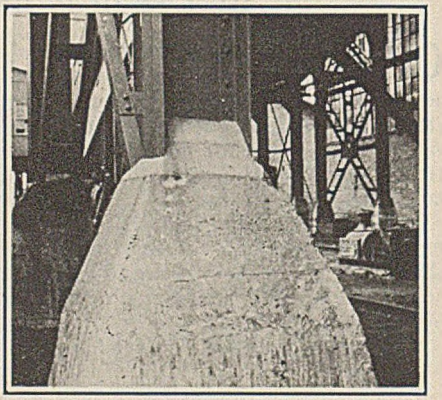
Not only is this device used for docking purposes but for the disposal of slate and mine refuse as well. The slate and rock picked from cars of coal is preserved in locked boxes of heavy oak planking installed beside the docking table. Installation of this table cost little yet it has done much to improve the quality of the mine product.



Small in Cost; Great in Results

Tapered Column Piers Are Always Neat

In most instances the steel columns of mine buildings rest upon, and are fastened to, flat-topped concrete piers. The column footings and tops of the piers, therefore, form an excellent lodgment for dirt and débris such as small coal and dust. This is always unsightly and to a certain degree constitutes a fire hazard.

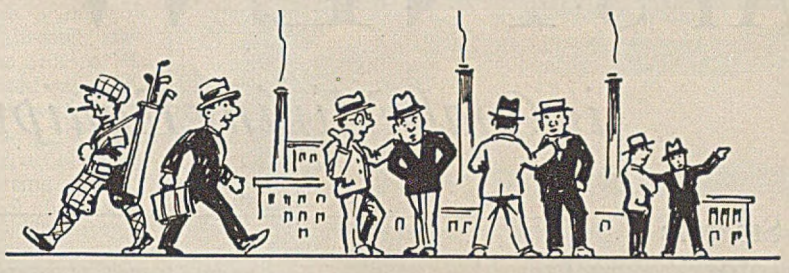


Keeps 'Em Clean

In the accompanying illustration may be seen the way in which the feet of tipple columns are kept clean at the No. 2 mine of Bell & Zoller at Ziegler, Ill. Here the base of the steel column, after it has been bolted down, is inclosed in a tapering concrete cap the angle of which is greater than the angle of repose of any material that is likely to fall upon it.

By this means the feet of columns supporting tipple, rescreener and other mine buildings are freed from the unsightly accumulations of coal, dust and dirt that otherwise would collect there. Further, the column is somewhat strengthened and the labor of cleaning up is much reduced.

Among the Manufacturers



Explosives Manufacture Fully Surveyed

"History of the Explosive Industry in America," is the title of a 1,132-page book by Arthur P. Van Gelder and Hugo Schlatter just published by the Columbia University Press.

One cannot peruse this volume without being struck by three significant facts. The first of these is that the history of explosives manufacture is in reality the history of the country itself. Second, the manufacture of explosives on a commercial scale has been largely a family affair, some families having been engaged in it for four or more generations; and third, that the industry like many others went through a period of fierce competition which was overcome by a series of company combinations that eventually resulted in fewer but more powerful units.

The book traces the development of explosive manufacture from the "homespun" colonial days, when, threatened by hostile Indians on the one hand and forbidden to manufacture by the Mother Country on the other, each farmer or planter made his own powder. Frequently he had to burn his own charcoal, refine his own sulphur and gather and leach the chief ingredient, saltpeter, from stable refuse or other decomposing organic matter. In those days each community had its powder hoard and stealing from it was almost a treasonable act. The timely arrival at Bunker Hill of a cartload of powder from such a cache saved the colonial forces from destruction.

For almost a hundred years the use of explosives in the United States was confined largely to military and sporting purposes. This was the period when the pioneer forced his way across the country from coast to coast. The great era of railroad construction, however, called for the use of explosives in blasting, and nitroglycerin and dynamite came steadily to the front as rock-shattering agents. Even today dynamite is the explosive chiefly used in industrial work. In coal mining, however, permissible powders have made steady progress for many years.

Naturally the World War imparted a great stimulant to the manufacture of military explosives such as picric acid, trinitrotoluol and dense smokeless rifle powders. In the past most explosives have received first attention as military agents and have later been applied to industry. This will probably be the case with these latter explosives.

The book is written in a decidedly readable style and is profusely illustrated. The price is $10.

The Mid-West Locomotive Works, Cincinnati, Ohio, announced the recent appointment of the following territorial representatives. James A. Ridgway, New York; the H. E. McCoy Co., Pittsburgh; H. B. Owsley, operating as the Lakewood Equipment Co., St. Louis, Mo.; Clare Osborn, Ltd., Montreal, Quebec.

* * *

The Wheeling Steel Corporation, Wheeling, W. Va., announces the appointment of J. E. Montgomery as vice-president in charge of operation, succeeding G. W. Moore, who has resigned.

* * *

Charles G. Olson, formerly of the main office of the Chain Belt Co., Milwaukee, Wis., has been transferred to the Detroit office. Mr. Olson was connected with the sales department for several years before his transfer. He will look after the Rex chain and engineering business of the company in Detroit territory with headquarters at the company's office at 8855 Woodward Avenue.

