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Illustrated.

Production of Lead in 1909

In the JOURNAL of April 9, 1910, we reported the production of refined lead in the United States in 1909. According to that report, the total of domestic origin was 369,164 tons, against 318,876 tons in 1908. In the accompanying table we give the production of lead, according to States. These statistics are based, so far as possible, upon the reports of the producers of work-lead (or base bullion) which bears the same relation to refined lead that blister copper does to refined copper. Consequently, it is not to be expected that these totals should agree with the totals representing refined lead production. Difference may arise through increased accumulation of stock at works or in transit, or the opposite. Also, we fancy that to a more or less extent the refiners include in their reports of lead of domestic origin the "exempt" lead of foreign origin which heretofore has been admitted free of duty, and has been marketed as domestic lead.

PRODUCTION OF LEAD IN THE UNITED STATES.
(In tons of 2000 lb.)

State.	1908.	1909.
Arizona	1,867	1,304
California	490	865
Colorado	26,707	28,413
Idaho	98,394	97,137
Kansas	2,400	1,500
Missouri	125,216	146,829
Montana	2,309	1,331
Nevada	3,676	4,086
New Mexico	611	1,275
Oklahoma	1,000	3,000
Utah	43,995	65,975
Wisconsin	3,486	2,740
Other States	600	629
Undistributed	2,026	3,062
Zinc smelters	1,290	2,796
Totals	314,067	362,851

The accompanying table represents, in our opinion, as near as it is practically possible to come to the source of the lead production in the United States. In the cases where it is possible to obtain reports of the mine production, it is uncertain as to what part of that production is actually recovered in smelting. Moreover, differences between mine and smeltery figures may be explained by differences in the stock of ore in transit or in the bins of the smelters.

The particularly noteworthy features of the statistics for 1909 are the large increases in the production of Missouri and Utah, while the output of Idaho and Colorado remained practically at a standstill. The lead output of Missouri in 1907 for the first time in recent years exceeded that of Idaho. Missouri now holds, without question, the premier position among the lead-producing States of the Union. If we should limit ourselves further and say the lead-producing district of southeastern Missouri, our statement would still be true.

Looking at the situation statistically, which view is confirmed by knowledge of the mining conditions, it appears that the lead mines of the Cœur d'Alene have passed their zenith. Idaho, which is equivalent to the Cœur d'Alene, made its maximum production of 121,584 tons of lead in 1906. Since then the output has decreased annually. On the other hand, Missouri has been making uninterrupted gains for many years, and now, if we lump with Missouri the nonargentiferous lead-producing States of Kansas, Oklahoma and Wisconsin, they account for nearly 50 per cent. of the total lead production of the country. This lead is chiefly produced by concerns that are independent of the American Smelting and Refining Company, and from the present magnitude of their production, it can

readily be seen why they are now so powerful a factor in the lead market.

Coal Mining

This issue of the JOURNAL, devoted chiefly to coal mining, is in accordance with the plan, followed for several years, of publishing an annual coal number. The subjects treated in this issue are broad in view and diversified in character; and we believe there is much of interest for everyone who has to do with any phase of coal production, while those who are especially concerned in metalliferous mining may also profit from knowledge of what the coal miners are doing.

No paper on coal, recently published, is deserving of closer perusal than the article dealing with "Safety Precautions in Alabama Coal Mines," by E. H. Coxe, in this issue. If anyone has doubts as to the sincerity of the efforts being made by our great coal companies to insure higher efficiency of operation, and afford greater safety to the employees, he need only read what Mr. Coxe has said, to be convinced that the industry is making forward strides.

Mr. Greer tells us of the moral revolution that has taken place among our anthracite miners, and numerous other writers have herein expressed themselves in a manner that leaves little doubt as to the present wide-awake attitude of coal men generally.

Mr. Young's article describing the "Kansas State Coal Mine" will be found of much human interest, while the paper on "Shaft Sinking," by Mr. Norris, is worthy of careful study, and should be filed for reference by all engineers who may have occasion to undertake such work.

Bituminous Coal Prices

Years ago, during the long period of competition which followed the Gowen management of the Reading road, a high authority in the anthracite trade summed up the situation by saying that it was the one great industry in the United States which had never earned an adequate return to the producers; all the profits had gone to the carrying railroads. Since that time the anthracite trade has passed completely under the control of the carrying companies; and further has been practically unified by tacit agreement and community of ownership, so that competition is a thing of the past. It is to be noted, however, that past custom has been so far followed that the total profits of each concern are divided in such a way that they appear on the transportation rather than on the mining side of the accounts in the published reports.

Taken generally at the present time the bituminous-coal trade of the United States is very largely in the condition in which the anthracite trade was in the days of the Gowen-Packer-Coxe managements. There is no great industry in the United States in which the returns to the producers are so small as in the mining of bituminous coal. The profits, if any, go chiefly to the railroads; and possibly to some extent to the dealers and the commission houses which sell the coal, though the profits of the latter have been growing smaller year by year. The reason for this condition is found in oversupply and excessive competition. It is probably not exceeding the mark to say that the existing mines of this country, if worked to their full capacity, could produce from 25 to 30 per cent. more coal than could possibly be used or marketed. Every producer wants to utilize the full capacity of the mines as far as possible, and to do this must extend his trade to new fields, or must shut out competitors from his established market by underselling them wherever he can. But underselling is a game which more than one can play at, and the players are only too likely to find themselves with the balance on the wrong side of their books at the end of the year.

