COAL AGE

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

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New York, July, 1935

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Vacuum Cleaning

IN A WESTERN MINE, men used to be sent along the haulageways at night to sweep the tops of the crossbars to remove dangerous dust, thereby doing little but throwing it down to alight on ribs and floor. By working with the air current, the dust could be dislodged a second or third time if it settled on other crossbars, and thus in the end all were clean. It was not a safe operation with open lights nor an efficient one. A motor and vacuum cleaner on a truck would have cleaned the timbers more effectively and rapidly, but in those days vacuum cleaners had not been invented.

Today, vacuum cleaners could be adapted to the work and to clean ribs, and even the floor, especially in places where fine dust is swept off the cars or is formed and swept by the current in dumping coal for hoisting by skids and belts. In dumping, of course, nothing is better than a current of air to take the dust from the mine to the surface. Where possible, this should be provided, though here again it will lodge on timbers and buntons in the slope or shaft by which the surface is approached, establishing a hazard.

Toll of Darkness

THOUGH BAD LIGHTING is the basal cause of most accidents, they are invariably credited to more obvious hazards. Bad lighting makes it difficult to note roof and coal defects that may cause falls of both. Falls of persons largely come from bad lighting and such falls often cause accidents listed as transportation casualties. In coupling cars darkness is a frequent hazard and in the darkness the men on the cars are exposed to the risk of low roof. Miners can avoid many such accidents by going slow, but they either do not take this precaution or, taking it, become less efficient.

At the face, bad lighting slows operation and makes it impossible to clean coal effectively. Here, even time and pains will not make amends for inefficient lighting. With coal ineffectively cleaned, the cars are loaded with dirt, which decreases transportation efficiency and makes the use of more cars, locomotives and transportation men inevitable. Arriving at the surface, the coal requires more men on the picking table to remove the dirt that should have been thrown away by the miner. He may be docked for dirty coal, causing labor discontent and possible trouble. If he is not, then the company has to stand the loss for the labor of cleaning, the disposal of the reject and, even more important, the mining of the dirt.

Bad lighting hinders and renders imperfect the work of others than miners. In fact, it takes toll at every point of the operation—and especially in compensation, cutting, loading, transportation, preparation, equipment, tonnage, administration and regularity of operation, and does it in such insidious ways that the losses are not readily apprehended—but a careful analysis will suggest the magnitude of these hidden costs.

Hardly Helpful

AMENDMENTS embodied in the revised Guffey-Snyder bill, reintroduced in Congress last month, hardly can be expected to bring opponents of that particular proposal for bituminous control into camp. Aside from making the allocation provision a mandate for further study instead of an order for immediate action, few of the major objections to the original

draft appear to have been eliminated. Indeed, some of the modifications incorporated into the new version will only provoke fresh attack and widen the breach already made in the industry over this bill.

Provision for excluding the ten per cent of the tonnage in each district "represented by the highest cost mine production" from minimum price calculations has disappeared in the redrafting. In its place is a "minimum-price-area" scheme which would place all the Appalachian region except three counties in Tennessee, Michigan, Illinois, Indiana, western Kentucky and Iowa into one group and split the remaining producing districts into eight "minimum-price areas." Ostensibly offered as a solution to the vexatious problem of price correlation, the new scheme is so confused and contradictory in its terms that it cries aloud for clarification.

Title II, creating a national reserve with the use of government credit to purchase marginal coal lands—a grandiose plan which the May-end conferences of operators had suggested should be deferred for further study—reappears in the revised bill in all its monopolistic vulnerability. The recommendation that the control system set up expire by statutory limitation at the end of four years is ignored in the Guffey-Neely redraft and loosely handled in the Snyder revision. Unilaterality still characterizes the labor provisions of the bill, with freedom from strikes dependent upon the will and the graciousness of organized labor.

Legislation to prevent a return to the chaotic and degrading conditions of a few years ago is highly desirable. The Guffey-Snyder bill should be a convenient framework upon which to build such legislation. But simply because the need is so pressing, however, is no reason why anything less than legislation soundly conceived and equitable in its terms should be jammed through. Shotgun weddings which impose a galling yoke can lead only to strife and disaster.

Rôle of Pyrite

CHEMISTS say that the seat of formation of ferrous sulphate from pyrite is not enough to explain the spontaneous ignition of coal, but they overlook the important physical effects which accompany that transformation. Just what the quantity of water would combine with ferrous sulphate in its formation is not certain, but assuming seven molecules, the volume of the ferrous sulphate crystal will be 6.1 times as great as the volume of the pyrite from which it is formed. Larger crystals of pyrite may be acted on only at their surface, but the microscopic kinds would respond to oxidation in their entirety. Consequently the coal is compressed all over its mass by the expansion of particles of pyrite. This involves not only chemical but physical action, which in turn opens up the coal to the adsorption of oxygen and carbon dioxide, which are both heat-creating actions. If pyrite also acts as a catalyst in the oxidation of coal and in other physical changes it will be easy to accept the idea formerly so prevalent that pyrite is the main cause of spontaneous combustion.

Storage Helps Anthracite

TESTS have shown that stored anthracite has a greater heat value than fresh coals, but such analyses are subject to error and the fresh-mined anthracite might not be representative of the coal put in storage; so some question the value of such indications. However, a few years' exposure to weather should improve anthracite, oxidize its pyrite and wash most of the products away and remove also not a little lime and magnesia.

Granting that the proportion of pyritic sulphur is 0.5 per cent, the pyrite content will be 0.93 and possibly 1 per cent, for the other impurities associated with the pyrite will come with it. Its heat in burning would be 20¼ B.t.u. per pound of coal. With coal of 13,000 B.t.u. the thermal value of the 99 per cent of the product remaining after pyrite oxidation will be 12,980 B.t.u. Hence, a full pound of coal will have 13,111 B.t.u.

The solution of lime and magnesium sulphates would still further decrease the volume of coal without decreasing its heating value, but some gas is lost which has a heat value greater than that of the coal, weight for weight; but this loss, though not determined, is unfortunate, more because it makes the coal slow to ignite than because it reduces its heating quality. However, the loss of the iron of pyrite decreases the clinkering tendency of the coal, so while appearance and response to ignition decline, the actual heat value increases and clinkering troubles decrease when coal is stored.

ANTHRACITE ELECTRIFICATION

+ Shows Increase of Synchronous Drives

And Adoption of Lighter Power Cables

By J. H. EDWARDS

Associate Editor, Coal Age

EVEN without consideration of the number of substations operated by synchronous motors, these motors are far more generally employed in the anthracite region than in any of the bituminous fields of the United States. This exhibits advanced practice, but in one application—mine-fan drives—anthracite mines have fewer installations than bituminous. Shaft and borehole cable installation practices of the anthracite region show a wide diversity—certain companies use leadless cables without metallic armor for wet installations to depths as great as 1,000 ft. Studies of electrical equipment in the anthracite region reveal other outstanding practices and indicate steady progress through the years since 1930.

Natural conditions, of course, are responsible for most of the distinctive anthracite practices, but some can be traced to the school of thought of engineers of the larger companies. An example is the predominance of motor-generator substation units over rotary converters.

Although many large bituminous groups have employed converters with apparent savings from higher efficiency, greater reliability and higher overload capacity, anthracite engineers have in general agreed that the advantages of power-factor correction and d.c. voltage adjustment outweigh the disadvantage of lower efficiency. They question also whether converters are more reliable than motor generators. In only one of the large anthracite companies do rotary converters predominate, and, even there, the present engineering staff of that company believes that motor generators would serve the purpose more satisfactorily.

The strong preference for motor generators is further indicated by a recent statement of the electrical engineer of one of the largest anthracite producers. He said that even though he had plenty of synchronous motors on pumps and fans to provide ample power-factor control and correction, he would not for a moment consider installing converters.

Apparently this widespread use of motor generators is one of the reasons for the limited use of capacitors in the anthracite region. Other reasons are the extensive use of synchronous motors on mine pumps and the fact that several of the larger companies generate most of or all of their own power.

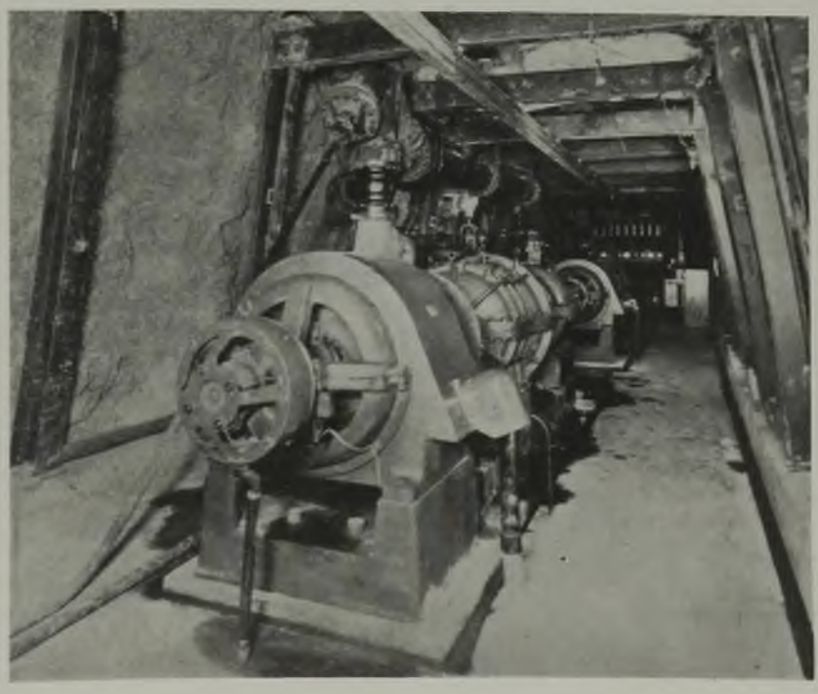
Only seven or eight collieries make use of capacitors, and four of the large companies have yet to make their first installations. Reports from companies using capacitors indicate, however, that in practically all cases the power savings being effected have returned or will return the investment in 12 to 24 months.

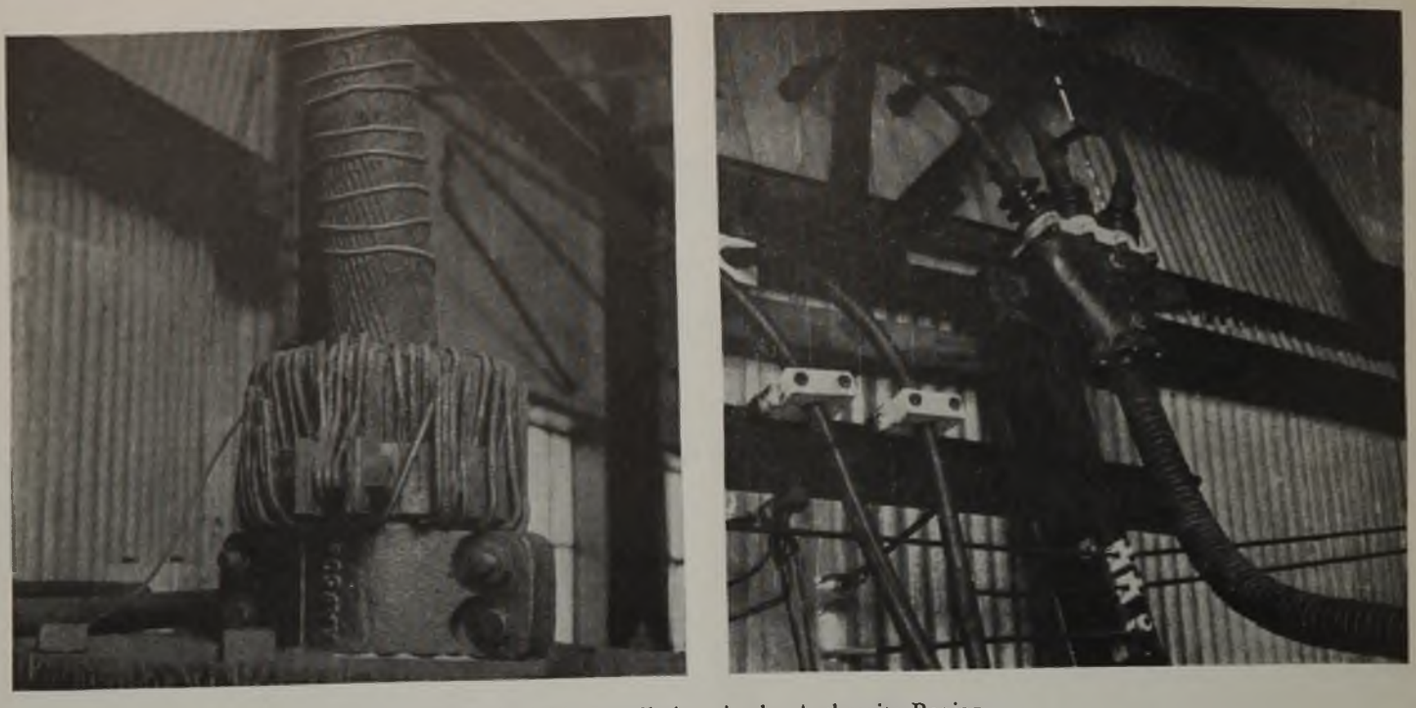
The Lehigh Valley Coal Co. is credited with being the first to install a capacitor in the anthracite region—that about seven years ago. Other companies using capacitors are the Haddock Mining Co., Lehigh Navigation Coal Co., Penn Anthracite Mining Co., and Madeira, Hill & Co. For the most part these installations were made during 1932 and 1933.

One of the early applications of synchronous motors was to the driving of large stationary air compressors, and the anthracite region was among the first few that installed this type of equipment. Most of these motors, many of them 750 to 1,000 hp., are still in use. For the most part they are unity-power-factor motors, hence are not adapted to furnishing reactive current for power-factor correction. Due to the gradual increase in use of electrical equipment underground, few stationary air compressors have been installed in the last fifteen years.

Widespread application of synchronous motors to mine pumps has been the out-

Automatic Pump Station With Two 2,200-Volt Synchronous Motors Each Driving an 8-Stage 1,500-G.P.M. Pump.





Electric Cable Installations in the Anthracite Region

standing development of the anthracite region in the last six or seven years. Power-factor correction is the principal reason for installing this type of motor, hence most of them are designed for a rating of 0.8 leading power factor. A recent survey of anthracite pumping brought to light 67 synchronous motors totaling 25,500 connected horsepower.

Referring to the accompanying graph, it will be noted that the first installation of record was in 1908; that 1922 marked the beginning of an increase which continued at a practically uniform rate for seven years; that in 1929 and 1930 approximately 15,000 hp. (60 per cent of the present total) was installed; and since 1932 installations have increased at a fairly rapid rate.

The first pump installation, made by the Glen Alden Coal Co. in 1908, consisted of two 100-hp. motors. Until 1926 that company was practically the only one to use synchronous motors on pumps and it now operates seventeen units ranging up to 500 hp.—the latest installed in 1933. This company generates all of its own power at the standard 60-cycle frequency.

No synchronous motor of more than 800 hp. has been installed in pump service, but there are more than one of this size being used for that purpose. The starting equipment has full-automatic control, now a common feature of anthracite pumping, and across-the-line starting is employed. Synchronous pump motors of 150 hp. are the smallest in common use, but in numbers those of 500 hp. exceed all other sizes. Some companies set 100 hp. as the smallest to be installed and others place the lower limit at 300 hp.

Collieries of seven companies comprise practically the entire list of those using synchronous motors on mine pumps. Among those listed as using such equipment for this purpose are Madeira, Hill & Co., the Lehigh Valley Coal Co., the Susquehanna Collieries Co. and the Jeddo-Highland Coal Co.

Radical differences in practice are illustrated by the following examples: The Hudson Coal Co., one of the largest producers, uses no synchronous motors on mine pumps or on mine fans, and has no capacitors. For many years it has been the practice of the company to employ synchronous motors on all motor generators and stationary air compressors, consequently additional power-factor correction has not been deemed necessary. This company generates practically all of its power requirements, and the frequency is 25 cycles.

The Susquehanna company, which also generates a large percentage of its power consumption, operates twelve synchronus mine-pump motors totaling 5,900 connected-horsepower. As a general rule, all pumps requiring 300 hp. or over are equipped with synchronous motors, and all are started at reduced voltage. The latest automatic controls employed use a slip-frequency field relay to excite the field when the motor is up to constant speed instead of a timing relay. They also incorporate a Telechron motor relay to transfer to full voltage.

Only two anthracite companies are reported to have installed synchronous motors on mine fans. The Glen Alden Coal Co. has six motors totaling 1,650 hp. Five are the slow-speed unity-power-factor super-synchronous type (revolving stator with brake) and the other is an 0.8-power-factor 1,200-r.p.m. standard-type motor. In 1931 the Lehigh Valley Coal Co. installed one 125-hp. synchronous fan drive, and it employs a Bethlehem snub-starter constant-torque friction clutch to allow the motor to pull into synchronism before the fan attains full speed.

The type of power-factor corrective equipment used is influenced to some extent by the fact that the power companies equip their metering apparatus with ratchets which prevent the customer deriving any benefit from operating at a leading power factor during any periods, day or night. Some engineers assert that it is better to install capacitors with their lower first cost than to equip their pumps with synchronous motors. Apparently, it is a problem individual to each set of conditions. It depends, of course, upon whether a new motor of one type or the other would have to be purchased in any event, and upon load characteristics. Usually the power-factor correction is most needed during peak-load hours, when, from the standpoint of energy cost, mine pumps should in general be shut down.

Motors of 1,000 hp. are the largest of the induction type being used to drive mine pumps. The Glen Alden company installed some of this size more than ten years ago, and two others were put into use during 1933 by the Hudson Coal Co. The latter employ across-the-line starting.

Development of rubber insulations, which are far superior to those available a few years ago, is the principal reason for a trend away from the use of lead and wire armor on borehole and shaft cables. A cable without a lead sheath weighs so much less that it can be supported for hundreds of feet by the conductors themselves. But that lead and armor have never been neces-

sary is argued by the fact that for more than twenty years one large producer, the Lehigh Valley Coal Co., has consistently installed cables devoid of those features.

In 1924, during a visit to a mine of that company, it was noted that in boreholes, three-conductor 2,300-volt varnished cambric and braid cables were supported by the conductors themselves. At that time a factor of safety of five was used in determining the maximum length of cable that could thus be supported. The company now has cables up to 700 ft. long supported solely by conductors.

Two leading companies, the Hudson Coal and the Lehigh Navigation, have not deviated from their earlier standards of using armored cables in boreholes and shafts. The former company still employs lead but the latter has omitted the lead in a recent installation of the largest cable used in the coal industry in No. 12 shaft, near Lansford. This cable, which operates at 2,300 volts, contains three 800,000-circ.mil copper conductors and is 880 ft. long.

Specifications are: 11/64-in. 30-per cent Amerite rubber insulation, rubber-filled tape, conductors cabled together with jute fillers, one rubber-filled tape, three layers reinforced rubber-filled tape to form the jacket, jute and No. 4 B.w.g. galvanized wire armor heavily asphalt-covered. The cable weight is 18.8 lb. per foot and the outside diameter is 3.85 in. The total load of 16,544 lb. is supported at the top by the steel armor wires—no anchorages are made to the buntons.

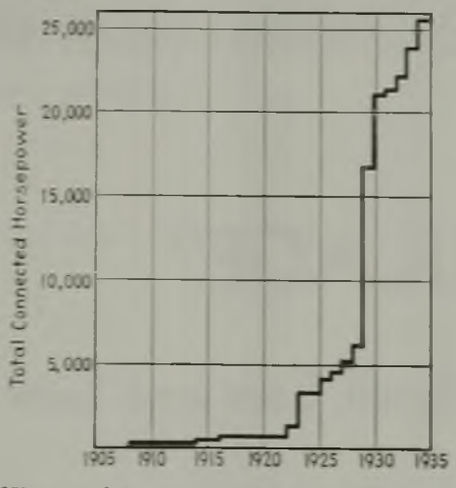
Varnished cambric insulation has been the standard of the Hudson Coal Co.; however, with a three-conductor 600,000-circ.mil cable, 500 ft. long, supported by the armor, the conductors showed a tendency to slip. Rubber insulation may therefore be adopted for future cables. This company limits to 600,000-circ.mil the size of three-conductor cable for its 25-cycle distribution; for greater capacities two or more cables are installed.

In the last few years the Glen Alden Coal Co. deviated from its former standard, which prescribed lead and armor for all 2,300- and 4,400-volt cables. It has installed a number of three-conductor rubber-insulated weatherproof spiral-weave braid cables in boreholes and shafts. The size is limited to 300,000 circ.mil because of the skin effect and the diversity afforded by having more than one cable.

Also for a.c. distribution inside the mine, cables without lead and without metallic armor are finding favor from several standpoints. In case of a roof fall or other difficulty, a cable of this type can be repaired quickly or replaced by the mine electrician, and the spare lengths are not costly to keep in stock and are light to handle. Furthermore, in case of an insulation failure the high voltage is not conducted to points where it might prove dangerous, as it may be by a lead sheath or metallic armor. Safeguarding by connecting the lead and armor to pipes or rails, the best grounds usually available, has its objections.

Beginning about two years ago the Madeira-Hill organization changed from the use of steel armor over lead to a non-metallic covering over the lead and to suspending the cable by the conductors. This construction is considered entirely adequate for boreholes and shafts, the deepest of which, on the company properties, are about 150 ft.

Single-conductor cables without lead and/or armor and supported by the conductors do not exceed a depth of 1,000 ft. in existing anthracite installations. Some of these cables are operating where they are subjected continuously to dripping water. Lower labor cost, less risk of dropping, lighter gear required, cable not so likely to be entirely ruined if dropped, necessity of replacing but one conductor instead of three, and low cost of carrying in stock a spare conductor are advantages cited by users of these single-conductor leadless cables without armor.



History of Synchronous Motor Applications to Pumps.

One of the anthracite electrical engineers who recommends adherence to cables of the leaded and armored type specifies for suspension jobs that a wire serving be placed over the armor wires every 25 ft. This is to minimize the tendency for the conductors to creep when the armor is carrying the weight.

As a rule, anthracite mining equipment is not electrified to the extent that is general in the bituminous fields. Steam hoisting is common, steam-driven reciprocating and turbine centrifugal pumps are in use inside the mines, and some of the breakers are driven by steam engines. Nevertheless, electric power demands per ton of coal shipped are comparatively high.

One large group of mines which employ electricity for somewhat more than 50 per cent of the power equipment uses 10 kw.-hr. per ton of coal shipped. Collieries which use no steam equipment usually consume between 17 and 38 kw.-hr. per ton and the wide variation is due generally to the difference in pumping loads.

The range between 1c. and 1.7c. per kilowatt-hour covers the purchased power costs of most collieries. Several of the larger companies generate 60 to 100 per cent of their electrical requirements. In some cases the reason for continuing to purchase a limited amount of power is to reduce the net cost of maintaining a standby connection with the power company.

The general change of some years ago from mine-generated power to purchased power has not carried as far in the anthracite region as it has in the bituminous fields; nevertheless, the tendency of the last few years to return to mine-plant power has not been absent in the anthracite region. Last year the Jeddo-Highland Coal Co. put into service a new generating plant with 2,250 kw. of installed capacity. Chain-grate-fired boilers operate at 450-lb. pressure and 125-deg. superheat. One turbine unit is bled to supply steam for hoisting and for other low-pressure equipment. Automatic reducing valves and de-superheaters supply low-pressure low-temperature steam in case the high-pressure turbine is not running or does not furnish enough steam.

Application of steam turbines to centrifugal pumps is a recent development in the anthracite region, although in 1917 a 500-hp. turbine geared to a reciprocating mine pump was installed by the Kingston Coal Co. and is still in use. The usual condition under which a turbine is installed on a pump is that where plenty of steam is available and where an attendant is on duty for other reasons, and where, therefore, the advantage of full-automatic operation of electric pumps does not apply. One company tried direct connection of the turbine to the pump, but found that the excessive pump speed thus required wore out the pump in a short time. Now the practice is to use a 1,200-r.p.m. pump and a high-speed turbine connected through a reduction gear. First cost of a 500-hp. turbine complete with reduction gear is approximately $3,000, which is about the same as the cost of a motor.

Developments in the use of permissible equipment and of storage-battery locomotives closely parallel those in the bituminous fields. In the latter fields, however, a larger percentage of the storage-battery locomotives are in use for other reasons than safety. Speedier operation in servicing loading machines accounts for many of the batteries used by bituminous mines. In the underground use of totally inclosed steel-clad switch gear for voltages of 2,300 to 4,400, anthracite mines lead bituminous.

Loading Machine Working Across a 90-Ft. Face in 4-Ft. 9-In. Coal.

"CIRCLE HAULAGE"

+ Compensates for Small Cars and Low Coal

At Binkley Mechanical Mine

"CIRCLE HAULAGE" has been adopted at the Binkley No. 10 mechanical mine of the Binkley Mining Co., near Universal, Ind., to compensate in part for the disadvantages inherent in the small-car and low-coal characteristic of the operation. The circle-haulage principle, which also has been applied to surface haulage at the Pyramid strip mine of the same interests in southern Illinois (*Coal Age*, January, 1935, pp. 21-22), allows the loading of trips along the face, thus eliminating most of the car-changing time that otherwise would be required, and is supplemented by the application of the "circle" idea to the main haulage system to insure that the car reaches the cage with the endgate in the proper position without the use of Y's. With cars holding an average of 3,000 lb. when mechanically loaded, this system has made possible a production of 318 tons in seven hours from a single loading unit.

Installation of mechanical loaders at No. 10—a shaft mine formerly known as Miami No. 4—took place in 1933, and returned the operation—originally a solid-shooting, hand-loading mine—to the production roll after a shutdown of seven years. Clean-up work was started by the Binkley organization on July 11, 1933, and the first coal was shipped Sept. 5. Production comes from the Indiana No. 4 seam, which varies in thickness from 4 ft. 9 in. to 5 ft. 4 in. at No. 10, and is immediately overlaid by a gray slate 4 to 9 ft. thick. This slate makes a good roof if proper support is provided immediately upon extraction of the coal. Available information indicates that the cover, which averages 335 ft., consists largely of limestones and sandstones below the surface wash of approximately 50 ft. While relatively difficult, the cover has been broken to the surface in three separate instances since the present system of mining—which contemplates such breaks—was adopted.

Operations at No. 10 are based on driving to the boundary and mining on the retreat. Entries driven to develop working territories consist of three headings 12 ft. wide on 24-ft. centers. Groups of ten "rooms," each turned from both sides of the entry, constitute working sections for the loading units. In general, each entry is arranged to provide for two groups of ten rooms on each side, the two inner groups—one on each side—being completely worked out before the outside groups are attempted. Inner and outer groups on a side are separated by a solid pillar made by eliminating breakthroughs in the dividing pillar between Nos. 10 and 11 rooms. This allows the inside rooms to be completely sealed off in case of trouble before the entry is completed.

While two of the mobile loaders in

use are at present engaged in development work in narrow places, Northern pit-car conveyors normally are employed for driving entries. Three of the latter units are in service, and, in addition to the conveyor itself, include a cutting machine, drill, mule or locomotive and other necessary supplies and equipment for driving entries, turning room necks, timbering, laying track, pulling coal to the parting and other necessary duties. These units are double-shifted at the present time, and each is operated by a crew of three men per shift, each receiving $6.75. Single units have produced as high as 50 tons of coal from four cuts in seven hours. Average performance, however, is approximately three cuts 6 ft. deep and 12 ft. wide per shift, producing about 35 tons of coal.

Rooms are turned on 27-ft. centers, and widening starts after the first cut, as indicated in Fig. 1. After the rooms are in 30 ft., the middle pillar between adjacent rooms in each group of two is omitted, making five places out of the original group of ten, each of the five places having a width of 40 ft. Track is then laid across the face, as shown, the cars coming in, for example, through "Room 1" and leaving through "Room 2." When the rooms have advanced 150 ft., the pillars between Rooms 2 and 3 and 8 and 9 are omitted, reducing the number of faces to three, one 40 ft. wide and the other two approximately 93 ft. wide. Cars then enter through Rooms 1, 5 and 7 and leave through Rooms 4, 6 and 10. When the places, which generally are driven 285 ft. deep, reach 210 to 235 ft. and roof conditions permit, all room pillars are omitted and the three working faces are thrown into one approximately 258 ft. long. Trips then enter through Room 1 and leave through Room 10. Until all ten rooms are thrown together, the face made by combining Rooms 5 and 6 usually is kept two or three cuts behind the others so that the extra coal will act as a brace for the roof.