* * *

R. V. Bingay, president of the Pittsburgh Transformer Co., has been made a director of Allis-Chalmers Co. of Milwaukee, Wis. The latter company recently secured control of the Pittsburgh Transformer Co., which will continue the manufacture of transformers, with Mr. Bingay remaining as president.

* * *

Walter Cary, vice-president of the Westinghouse Lamp Co., has been elected also president of the Bryant Electrical Co., Bridgeport, Conn., succeeding Mr. Bryant, who has become chairman of the board. Mr. Cary has been identified with the Westinghouse Lamp Co. since 1904.

* * *

Walter S. Finlay, Jr., who for a number of years has been vice-president of the American Water Works & Electrical Co. of New York City, has been elected president of the West Penn Electric Co., with headquarters in Pittsburgh, Pa.

* * *

The Chicago Office of the Climax Engineering Co. has been removed to 1608 Harris Trust Building, 111 West Monroe Street. This office was previously located in the same building, but on a different floor. F. E. Blanchard is in charge. The J. L. Latture Equipment Co., of Portland, Oregon, representatives in Oregon, Washington and Idaho of the Climax Engineering Co., is now located at 312 to 314 East Madison Street, Portland, Ore. The new location is in a four-story fireproof building and will house both offices and warehouse of the Latture organization.

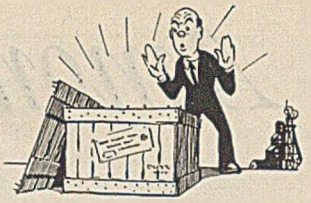
* * *

The Earle Gear & Machine Co., with main office and plant at 4707 Stenton Avenue, Philadelphia, Pa., announces the opening of a new York District Office at 95 Liberty Street, New York City. C. N. Walsh and George E. Barrett are in charge. The company also maintains a district office in charge of Wm. H. Allen at 110 State Street, Boston, Mass.

* * *

George Kirtley has been appointed Western sales manager of the H. K. Porter Co., Pittsburgh, Pa. He will have offices in the Monadnock Building, Chicago. Mr. Kirtley has been connected with the home sales office in Pittsburgh for the past five years.

WHAT'S NEW

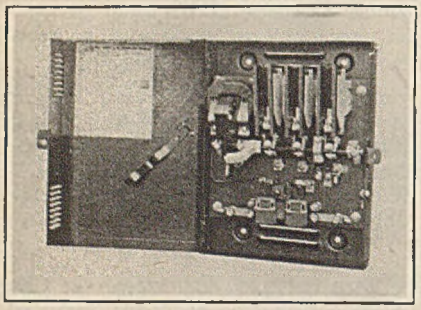


in Coal-Mining Equipment

Across-Line Starters Fit Any Motor

A complete stock of across-the-line starters, built in four types to handle all sizes of motors, has recently been announced by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Although the accompanying photograph shows the type B starter, the features mentioned in the following description are common to all four types.

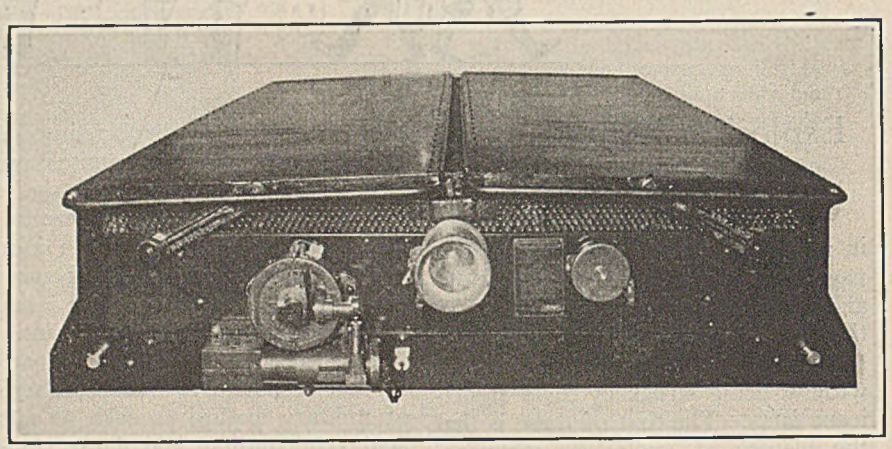
The entire switching and overload mechanisms are mounted on a unit insulating base which is easily removable.



Efficient and Long-Lived

The magnet is of the double-pull type, giving quick and positive pull on the contacts, which results in good connection without heating. The magnet frame is supported on a spring plate which absorbs the shock when the magnet closes. A rolling action in closing is said to increase the efficiency and life of the butt contacts.

Chimney-type arc shields pull the arc away from the contacts and blow-out coils quickly snuff out the arc. The arc shields are easily removable for inspection and replacement of contacts. The thermal overload is not only simple in construction and easy to operate and maintain, but permits of extremely accurate overload adjustment. This, in turn, allows loading of the motor to maximum capacity and yet prevents dangerous heating of the windings. The thermal overload is said never to cut the motor from the lines unnecessarily—starting surges and momentary overloads are permitted, and nothing need be replaced when the device trips. Pressing a button on the outside of the starter case resets the relay. The same starter, up to maximum capacity, may be used on any size of motor by merely changing the heater coils.