Numerous concrete examples could be cited, and perhaps some of the more striking can be found in the seaboard bituminous trade. It is well known, for instance, that Pocahontas and New River coals were offered last spring in New England at $2.25 per ton, f.o.b. Norfolk or Newport News. The freight rates from those fields to tidewater through the season have been $1.40; which would leave the price at mines only 85c. per ton. This is not a solitary instance, for all through the past season good grades of steam coal could be bought in New York at prices which realized only 90c. or $1 at mines; while gas coal sold as low as 65c. for run-of-mine and 55c. for slack. There is not room here to calculate the cost of mining; but it must be evident that if coal operators can manage to come out even, or possibly figure a little profit on such prices, they would be realizing nothing to balance the depreciation of their property. That is, they would be poorer at the end of the year by the quantity of coal taken out.

The situation in many of the Western coal districts is substantially similar. It will probably be made even worse by the advances in the mining-wage scale, which have generally been conceded, and which must increase the cost of coal at the mines fully 10 per cent. Whether any corresponding increase in prices can be obtained under the existing competitive conditions remains to be seen—but it is extremely doubtful.

Mining Conditions in Joplin District

The Joplin district, during its long history, has been singularly free from labor difficulties, but now is experiencing a strike of moderate proportion. Irrespective of the merits of the present case, there is no mining district of the United States where we are so well pleased to see the miners get all they can. It is not generally known that the mining conditions of the Joplin district are highly dangerous and unsanitary, but such is the fact.

The mines of the district are operated to a large extent upon a relatively small scale, and with a good deal of carelessness. The ore is extracted in large chambers, untimbered, and falls of roof are a common source of accident. With one thing and another the result is an annual fatality rate of about four per 1000, which is high. If, however, the death rate from causes other than accidents were reckoned, the figure would be found to be far higher.

These mines, especially those of the "sheet-ground" type are opened in a formation of mineralized chert, extremely brittle and breaking into sharp angular fragments. The stopes are generally dry, and the dust inevitably inhaled by the miners makes them peculiarly subject to pulmonary troubles, from which a large number die at comparatively early age. We have been, perhaps, incorrect in saying, "inevitably," because the danger can be avoided, or at least greatly minimized, by simple means for keeping

down the dust at the faces, but the miners themselves are not disposed to take this trouble, and the more enlightened operators who have tried to introduce systems for ameliorating the conditions have not met with any great success in making them effective.

This seems to be really a case for the enforcement of a drastic, sanitary law, but until the miners of the district awake to the dangers under which they work and demand such a law, they will continue to court the chance of early demise by disease originating from their occupation. There are no statistics to serve as a basis for a sound conclusion, but we should not be surprised if mining in the Joplin district were really as dangerous as work in an arsenic factory.

Western Coal Situation Nearing a Climax

The strike of coal miners in Illinois and the Southwestern States, although being continued in a quiet, orderly way, is fast approaching the explosive point. The miners in Illinois are now endeavoring to negotiate settlements with individual companies, hoping, in this way, to break the ranks of the operators.

This plan proved successful in past strikes, but it is likely to fail this time. The operators in two Illinois districts (the fifth and ninth), comprising the mines in the Belleville and Mount Olive fields, came to terms with their miners last week by adopting the entire program of the miners. This defection from the ranks of the operators is likely to be the only desertion that will occur, and takes place in an unimportant field.

The operators in the remaining seven districts are strongly united, while the miners are fast depleting their resources. Many locals are showing distress signals over a lock of funds, and we may expect aggressive action in Illinois very soon.

The Southwestern operators are standing firm, while the miners are showing a tendency to desert the union cause. There is the best of reason for believing that many mines in the Southwest will open with nonunion labor in a few days. There is more danger of the miners' organization going to pieces in the Southwestern States than in any other part of the country.

One serious phase of the situation in the Southwest is due to the attitude of the Governors of the various States. These authorities seem to be in sympathy with the miners, and as a consequence may refuse the service of the militia to protect property. It is evident, therefore, that if the mines open on a nonunion basis, the operators will have to employ their own guards, and much trouble will likely result.

The operators in northern Colorado have made but little headway toward opening their mines with nonunion labor.

Cactus Copper Company

The affairs of the Cactus Copper Company, or its promotion, or something about this concern, have impressed us as being mysterious. This company, owning property near Globe, Ariz., was brought out by the Cactus Development Company. Early in 1909 the property was transferred to the Cactus Copper Company. We shall not attempt to analyze the finances and stock arrangements of these companies.

The Cactus Copper Company has its main office at Duluth, Minn., where W. A. Eaton is president. C. W. Pritchett, of Denver, Colo., has been, and still is, the consulting engineer. Mr. Pritchett is a mining engineer of sound reputation and good standing in the profession.

From the beginning the promotion of this company has been accompanied by an active campaign of publicity, and in connection therewith it is obvious that some misleading statements have been made by somebody for public consumption. Mr. Pritchett made reports upon the property under date of Oct. 21, 1908, and Oct. 14, 1909. These were good engineering reports as to the development of a prospect. In neither of his reports did Mr. Pritchett refer to the development of any estimated tonnage of commercial ore. In a letter under date of Dec. 20, 1909, a brokerage house stated that they "understand that from a conservative estimate made lately that 2,500,000 tons of commercial ore are measured in the development works already opened. Four or five million tons can be figured within bounds of absolute safety."