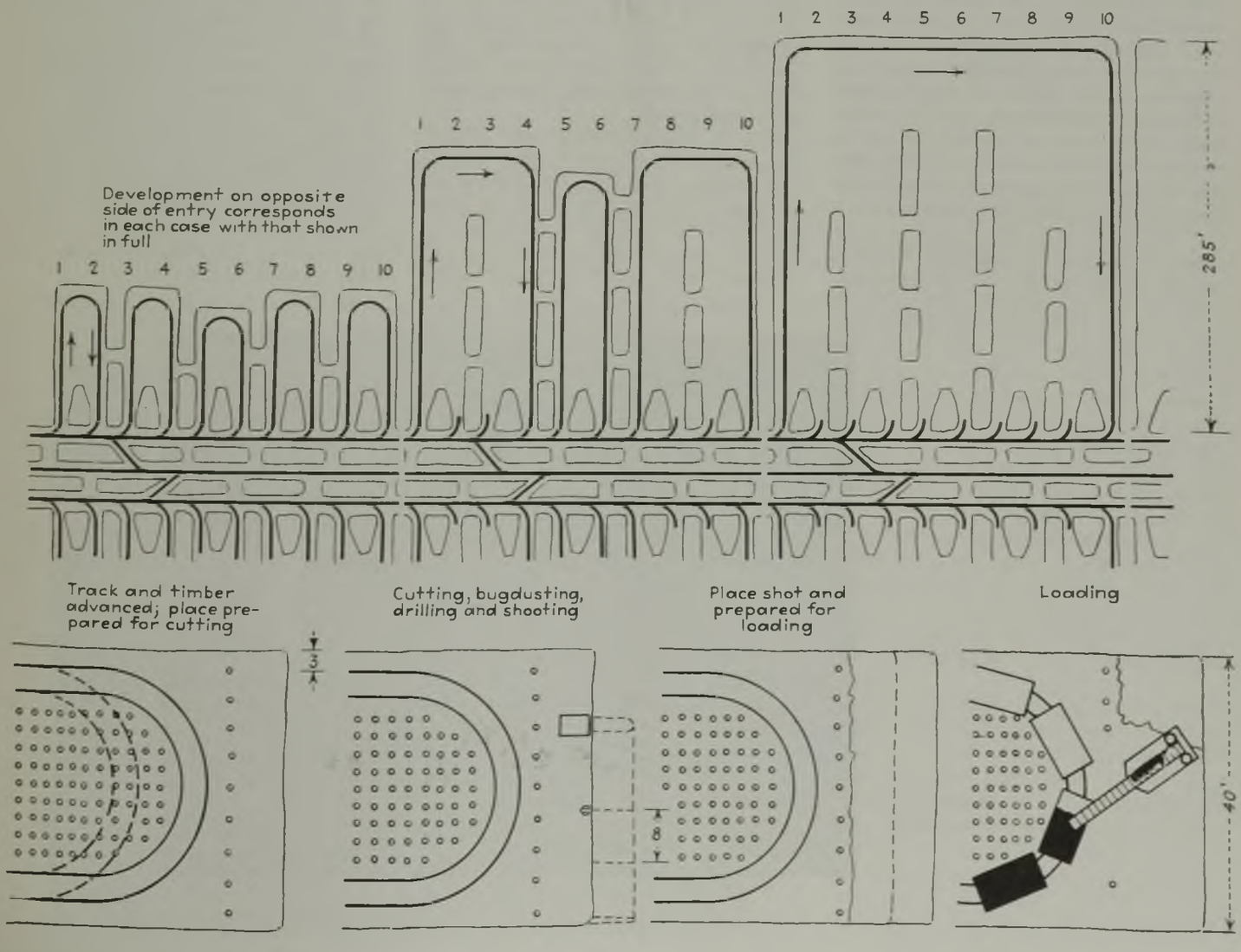
Upon completion of a group of ten rooms, track and timber are removed and the place is left to its own devices. After the two outside groups of rooms are finished, the final step in an entry consists of slabbing the chain pillars and removal of material. Double-swing doors held shut by light strips nailed across the leaves are then installed until the entry caves and ends the possibility of an air blast, whereupon permanent seals are installed across the mouths of the headings.

Equipment employed in a ten-room unit includes one Joy 7BU loader, one Goodman shortwall mining machine with 6-ft. cutter bar, one Chicago Pneumatic portable post-mounted electric coal drill and one 5-ton Goodman cable-reel locomotive. In addition, each unit generally is served by an 8-ton Goodman trolley locomotive hauling from the storage track in the middle heading to the shaft bottom, although at times, depending on grades encountered, one such locomotive may serve as many as three loading units.

Excluding main-line locomotives, a unit crew consists of thirteen men, as follows: loader operator, $6.75 per shift of seven hours; helper, $6.75; clean-up man, $4.57½; motorman, $5.14; trip-rider, $4.69; cutter operator, $6.75; helper, $6.75; driller and shooter, $6.15; two trackmen, $4.57½ each; two timbermen, $4.57½ each; and a unit boss, $6.75.

Assuming loading completed in a place, the first operation is moving up the track and timbering. The track entering and leaving the place is laid with the nearest rail 3 ft. from the rib.

Fig. 1—Above, Three Stages in the Advancement of a Ten-Room Working Territory; Below, Cycle of Operation in a 40-Ft. Place.



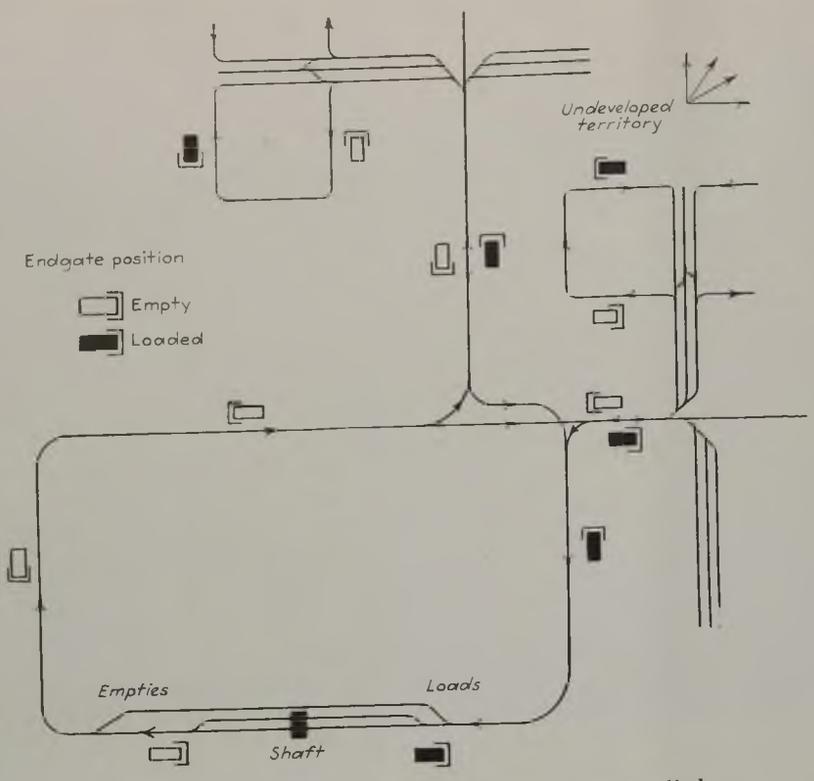


Fig. 2—Diagrammatic Sketch of Circle Haulage as Applied to Room and Main-Line Track Layouts.

Gage is 41 in. Curves connecting the room track to the face track are standardized on a radius of 15 ft., which provides sufficient clearance for the loader to dig in in the right-hand corner and clean up in the left. Moving up then consists of disconnecting the face track back of the curves, slewing it up to within 10 or 11 ft. of the face and adding 6- or 12-ft. lengths, or whole rails, if possible, to make the connections.

Timbering is based on the use of round props with a minimum diameter of 5 in. at the small end set on approximately 2½-ft. centers. With each move-up, the space behind the face track is filled up and a row of safety posts just clearing the cars is set in front along the face. These safety props stay in place as far as possible during subsequent operations.

During or immediately after timbering and track extension, the clean-up man prepares the face for cutting and drilling, and after cutting is completed bugdusts the kerf in preparation for blasting. Shotholes are drilled 7½ to 8 ft. apart, and are loaded with Atlas Coalite "M." Average loading is 1½ sticks in rib holes and 1 stick in face holes. After the coal is shot down, the clean-up man shovels up scattered lumps and otherwise prepares the place for the loading machine.

Track is laid in all three headings comprising an entry, and crossovers are made approximately every tenth room. Empty trips are brought in on one or the other of the outside headings by the main-line locomotive, which then uncouples and goes to the back of the trip to push as many cars as are required into the various places, where they are coupled onto the preceding trip if one is being loaded. The main-line locomotive then pulls the loads, which are stored in the middle heading.

With this system of development, the cars naturally are turned around in their trip across the face. Y's are being used to turn them to the right position pending the completion of new haulways to allow trips to proceed continuously from the empty side of the shaft to the loaded side (Fig. 2), thus automatically turning the cars to the proper position in transit.

Using the system outlined, three loaders in rooms were averaging 250 tons per shift at the time this article was written. Two additional units in narrow work (12-ft. places) were averaging 200 tons each per shift. Excluding pit-car loader units, the average number of men underground, including night men, was 95; surface employees totaled 30. Bosses are included in each case, and seven-hour shifts were worked. As noted above, maximum individual loader output was 318 tons in seven hours, produced by No. 3 unit, including Lee Black, operator; Chancy Sampson, helper; Earl Hensely, motorman; George Frischman, triprider; and Cliff Vitallie, unit boss.

90-Ft. Place Ready for Loading.

SHAFT HEATING

+ Meets the Test of Winter Operation

At Pond Creek Pocahontas Mine

Radiator Sections Viewed From Inside of the Building. Bright Sunlight Appears Coming Through the Air Spaces Between Tubes.

COLD WEATHER last winter failed to interfere with operations at No. 1 mine of the Pond Creek Pocahontas Co., Bartley, W. Va., as it had done at times during several previous winters. Minimum temperatures of 5 deg. F. brought the first test of a shaft heating system installed last autumn to prevent formation of ice on the shaft walls and structures. At the minimum temperatures encountered, airlocks which had been installed did not have to be put into operation.

When engineers of the company set about designing the heating facilities a search failed to reveal data on installations of a similar type, hence the practical tryout was watched with considerable interest. The heating proved entirely adequate and appears to have a safety margin which is desirable. Actual service indicated an unexpected shaft-heating efficiency with airlocks left wide open, thus allowing a large percentage of the air to enter without going through the radiators employed.

Both the skip hoisting shaft and the man-and-supply compartment of the auxiliary shaft were equipped with heating installations. Both shafts are 585 ft. deep and are entirely concrete-lined, but considerable water seeps through the walls. Dimensions of the skip shaft, which contains no curtain wall, are 9x26 ft. The other shaft, 14x27½ ft., is divided by a 4-in. concrete curtain wall, providing one compartment for a single-cage hoistway and another for the main upcast to the 12x5-ft. exhaust fan, which is driven by a 600-hp. synchronous motor.

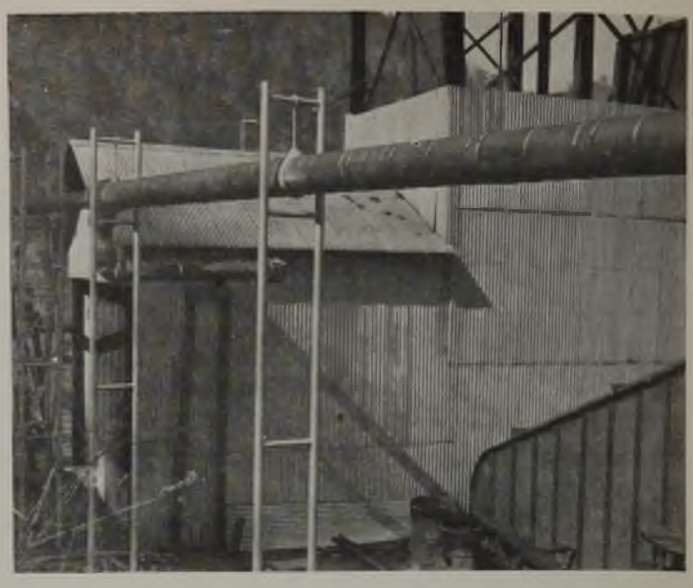
Total ventilation current when the heaters were planned was approximately 300,000 cu.ft. per minute—65 per cent of it entering through the skip shaft and 35 per cent through the cage compartment of the auxiliary shaft. Heating down-cast air by releasing steam directly into the air was deemed objectionable; therefore it was necessary to provide structures at the top of each shaft to house radiators and direct the air through them.

A boiler plant consisting of four 150-hp. hand-fired return-tubular boilers formerly employed in connection with a fan engine was available to furnish ample steam for the heating. Aerofin Corporation radiator units providing single-pass air contact were selected. Each unit contains 190 sq.ft. of heating surface and the over-all dimensions are: width, 29 in.; height, 10 ft. 8½ in. Including the casing, net weight is 242 lb. Tubes are 10 ft. long and the gross air-pass area is 20.8 sq.ft. Eleven units were installed at the skip shaft and seven at the auxiliary shaft. A possible increase of 30 per cent in mine air for future developments was assumed in calculating the total radiation necessary.

At each shaft, the bank of radiator units forms a large section of the side wall of a steel building constructed with the opposite side open to the shaft, which in turn is inclosed to a height a few feet above the top of the building. At the skip shaft, the building is 25x29 ft., including the shaft area, and houses one end of the shaft and guide frame, as well as the side. At the top of the

Radiator Building of Large Dimensions Provides Ample Room for Handling Materials in Case of Changing Skips or General Repairing.

Large Dimensions of the Skip Shaft Radiator Building Shown in This Construction View.



Showing Main Steam Line and Guide Frame Inclosure of Auxiliary Shaft at No. 1 Mine.

shaft inclosure, two double doors were installed which when swung down to the horizontal position close the vertical skipway openings and make it necessary to draw all of the air through the radiator face of the building.

On each side of the building a door 9 ft. wide by 12 ft. high is installed to provide large openings for handling materials when changing skips or making general repairs, also to reduce water gage when the heaters are not in use. In each large door there is a 3x7-ft. manway door. Radiator units are provided with pipe-union connections so they can be removed if still greater work space is required.

Floor dimensions of the structure at the auxiliary shaft are 16x19 ft., not including shaft area. At this shaft, it was necessary to install a steel door to close the gate-entrance side, as well as horizontal double doors over the top. To facilitate handling long materials, the vertical door is 20 ft. high and consists of two sections, one above the other, each hinged independently at the side. The lower section contains a 3x7 manway door.

The plan was to arrange the skip-shaft horizontal doors to open and close automatically to allow ascending and descending skips to pass through. Electric motors were to have been used to move the doors, their starting contactors to be actuated by cams added to the Lilly control of the skip hoist. The advent of cold weather before this feature was installed demonstrated, however, that it will be unnecessary.

During the 5-deg. F. weather, the temperature of the incoming air at the shaft bottom with the horizontal airlock doors left open was 38 deg. F. Apparently if the doors were kept closed during the off-shift hours and then left open continuously during the hoisting shift, ice in quantities sufficient to cause hoisting difficulties or become dangerous would not form even in minus-7-deg. weather, which is the coldest that has been observed at the mine in the last seven years.

Steam lines feeding the shaft heaters are carried overhead. An existing 8-in. line from the boiler room to the fan was extended a few feet to the auxiliary shaft. From here a 5-in. line with slip-type expansion joints is carried 400 ft. to the skip shaft. Heat insulation on the pipe line consists of 2-in. multi-ply sectional asbestos with weatherproof covering. Radiator units are equipped with individual steam valves and drain traps, and condensation is returned to the boiler house for reuse as boiler feed. Automatic reducing valves are not employed. Control of steam supplied to the heaters is effected by varying boiler pressure or throttling the main line at the boiler plant.

By what proportion the total air would be reduced through resistance introduced by the shaft heaters was open to speculation when the installations were made. No check has been made with all doors closed, but with all of the airlock doors open the volume was reduced approximately 5 per cent. The increase of effective shaft lengths by reason of the vertical inclosures (27 ft. at the skip shaft and 20 ft. at the auxiliary shaft) introduced sufficient water gage to pull large quantities of air through the radiators.

A $\frac{1}{4}$-in.-mesh screen was installed on the outside in front of the heating units to protect them from damage. Mine officials are considering removing these screens before next winter in order to reduce air resistance and encourage more air to flow through the radiator when the airlock doors are open.

Airlock Doors of the Auxiliary Shaft Appear at the Top of This Construction View.

WHAT ABOUT THE FAN

+ In Mine Ventilation?

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IN THE three preceding articles emphasis was laid on ventilation improvement below ground because that phase has been much neglected. But this is not to say the job is necessarily completed, once the underground system is put in order. What about the fan? Is it modern and mechanically efficient? Is it suited to the mine: not too large or too small? Is it mechanically safe? Is it a fire hazard? Are its drive and source of power dependable?

For reasons already stated in the fan-generator analogy (*Coal Age*, March, 1935; pp. 107-108), do not condemn your fan for not delivering its rated volume before making an investigation. The fan is frequently pronounced faulty when in reality the airways have been allowed to become too small to carry the rated volume of the fan. The fan may have a rated capacity of 150,000 cu.ft. at 3-in. gage and may have performed its duty satisfactorily through a number of years. If the operator later finds that the volume has gradually slipped back to 100,000 cu.ft., he immediately reaches the conclusion that something is wrong with the fan. The first step he should take is to ascertain whether the speed of the fan corresponds to the manufacturer's specifications for a 3-in. pressure. He should take a pressure reading, and if a 3-in. pressure is obtained, he no longer should condemn the fan but look toward improvement of the airways. The final conclusion can be checked by bypassing or short-circuiting 50,000 cu.ft. additional to the 100,000 passing through the mine, making a total of 150,000 cu.ft. Again, the gage should be read and the r.p.m. taken. If the gage and speed correspond with those taken when 100,000 cu.ft. is passing, conclusive proof is furnished that nothing is wrong with the fan and that the reduced volume is due to insufficient airway capacity.

When a new fan is needed, correct specifications are indispensable. If the operator is unable to determine the volume required and, more important, the pressure necessary to force the air through the workings, then an engineer who is thoroughly versed in mine ventilation should be consulted. Operators too often ask for a quotation on a fan with a certain volume capacity without even mentioning the pressure required. Obviously, it is impracticable to propose a fan without knowing the water gage against which it must operate. On the other hand, frequent inquiries are received about as follows: "We need a new fan to deliver 150,000 cu.ft. of air at 2-in. pressure. Our present fan is too small and gives us only 75,000 cu.ft. at 2-in. pressure. We must have double this amount of air at once." Of course, upon receiving such an inquiry the fan manufacturer will make a thorough investigation before offering a recommendation. If the mine is passing only 75,000 cu.ft. at 2-in. gage, it would require a pressure of 8 in. to pass 150,000, which is a prohibitive pressure for the average mine. The purchaser would be so advised and instructed how to reduce the mine resistance by providing additional airway capacity, by splitting and by cleaning up old airways. If, after corrections are made underground, the mine characteristics are not in keeping with the normal rated capacity of the fan, it would be advisable to install a new fan.

The economy of using a second-hand fan is always open to question, whether the procedure be that of shifting a unit from one plant to another or of purchasing a used fan on the open market. The difficulty in either case lies in having or acquiring a fan with characteristics that match the requirements of the mine. Most transferred installations have brought disappointment.

Obvious makeshifts and antiquated installations call for immediate replacement by a modern fan. Sometimes massive, sometimes housed fragilely in grease-soaked wood, those old fans are, if not unreliable in operation, incapable of producing sufficient pressure or decidedly wasteful of power. Knowing that the modern fans offer an efficiency of at least 70 per cent, continued use of units with an efficiency from 50 per cent down carries no excuse.

Many centrifugal fans in use are either too large or too small. Though they may be efficient when operating under normal conditions, their nonconformity to the mines they serve prohibits economical performance. Where the fan is too large, the trouble generally dates back to the early development days of the mine. The first aim had been to install a unit of sufficient capacity to allow an extensive tonnage increase. But in eagerness to make production sustain development expense, progress was measured in terms of areas tapped, without thought of adequate airway capacity for future ventilation requirements. Coal was taken "on the go" and, so long as air travel continued short, ventilation caused no worry. Later, with the workings fully extended, the arteries are found to be too constricted for normal functioning of the heart of the mine—the fan. Many a superintendent with determination to tolerate no neglect of ventilation provisions has been summarily discharged by an owner who could see no virtue in the steps taken to insure future efficiency. The attending costs appeared too great.

Uncontrolled growth of production areas usually ends in chronic ventilation difficulties. The cause is insufficient airway capacity, usually within a radius of 2,500 ft. from the mine portals. If it is impracticable to enlarge the airway capacity to at least 70 per cent of the fan capacity, then a new fan with characteristics more in keeping with the mine should be installed. A modern fan operating at 30 to 40 per cent capacity can offer no better than a like range in mechanical efficiency. In many cases the cost of excess power consumption would pay for a suitable fan within a year. Since best practice requires two fans, the old fan may be maintained for emergency use.

Even more wasteful is the continued operation of a fan at a volumetric ratio far above its normal rated capacity.

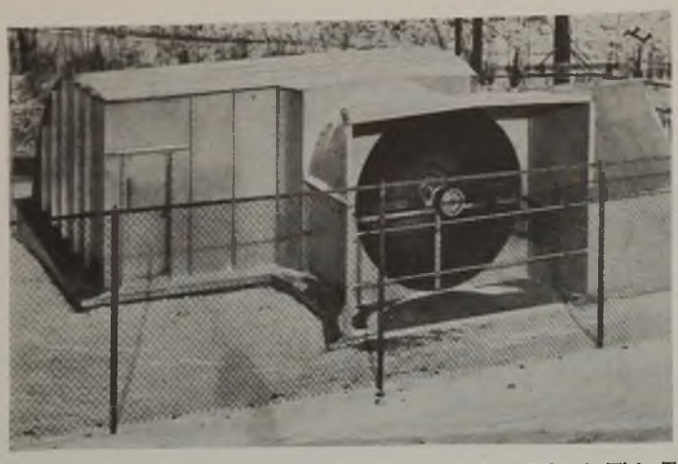

Fig. 1 (Left)—Now Using Only One Wheel, This Two-Stage Aerovane Fan Installation of the Elm Grove Mining Co., Near Wheeling, W. Va., Is Operating as a Single-Stage Unit Delivering 77,000 C.F.M. at a 1.55-In. Water Gage and Consuming 28 Hp. This Fan Is Connected to a New 240-Ft. Deep Air Shaft at the Working Faces. Fig. 2 (Right)—Low-Cost Modern Fan Installation at Muskingum Coal Co. Mine, Near Zanesville, Ohio.

Perhaps purchased in the first instance for a temporary installation, the fan is ordained by custom to provide the mine with a volume greatly in excess of its capacity, sometimes for years. So long as it delivers the requirements of the mine, its economy may never be questioned. Rather, if delivery is double its normal capacity, the unit is likely to be viewed with admiration. An efficent fan? Volumetrically, yes; mechanically, no. The paradox is that to deliver the surplus volume the fan consumes a great deal more power than would another fan delivering the same volume at normal capacity. A part of what normally would be effective depression produced by the blades is used to draw the excess volume through the fan itself. This is accomplished at a great sacrifice of power economy. The remedy is a new fan matching the requirements of the mine.

The practice of installing a small fan as a temporary measure is more than questionable. It invites the temptation to place the temporary fan most advantageously with respect to the mine opening, a step which interferes with and sometimes prevents correct location of the permanent unit later. Psychologically, too, a temporary installation is bad. It causes the management, as a result of faith in the ability of the permanent fan to take care of the inadequacy, to overlook the development of adequate airway capacity. Then, the discovery is made that complete correction is beyond the power of a new or permanent fan. Had a permanent fan been installed initially, it would have exposed the inadequacy of airway capacity in time to allow correction. Besides, utilization of the permanent fan during development stages—when air travel is short and resistance consequently low—adheres to a fundamental of good practice: namely, that the lower the gage for a given volume, the larger should be the fan.

The old type disk fan with low efficiency may do for a small mine where resistance is low by virtue of many openings to crop, but it should never be installed at a large mine, temporarily or otherwise. In the latter case, the pressure it will develop soon falls short of requirements. The convenience of operating fans of this type in series has in the past led to the addition of a second and sometimes a third unit, as the resistance grew. Instead of this, a centrifugal or aerodynamic propeller type fan should be installed. One fan is normally more efficient mechanically than several fans for the same duty.

More than ordinary attention should be given to the choosing of a large fan and to preparations for its installation. The size and type of fan best adapted to the particular mine obviously is important; so are the methods of driving the position and arrangement of the drives, and the design of the housing for the particular application; also whether the mine projection provides ample airway capacity to enable the fan to perform near peak mechanical efficiency during much of its life. This last has been considered in detail in the first article of this series.

It should be borne in mind that there is no such thing as a strictly standard fan installation, that the requirement of each mine is more or less a problem in itself. Starting with the simplest layout, there is no limit to the degree of refinement which may be incorporated into the plans. The crux of the problem, therefore, lies in deciding how far up or down from a median level of refinement it will be profitable or safe to go.

A Modern Fan Installation — No better illustration of these processes can be contrived than by presentation of the steps taken by a certain large company in handling a fan problem at one of its mines in West Virginia. The analysis prompted adoption of a layout of more than ordinary refinement. Acquisition of the property as a going operation was followed by a large program of expansion and improvement, in which revamping of the ventilation system was made the start.

In the preliminary planning many designs were proposed for the ventilating equipment, some that are now being used at many of the largest mines. One suggestion called for the installation of a single fan with an electric and an auxiliary steam-engine drive. Several modifications of the duplicate drive were proposed, as placing the engine on one side and the motor on the other side of the fan, connecting each unit to the main fan shaft through clutches, couplings and other well-known means, or placing both drives on the same side of the fan and connecting the main fan shaft through a heavy jaw cutoff coupling, using a belt drive from the engine. But none of these arrangements met with the basic specifications evolved by the management: namely, that a transfer could be made from one driving unit to the other without interruption of the ventilating current. The mine is rated "gassy." Conditions lent themselves to the application of two fans, each capable of delivering the mine's maximum capacity requirements. This arrangement, which took into account the continuity of ventilation, satisfied all questions of safety.

It was decided that a capacity of 300,000 cu.ft. delivered against a 4-in. water gage was the ultimate volume and pressure required. The equipment chosen were twin primarily exhaust, reversible 12x5-ft. fans, one direct-connected to an engine and one arranged for belt drive from an electric motor. Operated normally exhausting, these fans place the intake air on the haulage roads.

Fig. 1 shows an exterior view of the fans. They are fitted with steel casings extending down to the floor line and with steel évasée chimneys. The four side drift doors, of steel construction, are fastened to their respective parts of the fan casing with malleable-iron hinges. The fan shafts, of hammered steel, 0.35 carbon, are supported on double-ring oiling, self-aligning, dust-proof, dynamo-type bearings, mounted on heavy cast-iron pedestals independent

of the fan housing. The side drifts connecting the fans to the air shaft are built with cut stone as shown.

One of the ultra refinements of the twin installation is the arrangement of doors, which function automatically to cut off one fan from the other without shutting down the ventilating current or requiring manual effort to make the change. This is illustrated in Fig. 2. The doors are shown at the top of the air shaft. They swing toward each fan and are made in pairs owing to the great width of the drift connecting the air shaft at the hinge point—about 13 ft. When the engine-driven fan is idle, the doors adjacent to this fan are held tightly shut by the suction pressure of the electrically driven fan, while the doors adjacent to the latter are drawn tightly back along the drift walls to permit an unobstructed flow of air to the inlets of the operating fan. When it becomes necessary to change over from the electrically driven to the engine-driven fan, the throttle of the engine is opened and the latter fan is placed in operation. The switch on the electric fan is opened, cutting off the power. Both fans are now in operation, the engine fan being accelerated while the electric fan is slowing down. But just as soon as their respective speeds cross each other, the doors on the electric fan are closed and the doors on the engine fan are opened, automatically in both cases.

Assuming that the electric fan is operating at 150 r.p.m., when the current is cut off and the engine fan started, the doors will remain stationary for a few moments. But when the engine fan has attained a speed of, say, 75 r.p.m. and the electrical fan has slowed down to about 70, the pressure on the inside of the doors adjacent to the engine fan becomes greater, and consequently these doors are opened. There is a tendency at once to draw air through the electric fan. Initiation of this air current immediately shuts the doors adjacent to the electric fan and the full air volume is then handled by the engine-driven unit.

Use of this arangement obviates the necessity of an attendant entering a drift possibly laden with gases. The doors swing gently from one position to another, for the pressures on each side of the doors are nearly equal when the change in position occurs. This shifting of door positions is audible to the attendant on the outside. A mechanical indicator could be provided, if desired, in the engine and motor house.

It is the opinion of the writer that in the installaton of a mine fan where the hazards of ventilation interruptions are so critical as to suggest auxiliary drives, serious thought should be given to the installation of duplicate fans. This recommendation is based on the axiom of good practice that the fan be made as foolproof as possible. The driving mechanism should be such that it will not be likely to get out of order, and general design and construction such that attention is reduced to a minimum. It is not absolutely necessary to have both fans of the same capacity, but each should have its own independent drive, thus eliminating all clutches, cutoff couplings and complicated mechanism which so frequently cause trouble.

Fig. 3—Modern Double Installation of Primarily Exhaust Reversible Fans. One Fan Is Directly Connected to an Engine, and the Other Is Arranged for Belt Drive From an Electric Motor.

Power failures are more likely to occur than failures of motor or drive mechanism. Therefore, where only one fan is installed and continuous operation of that fan is essential, at least two sources of power supply should be provided. The following suggestion is offered as an economy measure for adoption where the fan is large.

Assuming that the mine requires 200,000 cu.ft. at 3-in. water gage, a motor of at least 150 hp. will be required. The power supply is 3-phase, 60-cycle. In order to have an independent source of power, it is frequently necessary to provide a gasoline-driven generator. Obviously a 150-hp. engine and generator unit is expensive in purchase and maintenance cost.