Saves Time, Eliminates Danger

Battery Box Is Safer With Lid Lifter

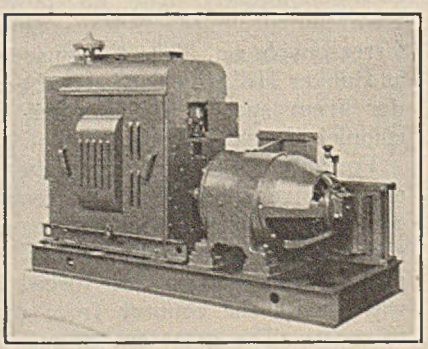
Storage-battery locomotives are constantly growing larger and it has been recognized for some time that battery boxes must be made much heavier to give proper protection to the battery. This not only is the most expensive single item on the locomotive but it is placed in the most vulnerable position so far as falls of rock are concerned. Opening and closing these battery boxes, with their increase in weight, has become more and more of a problem. The Mancha Storage Battery Locomotive Co., St. Louis, Mo., has developed a mechanical lid-lifting device operated by one man only. This is said to be self-aligning and self-locking and to permit the lids to be left in any position. This, it is claimed, eliminates a ratchet or any secondary locking device and has been accomplished by using two self-locking worms. One man stands in a safe position and by hand revolves a crank. In this way the lid is either raised or lowered with a smooth continuous motion, said to be entirely free from "buckle" and "jerk".

The Mancha unit is almost impervious to wear and its life is not shortened by excessive friction. A single cast housing, containing the entire reduction unit, has been adopted. This method permits interchangeability and it is claimed relieves the battery box of unnecessary stress by properly distributing the compressive loads and completely absorbing any bending produced by the eccentric load at the thrust bearings. The entire mechanism is within the battery box, thus eliminating any danger of clothing becoming engaged in the transmission.

It is seldom that the box lids must be completely open. With the self-locking device, the lids can be raised to the desired height and left there safely and securely. This eliminates much lost time due to unnecessary cranking, and also permits the proper and necessary ventilation of the battery. At the same time, it furnishes protection to the battery against light roof falls and dripping water.

Portable Welding Outfit Is Engine-Driven

A small engine-driven welding outfit, particularly adapted to field, shop and garage work where portability is desirable or for any application where no power supply is available for driving a motor-generator type of welder, has been added to the line of welding equipment manufactured by the General Electric Co., Schenectady, N. Y. This set incorporates the company's WD-11



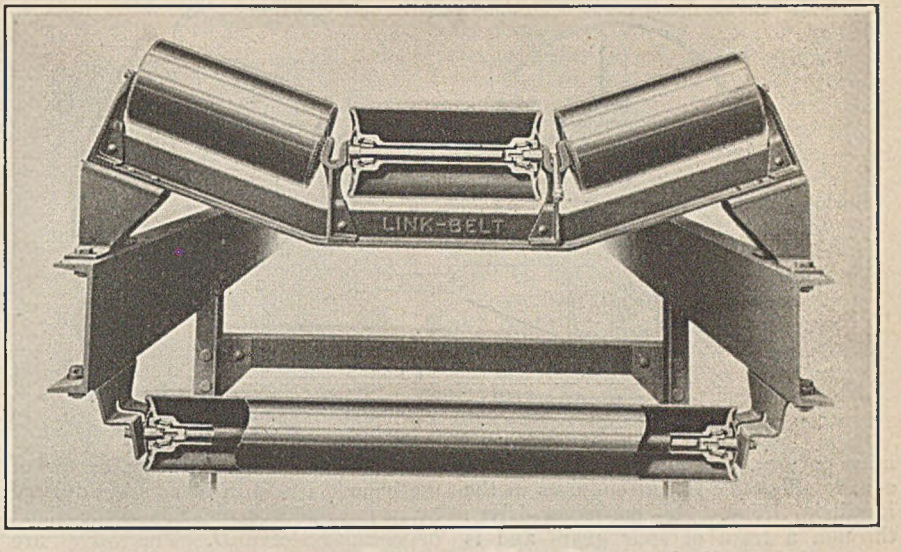
Entirely Self-Contained

welding generator with a continuous rating of 150 amp. and a one-hour rating of 200 amp., the current varying from 50 to 250 amp.

The generator is driven by a Continental P-20 power unit capable of developing 23.5 hp. at 1,400 r.p.m. The generator is equipped with a control panel, rheostat and self-adjusting stabilizing reactor. The engine accessories include a strongly constructed radiator, pressure-feed lubricating system with oil-pressure gage and indicator, vertical tube gravity-feed carburetor, air cleaner, centrifugal governor, starting crank, 10-gal. gasolene tank, tool box and sheet-metal hood with side panels that can be locked in place.