About that time it was stated in various ways that Mr. Pritchett had made a later examination and that his report would be given out, but up to date the officers of the company have not produced it.

The misrepresentation by someone respecting this property became so bald that Mr. Pritchett, under date of Feb. 1, 1910, was led to publish a letter in a local Arizona newspaper, denying that he had ever said that he expects Cactus to develop into a greater property than Miami and Inspiration combined, and saying, "The Cactus property is still in the development stage and hence cannot be compared with developed property of this class in the district."

According to our information, this property is still distinctly a prospect, but misleading reports about it continue to circulate. These undoubtedly are inspired in some interested quarter. The directors of the company should publish the later report of Mr. Pritchett, which responsible officers of the company promised to do five months ago.

Cosmopolitanism in Technical Work

The Wallaroo & Moonta Company in South Australia is completing a copper-converting plant for treating its copper matte in place of the reverberatory refining furnaces, which had been used at this plant for many years. We do not doubt that this change could have been made to advantage long ago and illustrates the benefits to be derived from cosmopolitanism in technical work. That there have been capable and original minds at the head of the Wallaroo & Moonta operations is illustrated by the development of the Hancock jig, but there has undoubtedly been a strong leaning toward independent progress.

There are other districts more or less isolated where similar conditions prevail. Frequently, operators become so engossed with the details of their daily operations that they do not find time for visits to other sections or even other plants in their own district. They thus come to depend entirely upon their own initiative. There are few single minds that can keep pace with the united effort of the remainder of their profession, and we think it behooves every company to see that members of its technical staff are given an opportunity to visit other districts where similar work is being done.

Smelting in Bond Regulations Expected Soon

SPECIAL CORRESPONDENCE

Secretary McVeagh is determined not to wait longer before issuing the new regulations governing smelting in bond, under the Payne-Aldrich tariff. The latest delay of the series which has held up the regulations has been the illness of Assistant Secretary of the Treasury Curtis, who had the matter in charge. Mr. Curtis was in New York when taken sick, and in order not to retard matters further, Secretary McVeagh himself has sent the draft of the regulations to officers of the American Smelting and Refining Company for examination It is expected that the rules will now be issued without additional changes. The only alteration that has been made since the last draft is a small modification in the percentage of wastage. This was intended as a concession to some points criticized by the smelting people in the earlier drafts. The action, however, was taken with the concurrence of Professor Hofman, of Boston, who has been the expert in charge of the subject for the Treasury Department.

APPEALS

A new complication in this matter has, however, appeared. It is held at the Treasury that the regulations can be carried to the Board of General Appraisers for review, and from there, if desired, to the new Court of Customs for final adjudication. Whether any of the smelting interests will be sufficiently dissatisfied with the rules to appeal the issue in this way or not is still uncertain, but the prolonged delay, the sharp differences of opinion that have occurred, and the rather severe language that has been used by Secretary Brush of the American Smelting and Refining Company encourage the belief that such an appeal may be taken. The customs court begins operations on June 7, and has already a long list of cases that have been transferred to it from the various circuits that formerly had jurisdiction of them. It would take a good while to get the regulations passed upon if this plan were to be adopted.

Rescue and Experiment Stations

SPECIAL CORRESPONDENCE

The recent accidents in coal mines have led to a renewal of the agitation in Congress for the appropriation of money to extend the service of mine rescue stations that has been inaugurated under the direction of the technologic branch of the Geological Survey, and which is shortly to be transferred to the new Bureau of Mines. Bills have been introduced in both houses for the purpose and it is probable that before the close of the session, the provision desired will have been made. The bill likely to be adopted is that of Senator Dick, the chairman of the Senate committee on mines and mining, which provides:

"That the sum of $160,000 be, and the same is hereby, appropriated, to be paid out of any money in the treasury of the United States not otherwise appropriated, to be immediately available and to be expended under the direction of the Secretary of the Interior, for the establishment and maintenance of mine rescue and experiment stations."

Canadian Iron and Steel Bounties

The statement of iron and steel bounties paid by the Canadian Government during the fiscal year ended March 31 shows a total pig-iron production of 740,244 tons, upon which the bounty amounted to $573,968. Of this total, 547,063 tons were made from Canadian ore, on which a bounty of $480,763 was paid, and 193,181 tons from foreign ore, the bounty on which was $93,205. The production of steel was 740,390 tons and the bounty paid $695,762. The output of wire rods was 89,802 tons, on which a bounty of $538,812 was given. The total bounties paid amounted to $1,808,533. The steel and pig-iron bounties will cease Dec. 31, the wire-rod bounty continuing for six months longer. The largest beneficiary was the Dominion Iron and Steel Company.

Hawthorne Silver and Iron Mines, Ltd.

The Hawthorne Silver and Iron Mines, Ltd., is the latest promotion of Julian Hawthorne. This company claims to have a large iron-producting property in Ontario. Mr. Hawthorne's statements regarding the iron-ore business in general are regarded as ridiculous by those who are well posted respecting the iron business. As usual, however, the prospectus is alluringly written.