An alternative is to use a 50-hp., 40-cycle gas-driven generator wired to the existing 60-cycle, 150-hp. motor, with the necessary switching equipment provided. When the main current fails, the gas engine is started and the 60-cycle fan motor supplied with 40-cycle current. This will operate the fan at two-thirds speed, give 133,500 cu.ft. at 1.34-in. gage and require only about 44.5 hp. In most instances this volume will suffice until regular service is restored.

Consensus of opinion recommends that the fan installed at all mines which generate gas, irrespective of their classification and size, be of the reversible type. Since coal dust has been discovered to be an explosion menace in many of the so-called gas-free mines, this recommendation ought to be extended to certain mines in this classification. In all cases the fan applied should be of a design pointed primarily to the duty corresponding to the system of ventilation used, exhausting or blowing. It is possible, of course, to build a fan that will be equally efficient for both duties, but in neither case will it be as efficient as a primary-duty unit.

While reversible features are desirable in a fan, attention must be sharply called to the sometimes unfortunate consequences of shifting from one duty to another in rescue procedure. Air should never be reversed until conditions underground are fairly well known. A practical scheme is to outline plans of strategy in preparation for a possible explosion and train the personnel in alternate procedure, depending upon the origin of the explosion. The workers would then have a better idea of what to expect and plan their excape accordingly.

Booster Fans—Introduction of the small auxiliary blower fan in connection with mechanized mining requires that a distinction be made between this type, which delivers but a small portion of the main volume to the working face, and the long-known booster fan, which delivers the entire volume of one or more splits. Much of the prejudice directed against the use of the booster fan is due to a misunderstanding of its function and application. It has a definite place under conditions where ventilation is difficult and impracticable by ordinary means, as in certain mines in foreign countries. Though our mines are more easily ventilated than overseas mines, the development of some calls for a booster fan to ventilate a remote section properly without increasing the pressure on the entire mine. It is not the purpose here to indorse this type of fan as a remedy for ventilation ills such as clogged airways or water-filled entries, as these troubles should be handled by other means.

Even so, the booster fan must and will come back into its own, and for logical reasons. To illustrate, assume that the fan on the outside of a mine has

a normal capacity of 80,000 cu.ft. at a certain speed and the mine is divided into four districts each of which requires 20,000 cu.ft. If the resistance in one lone split is such that only 10,000 cu.ft. will pass at the pressure required for 20,000 cu.ft. in other splits, the use of a booster fan is practicable, economical and recommended. The pressure can be raised on this split and the 20,000 cu.ft. circulated without increasing pressure on the other districts or increasing the speed of the main fan. If an attempt were made to ventilate this remote split by speeding up the main fan, the present fan speed would have to be doubled, regulators placed on the other three splits and 80,000 cu.ft. delivered against four times the present resistance, thereby increasing the power consumption at least fourfold.

This recommendation is made knowing full well that State departments of mines are somewhat averse to the use of booster fans. But is it not much better to have a remote section properly ventilated with a booster than inadequately ventilated without? It might be asked, "Why not drive new airways or enlarge present ones?" The answer to that is that the layout does not permit. Many of today's mines were opened 30 or 40 years ago, when knowledge of mine resistance was limited and mining law was less demanding. In consequence, the existing layout in most cases forbids the driving of additional airways.

A booster fan, properly applied, can be made safe by education, and it serves a real purpose. Consider the automobile. It kills hundreds of people, yet no one dares prohibit its use, for it serves a real purpose; and laws are being passed to eliminate accidents from its misuse. The following suggestions relative to the installation of a booster should be followed: (1) The fan should be constructed of non-combustible material and equipped with bearings which prevent leakage of oil. (2) The installation should be fireproof. (3) The stopping between fan intake and fan discharge should be built fireproof and equipped with a large door which swings in the direction of air travel; and if the fan is working on a 2-in. gage or higher an air lock should be provided so that the attendant may pass from one side to another. (4) The booster installation should be made on the fresh-air intake, adding another safety factor. (5) The motor should be equipped with an automatic starter. (6) If the mine is operated with permissible machines, an explosion-tested motor and starter should be used to drive the fan.

Auxiliary Fans—Much of the loss caused by fugitive air can be avoided by taking advantage of auxiliary ventilation to eliminate stoppings. Continuing development of new methods and more productive mining machines and progress in combining these for greater concentration of operations have proved the indispensable need for the auxiliary blower. The time has arrived when ventilation by blower and tubing no longer needs excuse or defense. In the new scheme of mining, safety has become a greater consideration in governing how this unit is to be used than it earlier was in arguing against its use altogether. Since the blower is readily adaptable to mechanization plans, mine operators have choosen to use it. Realizing that it promotes safety, good judgment suggests its acceptance with the provision that every precaution be taken to install it safely.

Properly installed, blowers will provide satisfactory ventilation. More important, they will contribute to more effective ventilation at lower cost during the years remaining in the life of the mine by minimizing crosscuts and fugtive air. They permit entries to be driven at least 600 ft. without crosscut and provide adequate ventilation throughout this advance. Driven in the orthodox way, entries are extended 60 to 100 ft. ahead of fresh air and, since the crosscut usually is made from one side, often 80 to 120 ft. of entry is driven in dead air.

True, air may be carried to the advancing face of headings by line brattice, but this has limitations as to effective distance and other factors. Where mobile loading machines are used, utilization of brattice is definitely limited by space requirements for maneuvering the machines and shifting cars. A line brattice must be carried from the inside rib at the last breakthrough and frequently crosses mine track, while tubing is hung out of the way and occupies little space.

Mines in the thinner coal seams have found use for conveyors and other mechanized loading equipment imperative as means to compete with thick-seam mines. To effect a still further gain in efficiency, working faces are being established much wider than was necessary in earlier years. In some cases the places are developed by single headings, largely because double headings put too heavy a burden on operating cost or require too much time for development. Auxiliary ventilation obviously has a place in such mines.

The blower should be kept level at all times by installing it on a substantial footing, not on the uneven surface of the floor or the loose footings provided by slack, as then fan-bearing trouble is likely to ensue. It must be located at least 15 ft. upstream in the fresh air. Never should two or more blowers be installed in series, which arrangement allows air delivered to a face by one blower to be passed through another blower.

It is recognized that with the blower, as with all mining equipment, certain hazards exist. But the point is that a great margin is left in favor of the blower after the safety it creates is devaluated by its hazards. The hazards can be eliminated by education.

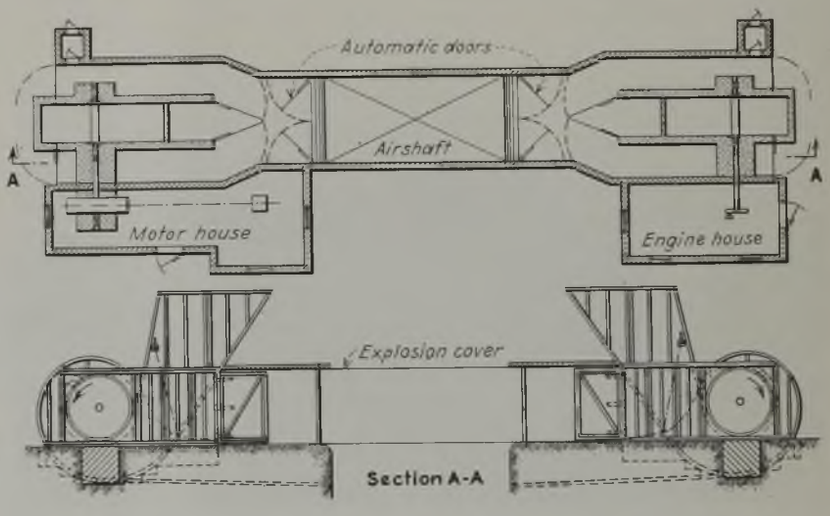

Fig. 4—Door Arrangement Shown Is One of the Refinements of the Double Installation in Fig. 3. Automatic Operation of the Doors Permits Switching From One Fan to the Other Without Manual Effort or Shutting Down the Ventilating Current.

Turn the tables and imagine that the earlier ventilation method in development was exclusively by use of blowers and that an attempt were being made to substitute the now orthodox system. How impracticable and dangerous it would appear to discard positive auxiliary ventilation for a non-dependable method! Could the operators see how it would be possible or could they be induced to drive 100 ft. or more ahead of fresh air or clog up the airway with leaky line brattice? Could they be persuaded to make crosscuts every 60 or 80 ft. and afterward spend considerable money to close them up again, ineffectively, by stoppings? If the operators knew the ultimate cost of these stoppings in continuing losses entailed by fugitive air, they would have good grounds to question the method.

SAFETY RECORD

+ Of Coal Industry Shows Improvement

Despite Increasing Hazards*

By D. HARRINGTON
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U. S. Bureau of Mines

MANY PEOPLE, including some of those engaged more or less intimately with coal mining, at times are pessimistic because they believe that little or no progress is being or has been made in safety of operation of coal mines and far too often offer misleading statistics or impressions. Some critics even intimate that our mines are conducted with less safety today than they were thirty or more years ago. But Table I tells a rather illuminating tale as to fatal-accident occurrence and rates since 1905.

Reduction in the fatality rate starting about 1912, when the rate per million tons first dropped below 5.00, was relatively slow for about two decades. Real progress dates from 1931, when the rate went below 3.5 and then continued below 3.5 in 1932, 1933 and 1934.

From this one might infer that the hazards today are less both in number and severity than those that confronted the industry 30 years ago. Although this inference would represent the truth as regards some vital features of operation, on the whole it would be incorrect. There is good reason to believe that in the aggregate the present-day hazards are much greater than those 30 years ago and that our better safety record is due to the greater intelligence with which mine operations are now being conducted.

In 1905, for example, about 25 per cent of the bituminous coal was cut by machines; although definite figures are not yet available for 1934, there is good reason to believe that 85 per cent or more of the bituminous coal last year was machine cut. While it is here inferred that all phases of operation have been mechanized to as great an extent, there is no question that in practically all phases of operation machines are used much more extensively today than they were 30 years ago. Since every piece of mechanical equipment introduced into a mine adds to the accident hazard, the gradual decrease in accident occurrence must be credited to the much greater vigilance, resourcefulness and persistence of the mining industry in the application of up-to-date mine safety precautionary measures.

A careful survey of existing data indicates that accidents from gas and dust explosions, from explosives, and from shafts have shown decided improvement. Surface accidents and those from miscellaneous underground causes have remained essentially stationary or have improved slightly, but haulage accidents and those due to electricity have shown definitely poorer performance in the recent past as compared with 1905-9.

Less progress has been made in protecting workers from accidents from falls of roof and coal than from any of the other major causes of accidents except haulage and electricity. That there is no really good reason for this lack of progress is proved by the fact that many individual mines, even whole districts and at least one State, have reduced this type of accident occurrence very materially. After 61 fatalities from falls in 1927, Alabama instituted a State-wide campaign against such accidents, cut accidents from falls to 28 in 1918 and has held to a relatively low number since—28 in 1929, 34 in 1930, 8 in 1931, 14 in 1932, and 11 in 1933. Many mines have operated 20 or more years without a fatality of any kind; many others have produced from 1,000,000 to over 6,000,000 tons without a fatality. A great many mines—including several in the anthracite region—have produced several hundred thousand tons of coal without even a non-fatal fall accident, and at least 25 underground coal mines (some of them with decidedly hazardous roof conditions) have operated a year or more without a lost-time accident.

Unquestionably many accidents (both fatal and non-fatal) from falls are caused by placing too much dependence on supposedly "good" roof or even on roof thought to be "fairly" secure. If all mines took the precautions against accidents from falls which *must* be taken where roof conditions are known to be "bad," their occurrence would be curtailed 50 per cent or more. True, the immediate cost of this procedure would be considerable, but if the present-day rate of about 500 roof-fall fatalities per year and of 15,000 or more non-fatal lost-time accidents were eliminated or were even decreased 50 per cent (and unquestionably the latter can be done), the savings in the attendant decrease of accidents would "pay" for much of the additional cost of timbering and other precautions necessary. If the direct cost of a fatality is placed at $5,000 and a non-fatal lost-time accident at $300 (both figures not far from average cost for the United States), the direct saving to the operators in the prevention of 250 fatalities and 7,500 non-fatal accidents per year would be around or over $3,500.000, which would pay for a considerable amount of the timber, supervision, etc., necessary to bring about the prevention of half of our present-day roof-fall accidents.

If the annual expenditure of this sum (amounting to about 1c. per ton on our present production of coal) should be effective in preventing half our accidents from falls, the mining companies would really reap a handsome profit, inasmuch as the direct cost of accidents is said to be but one-fifth of the total cost of accidents to the employer. Gains to employees in dollars and cents also would be decidedly important; the advantages to workers in the avoidance of pain and misery would be far beyond any reasonable calculation.

In proportion to number employed, accidents are more numerous to those

*Abstract of an address entitled "A Comparison of Coal-Mine Hazards Today With Those of Thirty Years Ago," delivered at Mine Inspectors' Institute of America, June 3-5, Beckley, W. Va. Published by permission of the Director, U. S. Bureau of Mines. (Not subject to copyright.)

engaged in haulage than in any other major activity in coal mining, including the miner at the face with his exposure to roof and coal accidents. It is by no means unusual to find that the number of haulage accidents in a mine in a year exceeds the number of persons engaged in haulage work, meaning either that some haulage employees have been injured more than once during the year or that some non-haulage employees have been injured in haulage accidents. Despite the tendency toward a lower haulage accident rate during the last few years, the rate is still considerably higher than it was 30 years ago. Hence much remains to be done if we are to prevent approximately 200 persons from being killed and probably as many as 10,000 injured (many of them rather seriously) every year.

When one of the larger size, larger capacity cars today gets out of control the probability of serious injury to workers is much greater than with the lighter car of 30 years ago, hauled by mule instead of by the usual mechanical haulage of today. One of the features which has intensified the risk of accident and injury to workers is that far too frequently the larger cars (and possibly also heavy locomotives) have been installed without increasing the size of track and ties. As a result there is an increase in wrecks and derailments, which very frequently are accompanied by accidents to workers as well as to equipment. In some cases much wider or higher locomotives have been installed without increasing the side or top clearance of the haulageways, and many workers have suffered seriously from this.

The much greater use of trolley locomotives during the past twenty years unquestionably is responsible for a considerable part of the higher haulage-accident rate. Bare trolley wires have in far too many instances caused workers to be thrown under cars or locomotives or between timbers and cars with resultant accidents, many of them fatalities, charged to haulage; in addition, the trolley-locomotive system has caused the death of many workers (haulage as well as non-haulage) from electric shock and has initiated several mine explosions in one manner or another. Although the trolley-locomotive system has numerous advantages from an operating viewpoint, it certainly is ultra-hazardous and should be superseded by some less inherently dangerous method of transportation, such as the storage battery, compressed air, or possibly in time diesel engines.

Thirty years ago the railroads of the United States had a decidedly unsavory reputation because of wrecks; today railroading has established and for years has maintained a record of safe operation that commands the admiration of the entire world. How was it done? Chiefly by application of good, sound

D. Harrington

engineering to installations, including double-tracking, use of heavy rails and of treated timber, providing and maintaining well-ballasted roadbeds with unnecessary curves and grades reduced to a minimum, the purchase and maintenance of modern equipment, and scrapping of worn-out or obsolete or obsolescent equipment, the installation of the best available signaling system and of methods of operation both humane and efficient. What the railroads have done in the prevention of their haulage accidents mines can do, at least in part, and in doing this mines undoubtedly will find, as the railroads did, that carefully thought-out accident prevention work pays well in many ways.

As indicated in Table I, there has been a very decided improvement in our coal mines with respect to mine disasters, which in general mean multiple accidents from fires or explosions. The most dangerous coal mines of 30 years ago were operated largely in the dark, both from the viewpoint of vision and also from the viewpoint of real knowledge of the cause of widespread disasters and methods of prevention.

Today we have an entirely different picture. More than 85 per cent of the tonnage is machine-cut. Solid shooting is done to only a limited extent and chiefly in the most backward types of mines or where pitch or similar conditions make machine mining difficult. More than one-third of the explosives used are of the permissible type and, while this is far from being the 100 per cent which real safety demands, it is much better than the very small amount of so-called safety explosives used before the Bureau of Mines started its campaign for safer explosives in 1910. Although squibs and so-called safety fuse are still largely used in coal-mine blasting, much progress has been made, especially in the past five years, in the adoption of the much safer (though by no means foolproof) electrical blasting methods. While much coal is still blasted during the working shift (and many accidents of various kinds occur from this reprehensible system), many progressive mining companies and some State laws require that blasting be done either at the end of the shift or by shotfirers after the working shift is over. Tamping blasting holes with coal dust is now universally condemned. Although much unsafe open-type electrical equipment is still in use, much of it is now of the permissible type; the latest available data indicate, for instance, that about 5,000 of the 12,000 cutting machines in use are permissible.

Practically all progressive bituminous coal mines (and some that are not very progressive) now are taking precautions against dust explosions by watering, rock-dusting, etc. Every year numerous incipient explosions are stopped thereby and prevented from becoming widespread, and there is good reason for believing that in nearly every year since 1925 at least 200 lives have been saved through rock-dusting, notwithstanding the fact that many of our mines are using rock dust in a half-hearted, desultory manner. Ventilation practice in our coal mines today, while far from perfect or being even reasonably efficient, is much more systematic than ten, twenty or thirty years ago. Progressive companies now realize that it pays well in efficiency and lowered operating costs—to say nothing of safety—to scrap obsolete or inefficient ventilating fans or other equipment to clean and clear aircourses. Continuous coursing of air in large mines, relying on doors on main haulageways, and similar makeshift ventilation practices, formerly far too prevalent, are seen far less frequently.

Compared to the present, electricity was used to a relatively slight extent in coal mining between 1905 and 1909, so that the hazard from the electrical current is far greater now, even though our electrical installations are individually much safer than those of twenty-five or thirty years ago. The peak of this hazard, however, seems to have been reached in the period 1926-30; the trend now seems to be downward, and this is one of the encouraging signs of the times. About 100 persons per year (or possibly somewhat fewer) have been killed by direct contact with electricity in our coal mines for the past twenty-five or more years. Many of the 350 to 400 or more annual mine-car and locomotive fatalities also are due primarily to electric shocks with resultant subsequent crushing by the cars and locomotives. This likewise is true regarding some of the fifty or more machinery fatalities and at least a few of the twenty-five to forty annual shaft fatalities. The trend in all of these accidents was definitely upward until they reached a peak in 1926-30, but since 1929, 1930, or 1931 the trend of such accident occurrence appears to be downward.

In a study of 200 coal-mine explosions and fires occurring from 1910 to 1924, only 7½ per cent were assessed against electricity as the ignition agent; similar studies in 1927, 1928 and 1929 indicated that more than 50 per cent of the deaths from explosions in those years were of electrical origin, and in the year ended June 30, 1928, mine explosions of electrical origin took 282 lives and were responsible for 82.5 per cent of the fatalities from mine explosions. Only 11 were killed in explosions of electrical origin in the year ended June 30, 1932; but 25 in the year ended June 30, 1933, and 21 in the year ended June 30, 1934, indicating that this hazard, which grew rapidly from almost nothing thirty years ago to become a very definite menace in 1926-31, inclusive, now appears to be again under at least reasonable control.

There is good reason to believe that in the period 1926-30 electricity was responsible every year directly or indirectly for at least 250 and in some years for more than 500 fatalities in our coal mines, at least double or treble the number from that cause in any year from 1905 to 1909. The recklessness with which electrical equipment was introduced into the mines carried its own penalty, and the much better mine electrical fatality record of the past four years (for direct contact as well as other types, including explosions of electrical origin) shows fairly definitely that the problem is now being handled with at least fair success. It will never be a "finished job," however, until the trolley-locomotive system is taken out of mines and until all electrically operated machinery in coal mines is of the permissible type, with adequate provision for maintenance of the permissibility.

The very definite decrease in occurrence of accidents during the past few years and the many fundamental influences now at work make it almost a certainty that, irrespective of the possible occasional setbacks, coal-mine safety will improve during the next several years. There is good reason to believe that within the next ten years—possibly much sooner—the rate of occurrence of coal-mine accidents (including fatalities) will be lowered at least 50 per cent. Among the fundamental influences favoring reduced accident occurrence in the near future are: (1) workmen's compensation laws; (2) national safety organization; (3) safety education, and (4) safer equipment.

Workmen's compensation laws were almost wholly absent in the United States thirty years ago. Today practically all our States have fairly comprehensive laws, and the tendency is toward making these laws more drastic: it would be utterly foolish for anyone to deny that the placing of a dollars-and-cents value on life and limb hasn't had a very decided tendency to reduce accident occurrence.

Thirty years ago there wasn't a nation-wide organization materially interested in accident prevention, and safety organizations, if existent at all, were few and far between. Today numerous organizations are functioning to forward safety not only in general industry but also in connection with specific industries, including mining, and noteworthy attainments in safety in mining have been made by such nation-wide organizations as the Bureau of Mines, the National Safety Council and others; and decidedly effective work is being done locally by safety organizations of various kinds.

Instead of relying almost wholly on the more or less perfunctory enforcement of inadequate State laws and regulations for safety, as was the almost universal condition thirty years ago, today the industry relies upon education to bring about safety in mining practices and conditions far beyond those delimited by the laws and regulations. This educational effort is manifested in many ways. The State inspector is no longer the inquisitor but a teacher pointing out unsafe practices and cooperating with mine employees and employers to bring about safe working conditions by education rather than by force. Many companies have plant publications devoted largely to safety and hold safety meetings of various kinds monthly or from time to time discussing safety matters; many mines now have Holmes Safety chapters. Mining executives all over the United States now have organizations in which safety work is given almost as much attention as taxes, freight rates, etc. The Bureau of Mines is doing its part in this educational work in numerous ways, such as first-aid and mine-rescue training; research and teaching on rock-dusting; and promoting the use of permissible explosives.

Thirty years ago manufacturers of mining machinery paid scant attention to safety. Today manufacturers have gone far in the making of safe and permissible equipment and devices. In trying to evolve really safe equipment, manufacturers frequently have spent far more money than they can ever expect to have returned in the sale of the specific equipment in question. Among the many safe and "safety" devices and equipment now in use in many of the mines (and which should be in all of them) are permissible electrical machinery, permissible electric cap lamps, permissible explosives, permissible flame safety lamps and safety clothing. Many lives and limbs are being saved every year by the use of these products; many more hundreds of accidents could be prevented annually if all mines and miners used the safety machinery and equipment now available to them instead of clinging, as they so often do, to out-of-date unsafe equipment.

While safety in coal mining has progressed considerably during the last thirty years, candor compels the admission that if we eliminate the very definite improvement in the occurrence of fatalities from explosions and in the use of explosives, the record would be decidedly unimpressive. Certainly this is no time for those really interested in safety to lie back and take it easy. The fact that coal mining still is given the undesirable position of having the worst accident rate of the major industrial occupations in the United States indicates that much effective work remains to be done if our coal-mine workers are to be given a reasonable degree of safety in their occupation. The fact that today individual mine or mining organizations can operate with relative safety and in numerous instances take over coal mines which have had decidedly poor records in safety, and within a short period produce unbelievably good safety performances, shows that "it can be done."

Table I—Coal-Mine Fatality Record, 1905-1934

Year	*Major Disasters— Number	Number of men killed	Coal tonnage, millions	Fatalities per million tons	Total fatalities	Total employed
1905	19	312	392,723	5.78	2,232	626,045
1906	17	235	414,157	5.27	2,138	630,283
1907	18	918	480,363	6.78	3,242	674,613
1908	11	348	415,843	5.97	2,445	678,873
1909	19	498	460,815	5.73	2,642	666,535
1910	19	485	501,596	5.62	2,821	725,030
1911	15	413	496,371	5.35	2,656	728,348
1912	13	254	534,467	4.53	2,419	722,662
1913	8	464	570,048	4.89	2,785	747,644
1914	11	316	513,525	4.78	2,454	763,185
1915	11	262	531,619	4.27	2,269	734,008
1916	11	154	590,098	3.77	2,226	720,971
1917	9	262	651,402	4.14	2,696	757,317
1918	4	54	678,212	3.80	2,580	762,426
1919	9	201	553,952	4.19	2,323	776,569
1920	8	61	658,265	3.45	2,272	784,621
1921	5	34	506,395	3.94	1,995	823,253
1922	14	285	476,951	4.16	1,984	844,807
1923	11	301	657,904	3.74	2,462	862,536
1924	10	458	571,613	4.20	2,402	779,613
1925	14	270	581,870	3.84	2,234	748,805
1926	16	348	657,804	3.83	2,518	759,033
1927	9	162	597,859	3.73	2,231	759,177
1928	14	326	576,093	3.78	2,176	682,831
1929	7	151	608,817	3.59	2,187	654,494
1930	12	225	536,911	3.84	2,063	644,006
1931	6	56	441,751	3.31	1,463	589,705
1932	6	145	359,565	3.36	1,207	527,623
1933	1	7	383,172	2.78	1,064	523,182
1934	2	22	‡415,780	†2.77	†1,161	------

* A major disaster is one in which five or more lives are lost. † Tentative: final figures will probably be 4 or 5 per cent higher. ‡Preliminary figures.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Skip-Hoisting Errors Prevented By Signal Systems

"In skip hoisting, it is imperative that the dump operator at the foot of the shaft know definitely that the gate to the loading pocket is properly closed before he dumps coal into the pocket," writes George E. Bayles, mining engineer, Ohio & Pennsylvania Coal Co., Cadiz, Ohio. "It is equally important that the hoist engineer know when the skip bin is full, so that he will not dump coal into a full bin, with resultant spillage back into the shaft. The Nelms mine of the Ohio & Pennsylvania Coal Co. has a system of signals for each of these two operations fully meeting the requirements of low cost and positive operation.

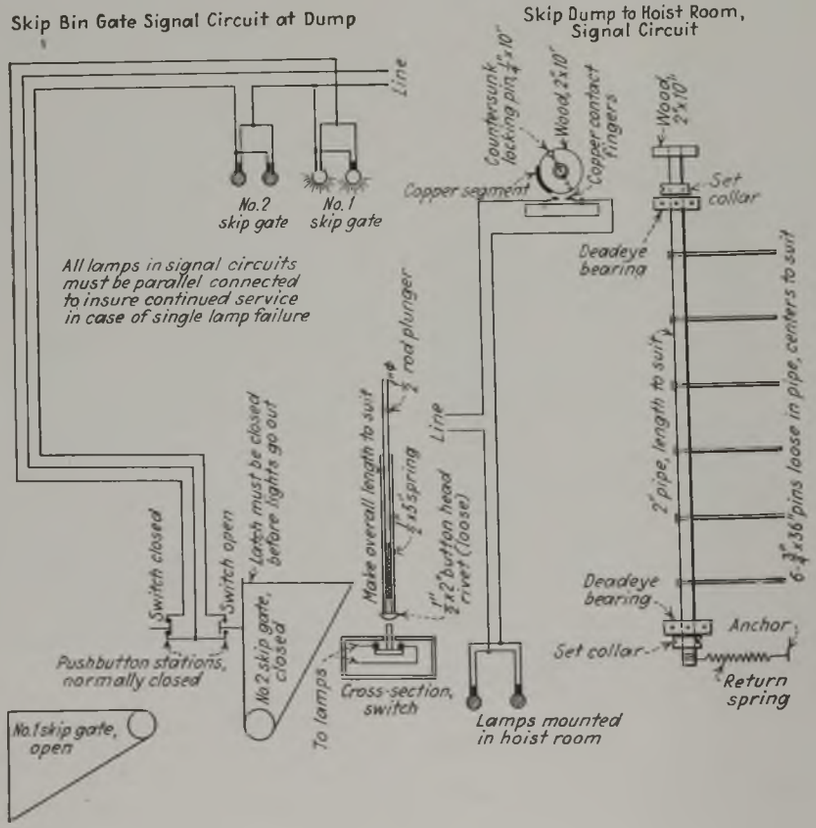
"The switches operating the signal circuit at the dump are made of materials found in any mine repair shop. A piece of ½-in. conduit forms a sleeve in which a plunger, made of a section of ½-in. round rod, slides. This plunger is moved one way by the skip gate in closing, and is returned by the ½x5-in. round spring in the conduit. A ½x2-in. button-head rivet inserted in the end of the conduit opposite the plunger forms a 'finger' which presses on an ordinary pushbutton station, arranged for normally closed operation.

"As the skip gate opens, releasing the pressure holding the switch contacts open, these contacts close and light a pair of red lamps mounted in a protective window-front box facing the dump operator. These lamps, wired in parallel, remain lighted until the gate is properly closed and latched, and as long as they remain lighted the dumper knows that he can let no more coal into that pocket.

"At the skip bin in the top of the tipple, another very simple signal circuit is installed. A section of 2-in. pipe is mounted in ordinary deadeye bearings across the upper part of the skip bin. Through holes drilled in this pipe ¾x36-in. pins are dropped. These pins reach down to within a foot or so of the sloping bottom of the bin. On one end of the pipe a circular wooden block 2 in. thick and 10 in. in diameter is mounted and locked into place by a pin. A short copper segment is attached to the block. Under the circular block a flat wooden block bearing two copper contact fingers is mounted in such a position that rotation of the circular block will make contact between the fingers and light the parallel-connected signal lamps in the hoist room.

"The lower ends of the 36-in. pins ride on top of the coal as it slides down the sloping bottom of the skip bin. As the pins are lifted by the coal they rotate the pipe, causing the copper segment to close the contacts in the signal circuit. The lamps remain lighted as long as the bin is full, and go out as coal is withdrawn from the bin sufficiently to allow the pins to drop, rotating the pipe and breaking the contact. Operation is made positive by installing a spring arranged to pull the pipe around to the open-contact position when there is no pressure against the pins in the skip bin. With this system, the hoist engineer knows that as long as the lamps are lighted he cannot hoist coal without spillage back into the shaft, even though he has received the hoisting bell."