New Post Puller Yanks 'Em Down Safely

An improved post puller, known as the "Temple," has recently been announced by the Mine Safety Appliances Co., Pittsburgh, Pa. The device consists of a toothed bar or rack, 36 in. long, having a swivel and chain block at one end to which is attached 3 ft. of chain terminating in a strong steel hook. The rack bar is notched on both edges, along which a steel block or pawl ratchets when manipulated by a long steel handle or lever—the lever handles engage the teeth on the top edge of the rack to move the block forward. Small teeth on the bottom of the rack tension engage the block to hold it as the lever is moved to a new position. A 15-ft. chain and hook attaches to the sliding block (by slipping a link into a recess in the side of the block), passes through a sleeve at the end of the rack bar and attaches to the timber to be pulled. The sleeve is drilled for a pin, and if it is desired to maintain the tension when the block has been ratcheted the full length of the rack bar, the pin slips through a chain link and sleeve holding "taut" while the block is moved the length of the rack bar for a new hold.



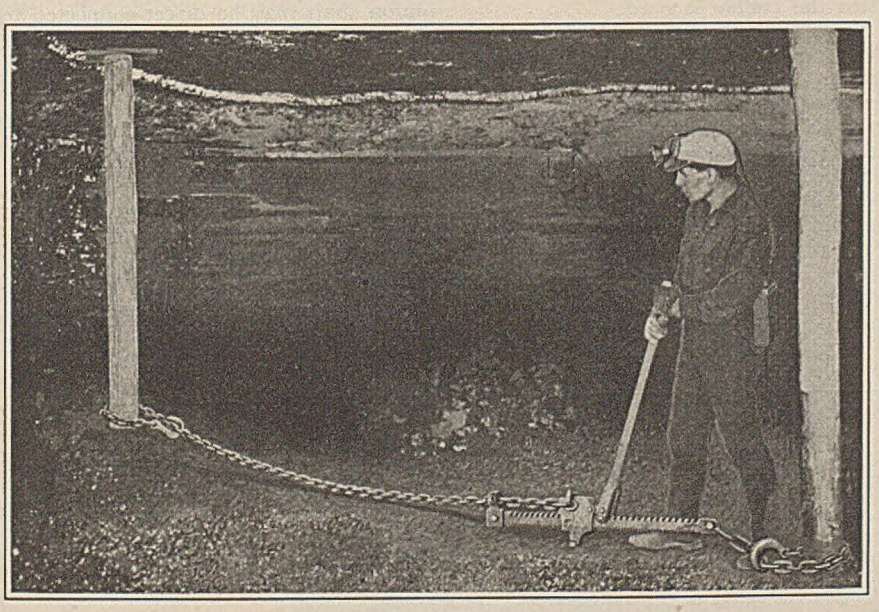
Increases Tonnage and Saves Power

Anti-Friction Bearings Improve Conveyor Rolls

Announcement has recently been made by the Link-Belt Co., Chicago, of the introduction of its anti-friction belt-conveyor idler and return rolls. It is said that this equipment embodies many salient advantages in design. Timken tapered roller bearings which are totally encased within the roll hub, are used throughout.

The most distinctive feature of the idler is claimed to be the absolute protection afforded by a labyrinth grease seal, mounted in a grease cap. This cap also serves as an outboard reservoir and is said to lubricate the bearing on the outside as well as on the inside, particularly when the roll is on an incline. This, in turn, is protected by a deflector plate which deflects dirt, dust, grit or any foreign material away from the bearings and grease seal, and will not permit the washing of the grease away from the labyrinth.

The rolls are mounted on a self-cleaning "T" base. All rolls are interchangeable, being capable of serving in any of the three positions. The entire frame is riveted. Another advantage claimed is the close working tolerances to which all parts are built. Special care is exercised in the machining of the roll shell, to obtain uniformity of thickness of the wall into which the machined heads are pressed and securely held in place by spinning. The heads are dished for rigidity and strength, and the entire construction is such as results in maximum strength.



Makes Miner's Work Less Hazardous

Cord-Grip Connector Easily Locked

The Hubbell cord-grip locking connector, with a rated capacity of 110 amp., 250 volts, has recently been announced by Harvey Hubbell, Inc., Bridgeport, Conn.

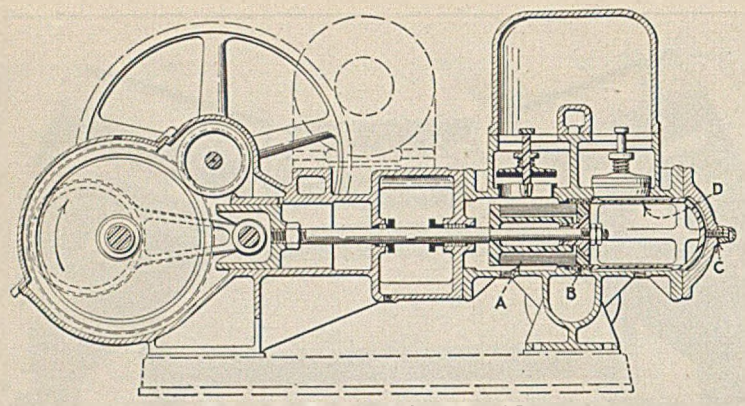
After plugging the cap into the connector, a slight turn is said to be all that is necessary to lock the two parts securely together.