The property mentioned is the Wilbur mine. This is a very old mine which has been worked spasmodically in the past. It was last operated by the Lake Superior Corporation, the ore being shipped to its furnace at Sault Ste. Marie. The Lake Superior Corporation took out all the ore it could find, which ran between 40 and 45 per cent. in iron, and then abandoned the property as worthless.

Hawthorne's engineer states that there are over 500,000 tons of ore available, showing an average of 58 per cent. iron, and further states that he can begin operations at the rate of 1000 tons of ore per day. A well known and thoroughly competent mining engineer recently examined the property and reported to us that he could see nothing of value there.

Mineral Production of Russia

The gold production of the Russian Empire in 1909, according to the official figures, was 155.1 poods from the Imperial domains, and 2974.3 poods from private mines; a total of 3129.4 poods fine gold, which is equivalent to 1,647,316 oz. If we add, according to the usual custom, 10 per cent. for gold not reported or returned to the Imperial mint, the total is 1,812,448 oz., or $37,455,032. This is an increase of $6,510,471 over 1908, and is $3,295,032 more than the preliminary estimate published Jan. 8 last. The large increase is due to the production of several new mines in Siberia.

PLATINUM

The production of platinum is officially reported at 322 poods, equal to 169,501 oz. This is crude metal, averaging 83 per cent. platinum, and is therefore equivalent to 140,686 oz. pure platinum.

OTHER METALS

The production of copper is given at 1,128,940 poods, equal to 40,751,347 lb., or 18,484 metric tons. The production of zinc was 484,745 poods, equal to 17,497,760 lb., or 7937 metric tons. Pig iron reported was 175,000,000 poods, equal to 2,820,078 long tons.

MINERAL FUEL

The coal reported for 1909 is 1,493,143,000 poods, equal to 24,447,230 metric tons. The output of petroleum for the year was 490,700,000 poods, or 8,134,231 metric tons.

Chronology of Mining for May, 1910

May 1—Nevada Consolidated listed on New York Stock Exchange.

May 5—Explosion in the Palos coal mine at Birmingham, Ala., killed 83 miners.

May 12—Explosion in the Wellington coal mine near Manchester, England, killed 136 miners.

May 13—F. Augustus Heinze acquitted by the United States Court of alleged irregular banking practices.

May 14—Announcement that Anaconda had acquired the copper mines and works of W. A. Clark, at Butte.

May 16—The President signed the Bureau of Mines bill.

May 17—A. Y. & Minnie surface plant at Leadville burned. Loss $25,000.

May 21—Mogollon mill at Cooney, New Mex., destroyed by fire.

May Dividends

The accompanying table shows the amount per share and total amount of the dividends paid during May, 1910, by a number of mining and industrial companies in the United States, Canada and Mexico.

U. S. Mining Companies.	Situation.	Amt. per Share.	Amt. Paid.
Alaska Mexican, g..	Alas.	$0.30	$ 54,000
Alaska Treadwell, g.	Alas.	0.50	100,000
Alaska United, g....	Alas.	0.20	36,400
Amalgamated, c....	Mont.	0.50	769,439
Bunker Hill&Sul.,s.l.	Ida.	0.327	98,100
Caledonia, s.l.....	Ida.	0.01	13,000
Champion, c.....	Mich.	1.00	250,000
Homestake, g.....	S. D.	0.50	109,200
International Nickel	N.Y.	1.50	133,689
MacNamara, g.s....	Nev.	0.02½	18,363
Pearl Cons., g.....	Wash.	0.01	20,000
Snowstorm, c.....	Ida.	0.15	22,500

Foreign Mining Companies.	Situation.	Amt. per Share.	Amt. Paid.
Buffalo, s.....	Ont.	0.03	30,000
Dolores, g.s.....	Mex.	0.22½	90,000
Mines Co. of Am....	Mex.	0.03	60,000
N.Y.& Hond. Ros.,g.	Hond.	0.10	15,000
Temiscam'g & H.B.,s	Ont.	3.00	23,283

U. S. Industrials.	Situation.	Amt. per Share.	Amt. Paid.
Cambria Steel.....	U. S.	0.62½	562,500
Lehigh Coal & Nav.	Penn.	2.00	764,520
U.S. Steel Corp., pf.	U. S.	1.75	6,304,919
Warwick I. & S....	U. S.	0.30	54,601

The Led Mule Lode

At the back of San Bernardino in Southern California (Barnardino is the local pronunciation) lies the desert. It is a land of aridity and inveracity. Those who dangle the bait of wealth say that over the hot and painful waste lies the trail to the lost lode, the Pegleg, the Gunsight, the Lost Cabin, the Spanish mine. Maybe not all of these are exactly in this one desert, but they are all equally lost and equally calling to the adventurous prospector. A fine prospect when the season is right for folk to pluck up their courage to go on pilgrimages.

Into San Bernardino have just come two prospectors, Col. Durham and Lieut.-Col. James Desmond, footsore and empty handed. Five months they have been pursuing a course in practical mineralogy, a liberal education in pure science, for it has brought them no practical result. With them has returned the faithful but ever melancholy companion of their wanderings, to wit, their pack mule; unfortunately the record in our news omits his name, and the omission is regretable because the mule shows himself superior, better man, better prospector. Footsore and empty handed the wandering men, even more deservedly footsore our fellow citizen this mule, but not empty hoofed. In sate, though inconvenient lodgment between coronet and pastern he has brought back from the gold trail the proof of wealth.