These Signal Systems Obviate Errors in Skip Hoisting.



Car-Change Spillage Caught By Trolley-Hung Basket

By manual positioning of a basket hung from trolleys, whole trips of mine cars are loaded without stopping the main belt and without incurring appreciable spillage in conveyor operation at the Jewell Ridge (Va.) mine of the Jewell Ridge Coal Corporation. By making it unnecessary to stop the main belt for car changes, spillage incident to coal piling up on the belt at points where the chain-flight room conveyors discharge onto it is eliminated; also, the strain on the belt and on its drive and electrical control is lightened.

The basket (see accompanying illustration) is a sloping pan with sides only a few inches high. The lower end is open but the other is closed by a back plate 12 in. high. The basket can otherwise be described as a short chute of slight pitch. Its bottom plate is 3 ft. wide by 4 ft. long.

Two tracks, each formed of two T-irons, are fastened to the roof by expansion bolts. The basket is supported at the corners by four-wheeled trolleys which run in the T-iron tracks. During regular loading of a car the basket is left in Position *B*, where it is out of the way. As the loading is completed and the car trimmer closes a switch to move the trip forward to effect a car change he quickly pulls the basket to Position *A*, where for a few seconds it catches the coal discharged by the belt.

As soon as the empty car arrives under the belt the trimmer pushes the basket back to Position *B* and then pushes the accumulated coal out of the lower end into the back end of the car into which the belt has begun to discharge. Therein lies the reason for making the basket with sloping bottom and with low sides—the trimmer can reach the coal easily and need exert but little effort to push it out.

Six chain-flight conveyors delivering from that number of 35-ft. rooms discharge onto the 26-in. belt conveyor, which is 1,500 ft. long. The Jewell Ridge conveyor system was described in the May, 1935, *Coal Age*, page 207. Photographs used in that article, however, were made before the trolley-supported basket had been installed.

Ideas Wanted

Send them in has been the long-standing invitation embodied in this little monthly reminder. This invitation, of course, refers to Operating Ideas—those short and meaty recitals of measures taken to promote efficiency, cut cost or stimulate safety in the various activities entering into coal mining—and the cordiality with which it is extended to operating, mechanical, electrical and safety men has abated no whit. Writing skill is not a necessity, as it is the idea that counts. Just set forth the things the idea is designed to do and how they are done in simple language, include a sketch or a photograph if it will aid the prospective reader in getting the point, and send it along. It will receive careful consideration and if acceptable will bring the author a minimum of $5 from *Coal Age*.

Templet Facilitates Spotting Trolley Frogs

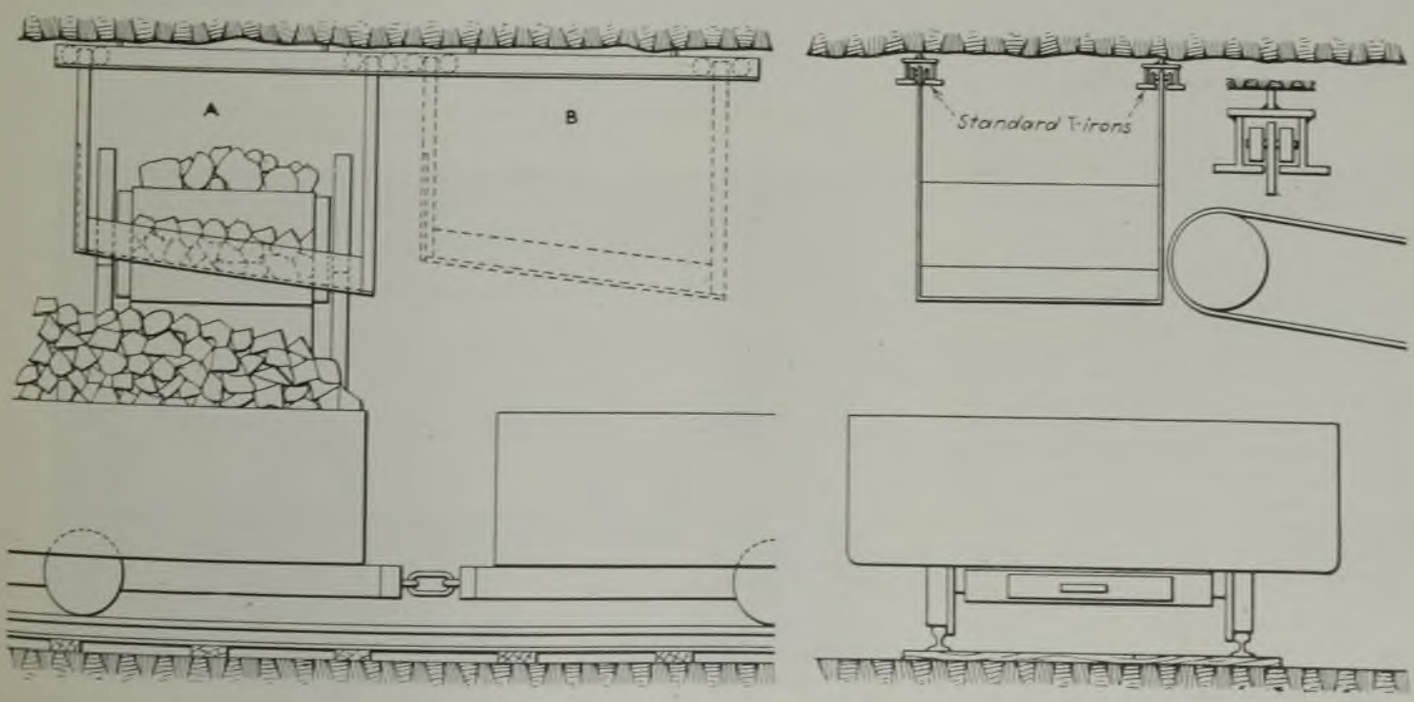
Two major factors, a recent issue of *O-B Haulage Ways* points out, must be taken into consideration in spotting a trolley frog: (1) making the frog "take," and (2) minimizing wear. A frog can be made to "take," but if due thought is not accorded location, wear occurs on both the frog and trolley wire, and may be greatly accelerated by spotting the frog too far into the curve. A standard overhead frog guides the wheel or shoe into a turnout by the angling, or twisting, of the harp. If the collector is allowed to twist or drag too much while approaching a frog, the trolley wheel becomes a milling cutter and the trolley shoe a planer, resulting in undue wear on the trolley wire and frog runners.

Usually, there is one point at which the frog functions best. This is the point at which the trolley pole is in exact alignment with the turnout leg of the frog when the collector is in the center of the frog. For a 15-deg. frog, for example, the angle between the horizontal projection of the trolley pole and the main-line trolley wire should be 15 deg. when the harp is making the turnout. When this condition exists, the groove of the collector will be in exact alignment with the turnout leg. Fig. 1 illustrates diagrammatically the ideal frog location, with the runner *U* directly in line with the trolley pole underneath it, while the collector is resting at *M*.

Location of the frog may best be arrived at by the use of a templet made of two sticks of wood as in Fig. 5. Stick *A-D* is cut to a length equivalent to the horizontal projection of the trolley pole (Fig. 2), while *A-C* may be of any convenient length. The two sticks are joined together at an angle equivalent to the frog angle. A stiffener should be added to insure maintenance of the correct angle. This templet may be used with the trolley wire offset either to the right or the left of the track.

In using the templet, it is first necessary to trace an arc representing the path followed by the center of the trolley base on the ground. Such an arc is represented by *R-S* in Figs. 3 and 4, and is made by marking the ties and ballast directly under the trolley base as the locomotive is moved

Basket Is Left in Position "A" Only During the Few Seconds Required to Move the Trip 5 or 6 Ft.



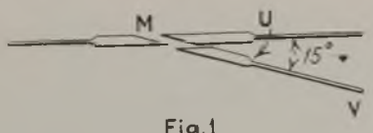


Fig.1

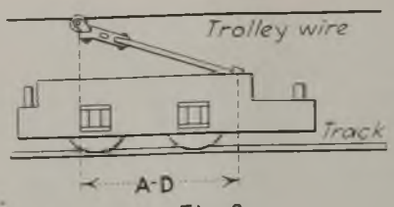


Fig.2

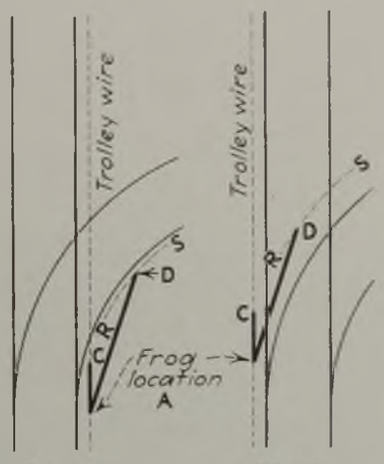


Fig.3

Fig.4

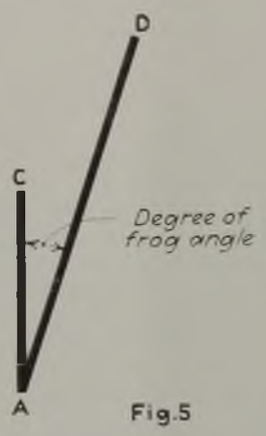


Fig.5

Steps in the Location of a Trolley Frog.

slowly around the turnout. The templet is then laid on the track with the leg *A-C* directly underneath and in line with the trolley wire and is moved forward until *D* of leg *A-D* coincides with *R-S*. Point *A* is then the location of the center of the frog pan for satisfactory operation under conditions on which construction of the templet is based. Where several types of locomotives with different locations of trolley bases and lengths of pole are employed, satisfactory results can be obtained by using the average horizontal projection of the poles in use.

By following this method on several turnouts a dimension from the trolley frog to some point such as the switch point or track frog may be obtained for future use. With varying types of turnouts, however, use of the templet has the advantage of securing an exact location of the frog, thus eliminating wear on the wire and overhead fittings which always accompanies faulty location.

Reconditions Burned Mine Shaft And Erects Water Column

After a fire at the shaft of No. 12 (Greenwood) colliery of the Lehigh Navigation Coal Co., from a cause not known, but probably electrical, timber sets to the number of 117 either were reconditioned or replaced. This shaft has outer dimensions of 15x22⅔ ft., and three compartments, two each of 7½x13 ft. for hoisting, and another half compartment which accommodates pipe lines for compressed air and water; a 2,300-volt a.c. electric 3-conductor cable for the pumping plant and a 250-volt d.c. cable for mine haulage. Originally, the a.c. current was carried by three separate conductor cables.

On one side, the shaft, which is 750 ft. deep, connects with the Primrose bed, and on the other side with the Top Split of the Mammoth bed. The shaft had caved at the bottom, and steel crossbars had to be set with stope work of timber above the steel.

In the half compartment carrying the pipe and electric lines, an 18-in. Byers wrought-iron column line was erected, replacing a 20-in. cast-iron pipe which was wood-lined. This old pipe had been in place for ten years and had given no trouble, but, when the supports burned, it collapsed and fell to the bottom of the shaft as a mass of scrap iron. Pump lift was 800 ft., but not all of this was in the column line, because a 45-deg. connection was made between the column and the pumproom, the end of which was 60 ft. northwest from the side of the shaft. The new pipe was placed in 18- and 20-ft. lengths and built up from the bottom, being connected with Dresser couplings. At the bottom of the shaft ten lengths were erected per 24-hour day, but near the top the short distance the pipe had to be lowered permitted the placing of fourteen lengths in the same period.

Wrought-iron pipe, being lighter and less expensive than cast-iron, was used in the construction of the column line. The pipes, which were wood-lined throughout, were sandblasted for a distance of 5 or 6 in. from the end, and then these surfaces of the pipe were sprayed with lead. On the exterior the pipe was painted. In the pumproom are three Barrett-Haentjens 8-stage centrifugal all-bronze pumps of 2,000-gal.-per-minute capacity.

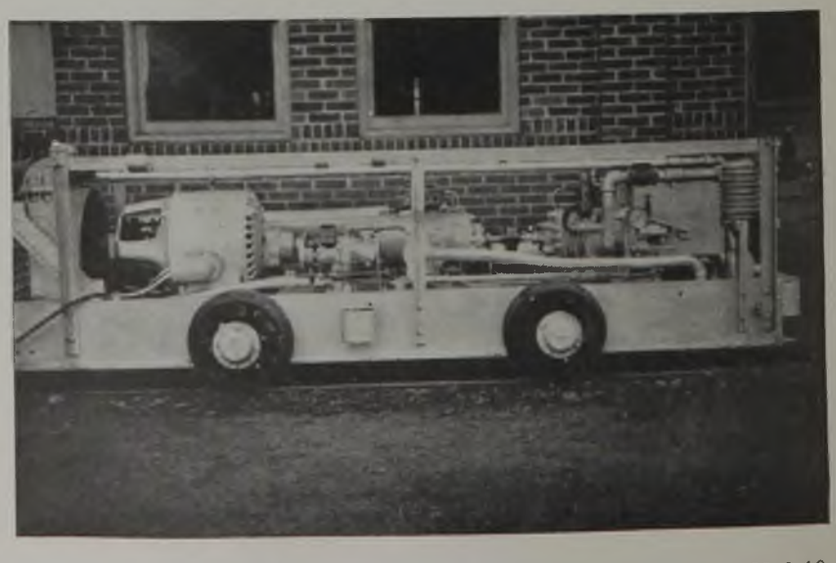
Many of the timber rings were entirely burned away; some were damaged and needed entire or partial replacement; many were torn from place by collapse of the cast-iron column line; the shaft contained much rock that had spalled off the sides, particularly at the landings, and some coal had been burned in the Top Split of the Mammoth bed. Despite these difficulties, the shaft was ready for operation Sept. 1 and actually was put in service on Sept. 4.

Wide Application Found For Compressor Unit

Compressed air is used for a variety of purposes at the Dresser mine of Walter Bledsoe & Co., Terre Haute, Ind., including lifting bottom for height on roadways, rock work, drilling holes for trolley and cable supports, cutting footings and hitches for seals and blowing out electrical equipment. To perform all these tasks, the compressor unit must be able to travel easily around the mine, and to meet this condition, as well as height limitations imposed by minimum clearances of 5 ft. over the rail on main entries and 4 ft. in secondary (cross and room) entries, mine officials designed the portable unit shown in the accompanying illustration.

Motor and compressor—Allis-Chalmers two-stage rotary type with a capacity of 103 cu.ft. of free air per minute at 120 lb. per square inch—were purchased as a unit assembled on a base; the fan was acquired separately. The

Side View of Compressor Unit Used at Dresser, Showing Rack and Holders for Pavement Breaker and Drill.

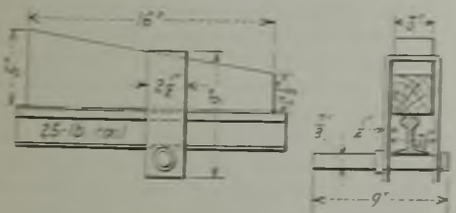


truck was made at the mine and the unit assembled there. The frame of the truck consists of 10-in. channels to which the bottom and stub axles are welded. The top of the unit is supported on small angles bolted to the side channels and is made in the form of a rack for the hose and tools during moves. Clips near the center (see illustration) hold the pavement breaker, and another holder near the fan end receives the pneumatic drill carried with the unit. Over-all height of the unit is 32 in.

Lifting the medium-hard slate bottom at Dresser is practically all done with the pavement breaker, as experience has shown that the work can be done faster than by shooting. The average stint of a two-man crew in seven hours is 100 ft. of bottom 6 ft. wide and 15 in. deep with the pavement breaker. With shooting—same width and thickness of material removed—the average advance would be 50 ft. in seven hours.

New Car Blocks Identified By Serial Numbers

In many mines the proper blocking of the car at the face is an important phase of underground safety practice. Like certain other safety precautions, it is made more certain by supplying the loader with handy and reliable equipment and employing a method which encourages him to take care of it. The drawing illustrates a car block recently adopted as standard at a large bituminous mine.



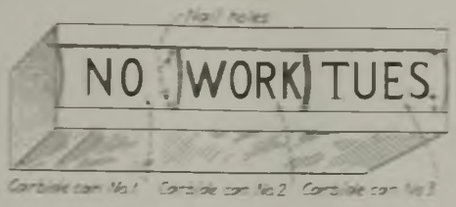
Block in Place on 25-Lb. Rail.

The two parts, wood block and clevis with pin attached, are stamped with a serial number and the loader is charged with equipment thus identified. This checks the tendency for a loader to be careless with his equipment and then appropriate that belonging to someone else.

Collars on the clevis pin hold it in place and prevent its coming entirely free of the clevis. The hole through one leg of the clevis is large enough to allow the collar to pass through, but the hole in the other leg accommodates the pin only.

Carbide Cans Make Work Sign

Three empty 25-lb. carbide cans and a wooden box are the essential elements in the work sign shown in the accompanying sketch, in use at the Manor Coal Co.'s mine at Vindex, Md., for the past two years. The cans, according to Walter Iman, Kitzmiller, Md., who supplies the details, are painted black with the essential information lettered on in white. Can No. 3 is lettered the six days of the week, while Nos. 1 and 2 require only the words shown. The box is made just large enough to hold the three cans, the rims of which rest on round-headed thumb tacks, which serve as bearings of sorts and prevent the enamel and lettering from being worn off on the box. Nail holes are punched in the ends of the cans as indicated, and to bring the proper wording into place, a nail, key, knife blade, or the like, is inserted in the hole and pulled up or down to rotate the can. The sign was placed at the top of the check board. Formerly, the information was written on the board with chalk.



Details of Work Sign.

Automobile Wheel Cuts Cost Of Trolley Base

Use of one standard make of trolley poles on both the Goodman and Jeffrey locomotives employed has been the standard practice at the mines of the Reid Coal Co., Inc., for the past several years, writes James Thompson, mine foreman, Distant, Pa. Quite often, he continues, the ball bearings in the bases of these poles become worn, with the result that the pole no longer follows the wire with ease. Several months ago, the bearings and races in the trolley base on a 10-ton locomotive went bad, and to obviate purchase of the usual expensive equipment a search for a substitute was initiated.

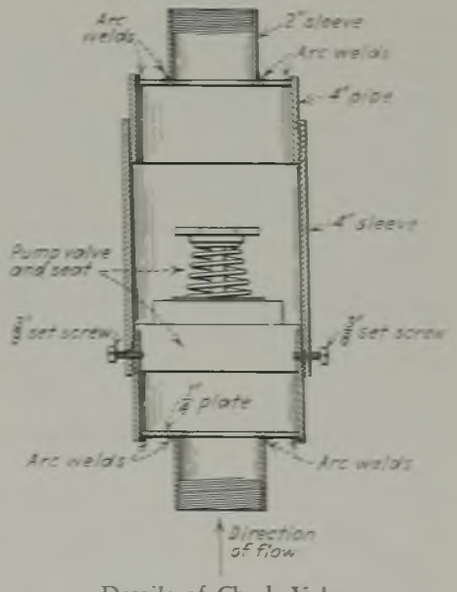
An old Hudson front wheel was purchased from a garage for 50c., and the wooden spokes were cut off close to the hub with a hacksaw. Next, four of the rivets holding the spokes and the two halves of the hub together were removed and replaced with bolts about 1 in. longer than the rivets. These bolts were used to fasten the entire hub assembly to a steel plate, which in turn was welded onto the end of the locomotive, with the spindle turned up vertically. The trolley base and bearings were then removed from the pole, which was mounted on the hub assembly by welding the pole base to that portion of the spindle which formerly accommodated the spindle bolt connecting the spindle to the auto axle. This permits the pole to revolve through a full circle while the hub is held in position by the four bolts.

When this bearing becomes slightly worn, Mr. Thompson points out, it can be tightened by removing the hub cap and giving the spindle nut a turn or two. Greasing is effected by placing the lubricant in the hub cap and giving it a few turns in exactly the same way as a grease cup. Only a few greasings have been required in the several months the base has been in service, and no wear has as yet been observed. Time spent by the electrician in assembling the base was 2½ hours, and the total cost was close to $2.50. An additional feature of the base is a high degree of protection against the entrance of dirt.

Showing Trolley Pole With Original Base, Below; With Auto Wheel Base, Above.

Check Valve

Robert Andrews, New Jellico Coal Co., Morley, Tenn., supplies the accompanying sketch of a check valve developed by him for use in the New Jellico mine. Essential parts include short lengths of pipe, pipe sleeves and a pump valve and seat from a 6x12-in. Goulds pump. The interior is painted with G. E. Glyptal compound, which has been found very successful in arresting corrosion from the moderately acid water encountered. With the dimensions shown, Mr. Andrews advises against the use of the valve on any line larger than 2½ in. For lines up to 4 in., a 5-in. pipe sleeve should be employed to increase the effective area of the water passages.



Details of Check Valve.

NOTES

. . . from Across the Sea

A MIXTURE of as little as 3 per cent or as much as 75 per cent of methane with air will burn and the flame will travel all through the mixture; but that happens only when the firedamp is already greatly compressed and hot from the compression. Sudden compression not only ignites firedamp but causes it to burn at a wider range of methane content than when under normal pressure. All of which is of utmost importance, for it seems to indicate (1) that mixtures of methane with air, even when lean, can be ignited by the pressure resulting from a sudden and extensive roof fall and will propagate flame, and (2) that if—at least under certain circumstances—a shot finds a crevice and there is methane in the borehole, the flame may pass along the crevice and ignite surrounding firedamp. It was this latter hazard that the late Prof. H. B. Dixon was studying shortly before his death and that R. V. Wheeler recently discussed before the Midland Institute of Mining Engineers at a Sheffield (England) meeting. The latter made no reference, however, to the hazard of ignition from roof-fall compressions.

When, declared Dr. Wheeler, mixtures of methane and air are at atmospheric pressure and temperature, they will burn if 5 to 14 pr cent of methane be present. The wider limits of flammability obtained in Dr. Dixon's experiments result from high compression (40 to 120 atmospheres) and from temperatures of 450 to 550 deg. C. produced by the compression. Perhaps one might add another reason for widening of the limits, namely: that the burning scarcely has to be transmitted, as the entire volume of gas is under conditions tending toward a spontaneous combustion. The beginning of the flame was for this reason indefinite; the flame originated within a region rather than at a single point. Usually this region was near the piston by which the methane-air mixture was compressed. Lag on ignition was shortest with mixtures containing 6 to 17 per cent of methane and was then about 0.02 to 0.05 second. Mixtures of which methane forms 6 to 8 per cent, when at a temperature of 16 to 18 deg. C., would almost certainly be ignited if suddenly compressed from 12 volumes to 1, and might be ignited if compressed from 11.5 volumes to 1.

The closed cylindrical chamber in which the mixture was compressed (see illustration) had at its end a concentric low-pressure cylindrical chamber filled with a methane-air mixture with varying percentages of methane, but the passage from the compression cylinder to the low-pressure chamber was closed always by one of the several sturdy end pieces, in the center of each of which was a single small aperture of varying size, rapidly widening toward the low-pressure cylinder. A 7 per cent methane-air mixture in the compression chamber could always be ignited by compression if the diameter of the hole in the air piece was 2.25 mm. (0.088 in.), but only once was ignition obtained in that compression chamber when the diameter of the hole was increased to 2.5 mm. (0.098 in.). Similar experiments were made with 9.5 per cent methane, and the same respective ignition and failure to ignite were obtained with apertures of the same size.

With both these mixtures bright flames were projected from the aperture through the low-pressure chamber over about one-third of its length whenever ignition occurred on compression. But, strangely, these flames were incapable of igniting any mixture of methane and air with which that low-pressure chamber might be filled.

Diaphragms were then used to delay the expulsion of flames through the aperture in the end piece of the compression cylinder. The most suitable metal for such diaphragms was found to be copper. Tests showed that a thin sheet of copper of a given thickness was of uniform strength and that the breaking pressure was nearly proportional to its thickness, and inversely proportional to the diameter of the hole it covered.

When the diameter of the hole in the end piece was 4.75 mm. (0.187 in.), the copper disk was 0.09 mm. (0.0035 in.) thick and the methane-air mixture was 9.5 per cent methane, the mixture ignited on compression and the flame that was projected into the low-pressure chamber when the diaphragm burst ignited the methane-air mixture it contained.

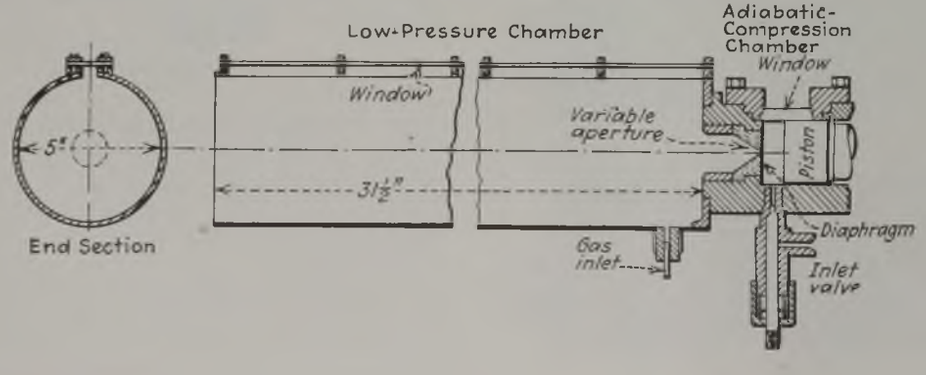
With larger holes in the end piece, the thickness of the copper disk had to be increased or the methane-air mixture in the low-pressure chamber would not be ignited with any given percentage of methane in the compression chamber. It was found that, with a 4.75-mm. (0.187-in.) aperture in the end piece, a copper diaphragm of 0.1 mm. (0.039 in.) and a breaking pressure of 110 atmospheres, methane-air mixtures in the compression chamber between 10.5 and 11.5 per cent methane would ignite a methane-air mixture in the low-pressure chamber of 11.5 per cent methane, and that a methane-air mixture in the compression chamber between 8.3 and 18.5 per cent would ignite a methane-air mixture in the low-pressure chamber of 4 per cent, when the volume of the compresison chamber was 1 liter (61.025 cu.in.) and the volume of the low-pressure chamber was ten times as large. Mixtures in the low-pressure chamber having more than 11.5 per cent methane could not be ignited.

It will be noted that a mixture of methane and air in the low-pressure chamber of only 4 per cent methane was ignited by means of the flame from the compression chamber. Such a mixture at such a low pressure (atmospheric) should be unflammable, but Dr. Wheeler is of the opinion that flammation arises from the issuing gas containing not only unburned methane but also hydrogen and carbon monoxide, which mix with the gases in the low-pressure chamber, thus rendering them flammable. The effect, he says, is only local, and in support of that conclusion it was found that flame could not propagate throughout the larger low-pressure chamber unless the mixture in it were flammable originally.

In still other tests the piston in the compression chamber was operated by an explosion of powder. The end piece in the compression chamber had a hole of 8 mm. (0.315 in.) diameter which apparently was uncovered by a diaphragm. With 2.75 per cent of methane in the methane-air mixture of the compression chamber and 8.85 per cent in the low-pressure chamber, there was a general flammation, also with 5.43 and 6.25 per cent in both compression chamber and low-pressure chamber.

It is possible, Dr. Wheeler says, to

Equipment to Show Under What Conditions Compression Will Ignite Gas.



ignite mixtures of methane and air by compression in cavities from which the compressed gases can escape, and the passage through which they escape can be wide enough to permit flame to travel through it and to ignite a flammable mixture beyond, but the conditions under which, in shotfiring with permitted explosives, there can be simultaneous compression of all the gas in the break must be exceedingly rare. Such conditions would be provided by the projection into the break, under the force of the explosive, of a plug of material which could act as a piston.

"The passage, through a mixture of methane and air, of a pressure wave, such as all detonating explosives produce," he added, "only compresses the gases in the path of the wave and heats them momentarily. So far, experiment has failed to cause ignition of any mixture of methane and air by passage through it of such a pressure wave."

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Where no price is appended in the notice of a publication of the U. S. Bureau of Mines, application should be directed to that Bureau. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

Froth Flotation of Coal: Sulphur and Ash Reduction, by H. F. Yancey and J. A. Taylor. Bureau of Mines. R. I. 3263; 20 pp.

For froth flotation, declare the authors, the feed in general must be less than $\frac{1}{8}$ in. An unwetted substance tends to attach itself to the froth and one that is wetted tends to sink. On mixing with the water an agent that will not wet the refuse or some extremely fine (colloidal or ionic) and easily wetted material which will attach itself solely or preferably to the refuse, the latter will become wet and, being wet, will refuse to enter the froth. Thus, theoretically at least, the froth will be free of refuse.

With oxidation products of pyrite in the mix less pyrite enters the froth, but the liquid has to be mildly acid when the froth mixture is made; that is, the pH value must range between 4.5 and 6.9. But after the ferric salts have been added, other agents can be added to make the pulp basic, and the earlier effect will not be lost. With the exception of lime, the other agents tested were either ineffective or too expensive to be used in coal flotation. Ferrous and ferric sulphates under certain conditions will keep a large part of pyrite out of the froth, but the effects are not so pronounced when coal is absent because of the large proportion of the feed that necessarily must be recovered as a froth product. The percentage of clay in the froth depends upon the concentration of the coal in the pulp and does not depend on the quantity of clay in the feed. With Roslyn coal the quantity of lime or sulphuric acid added to control the acidity of the pulp made no difference in the quantity of ash in the froth, but the ash content of the froth was lowered appreciably when the pulp was too acid or too basic to give a good recovery of coal.