The locking feature of this connector provides an extra and, it is claimed, very effective safeguard against accidental disconnection. This is of distinct advantage in industrial plants and other places, particularly where the service is unusually severe or where connectors are subjected to considerable vibration. These connectors are built for hard service, the bodies being made of a strong, black composition and the caps being completely armored by a heavy shield of steel, which is heavily galvanized to prevent it from corroding.

Horizontal Plunger Pump Built for Mines

A recent addition to the line of pumps manufactured by the Aldrich Pump Co., Allentown, Pa., is the horizontal double-acting plunger pump. The accompanying illustration shows the details and driving arrangement.

Although designed primarily for



Primarily Designed for Mine Use

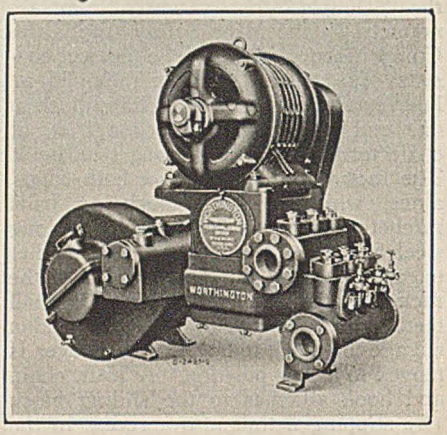
mine service, the pump is said to be equally adaptable to various uses in the industrial field. It is motor-driven through a train of spur gears and is arranged for self oiling on the power end. The porcelain plunger *A*, which is held between acid-resisting heads, forms a separate unit from the plunger rod. The packing *B* at the center of the barrel is held in place and adjusted by means of the screw *C* and the gland or circular sleeve *D*. The valves are of bronze with rubber facings. The pump is made in three sizes, with capacities of 50, 100 and 150 gal. per min. with a maximum lift of 300 ft.

Self-Oiling Power Pump Impervious to Grit

A self-oiling, triplex power pump has recently been announced by the Worthington Pump and Machinery Corporation. The mechanism, by reason of its cast-iron case and cover, is said to be practically impervious to dust, grit and other destructive particles of matter.

The pump, it is claimed, requires remarkably little maintenance or attention. All moving parts are thoroughly lubricated from oil in the crank case so that the only work that devolves upon the pump operator is an occasional draining and refilling of the crank case.

This new Worthington product is of the horizontal triplex, single-acting, outside-packed plunger type, and is being made in two sizes: 2¾x5 in. and 3¼x5 in. The pump will run at 200 r.p.m. crankshaft speed which gives the smaller pump a displacement of 78 gal. per min. against a pressure of 500 lb. per sq. in. The larger will displace 108 gal. per minute against a pressure of 360 lb. per sq.in. Reduction of speed will cause a corresponding reduction in capacity and horsepower requirements. The gear ratio is 6 to 1; hence, the pinion shaft may be direct-connected to a 1,200 r.p.m. motor or engine without any additional gearing or belts.

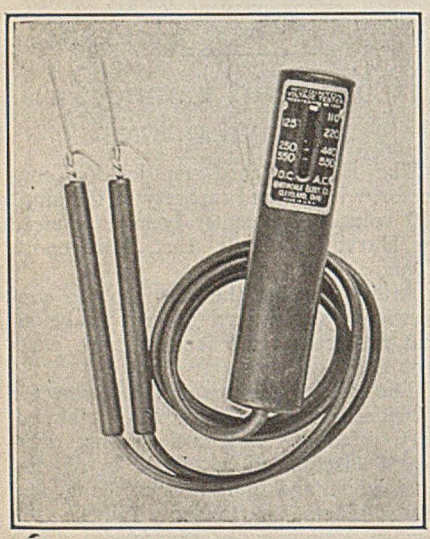


Small but Powerful

The inclosed crankcase provides a large oil reservoir for the flood lubricating system. The rim of the main gear runs submerged in the lubricant and carries oil to the top of the crankcase whence it is distributed generously to all bearings. The fluid end of the pump is cast integral with the frame with all valves separately accessible from above through individual handhole covers, making all moving parts easily accessible for inspection or replacement.

Voltage Tester Performs Many Functions

An ingenious device, known as the Wigginton voltage tester, recently has been announced by the Martindale Electric Co., Cleveland, Ohio. The instrument registers the approximate voltage, whether the current is alternating or direct, detects blown fuses and has many other uses. The tester consists of a solenoid operating against a spring which holds the pointer down to the voltage indicated on the scale. When operating on alternating current the instrument vibrates and hums, while on direct current there is no vibration or noise—in this way the operator can determine the nature of the current.



Fits the Pocket

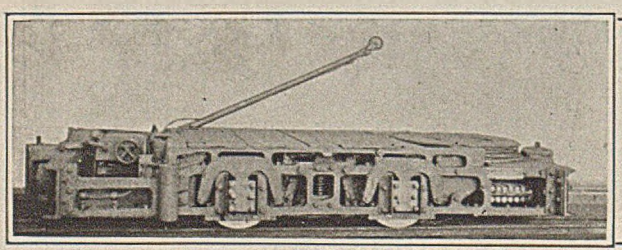
The tester is only 1⅛ in. in diameter, 5 in. long and weighs but 9 oz. It can, therefore, be easily carried in the pocket and is claimed to be better, safer and more convenient than a test lamp. Such a lamp may be burned out and indicate a dead line when it is alive and a 110-volt test lamp, if accidentaly placed across a 440-volt line, may blow up in the operator's face.