He delivered a limp, the chroniclers of San Bernardino tell us, and thus it was discovered that in his hoof he had concealed a nugget "estimated to be worth $500." Let us estimate also; with gold at $20 the ounce troy, that nugget must weigh 2 lb. 1 oz., without allowing a pennyweight to the quartz gangue which must hold it. Considerable of a dornick that; no wonder the mule limped. If only he had done as well with the other hoofs! Fancy the pride of ownership in a mule that assays $2000.

How like a mule this is. If it had been a pebble of barren country rock no bigger than a pea, that mule, any mule, would have trumpeted his woe and have taken no step until the intrusive geology had been extracted. But when he stepped on float and kicked up gold at the grass roots he says never a word until he reaches such civilization as San Bernardino affords. Then he reveals his auriferous deposit and sets the bipeds mad in the sacred famish of gold. Somewhere there is gold like pebbles, but it may be any part of five months back track on the trail of this mule who concealed his limp.

The wisdom of this mule has given the desert one more lure of gold. We hasten to claim the Led Mule Lode wherever it may lie—and a whole lot lies at the back of San Bernardino; we lose no time in staking 600 ft. along the lode, with all its dips, spurs and angles.—New York *Sun*.

Steel Production in 1909

The production of open-hearth steel in the United States in 1909, as collected and reported by the American Iron and Steel Asociation shows, as was expected, a very large increase over that of 1908; the remarkable point is that it exceeded the extraordinary outputs of 1907 and 1906. The figures are as follows, in long tons, for two years:

	1908. Tons.	1908. Per Ct.	1909. Tons.	1909. Per Ct.
Acid open-hearth	696,304	8.9	1,076,464	7.4
Basic	7,140,425	91.1	13,417,472	92.6
Total	7,836,729	100.0	14,493,936	100.0

The total increase last year over 1908 was 6,657,207 tons, or 85 per cent.; over 1907 it was 2,944,200 tons, or 25.4 per cent. Included in the totals for 1909 are 601,040 tons direct steel castings, of which 295,035 tons were acid and 306,005 tons basic steel. The increase in acid open-hearth steel over 1908 was 380,160 tons; in basic, 6,277,047 tons. The gain last year was in much greater proportion from the basic than from the acid furnaces. The make of basic steel was by far the largest ever reported, while that of acid steel was exceeded in 1907, 1906, 1905, 1903 and 1902—five preceding years.

Crucible and Special Steel

The production of special steels remains almost stationary; while showing a marked increase over 1908, it was less than that of 1907 and several preceding years. The figures for two years are as follows:

	1908.	1909.	Changes.
Crucible	63,631	107,355	I. 43,724
Electric, etc	6,132	22,947	I. 16,815
Total	69,763	130,302	I. 60,539

The second heading includes a small quantity of steel made by special processes, besides electric steel. Of the crucible steel reported last year 94,672 tons were ingots and 12,683 castings; of the electric and special steels 14,242 tons were ingots and 7005 tons castings.

Included in the steel ingots and castings made in 1909 were about 182,000 tons of alloyed steel, of which 159,000 tons were ingots and 23,000 tons castings. Of the total of 182,000 tons approximately 42,000 tons were made in bessemer converters, 120,000 tons in open-hearth furnaces and 20,000 tons in crucible, electric or special furnaces.

Total Steel Production

The total steel production of the United States for 10 years past has been as follows, in long tons:

	Converter.	Open-hearth.	Crucible, etc.	Total.
1900	6,684,770	3,398,135	105,424	10,188,329
1901	8,713,302	4,656,309	103,984	13,473,595
1902	9,138,363	5,687,729	121,158	14,947,250
1903	8,592,829	5,829,911	112,238	14,534,978
1904	7,859,140	5,908,166	92,581	13,859,887
1905	10,941,375	8,971,376	111,196	20,023 947
1906	12,275,830	10,980,413	141,893	23,398,136
1907	11,667,549	11,549,088	145,309	23,361,946
1908	6,116,755	7,836,729	69,763	14,023,247
1909	9,330,783	14,493,936	130,302	23,955,021

The open-hearth production approached closely to that of bessemer or converter steel in 1907, and in 1908 it exceeded it. The proportion of bessemer steel has fallen from 65.6 per cent. in 1900 to 39 in 1909; while that of open-hearth has risen from 33.4 to 60.5 per cent. The proportion of crucible steel was 1.03 per cent. in 1900; since then it has been always under 1 per cent., and in 1909 it was 0.5 per cent.

Nipissing

The Nipissing Mines Company, of Cobalt, Ont., has produced from 1904 to April 1, 1910, 13,936,486 oz. of silver, and disbursed in dividends $4,290,000. In addition to this $400,000 was distributed among the original owners. The production for April is estimated at 455,086 oz., and the May figure will probably be about the same. The company is earning approximately $170,000 per month. The financial statement, as of May 21, 1910, shows cash on hand, $669,693; ore in transit, at smelteries and at mines, ready for shipment, $553,392, making a total of $1,223,086.