Though good results can be obtained by diluting the pulp, it is better to reclean the coal and thus avoid the difficulty of removing the water from too dilute a pulp. One recleaning of a coal froth at an original and recleaning pulp ratio of 6 is as effective in reducing ash content as a single cleaning test made at a pulp ratio of 36, two recleanings with a pulp ratio of 6 are as effective as if a single test were made at a pulp ratio of 216, and three recleanings at a pulp ratio of 6 as effective as if a single test were made at a pulp ratio of 1,296.

The Pressure Wave Sent Out by an Explosive. Part III—Spark Photographs With Permitted Explosives, by W. Payman and D. N. Woodhead. Safety in Mines Research Board (British) Paper No. 88. British Library of Information, New York, N. Y. 32 pp. Price, 33c.

Instantaneous sparks from a Wimshurst machine with the aid of a steel mirror enable a photograph to be made of the various products of detonation other than the flame as they expand from the shothole and aid in the correct interpretation of the more quantitative continuous (or "moving-film") photographs obtained with the wave-speed camera. In the forefront of the main shock wave are minor disturbances that appear as prominences; those of the simple, or "open," type being due to simple particles which produce conical waves such as have already been observed in shadow photographs of bullets in flight and those of the "cored" type which consist of a fringe and a core. These latter appear to exist only temporarily.

Both prominences, say the authors, are signs of the transfer of quantities of energy from the main disturbance to the atmosphere, and as such must be regarded as at least of inherent danger. The cored type may be due to the projection and combustion, beyond the main wave, of a particle or a number of particles which the detonation wave has not caused to undergo chemical decomposition, or to an aggregate of relatively inert particles with which a quantity of the compressed gases is mechanically associated, or to a combination of combustible and inert particles.

1935 Coal Mine Directory. McGraw-Hill Publishing Co., Inc., New York, N. Y. 184 pp., $8\frac{1}{4}$x$11\frac{1}{8}$ in., fabricoid cover. $7.50.

Light and convenient, the new coal-mine directory contains the same type of information brought up to date that it has carried in past years regarding company and mine officials, sales agents, store buyers, with address, post office, shipping point, seam name and thickness, kind of opening, number of employees, number of coke ovens, if any; source of power, voltage, preparation equipment and track gage. This is followed by a geographical index of mines and companies and an alphabetical index to mines and companies.

The directory covers the United States and Canada. Where companies do not sell coal on the market, that fact is indicated by the annotation "captive tonnage." References are made to affiliated companies where there are any.

Blasting Practices and Explosives Accidents in Utah Coal Mines, by D. J. Parker. U. S. Bureau of Mines, Washington, D. C., I. C. 6837; 15 pp.

Since 1924, in Utah coal mines where three or more men are employed on any shift, shots must be fired electrically by authorized shotfirers when all but they are out of the mine. Permissible explosives in permissible quantities must be used. However, since 1934, Cardox shooting has been permitted during the working shift.

For firing from the surface, three or more gap switches usually are provided between the shots and the surface, says the monograph, one near the mine mouth, one for the mine section and one for the room. The first may have: (1) heavy wires or copper-bar leads, leaving a 6-ft. gap; or (2) two socketed main conductors with flattened ends to fit into contacts, the conductors being 5 or 6 ft. apart when bent back and locked in place; or (3) a pipe current-conducting gate which when closed bridges the gap and prevents anyone from entering the mine.

Master switches are provided at the surface, either a double-pole knife switch

or a time-limit solenoid switch, which latter provides for the maintenance of the current for 645 milliseconds, which is planned to cause the shots to fire but to cut off the current after the firing occurs. Tests of the Bureau appear to indicate that a current of 5 milliseconds' duration would suffice and would permit the shots to fire after the current is cut off; speedy blasting caps not firing even with low resistance until after 7 milliseconds has elapsed, and after 22 or more milliseconds with high resistance. In fact, shots were fired with high resistance by machines with a timing of 4.31 milliseconds. With such firing after the current has been switched off, the blast can cause a contact of cap wires, connecting wires or shotfiring cable only when no current is passing, thus assuring that such contact will be unaccompanied by sparking.

Review of Literature on Effects of Breathing Dusts With Special Reference to Silicosis—Part I, by D. Harrington and S. J. Davenport. U. S. Bureau of Mines, Washington, D. C., I. C. 6835; 68 pp.

This circular has little to say about anthracosis, which it describes as "a dust disease of lungs found in coal miners; it is ill-defined and is presumed to depend on inorganic dust in coal. The lungs are black." Most of the monograph is on silicosis proper and in three chapters; a definition and classification of dusts, sources of exposure to dusts and physiological effects of breathing dusts. As regards sericite, it says little except that "the realization in recent years that asbestos can produce serious pulmonary fibrosis should have been a warning that a too-restricted view was being taken of the matter; this has been borne out by the recent work of Jones on sericite. However, the following definition adopted at the International Silicosis Conference in South Africa in 1930 is still accepted: 'Silicosis is a pathological condition of the lungs due to inhalation of silicon dioxide.'"

Bituminous Coal-Mine Safety Inspection Outline, by G. W. Grove and W. J. Fene. I. C. 6929; U. S. Bureau of Mines. 26 pp.

Those who have visited mines for the purpose of making any inquiry, whether about efficiency, improvement or safety, have often noted on return to headquarters that material adequate for a report or even for a decision is strangely lacking in the notes collected. Moreover, some controlling head may ask questions singularly disconcerting and pursue a line of reasoning which makes data necessary that have not been collected.

This questionnaire, prepared for those making studies for Bureau of Mines inspections, insures that when the inspection work is done it will be well done, though some subject headings necessarily are broad and need, as the authors will be first to admit, more space than is provided. Nor is it possible to ask questions about all the bad—and good—practices at mines. A question which might be more completely elaborated, for instance, is, "Are machines maintained in permissible condition?" But a complete questionnaire doubtless is not desirable, and the authors are to be congratulated on producing a form that, if properly filled, courageously answered and well used, would eliminate many of the accidents in mines.

Crushers for Stone and Ore, by William T. W. Miller. Mining Publications, Ltd., London, E.C., England. 234 pp., 6x9 in. Price, $3.65.

This exhaustive British treatise covers machinery of many nations and explains the rationale of crushing in all its details, the various mechanisms applied to jaw crushers; jaw crushers as sledgers and as secondary breakers; jaws for rock crushers; toggles and toggle bearings for jaw crushers; jaw-crusher bearings, their lubrication and cooling; the gyratory crusher as a sledger and a secondary breaker; crusher heads, concaves, bearings and suspension systems for gyratory breakers; the relative merits of jaw and gyratory crushers; simple-roll crushers; crushing rolls for ore and rock; rolls for sledging; roll shells and centers; bearings and lateral adjusting devices for rolls; disk and swing-hammer crushers; ending with a chapter on the choice of a crusher and another on screen analysis of crusher products. Much of the material was written originally for publication in American technical journals.

Mountain Bumps in the Coal Felds of Harlan County, Kentucky, by D. J. Jones, N. M. Wilder and John F. Maurice. Series VIII; Bulletin I. Mining Engineering Building, University of Kentucky, Lexington, Ky. 60 pp., mimeograph; paper cover.

This monograph records the findings of a commission appointed by the Department of Mines and Minerals of Kentucky. The report finds that the disturbances are not mysterious but arise from methods of mining unsuited to the heavy cover of unusual strength encountered in the Harlan field.

The authors recommend that parts of mines be abandoned wherever bumps are frequent and likely to recur and where mining has extended so far that conditions cannot be radically and systematically changed; that long, straight pillar lines be provided and that areas of not less than 100 acres be regarded as a unit for pillar extraction, and these be isolated from adjacent workings by strong barrier pillars that will break the overburden; that panels be 1,000 ft. wide and 4,500 ft. long; that effort be made to make use of the natural joint planes in providing for collapse of the mine roof; that the immediate roof be supported as far as possible until the main roof falls so as to prevent the irregular falls of intermediate roof from forming rock masses which prevent the main roof from coming down onto the floor of the mine; that room and heading gob be hauled out of the mine; that all pillars, whether containing unmerchantable coal, thin coal or rolls, be brought out; that the work between adjacent mines be coordinated; that the work be conducted wholly on retreat and that as far as possible breaks be started near the crop; that daily record of progress in pillaring be made on the map, pillars being marked so that the progress can be noted; that pillars constitute 20 to 30 per cent of the coal. Perhaps the bulletin should preferably be taken to mean that only 20 to 30 per cent of the coal should be removed on first mining.—R. Dawson Hall.

Explosion Waves and Shock Waves. Part II—The Shock Wave and Explosion Products Sent Out by Blasting Detonators, by W. Payman, D. W. Woodhead and H. Tilman. Royal Society of London. 25 pp.

Sensitivity of detonators has been measured in many ways—nail test, sand test, lead-plate test, Hopkinson pressure-bar test, Esop test any gap test. The last determines the distance over which a detonator will detonate an explosive. It has been found that the detonating force thus measured is greatest in the direction in which the detonator is pointed, and great also, but not so great, in a direction at right angles thereto. Hardly any detonating effect is found at 45 deg. to the axis of the detonator.

Schlieren photographs hitherto taken have been made with the detonator inclosed in a steel tube to protect the surface of the stainless-steel mirror from flying particles, but the photographs in this monograph were taken in front of the mirror without serious damage to the latter. From these it becomes clear that the gap test exhibits the true nature of the detonation. However, the speed of the wave and the volume of gases projected are greatest in a direction at right angles to the axis of the detonator and may be a more important factor than the axial impulse when the detonator is embedded in the explosive, as is the practice.

A List of Books and Other Sources of Information Regarding Coal and Coal Products, by F. R. Wadleigh. 64 pp., 6x9 in.; paper boards; $1.

This booklet lists general books, year books, books on technical subjects, trade, labor and wages, marketing, storage, transportation and use. Sources listed are associations, British commissions, conferences, departments of mines, geological surveys, periodicals, societies and colleges, etc. A handy little manual.

WORD from the FIELD

Marketing Agency Plans Revived

A committee to consider the formation of a central sales agency for producers in the smokeless fields of West Virginia and Virginia was appointed June 11 at a meeting at White Sulphur Springs, W. Va. The agency is to be along the lines proposed at the time of the organization of the Smokeless Coal Corporation, in May, 1933. The committee will meet at an early date in New York and report its conclusions and recommendations.

Similar organizations in process of formation include Alabama Coals, Inc., representing 85 per cent of the commercial tonnage of Alabama; and Eastern Coals, Inc., in eastern Pennsylvania. West Kentucky operators met June 14 to further plans for a proposed agency in that field.

New Preparation Facilities

New contracts and construction of preparation-plant facilities were reported as follows in May:

American Briquette Co., Lykens, Pa.—Contract closed with Wilmot Engineering Co. for coal-cleaning plant including two 2-stage Hydrotators with necessary screens and raw-coal conveyor to clean minus $\frac{3}{8}$-in. anthracite silt; capacity, 50 to 60 tons per hour.

Conoway Coal Corporation, Tazewell, Va.—Contract closed with Morrow Mfg. Co. for tipple equipped with three-track, three-grade screening arrangement; capacity, 125 tons of mine-run per hour.

Hanna Coal Co., Piney Fork, Ohio—Contract closed with Jeffrey Mfg. Co to replace existing tipple with new four-track steel tipple producing lump, egg, nut and slack coal, with complete mixing and crushing facilities; capacity, 300 tons per hour.

Jonathan Coal Mining Co., Dalton Washery, Deibler, Pa.—Contract closed with Deister Concentrator Co. for installation of new No. 7 Deister-Overstrom diagonal-deck washing table to treat No. 4 buckwheat coal; capacity, 6 tons per hour; to be completed early in July.

Lehigh Navigation Coal Co., Tamaqua, Pa.—Installation in remodeled No. 14 breaker of new 18-ft. diameter Chance cone for cleaning egg to pea coal inclusive at the rate of 250 tons per hour; also two 10x10-ft. square-top Chance cones for cleaning buckwheat to barley coal inclusive at the rate of approximately 150 tons per hour; completion expected in September.

Red Jacket, Jr., Coal Co., Ritter mine, Wyoming County, West Virginia—Contract closed with Morrow Mfg. Co. for construction of five-track steel tipple equipped with trip feeder, rotary dump, plate feeder, inspection table, mine-run belt conveyor, screens, picking tables, loading booms, Norton pick breaker, soft-coal crusher, rescreen conveyor, slack conveyor, reassembling conveyor, refuse and

soft-coal conveyors; steel structure to be furnished by Virginia Bridge & Iron Co.

Sandy Run Miners & Producers Co., Sandy Run, Pa.—Contract closed with Wilmot Engineering Co. for remodeling old breaker and installing four Type D Simplex jigs for egg, stove, nut and pea coal; capacity, 600 tons per day; also one 5-ft.-diameter Hydrotator with dewatering and sizing screens to clean Nos. 1, 2 and 3 buckwheat coal; capacity, 240 tons per day.

Standard Coal Co., Wheatland, Ind.—Contract closed with Deister Concentrator Co. for installation of two 4x10-ft. single-surface, motor-driven, double-vibrator Leahy heavy-duty vibrating screens to handle $1\frac{1}{2}$x0-in. coal, removing the $\frac{1}{2}$-in. fines; capacity, 125 tons per hour; installation completed.

Walsh Anti-Chiseling Bill Sets Federal Example

That Uncle Sam will not be No. 1 chiseler is indicated by the administration's sponsorship of the Walsh bill to bind all contractors supplying the government with goods or services to minimum wages and maximum hours fixed by the President. Standards will be designated in invitations to bid, either specifically or by reference, presumably to old NRA code requirements. The bill applies to all government contracts made prior to June 30, 1937, and will also cover purchase or construction contracts made by cities, States or other political subdivisions which obtain grants or loans of federal funds.

Breach of wage or hour requirements will render the contractor liable to the government for liquidated damages equal to the minimum wage; possibly to cancellation of the contract. Firms doing business with the government are almost unanimous in accepting in advance the conditions provided in the bill. That they are not unwise in doing so is indicated by the fact that the Navy, the Veterans' Bureau and the Procurement Division of the Treasury have recently contracted for coal at bid prices which they estimate are one-third higher than they would have to pay if they were to advertise for bids now.

Social Security Insurance Bill Passed by Senate

President Roosevelt's social security legislation was approved in the Senate on June 19, when the Wagner-Lewis bill was passed by a vote of 76 to 6. Several amendments were made in the Senate, however, since the measure was passed by the House. The bill provides for old-age pensions to the indigent elderly through federal and State aid, unemployment insurance, aid to dependent mothers and children, and aid to the blind (*Coal Age*, February, p. 95). The program would require federal appropriations of about $100,000,000 for the first year.

An amendment adopted by the Senate which it is feared in some quarters jeopardizes the compulsory old-age pension section was sponsored by Senator Clark. It would permit employers who maintain private pension plans to be exempted from the taxes set up in the bill. This proposal was adopted despite warnings that it might tend to restrict jobs to young people and cause their discharge before reaching pension age.

Following the action of the Senate, the bill goes back to conference with House spokesmen. Advocates of the pension provision stripped of the Clark amendment hope that President Roosevelt will urge that this section be restored to its original form.

Safety Awards Made

"C" mine of the Union Pacific Coal Co., at Superior, Wyo., was awarded the "Sentinels of Safety" trophy in the bituminous-coal-mine group for its record in 1934. The mine worked 225,426 man-hours without a lost-time accident. The trophies are donated by the *Explosives Engineer* magazine, competition being sponsored by the U. S. Bureau of Mines.

In the anthracite mining group, the winner was the Lawrence mine of the Harleigh-Brookwood Coal Co. This mine was operated for 727,979 man-hours in 1934 with 53 lost-time accidents, causing 857 days of disability.

Honorable mention in the bituminous industry was given to the following: Ingram Branch mine, Elkhorn Piney Coal Mining Co., Ingram Branch, W. Va.; Princewick mine, C. C. B. Smokeless Coal Co., Princewick, W. Va.; Arno mine, Stonega Coke & Coal Co., Arno, Va.; and Rockhill No. 7 mine, Rockhill Coal & Iron Co., Robertdale, Pa.

In the anthracite group, the following operations received honorable mention: Tomhicken mine, Coxe Brothers & Co., Inc.; Miles Slope mine, Hudson Coal Co.; Drifton mine, Coxe Brothers & Co., Inc.; and Jeddo No. 4 mine, Jeddo-Highland Coal Co.

Strike Truce Puts Guffey Bill on "Must" List While Opposition Shifts Fight to House

WASHINGTON, D. C., June 25—With prospects for the enactment of bituminous coal-control legislation before the end of the month fading, whether July 1 will usher in a general suspension of mining activities in the soft-coal fields dominated by the United Mine Workers is still any man's guess. Spokesmen for the miners' union preserve a discreet silence on the subject, but opinion in other informed circles here discounts the possibility of any walkout so long as Congress continues in session with the Guffey-Snyder bill on its list of unfinished business. These circles, which look upon final Congressional action on that measure this month as highly improbable, expect to see another last-minute postponement of the union suspension order.

As a result of the second postponement, extending the strike truce from June 16 to June 30, the Guffey-Snyder bill was given a definite place high up on the Roosevelt administration program of "must" legislation. That commitment, however, has not swelled the ranks of the coal operators favoring the enactment of this measure. Neither have the amendments proposed by the National Conference of Bituminous Coal Producers nor the changes embodied in revisions submitted by the Congressional sponsors of the bill lessened the oppositions.

Barring the administration preferment in placing the measure on the "must" list, the way of the pro-Guffeyites the past few weeks has been a stony one. While the National Conference of Bituminous Coal Producers was still polishing up its May 31 redraft of the bill and was modifying its previous stand on the coal-reserve section, the conference suffered the defection of an influential western Pennsylvania group. J. D. A. Morrow, president, Pittsburgh Coal Co., and one of the promoters of the conference, withdrew with the declaration that he had been advised by the executive committee of his company that the Guffey bill was unconstitutional. George H. Love, president, Union Collieries Co., and R. E. Jamison, vice-president, Jamison Coal & Coke Co., also withdrew.

Constitutionality Under Fire

Although proponents of the bill insist that the measure in its present form is constitutional and avoids the pitfalls which wrecked NIRA in the *Schechter* decision (*Coal Age,* June, 1935, p. 271), the Committee Against the Guffey Bill has been keeping up a steady drumfire attacking the constitutional phases and has cited the opinion of a number of well-known counsel to back up its contentions. The constitutional phase also was interjected into hearings before a subcommittee of the House Committee on Ways and Means when Representative Treadway (Republican), of Massachusetts, asked that the committee request an opinion on that point from the Attorney General. Mr. Treadway's suggestion was sidestepped by his colleagues, but the question is still troubling some of the administration advisers, who are said to believe that further changes may be necessary to bring the measure in line with past court decisions.

The first change proposed by the revised bill raises the maximum membership of the district boards of coal producers from fifteen to seventeen and provides that the number of board members shall be determined by a majority vote of the district tonnage for 1934 at a meeting to which all known producers in the district have been invited. One producer member is to be elected by "the majority in number of the producers" represented at this meeting. The other producer members shall be elected "by votes cast in the proportion of the annual tonnage output of the preceding calendar year of the producers in the district." Producers may vote their tonnage cumulatively, but not more than one officer or employee of the same corporation may sit on the board.

As in the original measure, S. 1417, and the bill as amended by the Senate Committee on Interstate Commerce, S. 2481 (*Coal Age,* March, 1935, p. 132; April, p. 167), organized labor is given one seat on each of the district boards. The number of district boards is fixed at twenty-one in the Guffey revision. The Snyder revision, H. R. 8479, now before the House Committee on Interstate and Foreign Commerce, raises the number to twenty-two by setting up a district to embrace North and South Dakota producers. Such a district was provided for in the original Guffey bill, but disappeared in the revision.

Allocation Plan Deferred

The detailed provisions for establishing district and mine quotas have been stricken out. As a substitute, the Coal Commission is directed, "as soon as reasonably possible after its appointment," to "investigate the necessity for the control of production and methods of such control, including allotment of output to districts and producers within such districts"; to "hold hearings thereon and report its conclusions and recommendations to Congress not later than Jan. 6, 1936." Marketing agencies representing at least one-third of the commercial tonnage of a district or group of districts are recognized by the latest revisions; in the preceding draft, recognition was extended only to agencies representing at least two-thirds of such tonnage.

Part II of Sec. 4 of Title I of the bill—the marketing section—has been largely rewritten. Cost determinations and price fixing are now bound up with "minimum-price areas." In addition, the majority of the prohibitions against unfair trade practices embodied in the defunct NRA code are taken over bodily. These include the ban on consignment coal; post-dating or pre-dating invoices to effect price concessions; special allowances and rebates; prepayment of freight charges to effect discriminatory credit allowances; intentional misrepresentations of quality, size or origin of coal; inducing breach of contract between a competitor and his customer; splitting commissions or paying commissions when done for the purpose of giving special concessions to a consumer; unauthorized use or simulation of competitive advertising, trade names and slogans.

The text of the new provisions on price determinations, price evasions, contract quotations and disclosure of confidential information is given in full in the paragraphs which follow, with matter appearing in the preceding draft indicated by italics.

The district boards and code members shall accept and be subject to the jurisdiction of the Commission to approve or to fix minimum and maximum prices, as follows:

(a) All code members shall, in their respective districts, report all spot orders to the district board and shall file with it copies of all contracts for the sale of coal, copies of all invoices, copies of all credit memoranda and such other information concerning the preparation, cost, sale and distribution of coal as the Commission may authorize or require. All such records shall be held by the district board as the confidential records of the code member filing such information.

Each district board may set up and maintain a statistical bureau, and the district board may require that such reports and other information in this subsection described shall be filed with such statistical bureau in lieu of the filing thereof with the district board.

Each district board shall, from time to time on its own motion or when directed by the Commission, establish minimum prices free on board transportation facilities at the mines for kinds, qualities and sizes of *coal produced in said district,* with full authority, in establishing such minimum prices, to make such classification of coals and price variations as to producing areas and market areas as it may deem necessary and proper. In order to sustain the stabilization of wages, working conditions and maximum hours of labor, said prices shall be established so as to yield a return for the respective areas defined in the subjoined table designated "minimum-price area table," equal as nearly as mathematically possible to, and not less than, the weighted average of the total costs, determined as hereinafter provided, of the tonnage of such areas, including, but without limitation, the total cost of production, the cost of selling, and the cost of administration.

Minimum Price Area Table

Area 1—Eastern Pennsylvania, District 1; western Pennsylvania, District 2; northern West Virginia, District 3; Ohio, District 4; Pan Handle, District 5; Southern numbered 1, District 6; Southern numbered 2, District 7; west Kentucky, District 8; Illinois, District 9; Indiana, District 10; Iowa, District 11; that part of Southeastern, District 12 comprising Van Buren, Warren and McMinn counties in Tennessee.

Area 2—Southeastern, District 12, except Van Buren, Warren and McMinn counties in Tennessee.

Area 3—Arkansas-Oklahoma, District 13.

Area 4—Southwestern, District 14.

Area 5—Northern Colorado, District 15; southern Colorado, District 16; New Mexico, District 17.

Area 6—Wyoming, District 18; Utah District 19.

Area 7—North Dakota and South Dakota.

Area 8—Montana, District 20.

Area 9—Washington, District 21.

The minimum prices so established shall reflect, as nearly as possible, the relative market values of the various kinds, qualities and sizes of coal, shall be just and equitable as between producers within the district, and shall have due regard to the interests of the consuming public. Such prices shall be so related as to carry into effect the purposes of this Act, under such rules and regulations as shall be prescribed by the Commission.

A schedule of such minimum prices, together with the data upon which they are computed, including, but without limitation, the factors considered in determining the price relationship, shall be submitted by the district board to the Commission, which may approve, disapprove or modify the same to conform to the requirements of this subsection, and such approval, disapproval or modification shall be binding upon all code members within the district, subject to such modification therein as may result from the coordination provided for in the succeeding subsection (b): *Provided,* That all minimum prices established for any kind, quality or size of coal for shipment into any consuming market area shall be just and equitable as between producers within the district: *And provided, further,*

That no minimum price shall be established that permits dumping.

As soon as possible after its creation, each district board shall ascertain the weighted average of the total costs of the tonnage produced in the district in the calendar year 1934. The district board shall adjust the average costs so determined, as may be necessary to give effect to any changes in wage rates, hours of employment, or other factors substantially affecting costs, so as to reflect as accurately as possible any change or changes which may have been established since Jan. 1, 1934. Such ascertainment and the computations upon which it is based shall be promptly submitted to the Commission by each district board in the respective minimum price areas. The Commission shall thereupon determine the weighted average of the total costs of the tonnage for each minimum-price area in the calendar year 1934, adjusted as aforesaid, and transmit it to all the district boards within such minimum price area. Said weighted average of the total costs shall be taken as the basis for the establishment of minimum prices to be effective until changed by the Commission, upon satisfactory proof made by any district board of a change in excess of 2c. per net ton of 2,000 lb. in the weighted average of the total costs in the minimum-price area. Thereafter, at the end of each quarter, each district board shall ascertain the weighted average of the total costs of the tonnage production of the district during the preceding quarter, adjusted as may be necessary to give effect to any changes in wage rates, hours of employment and other factors substantially affecting costs which may have been established since the beginning of the quarter. The computation and ascertainment of such adjusted weighted average costs shall be submitted to the Commission by each district board in the respective minimum-price areas and the Commission shall compute the weighted average of the total costs so adjusted of the tonnage of each minimum-price area and transmit such weighted average to the respective boards as hereinbefore provided. The weighted average figures of the total cost determined as aforesaid shall be available to the public.

Each district board shall, on its own motion or when directed by the Commission, establish reasonable rules and regulations incidental to the sale and distribution of coal by code members within the district. Such rules and regulations shall not be inconsistent with the requirements of this section and shall conform to the standards of fair competition hereinafter established. Such rules and regulations shall be submitted by the district board to the Commission, with a statement of the reasons therefor, and the Commission may approve, disapprove or modify the same, and such approval, disapproval or modification shall be binding upon all code members within the district.

(b) District boards shall, under rules and regulations established by the Commission, coordinate in common market areas upon a fair competitive basis the minimum prices and the rules and regulations established by them, respectively, under subsection (a) hereof. Such coordination, among other factors, but without limitation, shall take into account the various kinds, qualities and sizes of coal and transportation charges upon coal. All minimum prices established for any kind, quality or size of coal for shipment into any market area shall be just and equitable, as between districts. Such coordinated prices and rules and regulations, together with the data upon which they are predicated, shall be submitted to the Commission, which may approve, disapprove or modify the same to establish and maintain such fair competitive relationship, and such approval, disapproval or modification shall be binding upon all code members within the affected districts. No minimum price shall be established that permits dumping.

(c) When, in the public interest, the Commission deems it necessary to establish maximum prices for coal, the Commission shall have the right to fix maximum prices free on board transportation facilities for coal in any district. Such maximum prices shall be established at a uniform increase above the minimum prices in effect within the district at the time, so that in the aggregate the maximum prices shall yield a reasonable return above the weighted average total cost of the district: *Provided,* That no maximum price shall be established for any mine which shall not return cost plus a reasonable profit.

(d) If any code member or district board shall be dissatisfied with such coordination of prices or rules and regulations, or by a failure to establish such coordination of prices or rules and regulations, or by the maximum prices established for him or it pursuant to subsection (c) of this section, he or it shall have the right, by petition, to make complaint to the Commission, and the Commission shall, under rules and regulations established by it, and after notice and hearing, make such order as may be required to effectuate the purpose of subsections (b) and (c) of this section, which order shall be binding upon all parties in interest. Pending final disposition of such petition, and upon reasonable showing of necessity therefor, the Commission may make such preliminary or temporary order as in its judgment may be appropriate, and not inconsistent with the provisions of this Act.

Subject to the provisions of subsection (h) of Part II, no coal shall be sold at a price below the minimum or above the maximum therefor approved or established by the Commission, and the sale of coal at a price below such minimum or above such maximum shall constitute a violation of the code.

Subject to the provisions of subsection (h) of Part II, a contract for the sale of coal at a price below the minimum or above the maximum therefor approved or established by the Commission at the time of the making of the contract shall constitute a violation of the code, and such contract shall be invalid and unenforceable.

While this Act is in effect no code member shall make any contract for the sale of coal for delivery after the expiration date of this Act, at a price below the minimum or above the maximum therefor approved or established by the Commission and in effect at the time of making the contract.

The minimum prices established in accordance with the provisions of this section shall not apply to coal sold by a code member and shipped outside the domestic market. The domestic market shall include all points within the continental United States, the Panama Canal Zone, Canada, and car-ferry shipments to the island of Cuba. Bunker coal delivered to steamships for consumption thereon shall be regarded as shipped within the domestic market. Maximum prices established in accordance with the provisions of this section shall not apply to coal sold by a code member and shipped outside the Continental United States.

All data, reports and other information in the possession of the National Recovery Administration in relation to bituminous coal shall be available to the Commission for the administration of this Act.