Locomotive Is Designed To Work Thin Seams

Modern trends in the development of haulage and gathering types of motive-power units are indicated in the Baldwin-Westinghouse mine locomotive shown in the accompanying illustration. This four-ton gathering locomotive is said to be the lowest and slowest of its type ever built and to meet the demand for motive power for working thin seams. It has an over-all height of 23⅞ in., a maximum speed of 2¾ miles an hour when operating from the conductor cable and of 6 miles an hour when the trolley is used.

Some of the features of its design include semi-magnetic control, bar-steel frames, self-equalizing coil springs, spacious accommodations for motorman, ball-bearing motors, vertical-type cable reel, new type resistor, and other standard devices.

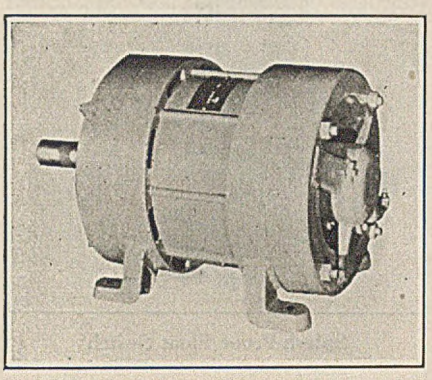
As the thicker beds of coal become exhausted, it will become increasingly desirable to operate the thinner ones either independently or in connection with thicker measures. This new locomotive is admirably adapted to this type of work.



A 4-ton gathering locomotive which is less than 2 ft. high

Latest Designs Feature Induction Motors

A complete line of all-steel ball-bearing polyphase induction motors, ranging in size from 1 to 100 hp. in all standard voltages and cycles, has recently been announced by The Lincoln Electric Co., Cleveland, Ohio. This type of motor is representative of the new designs of equipment being developed by The Lincoln Electric Co., in which gray iron and malleable castings have been entirely replaced by hot-rolled steel.



Up-to-the-Minute Design

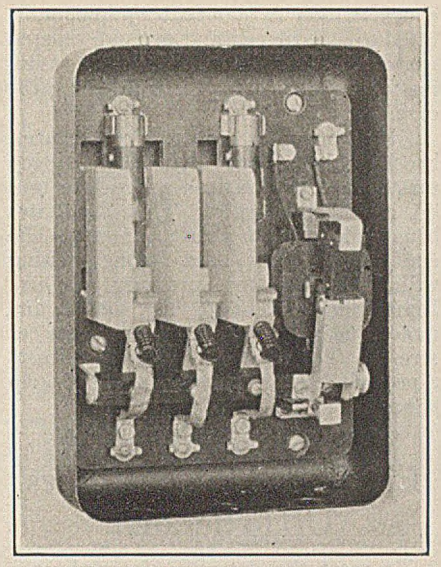
It is claimed that every part of the motor is at least twice as strong as the former type which was built with a cast-iron frame. An example of the increase in strength of the frame is cited in the case of the motor feet. Drop-forged steel feet are welded to the hot-rolled steel end-rings of the motor. This, it is said, eliminates a common source of trouble with most electric motors which arises from the fact that cast-iron feet are frequently broken off in rough handling. The end brackets or bearing supports are also of welded steel construction thus giving a complete all-steel motor.

It is claimed that the increased ventilation so obtained results in a large increase in the overload capacity of the motor. A continuous overload of from 10 to 50 per cent, depending upon the size and speed, can be handled by the motors.

Comprehensive Economy Distinguishes Switch

To meet the demand for a smaller and cheaper magnetic switch with temperature overload relays, the General Electric Co. has recently marketed such a device. This switch is said to require an unusually small mounting space, to be particularly neat in appearance and to have many desirable electrical features.

The inclosing case is of the drawn-shell type, both box and cover being of the same dimensions. The cover hooks over two pins at the top and is fastened by means of a screw at the bottom. During installation the base is removed from the case, thus making it easier to fasten the case to its mounting, to install the conduit and pull in the leads.



A Space-and-Money Saver

Overload protection is provided by means of a Trumbull relay held in position on the panel by fuse clips. These relays can easily be changed to suit the size of motors involved. The relays are self-resetting and, therefore, the switch can be used only with three-wire circuit (push-button) control.

Portable Pipe Threader Is Motor-Driven

A four-inch portable pipe threader, known as model No. 414, has recently been developed by the Oster Manufacturing Co., Cleveland, Ohio. It was produced to meet the demand for a larger machine of the same type as the model No. 412—a two-inch machine which has been on the market for more than a year. Model No. 414 is built of the same aluminum alloy used in the small machine and weighs only 380 lb.