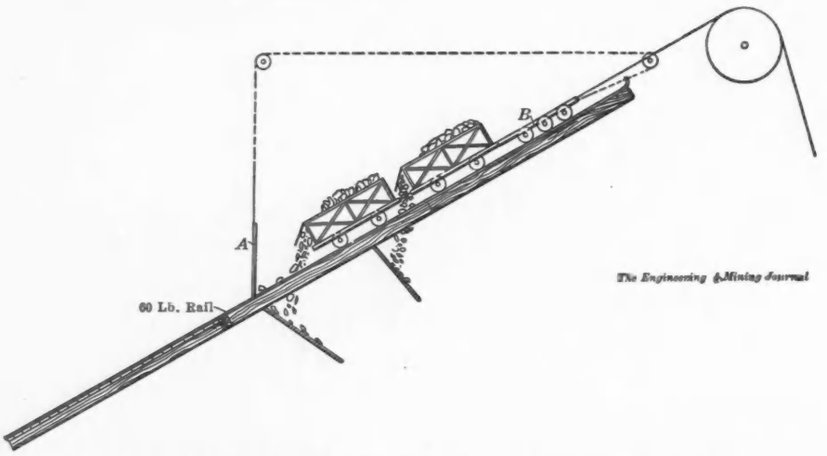
DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Head of a Coal Breaker Plane

The accompanying sketch illustrates the general method employed in the anthracite fields of Pennsylvania, to dump cars at the head of an incline or breaker plane. The pitch of the plane is usually 30 deg., which is sufficient to unload the material in the cars by its own gravity. The capacity of the cars is two tons each, and a trip consists of two cars. The accompanying sketch shows the cars in the unloading position.

The part marked *A* is a safety gate to prevent the falling particles from rolling down the plane. This gate slides up and down along the guides and is automatically operated by means of a counterweight *B*, which latter is connected to *A* by a rope as shown by the dotted lines. When a trip of cars is lowered after the coal is dumped, *B* will descend about 10 ft. from the present position, as shown, and then stop as the length of the rope is limited between the gate and the pulley above it. *A* rises as *B* descends with the empty trip; thus, the gate is automatically raised and lowered.



SKETCH SHOWING GENERAL ARRANGEMENT USED AT HEAD OF AN ANTHRACITE BREAKER PLANE

A Mine Farm

An experiment in farming in connection with mining is being made by the Hercules Mining Company, Wallace, Ida. A small farm has been started and the products are being used to supply the table of the mine boarding house. As the first attempt of the sort among the larger properties in the district, the experiment is being watched with interest.

Reheating Compressed Air with Steam

The practice of reheating compressed air by mixing it with steam is employed generally in the Cœur d'Alene mines of the Federal Mining and Smelting Company. Results obtained at these mines seem to indicate that this is the most economical and efficient method of getting the full measure of energy from the air.

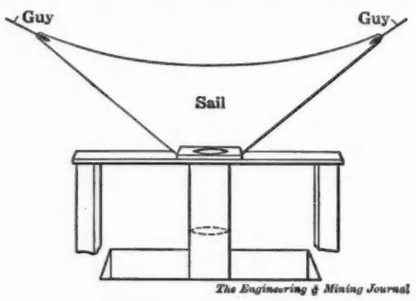
At the Mace mines, air at 90-lb. pressure for drills, and steam for the hoist were formerly conducted the 3000 ft. through the entry tunnel in separate pipe lines. The air is now compressed to 100 lb., mixed with superheated steam at the compressor house and piped into the mine in one line to supply both hoist and machine drills. The daily saving by this arrangement is figured at about $40, and besides an increase of 10 lb. in pressure is gained for drills. The steam plant formerly required 14 tons of coal per day, while from six to eight tons is all that is burned now. The boiler at this plant is rated at 80 h.p. and the capacity of the compressor is 4000 cu.ft. of free air per min. No trouble has been experienced from either freezing or condensation.

At the Morning mine the boiler for generating steam for reheating air will be situated at the underground hoisting station. The shaft will have four compartments and through it 1000 tons of rock per 24 hours will be hoisted. The engine and drills will be run on a mixture of compressed air and steam.

Wing Sail for Ventilating Shafts

BY A. O. CHRISTENSEN*

After sinking our shaft 60 ft. the gas from the powder smoke become so bad that work had to be suspended until we installed a "wing sail." The apparatus consisted of a canvas funnel, held open by hoops made of willow branches, which was run down the shaft, and to the upper end of which a wing sail was attached. The illustration shows the features of this arrangement. The sail is held in place by ropes stretched to nearby trees. Auxiliary ropes fastened to the middle of these can shift the direction of their pull, thus altering the position of the sail without necessitating more than two hitching posts. The sail can be turned to catch wind from any direction.



SAIL FOR SHAFT VENTILATING

It is necessary to set the sail so that it will draw air out of the shaft. When first tried, the air was blown down but it was found that the heavy gases remained at the bottom while the fresh air merely worked to the surface again. When sucking air out, the draft through the bag is strong enough to carry the heavy gases up without trouble.