(e) *The Commission may require reports from producers and may use such other sources of information available as it deems advisable, and may require producers to maintain a uniform system of accounting of costs, wages, operations, sales, profits, losses and such other matters as may be required in the administration of this Act. No information obtained from a producer disclosing costs of production or sales realization shall be made public without the consent of the producer from whom the same shall have been obtained, except where such disclosure is warranted by a controversy with the producer over any order of the Commission* and except that such information may be compiled in composite form in such manner as shall not be injurious to the interests of any producer and, as so compiled, may be published by the Commission.

(f) Any officer or employee of the Commission or of any district board who shall make public any information obtained by the Commission or the district board, without its authority, unless directed by a court, shall be deemed guilty of a misdemeanor and, upon conviction thereof, shall be punished by a fine not exceeding $500, or by imprisonment not exceeding six months, or by fine and imprisonment, in the discretion of the court.

(g) *The price provisions of this Act shall not be evaded or violated by or through the use of docks or other storage facilities* or transportation facilities, *or by or through the use of subsidiaries, affiliated sales* or transportation *companies or other intermediaries* or instrumentalities, or by or through the absorption, directly or indirectly, of any transportation or incidental charge of *whatsoever kind or character, or any part thereof. The Commission is hereby authorized, after investigation and hearing, and upon notice to the interested parties, to make and issue rules and regulations to make this subsection effective.*

(h) No coal may be delivered upon a contract made prior to the effective date of this Act at a price below the minimum price at the time of delivery upon such contract, established as in this Act provided: *Provided,* That this prohibition shall not apply (a) to a lawful and bona fide written contract entered into prior to Oct. 2, 1933; nor (b) to a lawful and bona fide written contract entered into subsequent to that date and prior to May 27, 1935, at not less than the minimum price for current sale as published under the Code of Fair Competition for the Bituminous Coal Industry, pursuant to the National Industrial Recovery Act, at the time of the making of such contract; nor (c) to a lawful and bona fide written contract entered into on or after May 27, 1935, and prior to the date of the approval of this Act, at not less than the minimum price for current sale as published under said Code of Fair Competition, applicable as at May 27, 1935.

(i) *All sales and contracts for the sale of coal shall be subject to the operation of this Act and to the code prices herein provided for.* The Commission shall prescribe (1) the price allowance to and receivable by persons who purchase coal for resale, and resell it in not less than cargo or railroad carload lots, and (2) the maintenance by such persons, in the resale of coal, of the minimum prices established under this Act.

Instead of stating that aggrieved parties are entitled to the same judicial reviews of orders of the Commission or Labor Board provided in the Securities Exchange Act for review of orders of the Securities and Exchange Commission, the new version specifically provides (1) for appeal to the Commission for review and (2) appeal to the Circuit Court of Appeals of the United States. In the second case, peti-

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Cheering the Second Truce

Senator Guffey; Duncan C. Kennedy, chairman, Appalachian Joint Wage Conference; George L. Berry, NIRA; John L. Lewis, president, United Mine Workers; and Representative Snyder pose for the photographer as they leave the White House following the decision to postpone the expiration of the wage truce until June 30.

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"Unconstitutional," Says Van Norman

J. Van Norman, counsel for the anti-Guffeyites, attacks coal-control bill at hearing before the subcommittee of House Committee on Ways and Means.

tions for the setting aside or modification of Commission or Labor Board orders must be filed within sixty days after the entry of such order.

Hearings on the revised Guffey-Snyder bill opened before the House subcommittee on June 17 and continued through June 21, when the subcommittee recessed until today. In a short statement at the first session, Representative Snyder declared that a careful check indicated that "possibly" 65 to 75 per cent of the bituminous tonnage and 97 per cent of the mine workers were favorable to the bill. Harry Warrum, general counsel, United Mine Workers, followed with a discussion of the legal aspects of the measure which kept him in the witness chair until the afternoon session of June 19. Recovery and stabilization in the bituminous industry, he asserted, "carry their own destruction because they are followed at once by the development of marginal properties." Enactment of Title II, creating the National Bituminous Coal Reserve, he insisted, was the only way to prevent such destruction.

According to Charles O'Neill, chairman of the legislative committee of the National Conference of Bituminous Coal Producers, the conference represented 55 per cent of the commercial tonnage. Since last November, he testified, there had been a steady disintegration in NRA code prices; out of 43 recent bids on New York State business, 37 offered coal at 13 to 68c. per ton under code minimums. "With this situation," he continued, "there is no possibility whatever of negotiating a new wage agreement—even on the present level—unless something is done to stabilize prices. I hope that Congress will give us a law, if it can, that will stabilize prices so that wages may be decently maintained."

The new marketing provisions of the revised bill were explained by John L. Steinbugler, president, W. C. Atwater & Co., who said that an effort had been made to have these conform to the original provisions of the NRA code. Questioned by committee members who thought "the cost of production," as specified in the bill, was too broad and indefinite, the witness answered that he could see no objection to an amendment which would set up the factors to be considered in arriving at these costs. Discussing the elimination of the provision which excluded the 10 per cent of the tonnage which had the highest costs from base calculations in fixing minimum prices, Mr. Steinbugler stated that the only fair method was to include all mines in these calculations. Replying to queries as to the effect the bill would have upon Indiana producers in competition with low-cost western Pennsylvania mines, Mr. Steinbugler said:

"The individual cost of the producer simply goes into the consideration of the cost of all producers in the large area which includes both Indiana and western Pennsylvania. The cost of producing coal in all that large area having been established, the cost itself becomes the basis of establishment of minimum prices in Indiana as well as in western Pennsylvania. In other words, each district, both in Indiana and in western Pennsylvania, is charged with the duty of so arranging its prices locally as to bring about a realization equal to the average cost of producing all the coal in the large area."

Testimony of Mr. O'Neill that legislation was necessary for the preservation of the industry was indorsed by E. C. Mahan, president, Southern Coal & Coke Co. The modifications in the marketing provisions, said Mr. Mahan, removed the discrimination against Southern operators embodied in the original bill. As originally drafted, he continued, the bill would have compelled the Southern operators to establish such high prices on resultant sizes that they would have been unable to market these sizes in the North against the freight rate differentials in favor of the Northern producers.

Concluding the presentation on behalf of the proponents of the bill, Thurlow G. Essington, counsel, Illinois Coal Operators' Association, expressed the opinion that the proposed law would work to the advantage of the entire industry. Although the mining of coal is not interstate commerce, Sec. 1 of the bill makes a definite declaration by Congress that mining is affected with a public interest. While the court in the *Schechter* case found that the particular industry before it involved a business which would not affect interstate commerce sufficiently to come under the control of Congress, no conclusion could be drawn from the decision that the court would find the same situation in the case of other businesses.

The opening gun for the opposition was fired by Hugh R. Hawthorne, vice-president, Pocahontas Fuel Co., and chairman of the Committee Against the Guffey Bill. Challenging the statements of previous witnesses, he asserted that a survey of the coal-producing States showed 60.38 per cent of the tonnage definitely opposed to the bill. The remaining 39.62 per cent of the tonnage includes not only production favorable to the bill but operators who are noncommittal or whose position is unknown. Only two States—Illinois and Ohio—"show a substantial tonnage in favor of the bill." Mr. Hawthorne filed the following statement summarizing the results of his committee's survey:

TOTAL 1934 BITUMINOUS COAL PRODUCTION SHOWING ATTITUDE OF OPERATORS TOWARD GUFFEY BILL

	Total Tonnage	Against Bill	Per Cent	For, Unknown or Noncommittal	Per Cent
Pennsylvania	89,229,000	41,764,169	46.81	47,464,831	53.19
Maryland and Upper Potomac	2,506,000	2,063,000	82.32	443,000	17.68
Ohio	20,842,000	1,643,172	7.88	19,198,828	92.12
Panhandle of West Virginia	3,982,000	.....	.....	3,982,000	100.00
Michigan	648,000	.....	.....	648,000	100.00
Northern W. Va.	19,114,000	14,514,165	75.93	4,599,835	24.07
Southern Low Volatile No. 1	44,141,000	35,325,859	80.03	8,815,141	19.97
Southern High Volatile No. 2	72,526,000	50,954,710	70.26	21,571,290	29.74
West Kentucky	7,893,000	7,893,000	100.00	.....	.....
Illinois Subdivision	40,905,000	9,929,323	24.27	30,975,677	75.73
Indiana Subdivision	14,820,000	12,745,200	86.00	2,074,800	14.00
Iowa Subdivision	3,345,000	2,538,000	75.87	807,000	24.13
Alabama, Georgia and So. Tennessee	10,599,000	9,570,897	90.30	1,028,103	9.70
Division IV*	8,823,000	8,823,000	100.00	.....	.....
Division VI†	19,020,000	18,639,600	98.00	380,400	2.00
Total United States	358,393,000	216,404.095	60.38	141,988,905	39.62

*Missouri, Kansas, Arkansas, Oklahoma, and Texas. †New Mexico, Colorado, Utah, Wyoming, North Dakota, South Dakota, Montana, Idaho, Washington, Oregon, California, Nevada and Arizona.

In the opinion of Mr. Hawthorne, the best hope for stabilization lies in the establishment of additional marketing agencies, such as Appalachian Coals, Inc. So long as these agencies did not enter into agreements with one another, their legality would be unchallengeable. He objected particularly to the price-fixing methods and to the labor provisions empowering two-thirds of the production and the majority of the workers to establish minimum wages for an entire district.

J. Van Norman, who represented the western Kentucky operators in their successful fight in the federal district court against wage-fixing by NRA, testified on June 21 as counsel for the Committee Against the Guffey Bill. Directing his arguments to the constitutionality of the proposed law, he declared that no declaration of Congress could bring coal mining within the regulatory power of the federal government. Congress, he said, might suspend the anti-trust laws to permit operators to fix prices and such suspension would be unobjectionable because it merely permitted voluntary action, but the taxing provisions of the bill under discussion made the price-fixing there contemplated coercive, since no operator could survive the 25 per cent tax when competitors enjoyed a 99 per cent rebate.

Captive mines which do not compete in the commercial market, protested Thomas Moses, president, H. C. Frick

Coke Co., "should not be required to contribute to the salvaging of the bituminous industry." J. W. Carter, president, Carter Coal Co., drew the fire of John L. Lewis, president, United Mine Workers, by inferring that labor was using the strike threat to coerce Congress into enacting the proposed law. Responsibility for failure to negotiate a new wage contract, retorted Mr. Lewis, must be laid on the operators' doorstep. Instead of attempting coercion, the union, he insisted, had readily acquiesced in the suggestion, first of NRA and second of President Roosevelt, to extend the expiration date of the old agreement to June 16 and July 1.

Mr. Carter, one of the leading opponents of the bill, renewed the attacks upon its constitutionality which he had made earlier before the Senate subcommittee on interstate and foreign commerce (*Coal Age*, April, 1935, p. 168). He also assailed the measure for what he characterized as its monopolistic features. Apparently one of the primary purposes of the original allocation plan, he charged, was to shift tonnage to Pennsylvania and Illinois to the injury of Southern mines; leaving this question for future study and report, he argued, merely gave it "a far more dangerous form." He, too, could see no virtues in Title II.

Kentucky Union Protests Bill

R. M. Nance, representing the Independent Miners' Union (western Kentucky), challenged the bill as unsound in principle and vicious in practice. "In every instance where the national organization of employees is mentioned, it might as well be written 'U.M.W.of A.' This bill proposes to give that organization all representation in making it the only bargaining agency for all producing sections regardless of the number of employees in any section in the membership of that organization."

Two days before the expiration of the June 16 truce, the President, in conference with Mr. Lewis and Duncan C. Kennedy, chairman of the joint conference for the Appalachian region, suggested a further extension of the old contract terms until June 30. This extension was formally ratified at a reconvened session of the joint wage conference June 16 at which, however, no votes were recorded for the Pocahontas, Tug River, Greenbrier, Hazard, Harlan, Logan, Southern Appalachian and Williamson fields. Although some of the operators questioned the right of the chairman to reconvene a conference that had adjourned *sine die* on May 28, W. G. Crichton, speaking for the Southern fields not voting at the meeting and also for northern West Virginia, later announced that operators in these fields would agree to the extension. He further urged that, when the conference resumed deliberations on June 24, the negotiations be continued "until a new contract can be consummated and without regard for any possible bearing on the pending Guffey coal monopoly bill or any other special legislation."

The meeting of the joint conference yesterday resulted in another stalemate. On behalf of the operators, Mr. O'Neill proposed that the old agreement be extended until March 31, 1936. Mr. Lewis objected to this, saying that, with prices sliding, it would only mean demands next year for wage reductions on the plea that the operators could not afford to maintain existing wage levels. He renewed the earlier demands of the union for a six-hour day and increased base rates (*Coal Age*, March, 1935, p. 135). These proposals were referred to a joint sub-scale committee of nine operators and nine miners, which hopes to be able to report back to the conference tonight.

Other developments on the bituminous labor front this month included a two-year extension of the $4 wage scale with the Independent Miners' Union in western Kentucky and the refusal, on June 13, of the United Mine Workers to negotiate a one-year extension of the Alabama wage agreement with a proviso for upward revision in the event of base increases in adjoining fields. During the month, District 12 spokesmen at a meeting with Illinois operators formally presented the six-hour day and increased wage demands and these were as formally rejected. Asserting that operators in that State no longer can claim they are bound by contracts with United Mine Workers, the Progressive Miners' Union has extended a general invitation to Illinois producers to enter into contractual relations with its group.

Relation of Safety to Efficient Management Emphasized at Mine Inspectors' Meeting

THAT safe operation and efficient management are inseparable was echoed time and again in papers and discussions at the annual meeting of the Mine Inspectors' Institute of America, held at Beckley, W. Va., June 3, 4 and 5. Publication of monthly accident statistics and placing responsibility for accidents, two recent developments in activities of State departments, were heralded as revolutionary steps.

In a comprehensive study of all classes of coal-mine hazards of today compared with those of thirty years ago, Dan Harrington, chief of the health and safety branch, U. S. Bureau of Mines, concluded that the record of over 50 per cent reduction in fatalities per million tons is indicative of the progress that has been made in safer conduct of coal mining.

Carel Robinson, general manager, Kellys Creek Colliery Co., Ward, W. Va., said that the safety program begun two years ago at Ward is based on the statement, "Every good safety standard is also a good operating standard, and every good operating standard is also a good safety standard," which statement he credited to Wm. W. Miller, general manager, Hatfield-Campbell Creek Coal Co. All proposals for changes designed to increase production or reduce cost are thoroughly checked with reference to safety and every proposal for safety must be practical and be an aid in the production of coal.

The educational program includes monthly meetings and classes for first-aid training. Foremen exert their moral influence in getting the men to attend the classes, with the gratifying result that every employee has been awarded a certificate and that a large percentage of the men wear hard hats and safety-toe shoes.

The tie between efficiency and safety was illustrated by the substitution, at Ward, of the electric cap lamp in place of the carbide lamp. Cars loaded by electric light contained 25 per cent less impurities than those loaded by carbide light, yet the miner using the carbide light took 32 per cent more time in cleaning and loading. A summary of the complete test was given by Mr. Robinson at the Cincinnati convention (*Coal Age*, May, 1935, p. 248).

"Prevention of accidents is finally and primarily an operating problem and is the result of good management," said C. L. Lutton, safety director, H. C. Frick Coke Co. He asserted that production costs that do not include the costs of accidents are not true costs at all. "There is no place to charge the cost of accidents except to cost of production; therefore prevention of accidents is an operating problem."

Continuing, he asserted it is a wrong thought that the safety department is responsible for injuries. Referring to accident prevention, "It cannot be set aside and put in the hands of a safety department," he declared. It is the field of the operating department to execute the recommendations of the safety department. He emphasized training as the best approach to safety and closed with the plea, "Let's be supervisors, not bosses."

Illustrative of cooperation and the possibility for changed mining methods, R. C. Beerbower, Goodman Manufacturing Co., Pittsburgh, Pa., said that three of the large manufacturers of mining machines have decided to finance an investigation of the general mechanization of cutting out impurities and that a man has been appointed to begin the work this year.

"Show me a safe mine and it is an efficient mine; show me an efficient mine and it is a safe mine," remarked J. J. Forbes, chief engineer, safety extension service, U. S. Bureau of Mines, in setting forth the idea that safety and production are integral parts of operation.

In his paper Mr. Harrington first presented the record of fatalities, tonnage, and number of men employed for each of the thirty years, 1905 to 1934 inclusive. Generally speaking, there has been a consistent decrease in fatalities per ton from the figure of 5.78 in 1905 to the tentative figure of 2.77 in 1934, but in the first five years of the period (just prior to organization of the Bureau of Mines in 1910) 12,699 persons were killed, as compared to 6,958 in the last five years, 1930-1934, and the tonnages in the periods were approximately the same (2,163,901,000 tons, 1905-1909, and 2,137,197,000 tons, 1930-1934).

According to Mr. Harrington, an abstract of whose paper appears on pp. 295-297, little if any progress has been made during the thirty years in reducing accidents from falls of roof.

That hazards of practically all types have greatly increased in the last thirty years was the essence of a discussion of the Har-

rington paper by Edward Graff, general manager of mines, New River Co., Mount Hope, W. Va. Increase of coal preparation on the surface has increased the number of surface employees three or four times. The mining of more difficult seams and increasing use of machinery are other factors. Referring specifically to the New River Co., Mr. Graff said haulage accidents are the most difficult to control. For about five years an improvement was made, but in 1935 the experience has become worse. One hundred per cent first-aid training has been given to employees of the New River Co. four times in the last five years.

The West Virginia Department of Mines is classifying each accident under causes, occupation, length of experience, time of occurrence, and is charging them to the mine where they occur, then publishing monthly reports of the classification, said N. P. Rhinehart, chief of the department. Referring to the benefits derived by the mining companies, "these reports have enabled the directing officials to recognize weaknesses of operation and correct them before they have become habitual."

Monthly reports are made as interesting as possible, therefore are widely and carefully read and at the various safety clubs they form a subject for discussion and debate. Besides enabling the State department to recognize at an early date the signs of unsafe practices or carelessness at an individual mine, the monthly reports have resulted in better and more accurate individual reports from the companies.

Interest in Accident Reports Mounts

James McSherry, director of the State Department of Mines and Minerals, Illinois, in a discussion read by M. K. Herrington, secretary to the director, credited West Virginia as the first to publish comprehensive monthly reports. In March, 1934, Illinois began to publish monthly "Casualty and Recommendations" reports, but these dealt principally with fatalities, because the law requires only that type of accident to be reported at once by the mine operator. Usually the verdict of the coroner's jury and the findings of an investigation by the State mine inspector are included in the report. The location is given by county, but the name of the company and maker of the machine, if a machine is involved in the accident, are not given.

Seven hundred copies was the circulation of the first Illinois monthly report and in a few months the demand had grown to twice that number. Inspectors are urged to get at the real underlying proximate causes when making investigations, and the reports, so far as possible, are made accurate, reliable and interesting. Coal company officials sometimes order as many as fifty copies of the report. The same type of report is now being considered for nonfatal accidents.

In Colorado, said Thomas Allen, chief inspector, the operators' monthly accident report requirement is not enforced, but enforcement is now proposed. He thinks that the statistical publications should be made as simple as possible and remarked that the cost of an accident is but a small part of the loss due to the inefficient operation that leads to the accident.

The placing of responsibility for accidents as now done in Pennsylvania, Kentucky and Alabama was termed revolutionary by Dr. J. J. Rutledge, chief engineer, Maryland Bureau of Mines. Maryland tabulates accidents but does not publish them except that a monthly poster is sent to all mines. He believes that publication of preliminary reports meets the objection of delayed publication of annual reports. For a time two large companies operating in Maryland reported all accidents, but recently one of them stopped reporting those of no lost time.

In Pennsylvania complete reports are published only every two years, but now publication of monthly reports tell "where, what and how" accidents are occurring, said Richard Maize, Deputy Secretary of Mines, Uniontown. He favors accident statistics because they put the inspector or mine operator or both in the limelight, and "neither is proud of a bad record." Since the data are public information, he thinks that the company name as well as the State inspector's name and the district should be included.

Indorses Reporting Idea

J. F. Bryson, of Harlan, said that John F. Daniel, chief, department of mines, Kentucky, "who is strong for accident reports," encountered much opposition from the operators when in 1928 he started to publish accident statistics. Recently an expression from the operators favored the continuance. In Kentucky the local mining institutes classify lost-time accidents and exchange reports with other institutes.

In a position to make comparisons because his employers, the New River & Pocahontas Consolidated Coal Co. and affiliated interests, have mines in both Pennsylvania and West Virginia, C. L. Wilson, safety director, said that the West Virgina monthly reports showing time and other details of accidents are quite valuable to his company. Their use of the reports have pointed out that "the small things, not the big things, are the chief causes of accidents."

Ohio is reducing accidents about 20 per cent each year, according to D. M. Ryan, Division of Safety and Hygiene, Industrial Commission. He advocates that reports be used to foster a competitive spirit by showing the standing of the mine in its particular group. James Berry, chief of the Ohio Division of Mines, said the reports of the Department of Safety and Hygiene are not always accurate, as they are based on the claims filed with the commission.

"Unavoidable accidents are few in number, in fact we can almost say there are none," and "we believe that almost every accident in mining can be prevented by properly organized safety methods," was the preface of a paper written by F. M. Correll, mine inspector, Consolidation Coal Co., Jenkins, Ky., and read by Roy H. Gonia, district inspector, Harlan, Ky. Investigation of accidents should be made by a committee consisting of a miner, the mine foreman, and a safety inspector who is not under the jurisdiction of the mine superintendent. Points to be covered are the management, the individual, and the condition. Quoting from Mr. Correll's paper, "an investigation should have the following objects in view: first, to uncover the true cause of the accident and, second, to prevent a recurrence."

Careful investigation of every detail pertaining to each accident has disclosed that many miners of the inferior class injure themselves intentionally in order to secure compensation and insurance. Some have gone so far as to completely sever a finger.

"We cannot afford to take chances of sacrificing human lives in order to obtain a few trophies," was Mr. Correll's observation regarding reporting accidents. He believes that all accidents of the slightest nature should be reported. As the company goes farther and farther in correcting every known bad condition, he has found reason to revise his earlier observations that 98 per cent of the accidents were due to carelessness. Instead he finds increasing evidence of miner responsibility and believes that legalized liquor has been responsible for a great many accidents.

"Why not place the responsibility before the accident occurs?" was the comment of William Roy, Hanna Coal Co., St. Clairsville, Ohio. He suggested it would pay to have a complete unbiased investigation made of the supervisory force because "no accidents need occur if we have proper management." At the Hanna mines a monthly school of leadership is being conducted to develop an organization which will eliminate all accidents.

Beginning with the American Mine Safety Association, organized in 1913 and the first association of national scope for promotion of safety, a paper prepared by P. F. Nairn, bituminous inspector, Pennsylvania Department of Mines, and read by Mr. Maize, reviewed the activities of national mine safety organizations up to and including the present Holmes Safety Association. This latter organization was characterized as having passed the experimental stage long ago and as now representing the best medium for securing maximum cooperation in promoting mine safety.

Stresses Safety Education

Two mines of the Norfolk & Western Railway Co. have Holmes Safety Association chapters and another is without such a chapter, said C. J. Flippen, safety director of the fuel mines. At the two mines where chapters were organized some months ago fifteen lost-time accidents occurred last year and this year but three have occurred. At the other mine, which is without a chapter, twelve compensable accidents occurred last year and the same number have occurred so far this year. "Most of my safety work," said Mr. Flippen, "has been done by safety education, and I find the Holmes chapters an excellent means of providing that education."

Finally heeding the plea that he has made for several successive years, the institute retired James T. Beard from the active position as editor-in-chief to editor-in-chief emeritus. J. W. Paul was elected as editor-in-chief. Other officers elected for the coming year are: president, Thomas Stockdale, district mine inspector, Freeman, W. Va.; vice presidents, James Berry, Richard Maize, and Dr. Rutledge; secretary, C. A. McDowell, personnel director, Pittsburgh Coal Co.; assistant secretary, J. J. Forbes; treasurer, Dr. Rutledge; and publicity editor, R. Dawson Hall, New York.

Denver, Colo., was selected as the place of the next annual meeting. Registration at the Beckley convention was higher than at any previous convention and the financial condition of the institute is better than it has been for a number of years. John G. Hillhouse, of Illinois, retiring president, presided at the Beckley sessions.

Safety, Mine Operation and Coal Cleaning Discussed on Illinois Institute Trip

WITH 100 members and guests on board, the Str. "Golden Eagle" pushed off on the flooded Mississippi River on June 7 on the seventeenth annual boat trip and summer meeting of the Illinois Mining Institute. Combining business with pleasure, those in attendance discussed safety, mine operation and coal cleaning at the two technical sessions on June 8, presided over by Fred S. Pfahler, president, Superior Coal Co., and John E. Jones, safety director, Old Ben Coal Corporation.

The safety record in Illinois in 1934 was neither the best nor the worst in the annals of the State, declared James McSherry, director, Illinois Department of Mines and Minerals, in an address read by M. K. Herrington, chief clerk of the department. A total of 86 fatalities and 3,123 compensable nonfatal injuries was reported last year, of which a high percentage were "absolutely preventable." The growth in first-aid training in the State, said Mr. McSherry, is a favorable trend that should be reflected in results in the future. During 1934, the total number of men trained at the eight mine-rescue stations in the State was 5,930, and a number of 100-per-cent first-aid-training campaigns were begun or completed in that year. A significant fact, Mr. McSherry held, is "that some of the best safety records established in the industry in the State were made by those organizations which were 100-per-cent first-aid trained." Expressing the opinion that prompt dissemination of accident information is a vital tool in promoting safety, Mr. McSherry described the history of the monthly "Casualty and Recommendation Report," which his department began to prepare and distribute in April, 1934. The reports contain all the salient data on all fatal accidents as nearly as possible in the words of witnesses, mine managers and others and include usually the verdict of the coroner's jury and always the detailed report of the State mine inspector's investigation of the fatality, together with recommendations.

Fatalities Heavy at "Local" Mines

Opening the discussion, George C. McFadden, assistant vice-president, Peabody Coal Co., pointed out that the fatality rate at local mines was approximately 2½ times that at shipping mines. In Colorado, said Thomas Allen, chief inspector, the small-mine fatality rate is about twice that of the large mines. Small mines, however, can be operated without fatalities, he declared, citing experience among the Colorado "Western Slope" operations in 1927-28-29. As a result of an intensive drive, 126 small mines in the field operated throughout this period without a fatality. "Outlaw" mines in the State are now controlled by a license law passed by the last Legislature which, in addition to requiring an accurate statement of location and ownership of mines, provides for license fees of $10 per year for mines producing under 500 tons; $25, 500 to 1,000 tons; and $50, 1,000 tons or more.

"Where work requires a combination of mental and physical energy, manual labor has an undisputed field of usefulness," declared David W. Jones, superintendent, Valier Coal Co., in discussing the application of practical developments by operators to standard designs of coal-mine machinery and equipment. On the other hand, "it is futile for man to compete with a machine built primarily to perform mechanical work," although human effort is required to control and direct the work of machines.

Evolution of a machine, Mr. Jones pointed out, follows a well-marked path: Development by the designer with a definite operation to be performed in view, followed by revisions growing out of use. Constantly repeated, this cycle is responsible for the evolution of a machine from its original to its final form, which takes on many of the elements of a race between manufacturer and user, the latter constantly attempting to get more out of the machine than was intended and the former constantly improving the equipment to meet these increased demands.

In viewing present trends, indications point to a wider use of permissible equipment, not only because of safety but also because such equipment is more sturdily built to withstand burdens beyond the scope of the conventional type. "Application of permissible designs to mining equipment will be gradual," and means must be found to compensate for the increased cost of construction. Factors which justify the trend to better equipment are three: (1) safety, an ever-important consideration in coal mining; (2) lower maintenance cost growing out of ability to work continuously without interruptions for repairs; and, (3) reliability, which reduces the amount of reserve equipment which must be kept on hand to insure continuous operation. In the last analysis, "better equipment equals better operation," and "machines in the future will become obsolete in the ratio of their disregard for safety features required to prevent personal injuries."

In the transportation field, mechanical loading has resulted in the development of high-speed main-line locomotives, medium-speed, or relay, units and slow-speed gathering units. The latter will have a broader field in mechanical loading in the future. Coming refinements in locomotive construction, Mr. Jones pointed out, probably will include the following: replacement of knife switches and the larger sizes of drum controllers with contactors; replacement of cast-grid with alloy-steel-wire resistances; use of wires and cables of higher current-carrying capacity and inclosure of wiring in conduits for added protection; application of anti-friction bearings to axle journals and practically all other moving parts; improved suspension and equalization of weight to reduce vibration and wear; better accommodations to increase the safety of motorman and triprider; use of braking mechanisms which are not accessories but which are integral parts of the frame; more efficient sanding apparatus; and spring bumpers on each end of locomotives to absorb shocks and prevent their transmission to the frame and axles, which

Among Pace Setters on the Boat Trip

Left to Right, B. E. Schonthal, secretary-treasurer of the institute; Henry W. Leyhe, master of the "Golden Eagle"; C. J. Sandoe, vice-president, Gillespie Coal Co., and president of the institute; George C. McFadden, assistant vice-president, Peabody Coal Co.; D. W. Jones, superintendent, Valier Coal Co.; John E. Jones, safety director, Old Ben Coal Corporation; F. M. Schull, Binkley Mining Co.; and Thomas Allen, chief inspector of mines for Colorado.

Institute Members Swap Flood Stories With the Natives of Chester

should not be expected to act as shock absorbers.