The driving power is furnished by a ½-hp. universal motor which will operate from any 110- or 115-volt lighting circuit, either direct- or alternating current and of any cycle from 25 to 60. Although the motor is of a variable-speed type which, it is claimed, automatically speeds up on the smaller sizes of pipe and holds the required speed on the larger sizes, a two-speed transmission is also used to further increase production and power. A handy gear-shift lever on the side of the machine enables the operator to change speeds quickly and easily.

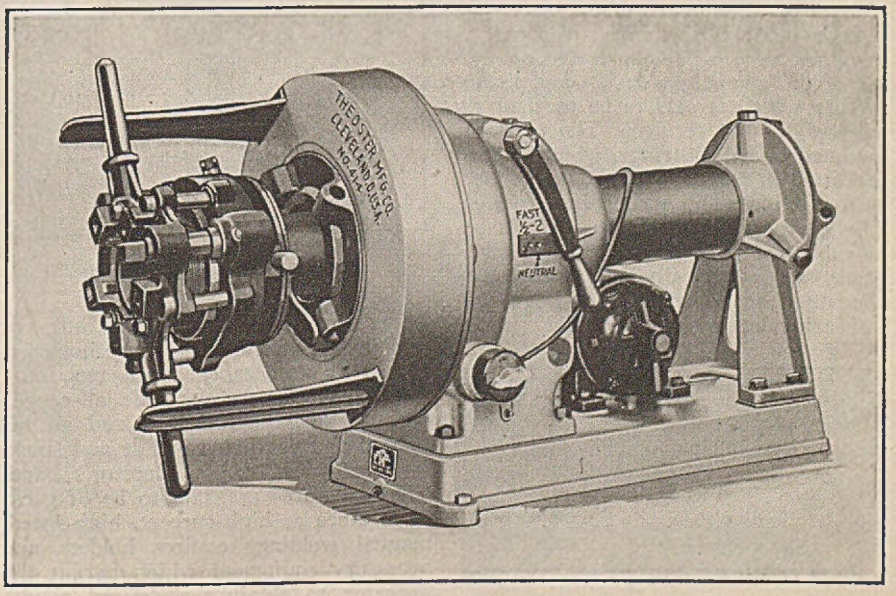
It is said that the machine will handle all sizes of pipe from ½ to 4 in. through its barrel, and will drive geared die-stocks from 4½ to 12 in. by means of an auxiliary drive shaft. Any square-end or roller-type pipe cutter of 2-in. capacity can also be driven.

The pipe is held stationary in a three-jaw self-centering chuck and the pipe tools are turned by the driving arms. Self-centering universal guides in the rear of the machine assist the front chuck in centering long lengths of pipe. An idea of the compactness of the machine can be gained from the fact that it is only 24¾ in. high, 47 in. long, and 20 in. wide.

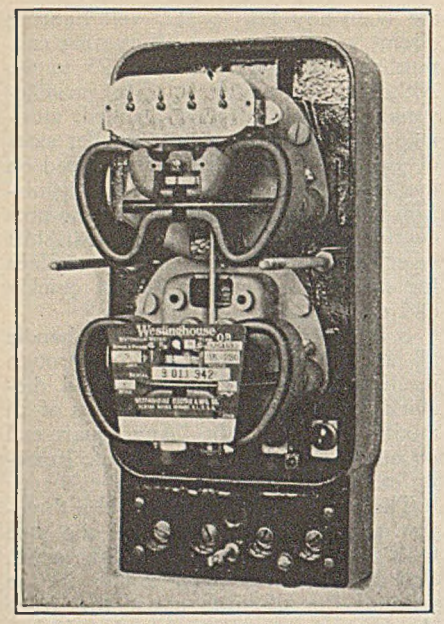
Watthour Meters Bear Distinctive Features

Two types of watthour meters recently have been announced by the Westinghouse Electric and Manufacturing Co. These are the OB polyphase watthour meter and the OB two-element three-wire watthour meter. The OB polyphase meter has all the distinctive features of the single phase OB type and is used on two—or three-phase circuits with either three- or four-wire distribution. Complete temperature compensation at both unity and low power factors is an additional feature claimed for this instrument.

The OB two-element three-wire watthour meter shown in the accompanying illustration, is patterned after the West-



Handles All Sizes of Pipe up to 4 Inches



Hallmarked with Improvement

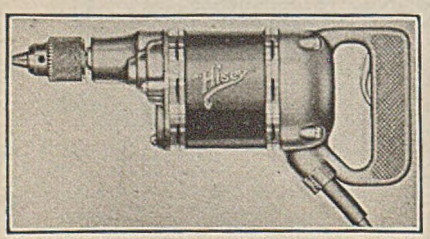
inghouse single-element OB meter and has been designed to solve two major metering problems. On three-wire circuits where greater accuracy is desired than is obtainable with the single-element meter it is stated this new instrument can be used to advantage. Electric-light and power companies are said to find this type of meter economical in metropolitan districts where two-element meters are required. The power consumption is often too small to justify the cost of polyphase meters, and these two-element OB meters are therefore preferred.

Universal Electric Drill Is Strongly Built

Production of the standard-duty, type 18-CU, ¾-in. universal electric drill, shown in the accompanying illustration, is announced by the Hisey-Wolf Machine Co., Cincinnati, Ohio.