Sharpening Steel Underground

Drill-sharpening furnaces underground are not so much used as they should be considering how cheap they are and how easy and comfortable they make the handling and sharpening of drills. This opinion was offered by Thomas Johnson (*Journ.* Chem., Met. and Min. Soc., of South Africa, February, 1910) in a paper discussing mining conditions on the Rand. Mr. Johnson further remarks that, of course, there is no use putting a furnace underground and then bringing the drills

*Zacatecas, Mexico.

in the skip to the level on which the furnace is, as when drills are once put in the skip they may as well go to the surface. To arrange things properly a furnace should be on each level and the drill sharpeners go to each; that is, they travel to the drills instead of the drills traveling to them. Not only does this save time and handling, but it brings the sharpener and user into much closer contact, which is a most desirable thing. It also keeps down capital expense of steel, thus providing the capital for the furnaces. Although the men do not and must not be expected to do as many drills underground as on the surface, it is still cheaper, for, as mentioned above, less steel is wanted, the machine men are much better served and things go more smoothly.

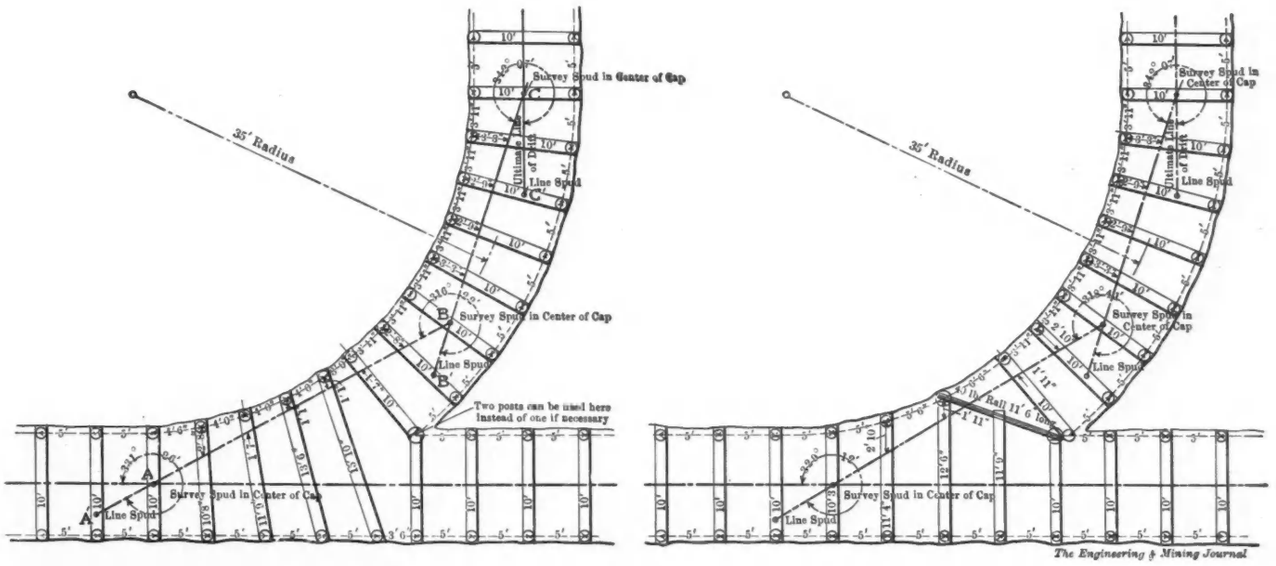
Underground Curves

Engineers in charge of mines experience some trouble in having underground turns put in just as they are planned. It is customary for mining captains to have the engineer spot a place for the beginning of a curve; the shift bosses are then instructed to put in an "easy curve" by setting each post back, say, 5 in. It then often happens that the first three sets are placed as planned and the following two sets are put in straight because the shift boss thinks that he has turned far enough. The engineer is then called upon to give a line for the straight drift and finds that it is necessary to put in a couple of more sets with a setback of 10 inches.

The curve is completed and is unsatisfactory both in the eyes of the general superintendent and to the engineer. The curve itself does not look as badly underground as it does on the flat map in the office, and it stands on these maps as a record of a mistake made in the underground work by the engineer. Errors of this nature can be overcome by having standard curves for the mine, and in having a system for giving lines. Following are curves used in some mines on the iron ranges of northern Minnesota.

Curve No. 1 is a 90-deg., left-hand turn. The turn begins at spud *A*. The instrument is set up here and a backsight taken on the next spud back in the main drift. The angle called for is turned off and the line spud *A'* placed. This is all the instrument work that is necessary for several days. Each shift boss is furnished with a set of blueprints of standard turns and he has but to follow the measurements given until cap *B* is reached, when it is again necessary to call on the engineer. Before placing the cap upon the post or in position, a spike should be driven into the cap the required distance from the end as shown on the blueprint. It is then easy to line the set in with the two line spuds.

Curve No. 2 is another standard turn in use and is a good turn to put in where a turn is wanted from a drift that has been standing for some time. This turn is preferred by some to the one above. When an engineer follows the above method for laying out turns, he not only clears himself from making mistakes, but the chances are that every turn planned for in the mine will be followed closely to the satisfaction of all.



STANDARD CURVES USED IN MINNESOTA IRON MINES

Jigging Practice in the Coeur d' Alene

The Federal company is said to be obtaining satisfactory results from the Hancock jig on the finer sizes of ore. This is not surprising, inasmuch as good experience in the Coeur d'Alene has shown that the Harz jig, as constructed and operated there, is susceptible of great improvement. The Bunker Hill & Sullivan company has achieved such improvement, particularly with the finer sizes, by the classifying Caetani jig, which is considered to do just as good work as the Hancock, while it has the additional advantage of successfully separating all the slimes and sending them to the slime department, directly from the first compartment, without causing them to travel the length of the jig, as the Hancock arrangement demands. The old-style Harz jig will probably, in the course of a few years, be entirely superseded in the Coeur d'Alene by improved jigs of the type of the Hancock and Caetani.