Use of caterpillar-mounted cutting machines and track-mounted drilling machines will increase. In the case of so-called one-man coal drills, possible avenues for improvements include: lighter-weight parts, decreased drill weights, and the use of telescopic guards to prevent injuries from thread-bars and augers.

Use of a "circular" track in working places at the No. 10 mine of the Binkley Mining Co., Clinton, Ind., has enabled one loading machine to load as high as 230 1½-ton cars in seven hours in coal slightly less than 5 ft. thick, declared F. M. Schull, general superintendent, in describing the mechanical loading plan at this operation (see p. 286).

Citing the results of improved lighting at the working face at the mines of the Kellys Creek Colliery Co. (June *Coal Age*, p. 248), Gordon McVean, Mine Safety Appliances Co., declared that better lighting is directly reflected in the efficiency with which the coal is cleaned by the miner, thus reducing the work required to handle and transport these impurities, in addition to a reduction in labor required in the preparation plant. The electric cap lamp offers one means of obtaining such improvement in lighting, and at one 3,000-ton mine was responsible for a reduction of 20 tons per day in the quantity of impurities brought to the tipple.

Fields in Illinois which have produced substantial quantities of mechanically cleaned coal in late months have materially increased their shipments to more distant markets where freights formerly were prohibitive, said John Griffen, Koppers-Rheolaveur Co., in opening the symposium on cleaning Illinois coals. Mechanical cleaning, however, is only one factor in a complete preparation program, which has as its primary objective maximum marketability of the product and thereby maximum realization. Planning for a cleaning plant requires a study of available markets, as well as a thorough investigation of the coal to be cleaned, and consideration of the factor of uniformity of product. One operator, said Mr. Griffen, has found that in the case of raw 1¼-in. screenings, 80 per cent of the complaints came from that 10 per cent of the cars which his records showed to be of the poorest quality.

As the cleaner itself is a relatively small proportion of the total cost of the preparation plant, it would be wise to provide some leeway for an increase in the stringency of competitive conditions in the future. Efficiency also is vital. Cleaner coal can be obtained by increasing the loss of coal to the refuse, but such loss may change the figures on the balance sheet from black to red. No. 6 seam coal from Illinois presents some special cleaning problems, said Mr. Griffen, as the coarser sizes contain considerable medium-gravity high-ash material derived from thin bands of impurities. As this material is too high in fuel value to be thrown away, separation as a middlings product and recleaning is the solution. The minus ⅜-in. size from the No. 6 seam also requires special attention, as it usually contains the greatest percentage of refuse material in the raw state and when efficiently cleaned generally is lower in ash than the coarser sizes.

Concluding his paper, Mr. Griffen gave a summary of results at the Fidelity cleaning plant of the United Electric Coal Cos. (May *Coal Age*, p. 197). With a designed capacity of 600 tons per hour, actual operating capacities have reached the following: monthly, 595; daily, 675; and hourly, 750. Delays in March and April this year were less than 1.4 per cent of the total operating time. Washed-coal ash is equal to the ash of the 1.50 float in the feed. The plant is designed to waste the minus 48-mesh (high-ash) material; this waste has been less than the tonnage of minus 48-mesh in the feed and the 28x48-mesh material has the lowest ash of any size produced. Clean coal shipped represents 99.5 per cent of the plus 48-mesh feed floating at 1.50. Over-all recovery, tipple and washery, is over 90 per cent of the mine-run input. With the slurry losses stated, moisture of the screenings, after dewatering by vibrators and Carpenter centrifugal dryers, is but a few per cent above the average of the corresponding sizes of raw coal and on the average is lower than raw screenings loaded in wet weather. Consequently, complaints of freezing have been less than from raw coal shipped from other plants of the company.

Washing and air cleaning supplement each other, said R. G. Lawry, Roberts & Schaefer Co. By division of preparation between hand-picking, wet washing and air cleaning, the latter for minus 1½-, ¾- or ⅜-in. coal, as conditions may indicate, generally will result in the following advantages: Large sizes can be treated in large-capacity units, cutting the number of such units to one or two; washing need only be carried down to such a size that moisture in the dewatered coal will come down to the proper figure without treatment other than dewatering over screens; reduction in quantity of suspended solids will simplify the problem of clarifying wash water; air-cleaned sizes will be shipping sizes without further treatment; soft shale that dissolves in water will be removed as refuse or drawn off as dust in air cleaning; amount of fines removed can be regulated in the air unit to suit dedusting requirements; and mixing of wet and dry sizes will reduce the final moisture.

Analyzes Cleaning Principles

Analyzing the principles involved in cleaning coal in Baum-type washers, J. W. Wilson, McNally-Pittsburg Mfg. Corporation, explained that this type of washer, in contrast with earlier types of equipment attempting a "densometric" classification in one operation, functions in two phases: (1) stratification of the material in accordance with its density and (2) accomplishment of the required separation by slicing the vertical column thus formed at the proper level, the upper stratum (clean coal) flowing over with the water and the lower stratum (refuse) discharging from the bottom ends of the washing compartments. The Baum-type jig rejects from both ends of the bed, the material on the feed, or primary, end with the highest density constituting the pure refuse or primary rejects and the material from the opposite end (intermediate-gravity, or middlings, material) constituting the middlings reject. The latter, depending upon its character, may be sent to the bank, sold as a low-grade fuel or crushed to liberate fuel values and recirculated. Automatic control equipment available for use on such washers controls both the depth of the concentrates, or refuse bed, and its consistency—impossible with manual methods—and therefore permits selective control of the ash in the cleaned product.

All sizes of coal may be bettered by dry methods, declared Col. Edward O'Toole, American Coal Cleaning Corporation, in a paper read by A. S. Knoizen, Joy Mfg. Co. Under this system, hand-picking would be employed for sizes over 3 in. and mechanical equipment using air for all sizes under 3 in. In dry cleaning, Colonel O'Toole

observed, the air used for cleaning also may be employed advantageously as the dedusting medium with little extra equipment or expense. Heating of air used in tables is a new development giving both dedusting and drying in the same operation by the installation of a simple furnace. Use of heated air with pneumatic separators may be particularly advantageous at strip operations, where rain and snow are factors at certain seasons. There is now being marketed a combined pneumatic cleaning and drying unit to replace wet washing and drying equipment at a lower cost. This equipment uses heated air as a cleaning medium, which dries the coal both before and after it reaches the deck. In dry seasons, the heat can be cut off.

Huber Is Appointed Dictator Of Anthracite Industry

Acting through the Anthracite Institute, "old line" anthracite producing companies have appointed Charles F. Huber, chairman of the board of directors of the Glen Alden Coal Co., to the post of "administrator" of the hard-coal industry as part of a plan to eliminate unfair trade practices and maintain the industry on a stable basis. Mr. Huber has resigned his position with the Glen Alden company. This plan was made known in a statement issued by the Anthracite Institute on June 4, as follows:

"The anthracite industry, in an effort to cure some of the ills resulting from unfair trade practices, and to restore confidence among producers, distributors and those they serve, is contemplating the adoption of a voluntary plan with these objectives. While the plan has not yet been formulated, it can be definitely stated that it does not contemplate any control or fixing of prices. For the administration of the plan, when formulated, the industry has enlisted the services of C. F. Huber, of Wilkes-Barre, Pa."

The plan, according to Walter Gordon Merritt, general counsel for the Anthracite Institute, requires that every signatory producer shall file with the Anthracite Institute the prices, terms of sale, and sales policies which have been applied by the producer in connection with all sales. These prices, terms and sales policies remain constant as the factors controlling all transactions except, when the producer shall file with the institute promptly full information as to changed prices, terms or sales policies which he has applied in connection with any sale of anthracite. When any changes are so filed, they become the sole prices, terms and sales policies of the producer applicable to all of his customers similarly situated, until such time as he informs the administrator of sales or offers to sell at different prices or on different terms.

"All such information," said Mr. Merritt, in address on June 21 at the convention of the National Retail Coal Merchants' Association, in Atlantic City, N. J., "filed with the administrator is subject to inspection by producers and purchasers and is promptly transmitted

Charles F. Huber

Resigns as chairman of the board of the Glen Alden Coal Co. to become administrator of anthracite industry

to all signatory producers and their customers, who pay their pro rata share for the cost of such service.

"Through the operation of this open-price plan every dealer will have greater assurance than ever before that he is receiving from the producer whom he patronizes as advantageous terms as any other dealer similarly situated. The days of secret haggling, under-cover concessions and special bargains will yield, it is hoped, to a new era of open, equal and impartial treatment. . . .

"The program further provides that certain unfair methods of competition, such as misrepresenting the size, grade or origin of anthracite, failure to comply with standard sizing, and the resort to various specified trade practices which have become generally recognized as unfair, shall not take place . . . In this program there is assurance that unfair practices will end and that when a producer lowers his price or raises his price, all producers and all customers will have full knowledge of that situation so that they may be governed accordingy. It will no longer be possible to make secret arrangements giving one dealer an advantage over other dealers similarly situated, without those advantages being extended to all dealers and without competing producers being placed immediately in a position to act in the interest of self-protection."

Mr. Huber's headquarters will be at the office of the Anthracite Institute, 19 Rector St., New York. His connection with the anthracite industry, which began in the engineering deparment of the Lehigh & Wilkes-Barre Coal Co., from which he was promoted successively to division engineer, chief engineer and general superintendent, covers 45 years. In 1914 he was elected president of the Lehigh & Wilkes-Barre company, and in 1930, when that company was merged with the Glen Alden, he was made chairman of the board of the latter company.

Power and Washery Control Problems Featured at Indiana Meeting

POWER, industrial relations and washery control problems were the themes of the seventh semi-annual meeting of the Indiana Coal Mining Institute, held at the Elks' Fort Harrison Country Club, Terre Haute, Ind., June 22, with P. L. Donie, vice-president, Little Betty Mining Corporation, Linton, Ind., and president of the institute, officiating in the chair.

Muscular energy costs from 100 to 500 times as much as electrical energy, said Prof. C. C. Knipmeyer, Rose Polytechnic Institute, Terre Haute, in a discussion of power and energy at coal mines. "It is this low-rate cost of electrical energy which gives enormous advantage to those who apply electricity to power needs." On the subject of power purchases, said Professor Knipmeyer, "instead of complaining over electricity bills on the basis of rates and dropping the problem when we are convinced that we have the lowest rates available as fixed for the producer by the public service commission, we should make a careful study of all the power-consuming machines in the plant or mine and all the conditions concerning their operation that might affect consumption. It is indeed important that we see to it that we get the lowest possible rate in cents per kilowatt-hour, but it is quite as important that we reduce to the lowest possible figure the kilowatt-hour consumption per ton of coal mined."

Reducing power cost requires consideration of three factors: energy charge, demand charge and power factor. "Whatever can be done to reduce power demand can be done after all other power economies have been accomplished," and involves largely the spreading and scheduling of loads to lower the possible demand peak. Power-factor improvement is a simple matter when part of the load consists of synchronous equipment. Otherwise, if the possible return warrants it, capacitors or static condensers may well be adopted.

"Through reduction of kilowatt demand and increase in power factor we have simple means for securing some reduction in the power bill. But the most promising possibilities for reducing costs lie in actual economies in kilowatt-hour consumption," which incidentally reduce demand. Factors which may well be studied in reducing energy consumption are: ventilation, including airway conditions; hoisting, whether steam or electric, particularly from the standpoint of determining input as a basis for reduction; haulage, from the standpoint of locomotive speed and its influence on operation on resistance, reduction of bearing friction in cars, cleanliness of track, and, in the case of battery equipment, charging through resistance; bit and chain condition on cutters; pump design, application and operation; reducing friction load in tipples by proper lubrication and maintenance of bearings; installation of sufficient copper and proper bonding to in-

sure adequate power and efficient operation of equipment; and adequate metering as a basis for checking distribution to various loads.

The problem of electrical distribution at mines has been changed materially by the advent of loading machines and auxiliary mechanization equipment, said Joseph Anstead, electrical engineer, Templeton Coal Co., Sullivan, Ind. Few mines, he continued, are penalized directly for low power factor but it nevertheless is an item —although invisible—in power cost. The demand charge always is important and is vital in slack times, in which case it might pay to cut off all non-essential loads and arrange to do certain types of work on the days before and after the mine operates.

A promising field for improvement stressed by Mr. Anstead is efficient operation of electrical equipment, involving proper voltage, lubrication, ventilation, correct size and type of motor, etc. Equally important is the matter of protection. Fusing is poor protection at best, and most efficient results call for magnetic starters, circuit breakers, thermal overload relays and similar equipment, which may prove advantageous on many types of mine equipment.

What Is Human Engineering?

Defining human engineering as "the supervision of human energy, or power, to the best interests of employer and employee," R. B. Gilmore, Knox Consolidated Coal Corporation, Bicknell, Ind., in a discussion of this subject, pointed out that the laborer brings to his work not only certain physical qualifications but also mental and emotional qualities derived from inheritance, environment, associations and training, which directly influence his ability to perform the task assigned him. The problem of the human engineer is therefore a matter of determining the exact place of this particular individual in the industrial organization.

In the sphere of human relationships, said Mr. Gilmore, a proper solution, if possible, would relegate the question of wage incentives to a secondary place. As it is, however, "I would emphasize the necessity of proper wage incentives in securing maximum production." But while monetary incentives are important, "they are secondary to the moral incentives of friendship and good will." Development of normal human relationships on which the smooth functioning of an industrial establishment depends can be accomplished by the foreman, who should know each man individually and be able to mold his working force in a spirit of agreeableness and helpfulness.

Pointing to the need for more study and a better understanding of human engineering, Wesley Harris, president, Bicknell Coal Co., Bicknell, stressed the value of kindness, sympathy and consideration in dealing with groups of men. Teamwork, he declared, is the rule now, rather than the exception, and requires not only organization but also the instilling of a proper mental attitude for best results.

Control in coal cleaning, said Byron M. Bird, chief concentration engineer, Battelle Memorial Institute, Columbus, Ohio, is concerned with the maintenance of a product not only uniform in ash, moisture and sulphur but also uniform as to gradation of sizes, mixing and screening. "Control deals with a uniform product in the aggregate, rather than a coal free from impurities." Every shipment of coal, in the nature of things, must contain material of high ash but in which the percentage of combustible matter is too high to permit wasting, "but if the coal company is to avoid frequent complaints, it is necessary that the portions of high ash content should be uniformly mixed with the portions of low ash content.

"Many men consider that the control of coal preparation deals with the mere regulation of the refuse draw of the cleaning apparatus to compensate for variations at different times in the proportions of refuse in the raw coal. Actually, the problem is more fundamental than this. Control deals not only with the regulation of the refuse draw but also with the maintenance of uniform stratifying conditions within the cleaning unit. Thus it is concerned with all elements that affect the efficiency of stratification, such as the preparation of the feed, the proper maintenance of the cleaning unit and, in fact, the proper functioning of the plant as a whole."

The first consideration in maintaining uniform stratifying conditions is a feed uniform in both quality and quantity. In the case of quality a uniform gradation of size fractions in the feed is necessary, particularly where a fairly wide range of sizes is treated at one time. Also, there should be no change in the proportions of the various size fractions from hour to hour. Uniform moisture content is another important element in quality, particularly with the growth of combination wet and dry plants. "Of course, it is fundamental that the fine sizes should be dry for best cleaning by dry methods," but dry processes will handle coal with a relatively high percentage of extraneous moisture if it is uniform. "In addition to uniform quality, uniform quantity of feed is important," as starting and stopping or extreme fluctuations in volume inevitably result in poor and irregular results.

How to Provide Uniform Flow

The solution, said Mr. Bird, is adequate storage and mixing facilities ahead of the cleaning units, which will provide a uniform tonnage and, if properly installed, "will flatten out peaks in the moisture content and variations in the proportions of sizes." If bins are employed, however, care must be taken to reduce segregation. Two satisfactory methods of accomplishing this result are distribution of the coal over a large bin and its withdrawal simultaneously from a number of levels, or by installing partitions to reduce the cross-section of each individual part of the bin.

Storage capacity should not be less than one-half hour and up to one-half shift of operation. In case capacity is less than a half hour, available steps include: careful scheduling of trips and the use of mine cars for storage; abolition of the practice of loading up mine cars at night, thus forcing the cleaning plant to work in excess of capacity, early in the shift to clear out rolling stock; segregation of wet cars and cars of fines and interspersing them with regular cars to distribute these types of material; and the delivery of fine coal, if screened out for dry cleaning or bypassing, to a storage bin where it can be mixed for a uniform moisture content. The latter plan also offers more uniform mixing of fines into the coarser sizes.

All the factors cited, declared Mr. Bird, also apply where automatic controls are installed, as all "I have ever seen are affected by changes in the size distribution of the feed, and all except one that I know of are affected by a change in tonnage." This is not to be construed as an argument against such controls, "as even a poor device of this sort is better than nothing. . . . The point I wish to make is that none of these devices relieves the company of applying good engineering judgment to the building of its plants or to their operation."

In addition to uniform quantity and quality of feed, "good stratification involves maintaining uniform conditions in the cleaning units themselves." On wet washers, this requires uniform water pressure; uniform pulsations in washers using pulsating currents; constant depth of refuse bed, etc. Building up of fine solids in the circulating water is a condition affecting most wet plants. One method of meeting this problem is the use of sludge tanks in place of dewatering screens so that the minus ½-in. material can be used as a filter bed for the fine sludge, thus removing all but a minimum quantity from the water. Where thickeners are employed, best results may be secured by operating them 24 hours per day, pumping the underflow back through the thickener during the idle period. Measuring water calls for the development of a cheap Venturi meter to eliminate variations caused by wearing of valves.

Uniform Air Pressure Needed

Maintenance of uniform conditions on dry-cleaning units necessitates a uniform air pressure. To secure this, use of a pressure-release valve adjusted to allow a small volume of air to escape at normal operating pressures has been suggested. When the fan motor speeds up as a result of a rise in voltage, the valve opens wider to release the excess air; when the fan slows down, the valve closes.

"Although the ultimate regulation of cleaning units depends upon the ash and sulphur content of the clean coal, these determinations are not satisfactory for control purposes," as the analysis merely indicates that some time before a slip-up was made in cleaner adjustment. Float-and-sink tests offer the best possibilities for primary control, and when a proper correlation between float-and-sink results and chemical analyses has been made, the operator can estimate the ash in the cleaned coal very accurately from the sink at a predetermined gravity. "And, what is especially important, he has the results 15 minutes after the sample is taken."

In using the float-and-sink method, accurate testing is imperative, including care in placing the sample in the testing machine and careful checking of the gravity of the solution. For the latter purpose, the hydrometer should read over a very narrow range—0.06 is satisfactory, as compared with 1.00 to 2.00 frequently employed. To save time, float and sink should be weighed in a wet condition, which necessitates working out a relation between wet and dry weights, the samples being allowed to drain a constant number of minutes to bring moisture to a uniform condition.

"The technique of sampling for control purposes is a matter of considerable importance, especially the point of sampling," which merits some study. "In particular,

it is to be noted that control work does not necessarily involve sampling all sizes of the clean coal," as in most instances float-and-sink tests on one size only will serve for control purposes in that a constant figure for this size generally will mean constant figures for the others. "Another method that I have used considerably is to sample the refuse product from the last compartment of the jig and to regulate the refuse draw to give a constant percentage of float in this product. This usually is an easy product to sample and results have proved entirely satisfactory."

If sampling the entire washed coal for control purposes is found necessary, it should be done when possible at the end of a dewatering elevator or screen to avoid taking large volumes of water which interfere with catching a true sample. Another matter of importance is the quantity of the sample to be taken, which depends upon the precision of the method of testing. In float-and-sink work, the weight of the sample should be 500 lb., where the maximum size of the coal is 4 in.; 3 in., 350 lb.; 2 in., 125 lb.; 1 in., 40 lb.; ½ in., 10 lb.

As auxiliary methods replacing a certain amount of float-and-sink work, the following may be of service: visual examination, which should be based on appearance of the refuse; panning washed coal in a manner similar to gold panning to separate out the refuse; and determination of the specific gravity of one of the products by an adaptation of the volumetric method. With the gravity determined, the ash content is read from a curve plotted from the washability curves of the raw coal. The specific-gravity method also offers the possibility of use with wet coal.

Corroborating most of the points made by Mr. Bird, Walter Buss, mining engineer, Knox Consolidated Coal Corporation, Bicknell, emphasized the importance of uniformity of feed and remarked that float-and-sink testing is almost indispensable in controlling cleaning-plant operation.

Responding to questions, Mr. Bird stated that washing is facilitated by including the fines with the coarse sizes, the principal disadvantage being wetting in the washing process; that he favored combination plants in which the minus ¼- or ⅜-in. material is dry cleaned; that the advantages of dedusting prior to washing are somewhat doubtful due to the cost of the process and the fact that jig operation is not materially helped; and that there is no reason for losing the fines when they can be recovered by use of equipment such as the sludge tank.

Kingston Coal Receivers Named

James H. Pierce, Scranton, Pa., and Walter S. Oliver, Wilkes-Barre, Pa., were appointed receivers on June 1 for the Kingston Coal Co., independent anthracite producer, operating at Edwardsville, Pa. The action was an equity receivership to preserve the assets of the company—not to liquidate them. Operations came to a standstill May 31, after employees had rejected a proposal to lend the company half their June earnings for six months and make other concessions. Mr. Pierce had been operating the company a little over a year. Counsel for the petitioners announced that operations may be resumed at a later date.

Illinois University Stages Second Short Course In Efficient Utilization of Coal

ATTENDED by coal and equipment men from eighteen States, the Second Short Course in Coal Utilization offered by the Department of Mining and Metallurgical Engineering and the Department of Mechanical Engineering, University of Illinois, held at Urbana, June 11-13, covered in detail not only the major characteristics of coal but also the various steps in the process of preparation, distribution and application from the mine plant to the consumer's firebox.

The bituminous coal industry cannot reasonably expect an annual output of much more than 420,000,000 tons for some years to come, said B. R. Gebhart, assistant to the president, Appalachian Coals, Inc., and principal speaker at the Short Course dinner June 12. Outlining the causes of the decline in per capita consumption of coal since 1918, Mr. Gebhart expressed his belief that the program of Bituminous Coal Research, Inc., offered one avenue toward increased tonnage in the future.

Pointing out that fuel values show a progressive decrease from East to Middle West and that analyses to determine the qualifications of a particular coal are wasted unless the samples on which they are based are representative, A. C. Callen, head of the Department of Mining and Metallurgical Engineering, discussed the problem of interpreting such analyses. In a second presentation, Professor Callen also called attention to the possibilities of the Parr formula for obtaining "unit B.t.u. value" from the results of the usual proximate analysis in calculating actual B.t.u. values from the "unit value," which usually is approximately constant over a wide area for a particular seam of coal. Applicability of the Parr formula to this purpose is based on the fact that variations in the heating value of different samples is due to variations in ash, sulphur and moisture, whereas the heating value of the pure coal substance, or "unit coal," is practically the same.

Screening Lessens Fusion

Observing that screening may improve the fusing temperature of the ash in actual service by removing the fines and insuring greater accuracy in sizing, W. D. Langtry, president, and J. F. Kohout, chemical director, Commercial Testing & Engineering Co., gave the results of a special investigation to determine the temperature range between initial deformation and softening of ash samples, and between the softening and fluid stages, which showed the range to be 101 to 200 deg. F. in the case of 57 and 60 per cent of the samples, respectively.

Developments in coal cleaning by wet processes (density separation, alluviation, jigging, froth flotation) and in air cleaners were summarized by H. F. Hebley, preparation engineer, Allen & Garcia Co., who also outlined progress in dedusting, clarification of wash water, including the use of chemicals to hasten settling, and drying of fine sizes. The effect of preparation on the value of coal for both steam raising and domestic heating was analyzed by D. R. Mitchell, assistant professor of mining and metallurgical engineering, University of Illinois, who pointed to removal of ash, reduction in moisture, uniformity and treatment to allay dust as the principal avenues of improvement.

Advantages and disadvantages of coal treatment to allay dust and improve combustion characteristics were outlined by J. L. Criswell, Coal Treating Products Co., in a series of questions and answers. Characteristics of oils for dustless treatment and methods of applying them were recounted by Berry N. Beaman, sales manager, Viking Mfg. Co. The production of packaged coal by pressing screenings into blocks and wrapping them in paper and experience with this type of fuel in various communities was outlined by R. F. Mitten, sales manager, C. M. Eberling Coal Cubing Machines.

Merchandising and application problems received major attention in the short course. Market potentialities of fuel and equipment in eighteen cities in the North Central States were analyzed by C. M. Smith, research assistant professor of mining engineering, University of Illinois, who based his presentation on the CWA real property survey in the first quarter of 1934. Except in three of the cities where natural gas has come in, coal represents 85 to 90 per cent of the fuel used. Condition of the dwellings and their relative value indicate a substantial market for modern heating equipment.

Glover Plan Increases Sales

Results of the operation of the "Glover Plan" for the promotion of retail coal sales in Cincinnati through fostering the sale of stokers were outlined by H. A. Glover, assistant to the president, Island Creek Coal Co., who stated that the downward trend of household sales was reversed and that in addition to the 420 stokers already sold a total of 450 more has been set as the goal for the present coal year. A plea for support of a program designed to present the coal picture to the public in understandable terms was made by C. V. Beck, executive director, St. Louis Coal Exchange, who pointed out that as a result of threats to bring in competitive fuels in that city, primarily to reduce the smoke nuisance, coal men had come to an agreement with the city under which the authorities would undertake to enforce regulations, employ competent inspectors, check on large users and take steps to educate the public in smokeless combustion, while the coal men would contract to lessen the household problem by fostering the distribution of small stokers and by other suitable means.

Consumer characteristics and how to attract his interest to coal as a fuel through proper advertising and merchandising methods were outlined by C. Franklin Brown, C. Franklin Brown Co.

Engineering is less a factor, while the personal element becomes more important in the installation of stokers in residences and apartments, declared W. J. Woodruff, retail coal and appliance dealer of Urbana, in opening a discussion of the factors involved in placing stokers in various types of boiler plants, control problems, service-water considerations and coal size. Boiler ratings and their relation to installation and

operation shared honors with an analysis of testing methods in an address by W. H. Severns, professor of mechanical engineering, University of Illinois.

Fundamentally, the function of the heating system is to offset losses to the outside, said A. P. Kratz, research professor of mechanical engineering, University of Illinois, in introducing an outline of methods of calculating such losses, corresponding grate sizes and estimated fuel consumption. Under the new conception of boiler testing, declared Joseph Harrington, advisory engineer, Commercial Testing & Engineering Co., efforts are directed to reducing ashpit, dry gas, smoke, unaccounted-for and other losses, as the only effective way of controlling the heat absorbed by the boiler is by controlling these losses. Discussing boiler efficiency, Mr. Harrington pointed out that cost of securing such efficiency in some cases may make a lower efficiency cheaper in the long run.

Concentrate on Commercial Units

Dividing stokers into three groups—(1) large industrial units burning over 1,200 lb. per hour, which usually are well engineered and operated; (2) small industrial and commercial units, 1,200 to 60 lb. per hour; and (3) residential types, burning less than 60 lb. per hour—T. A. Marsh, central division engineer, Iron Fireman Mfg. Co., pointed out that greatest possibilities for savings existed in Group 2 (up to 40 per cent in the case of coal and up to 60 per cent in the case of oil and gas). Economy is the primary factor in Groups 1 and 2, while comfort and convenience are the compelling factors in installation of residential types, although economy also plays a part. Present trend is toward long bin-fed types and toward the use of air controls, or "carburetors."

Echoing Mr. Marsh's conclusions on bin-fed units and air controls, A. O. Dady, chief engineer, stoker division, Butler Mfg. Co., in the course of a discussion of underfeed stokers, stated that the function of the stoker is to supply the proper proportions of coal and air to the furnace, which takes care of the actual combustion. On the subject of coals, Mr. Dady stated that uniformity, size, reduction of dust, fusion temperature and character of ash and free-burning qualities are the important considerations.

Experience with three systems of combustion control at the research residence in Urbana were outlined by S. Konzo, special research assistant in mechanical engineering, University of Illinois. What the trouble shooter should look for when he calls at the customer's premises was the subject of an address by C. J. Klermund, Klermund Heating Service. The coal itself, said Mr. Klermund, is responsible for only a relatively small proportion of heating troubles, the principal causes of complaints being the character and operation of the heating equipment.

Recent developments in the coal industry have necessarily required the fuel engineer to take an interest in production and preparation, as well as in application, declared J. G. Bently, fuel engineer, Sahara Coal Co., in a discussion of fuel engineering technique. The small stoker, said Mr. Bently, brings in its train the same problems in securing maximum efficiency as in the larger units, and offers a growing field for the fuel engineer.

Air conditioning, explained M. K. Fahnestock, assistant professor of mechanical engineering, University of Illinois, is not simply cooling in the summer but includes heating, humidifying, cooling, dehumidifying, cleaning, circulation and reduction of odors. Methods of calculating air-conditioning requirements under different conditions and the factors to be watched for formed the major part of Mr. Fahnestock's presentation.

Skeletonized NRA Organized Headed by J. L. O'Neill

An organization was set up in executive orders by President Roosevelt on June 16 to carry out a skeletonized NRA until April 1, 1936, in accordance with Congressional passage of the resolution extending the recovery administration's life as limited by the Supreme Court decision in the *Schechter* case. The House passed the resolution on June 7 and the Senate took similar action on the morning of June 15 after breaking a protracted filibuster by Senator Huey Long.