Like other Hisey drills, this unit is equipped with a standard electric motor of the company's design and manufacture which is said to be particularly adapted for the service. The motor is mounted on ball bearings, which in turn are fitted in such a manner, it is stated, as to eliminate slip and creeping action. The gear on the armature shaft is removable and all gears are made of high-grade steel, electrically heat-treated. The compound gear shaft is supported with a bearing at each end. The Jacobs chuck, which is standard equipment, is fitted to a hardened and ground, tapered spindle. The chuck spindle is automatically lubricated through the gear case.

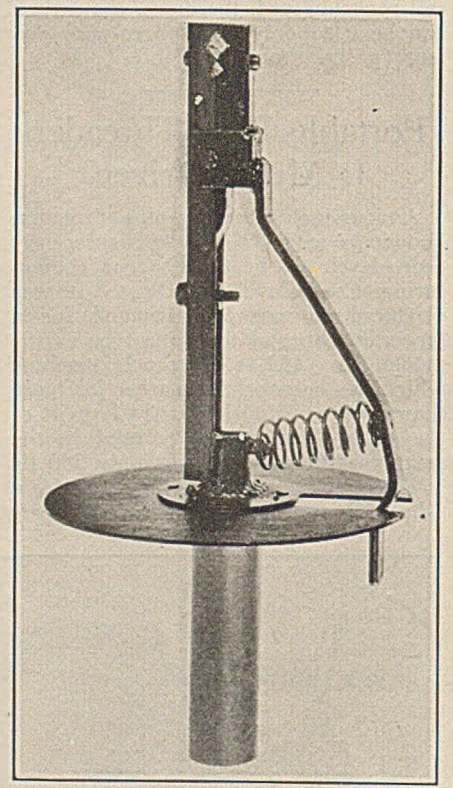
Including other construction features, brush-holders with adjustable spring tension are mounted as a separate unit on a Bakelite yoke. This facilitates brush adjustment when necessary. The end handle cover is a strong casting which carries the pressure applied. Being independent of the motor and motor bearings, it relieves them of stress. The automatic, quick-release-type switch is mounted in the end grip handle.



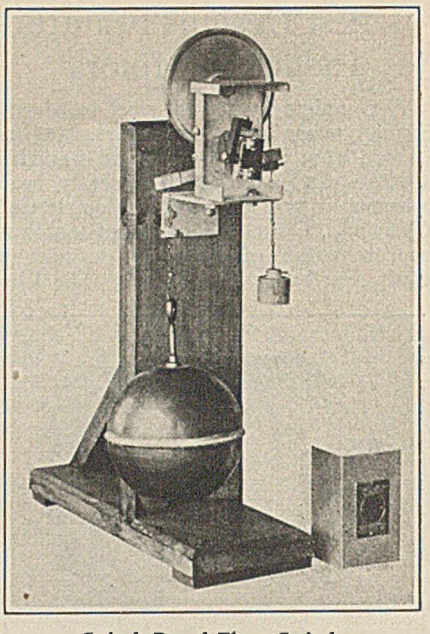
This Drill Fills the Bill

Electrode Holder Comes Up to Scratch

To meet the demands imposed upon arc-welding equipment and accessories by the introduction of heavy current welding, the Lincoln Electric Co., Cleveland Ohio, recently announced the type TR, 600-ampere metal electrode holder shown in the illustration. Designed to handle metal electrodes in sizes up to ½-in. diameter, the holder is fitted with replaceable copper jaws, four-line contact for the electrode, all-copper path for welding current, and an insulated and ventilated handle and shield for protection of the operator's hand. These features are said to be of great importance as high-current, high-speed, manual welding requires holders and accessory equipment which permit the operator to obtain the desired results with the maximum degree of comfort.



Designed for Heavy Duty



Splash-Proof Float Switch

Float Switch to Control Line Contactors

The General Electric Co., Schnectady, N. Y., has recently announced a new float switch for use in control circuits only. In general, this switch will be used to control the line contactor of alternating- or direct-current automatic starters. It has a capacity for handling one 600-amp., two 300-amp., or four 150-amp. alternating- or direct-current contactors at from 100 to 550 volts.

The design is simple and no castings are used. A double contact eliminates shunts, and oxidation trouble is said to have been obviated by the use of silver contacts. The movable contacts are held by a molded bakelite arm which has a snap action in opening.

The switch may be attached directly to a support extending across the tank, or by means of a side bracket supplied with it. This bracket is reversible, and provides for various methods of fastening. The case, which is splash-proof, has provision for a half-inch conduit at the top.

Drive Belt Economizes on Floor Space

The Pennsylvania Pump and Compressor Co. of Easton, Pa., a manufacturer of horizontal, double-acting air compressors, has recently marketed what is said to be a unique method of driving these machines where floor space is limited. The drive employed for these compact units is the multiple-belt drive, known as "Texrope," and manufactured by the Allis-Chalmers Mfg. Co. This consists of a number of extremely flexible V-shaped rubber fabric belts operating in grooved sheaves, similar to the English or separate rope drive.

The great advantage claimed for this "Texrope" drive is that it permits the use of unusually short centers.