The activities of the deflated recovery agency will be devoted to assembling statistics concerning the effect of the defunct codes on industry and labor and to aid in the maintenance of voluntary codes of fair competition. Deflation of the act restored the anti-trust laws, suspended under the original NRA, and the Federal Trade Commission will again see that fair trade practices are maintained and monopolies controlled under those statutes.

The executive orders, which terminated the life of NIRB, created Sept. 27, 1934, named these officers to carry out the skeletonized program of the extended act: James L. O'Neill, vice-president, Guaranty Trust Co., New York, acting administrator; Leon C. Marshall, director of the division of review; Prentiss L. Coonley, director of the division of business cooperation; George L. Berry, assistant to the administrator, to represent labor. An advisory council, consisting largely of members of the old NRA, was set up with these members: Charles Edison, Howell Cheney, Philip Murray, vice-president, United Mine Workers; William Green, president, American Federation of Labor; Emily Newell Blair and Walton H. Hamilton.

Among the 411 NRA cases terminated as a result of the Supreme Court decision in the *Schechter* case, which wiped out the code system, were seventeen involving coal companies, of which the most important was the pending appeal in the Hart Coal Corporation case from the decision of Judge Dawson declaring NRA unconstitutional and denying its right to fix wages in western Kentucky.

Permissible Plate Issued

One addition to the list of permissible equipment was made by the U. S. Bureau of Mines in May. The approval (No. 271) was issued to the La-Del Conveyor & Manufacturing Co. on May 20 and covers the Model SLS-10 shaker conveyor with 5-hp. motor, 230 volts, d.c.

Personal Notes

PRINCE DEBARDELEBEN has been appointed assistant to the president of the Alabama Fuel & Iron Co. He takes over the duties of H. M. Brooks, vice-president in charge of sales, who died May 19.

JAMES R. GILLIAM, JR., president of the Arlington Coal & Coke Co., the Gilliam Coal & Coke Co. and Glen Alum Coal Co., all of West Virginia, has been named to the board of directors of the Chesapeake & Potomac Telephone Co., of Virginia.

WILLIAM A. HAMOR, assistant director of Mellon Institute of Industrial Research, Pittsburgh, Pa., received the honorary degree of Doctor of Science on June 5 at the commencement of the University of Pittsburgh.

THOMAS S. HAYMOND was reelected president of the Big Sandy-Elkhorn Coal Operators' Association at the annual meeting held June 6 at Ashland, Ky. Other officers reelected were: A. D. SMITH, vice-president; S. B. HOSMER, treasurer; and H. S. HOMAN, secretary.

H. A. HENTHORN has been appointed general manager of the Arlington and Gilliam coal and coke companies, McDowell County, West Virginia, and of the Glen Alum Coal Co., Glen Alum, W. Va., vice Morris Watts, deceased. Mr. Henthorn was formerly assistant to Mr. Watts.

W. E. E. KOEPLER, secretary, Pocahontas Operators' Association, was reelected vice-president of the Smoke Prevention Association at the 29th annual convention of the association, held in St. Louis, Mo., early in June.

KARL LANDGREBE, vice-president, Tennessee Coal, Iron & Railroad Co., has been elected president of the Birmingham (Ala.) Rotary Club.

HERBERT RYDING, retired president of the Tennessee Coal, Iron & Railroad Co., has been appointed a member of the Birmingham (Ala.) School Board.

R. E. SALVATI, vice-president and general manager, Pond Creek Pocahontas Co., Bartley, W. Va., has been appointed acting general manager of the Island Creek Coal Co., Holden, W. Va., assuming the duties of A. R. Beisel, vice-president and general manager, now on leave of absence due to illness, and of W. A. Hunt, general superintendent, who has resigned.

CHARLES N. TEMPLETON, Terre Haute, Ind., has been elected president of the Glendora, Linton-Summit and Templeton coal companies, succeeding the late John A. Templeton. Mr. Templeton was general manager of the various properties for a number of years.

A. E. THOMPSON has been appointed superintendent of the Standard Coal Co.'s mine at Standardville, Utah. He succeeds R. R. Kirkpatrick, who has gone into private business. Mr. Thompson, the new superintendent, has had wide experience. For five years he was deputy State mine inspector in Colorado and for the past year he was associated with the Utah Fuel Co. at Castlegate. At different times he has been connected with the Colorado Fuel & Iron, Victor-American Fuel, Rocky Mountain Fuel and other well-known Western coal concerns.

Wagner Labor Disputes Bill Approved by House

Without a record vote, the House passed the Wagner-Connery labor disputes bill on June 19. The authors of the bill and its advocates seek its enactment to guarantee collective bargaining to labor and restore the rights conferred by Sec. 7a of NRA, nullified by the Supreme Court in the Schechter case.

The bill differs in one important particular, however, from the form in which it passed the Senate. An amendment sponsored by Representative Ramspeck, and adopted, forbids the National Labor Relations Board to fix as a collective bargaining unit a group of employees of more than one employer.

William Green, president of the American Federation of Labor, expressed keen gratification over passage of the bill. He characterized it as of a nature to "make the workers of the nation economically free," and called it "the Magna Charta of labor of the United States."

When Senate and House conferees got together on June 24 they agreed on every point in dispute except the House amendment providing that no collective bargaining unit shall include the employees of more than one employer. Chairman Walsh of the Senate conferees said that this amendment would be considered at a conference later in the week.

Peace Reigns in Anthracite Field

Peace was restored—at least for a time—in the anthracite region on June 6, when the United Anthracite Miners of Pennsylvania voted to end their strike at the collieries of the Glen Alden Coal Co. The strike, which had lasted since Feb. 2, was called off by a secret vote. A number of the strikers returned to work the following day.

The waning strength of the insurgent union was revealed in the reinstatement to membership in the United Mine Workers on June 4 of 27 former officers of younger organization.

Obituary

CHARLES B. SMITH, 50, general manager of the American Coal Co. of Allegany County and the Mill Creek Coal Co., operated by the Atwater interests, died June 1 in a hospital at Bluefield, W. Va., as a result of injuries received in an automobile accident on May 29. He had had extensive experience as an engineer and mine manager in the smokeless field.

JOHN M. MACDONALD, 77, mechanical superintendent of the Nova Scotia Steel & Coal Co., died June 8 at Sydney Mines, N. S.

CHRIS J. GOLDEN, of Hazleton, Pa., secretary of the Anthracite Board of Conciliation and long active in affairs of the United Mine Workers, died suddenly June 16 as the result of a heart attack. He began to take an interest in union work shortly after obtaining employment in a Shamokin mine as a boy. He was successively colliery committeeman, auditor of District 9, and in 1917 district president. He became secretary of the conciliation board in 1929, when James A. Gorman gave up that post to succeed Charles P. Neill as umpire.

The Late Chris J. Golden

GEORGE P. DANIELS, 60, president of the Christian Colliery Co., operating in Fayette County, West Virginia, died May 28 at his home in Brooklyn, N. Y., following an operation. Mr. Daniels was born in England, came to this country as a boy and became active in the bituminous coal industry on leaving school. During his 43 years in the industry he had also been associated with the late Justus Collins, Charleston, W. Va., and the Smokeless Fuel Co., a selling company.

Industrial Notes

F. H. ROSENCRANTS has been elected a vice-president of the Combustion Engineering Co., Inc. He will take charge of the proposition engineering department. He formerly was mechanical engineer with the Electric Bond & Share Co. and later was chief engineer of International Combustion, Ltd., of England.

ROCKBESTOS PRODUCTS CORPORATION, New Haven, Conn., has promoted KENDALL A. REDFIELD, advertising manager, to assistant general sales manager. He will continue to supervise the advertising and promotion program of the company.

HERBERT F. SAUER, for the last fifteen years manager of the Cleveland (Ohio) office of the Electric Storage Battery Co., Philadelphia, Pa., has been appointed manager of the Chicago branch. He has been succeeded at Chicago by William P. Roche.

C. V. HACKMAN, formerly with the Harbison-Walker Refractories Co. as manager of the Mount Union (Pa.) and East Chicago (Ill.) plants, has been made manager of the Stowe-Fuller Refractories Co., Cleveland, Ohio.

ALBERT C. BRUCE, president, United States Hoffman Machinery Corporation, has been elected a director of the Worthington Pump & Machinery Corporation, Harrison, N. J.

CHICAGO AUTOMATIC CONVEYOR CO., Chicago, announces the appointment of M. J. Hire as vice-president and general sales manager. He has been with the company since 1926.

Use of Coal Stokers Urged To Curb Smoke Evil

A careful survey before prescribing a remedy for the smoke evil of St. Louis, Mo., is advised in a joint report, with recommendations, to the Board of Alderman of that city by a group of coal producers and equipment manufacturers presented May 31. The group points out the importance of the use of stoker units, however, in a solution of the problem. The signatories to the report, including the Southern Illinois Reciprocal Trade Association, United Mine Workers, Progressive Miners, Illinois Coal Bureau, Central Illinois Coal Association, St. Clair-Madison County Coal Operators' Association, Belleville Group Coal Association, Coal Exchange of St. Louis and Stoker Manufacturers' Association, summarized its findings thus:

"(1) A city-wide survey must and should be made before any of us can intelligently discuss what remedy (or remedies) or what measure of correction is required. (2) We believe too much emphasis has been placed on necessity for other fuels than coal, and we ask your body to discover for yourselves that the coal industry has already provided the means of solution by the use of correct stoker units. (3) We urge that the entire subject be covered by a determined and orderly study by a commission, with authority and funds provided to properly prosecute its work. (4) We respectfully request representation on this commission . . . so that neither our business nor our reciprocal trade relations will be jeopardized. We have no wish to dominate such a commission, but neither do we wish to lack proper representation. (5) We think it obvious that the necessities of railroad operation in this district demand thorough and separate consideration, as will be brought out by the survey suggested. (6) We protest an unduly hurried determination of a solution to this enormous problem. Time is required. On the other hand, we shall vehemently protest any disposition to fail to press the question to a conclusion at the earliest possible moment, because the recurrent opening and closing of this involved question makes continual threats against our reciprocal relations and our livelihood, for which there is no longer any reasonable excuse."

Wyoming Operators to Meet

The annual meeting of the Southern Wyoming Coal Operators' Association will be held July 9 at Rock Springs, Wyo.

WHAT'S NEW
IN COAL-MINING EQUIPMENT

Coal Washer

Pittsburgh Coal Washer Co., Pittsburgh, Pa., offers the new Llewellyn automatic coal washer in either the single washbox model 6½ ft. long for use where the washing problem is not difficult or with two washboxes in tandem with optional middlings conveyor (see illustration) for use where light bone or other difficult washing problems are encountered.

Features of the two-stage unit outlined by the company are: self-contained; complete sludge recovery; provision for both primary and rewashing in one unit, for recirculation of middlings, either with or without crushing, if desired, or for reclaiming this product for sale separately (if middlings conveyor is omitted, this product joins the refuse from the first washbox), these features insuring maximum separation; vertically operating plungers hinged at one end to give maximum vertical motion and therefore maximum intensity of water action at the feed end of the washbox with a gradual decrease in vertical motion and intensity to a minimum at the discharge end; non-variable positive pulsating motion with every plunger stroke, resulting in increased washing capacity and efficiency; large capacity with low power cost (2½ hp. required per plunger); back suction eliminated by valve arrangement which allows movement of the water in a vertical direction only and insures a still body for refuse settlement during reverse stroke; plunger acts as pump to pump the water underneath the jig boxes from the overflow through a conduit, thus rendering a circulating pump unnecessary; automatic refuse discharge; complete separation of water in refuse compartment from water in clean-coal compartment, plus a design preventing mixing of water from the two compartments; and elimination of objectionable plunger guides through the use of vertical plungers.

Laboratory Crushers

American Pulverizer Co., St. Louis, Mo., offers a line of American "Rolling Ring" and swing-hammer crushers, grinders and shredders for laboratory service which, it points out, are designed for large capacity at low cost, as well as minimum space requirements—no more than the ordinary office desk when installed with motor ready for operation. These units, according to the company, incorporate many of the features of the larger units and are built to specifications and tested, before shipment, on the material to be reduced.

Construction features outlined by the company include: compact and simple design; all parts of housing machined for dust-tight fit; interchangeability of parts; split frame for quick accessibility and cleaning, thus preventing contamination of the

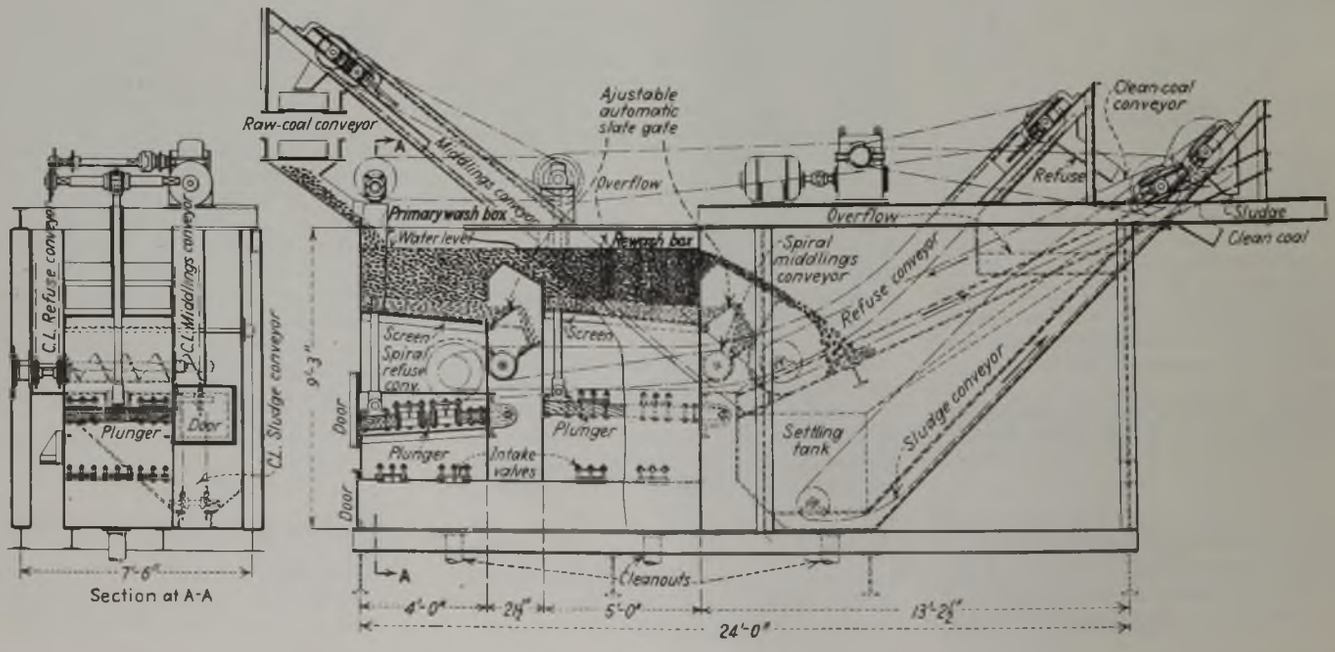
product and permitting quick changing of screen plates or cage bars; rotor or cylinder consisting of a heavy main shaft of alloy steel, cast-steel end disks and manganese steel rings or hammers; main shaft rotating in SKF ball bearings mounted in dust-tight self-aligning pillow blocks; screen plate sliding in grooves in the lower housing; grinding practically all done upon the breaker and grinding plates in the front of the chamber, which can be quickly and easily renewed; round back of upper frame protected by renewable liner.

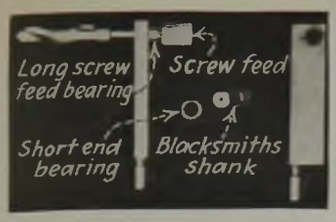
These mills are available in 9x9 and 15x9 sizes. Over-all dimensions of the 9x9 mill are: length, 27 in.; width, 18½ in.; height, 12 in. Weight is 350 lb. and the hopper opening is 9x7 in. Dimensions of the 15x9 mill are: length, 36 in.; width, 30 in.; height, 21 in. Weight is 750 lb., and the hopper opening is 11½x9¼ in.

Right-Angle Drills

C. A. Koza, Rochester, N. Y., offers a line of right-angle tool attachments for places hard to get at. In addition to tools for drilling, angle attachments also are adapted to a wide variety of other tasks. Tools and attachments, according to the company, can be driven by air or electric drill, drill press, lathe or milling machine either directly or through a flexible shaft. While the blacksmith shank is standard equipment because it permits working in closer corners, tools can be fur-

Llewellyn Automatic Coal Washer.

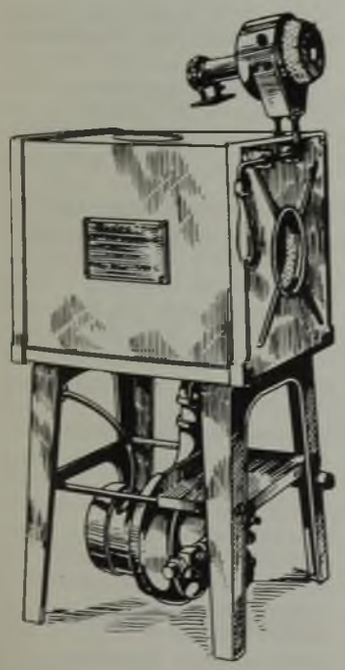




nished with any other type of shank. By removing the screw feed end bearing and putting in a short end bearing, all tools will work in spaces the width of the body plus drill length. All tools have 1 in. depth of feed on screw feed; other lengths are available at an extra cost.

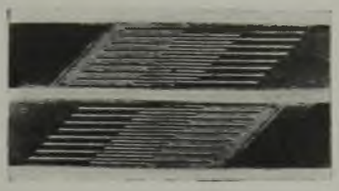
Fusion Furnace

Primarily for determining the fusing temperature of coal ash, Burrell Technical Supply Co., Pittsburgh, Pa., offers the Barrett fusion furnace for temperatures up to 3,000 deg. F. The furnace is adaptable without alteration to the use of natural, artificial or cylinder gas, and, according to the company, possesses the following features and advantages: large output growing out of ability to handle six cones at a time and make six to eight or more runs per day; convenient furnace and door controls, the latter allowing cones to be removed or inserted at any time; comfortable operation due to compactness and reduction in noise and heat emission; clear visibility of cones, allowing pyrometric measurement of temperature of cones themselves and accurate timing of changes in shape; and ease of regulation of rate of temperature increase within desired limits. Dimensions of the furnace body, mounted on 14-in. legs, are 12½x14½ in. Door and sight tube project 6 in. from the furnace face. Weight of the complete furnace, including blowing unit, is 134 lb. (120 lb. without blowing unit).



Vulcanized Splice

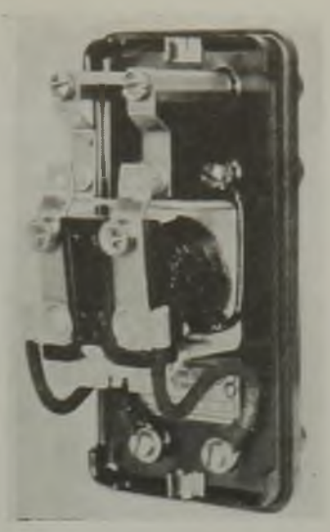
Goodyear Tire & Rubber Co., Akron, Ohio, announces a patent vulcanized splice for its "Compass Cord" transmission belt which, it points out, enables these belts to be made endless on the drive, thus making it possible for users to obtain Compass Cord belting in roll-lot endless lengths for use on belt drives where it formerly was necessary to dismantle pulleys to install an endless belt. The ends of the Compass belt are joined by dovetailing the load-carrying core of cords at the splice and by vulcanizing the



spliced portion of the belt with a portable vulcanizer developed for this purpose. Manufacture of endless Compass Cord belt for application where conditions permit will be continued.

Auxiliary Relay

A small, sturdy, low-priced auxiliary relay for a.c. or d.c. service and suitable for switchboard or panel mounting, has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The Type SK relay for switchboard mounting has a molded cover with or without glass front; the front-connected panel-mounted relay uses no cover. Both types have two independent contact circuits, according to the company, which may be easily adjusted for circuit closing or opening service. For two independently opening circuits, additional material must be added to the standard relay. Designed for continuous duty at rated voltage, the SK relay is obtainable for circuits up to 550 volts a.c. or 440 volts d.c. Ranges up to 250 volts can be handled in intermittent duty up to three times continuous value. The relay can be supplied with a coil for any current value up to 5 amp., and is adaptable for any thickness of panel from ⅛ in. (steel) to 2 in. (slate). Each contact will carry 12 amp. continuously and 20 amp. for 1 minute. Non-inductive ratings are as follows:



Westinghouse Auxiliary Relay

Volts, D. C.	—Interruption Ratings, Amp.— D. C.	A. C.
24	12.00	20
48	6.00	20
115	3.00	20
230	1.25	10
550	0.25	3

Westinghouse also announces a duplicate-position telemeter system for indicating and recording the position of mechanisms such as bridges, gates, valves, water-level position in power plants, engine-governor position, etc. The Type "GH" position recorder is assembled in a rectangular case for switchboard panel mounting. An im-

Receiving Equipment, Type "GH" Duplicate-Position Telemetering System

proved duplicate-position type of motor operates a direct-acting pen which records on a strip chart variations in the position of remotely controlled mechanisms operating a motor-type transmitter.

Power Jack

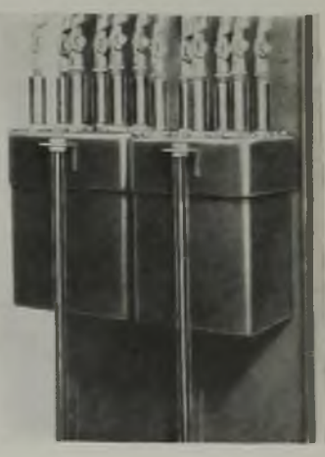
For repair work, Blackhawk Mfg. Co., Milwaukee, Wis., offers a portable workshop on wheels built around a portable hydraulic jack. Pump and ram in this unit, designated as the "Porto-Power" jack, are separated into two units connected by a 6-ft. flexible reinforced hose, which allows the ram (11⅜ in. long, 2¼ in. in diameter, with a plunger travel of 6⅜ in. and a weight of 10 lb.) to deliver 7-ton power in any direction. The unit includes a press mounted at one end of the stand and using the ram for power in either an upward or downward direction. A group of 30 attachments, including malleable-

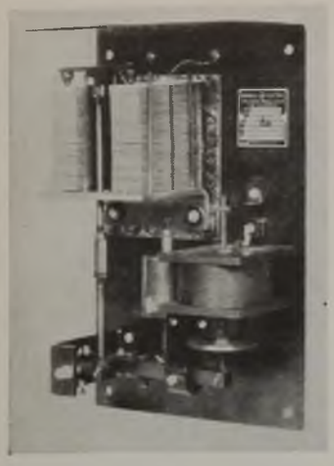
iron toes, body plates, chain blocks, spring spreaders, clamps, two heavy-duty steel chains and a group of pipe extensions of various lengths giving the ram an operating range of 95 in., allows the jack, with the proper combinations, to push, pull, spread, clamp, press and straighten, the company points out. The plunger of the ram is calibrated in ⅛-in. graduations for precision work.

Electrical Aids

New oil-blast breakers for panel mounting, designated Type FK-43, have been announced by the General Electric Co., Schenectady, N. Y., which points out that they require 35 per cent less floor space because of the

FK-43 Oil-Blast Breaker for Panel Mounting





Type G4A Voltage Adjuster

oil-blast principle of interruption, which also increases reliability of operation. Maintenance, it is stated, is reduced materially—silver-to-silver current-carrying contacts prevent cumulative heating and a new type of solid-butt interrupting contacts will stand thousands of operations. Any mounting—panels, cubicles, in cells, on pipe work, etc.—can be used, and the breakers can be operated either manually or electrically. FK-43 breakers are rated 600 amp., 15,000 volts; 1,200 amp., 7,500 volts, with an interrupting rating of 50,000 kva. at the rated voltage. A complete line of accessories is available.

A new automatic generator-voltage adjuster, Type G4, for use with small a.c. generators, synchronous motors and condensers and d.c. generators is another General Electric product, developed, it is stated, to meet the need for an inexpensive regulating device where requirements are not too exacting. The adjuster consists of a voltage-sensitive element of the movable-core solenoid type which directly operates, through levers, a wide-range quick-acting rheostat. The rheostat is connected in the exciter (or d.c. generator) shunt-field circuit, and any change in voltage is corrected by direct action of the solenoid on the rheostat. The solenoid is used for either alternating or direct current and in either case is excited through a fixed resistor from the generator armature potential. An air dashpot provides anti-hunting action. Adjustment is by a sliding weight on the main operating lever.

New distribution transformers with self-contained lightning protection by means of true valve-type lightning arresters, new electrical-design interiors, and new mechanical structures, clamp-terminal bushings and tank finishes are now available from the General Electric Co. In this transformer, according to the company, a valve-type Thyrite lightning arrester is combined with a removable pocket-type high-voltage bushing and installed as a part of the transformer, being sealed in that portion of the bushing external to the tank. This construction retains all the protection of the true valve-type arresters, places the arrester between the cutout and transformer and clears up the pole installation. Positive solderless connection of the primary line conductor to the transformer is made possible by a clamp-type line terminal on the bushing-arrester, terminal and line connection being inclosed by a strong threaded molded-insulation cap. Lightning stresses, according to the company, are limited to approximately 25 to 35 per cent of the impulse strength of the transformer. Interconnection with transformer secondary neutral and grounding are simplified, and because the bushing arrester has true valve action which, it is pointed out, permits only negligible primary power to follow current, protection against fuse-blowing is provided.

Oil-Immersed Automatic Compensator

Other features noted by the company include: new insulating materials and methods resulting in increased dielectric strength and higher insulation levels than have previously been attained in distribution transformers; new designs have provided a more uniform distribution of impulse stress throughout the windings and have been effective in improving regulation somewhat on 50-kva. and smaller sizes; unusually strong and light-weight steel core clamp forms a rigid framework securely holding laminations and windings permanently and accurately in place; low-voltage bushing also fitted with new clamp-type terminals, providing positive solderless connections for the secondary leads; metal parts rustproof to assure long life and ease in making and breaking connections; units finished in oilproof and weather-resistant Glyptal paint.

General Electric also offers a new line of oil-immersed magnetic starters of the reduced-voltage autotransformer type in which all arcing contacts are 6 in. under oil. An induction-type temperature overload relay is used, also mounted in oil. Either current- or time-limit acceleration is available, and an ammeter attachment can be supplied, if desired. Ratings range upward to 600 amp. at 600 volts and 200 amp. at 2,500 volts.

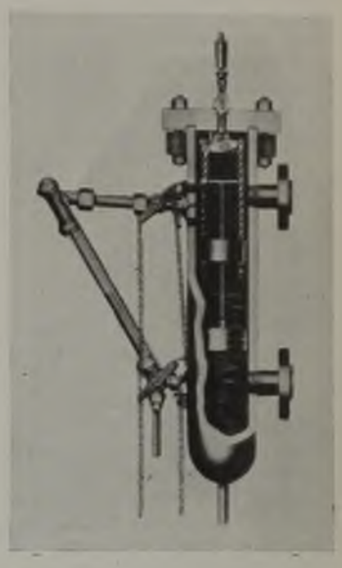
Single-Phase Distribution Transformer With Thyrite Bushing Arresters and Isolating-Gap Low-Voltage Clamp Terminal for Self-Contained Lightning Protection

Variable Drive

U. S. Electrical Mfg. Co., Los Angeles, Calif., offers the new U. S. "Varidrive" motor combining into one unit a constant-speed motor, variable-speed drive and gear case. Advantages cited for this construction include: reduction in space requirements and greater economy through elimination of mounting bases and transmissions, such as couplings, fans and belts, between parts. The accompanying illustration also shows a new lever-arm construction developed for the larger-horsepower ratings, and indicates the micro-speed method of varying the effective driving diameter of the "Varidiscs" to alter speed. These disks expand and contract for higher and lower speeds, and transmit power through the "Varibelt" to the take-off shaft. The self-contained features also facilitate direct-connection to driven machines and place any variation in speed in the hands of the operator, the company points out.

Water Column

Yarnall-Waring Co., Philadelphia, Pa., offers the floatless "Hi-Lo" alarm water column and "Sesure-Inclined" water gage for power-plant use with smaller, lighter-weight water-column body; simpler, more flexible and responsive mechanism for the alarm; and inclined connecting member at the top of the gage, which drains back condensate which might collect at that point and cause erosion and corrosion of the glass. Working pressures range up to 1,500 lb. per square inch, cast-iron water columns being provided up to 250 lb. and cast steel for higher pressure. Tubular glass gages are supplied for pressures up to 400 lb.; higher pressures, flat glass inserts.



Rubber-Faced Sheaves

Smooth operation and dependability with resultant savings in rope, power and maintenance are claimed for the Murray-Cavendish rubber-faced rollers and sheaves announced by the D. J. Murray Mfg. Co., Wausau, Wis., for use with wire ropes. As compared with the common wood lining, says the company, clatter is eliminated and weather cannot result in shrinkage or swelling. Anti-friction bearings cut the power required to turn the sheaves over, and slippage of the rope on the face of the sheave when the cable is stopped or reversed is eliminated. Standard sheave diameters are 21, 30 and 48 in., with special diameters available in addition. Design is said to provide for proper sections and strength, and the sheaves are made of high-test cast iron with rubber facing in one piece in smaller diameters and in segments in larger diameters.