Chain Ladders in Waste Chute

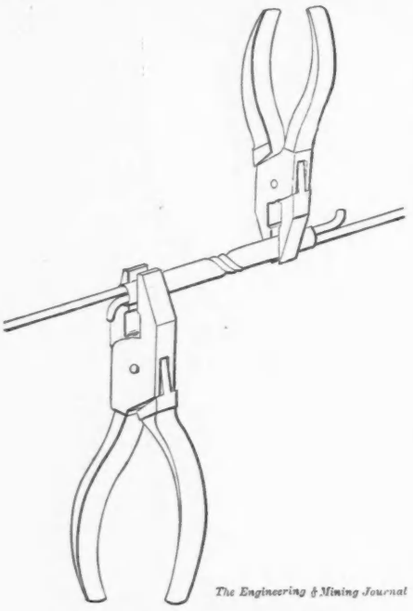
In the Utica mine, at Angel's Camp, Cal., waste is dumped into the stopes through raises from above. When an entrance to the stope is desired, chain ladders are used in the waste chutes. The ladders are built by connecting two chains with round iron rods at proper intervals. The connections are made by simply passing the ends of the rods through links of the chains and bending the rods back so as to have either end of each rod linked to a chain. Such ladders are practically indestructible even when used in chutes through which waste is constantly being passed.

A California correspondent reports that the use of a distillate forge for drill sharpening results in a saving in steel as compared with coal on account of the diminishing of oxidation during heating.

A Simple Joint for Underground Wiring

The need has frequently arisen for a simple joint which can be guaranteed to give good electrical contact without the necessity of having to resort either to complicated mechanical arrangements or to the use of solder. The latter is especially important in connection with fiery mines where any naked flame would bring about the danger of a disastrous explosion. For this reason it may be of interest to mention a useful arrangement for jointing single solid conductors which can be relied upon to give an excellent electrical contact and a joint which cannot be pulled apart.

The method adopted is to take a piece of copper tube from 3 to 4 in. long, according to the size of the wire to be



A Wire Joint Without Solder

jointed, and slightly flattened into an oval. The tube should be made of soft copper, or, if it has been hard drawn, it should be softened by heating and slaking in cold water in the usual manner. In order to secure good electrical contact the tube should be of such size that the two conductors to be jointed will nearly fill it.

After slipping the two wires through the tube and bending the ends of the wire back as shown in the accompanying sketch, each end of the tube is given a turn in opposite directions by means of two pairs of pliers. The soft tube will then bend to the shape of the joint and fill up the interstices with a close metal-to-metal grip, so that it will be practically impossible to pull the wires apart and a good contact is secured. This joint is useful not only in mining installations, but also for repairs to overhead telephone, telegraph and small lighting wires in country districts where soldering is difficult or impossible.

Churn Drill Prospecting in the Joplin District

By J. Frank Haley*

For many years some prospectors have used the churn drill as a means of proving a piece of ground. It is only in recent years that this method has been universally used in the Joplin district. In former years, most of the prospectors sunk a shaft blindly on a piece of ground with a consequent loss of time, money, and faith in the district. Thousands of these abandoned shafts dot the entire country surrounding Joplin, while in many cases drill holes afterward put down have shown good ore near the old shaft.

Although much prospecting is being done by drilling, a large percentage of the work is practically wasted. In many cases the records are not preserved for any length of time and in the case of a barren hole the record is not kept after the hole is completed. The records that are kept are in many cases vague and untrustworthy. The method used by the St. Paul Mining Company is given below.

Office Records

After each hole is completed the record is made in triplicate and one record is kept by each of the three offices of the company. This is to guard against loss by fire. The records are not kept in loose leaves, but are kept in a ledger in consecutive order. Loose leaves are too easily lost or displaced. Each drill hole represents the outlay of a certain amount of money and should, therefore, be guarded against loss.

Formations Passed Through

Each formation passed through, and the exact depth and thickness of same, are recorded, as well as the presence of any matter foreign to that formation. Its comparative hardness, color, whether broken or solid and whether or not it is fossiliferous, are carefully noted. The geological position of each different formation is given as near as possible and also the local name.

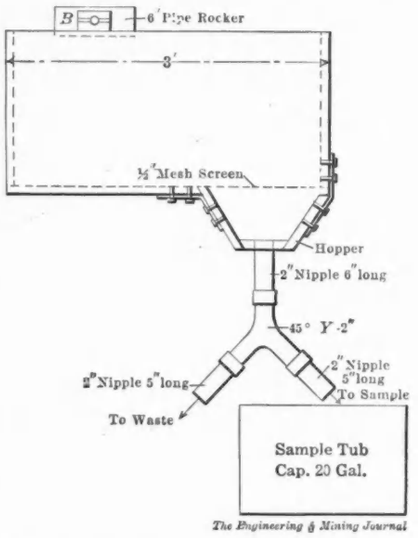
One point which is often overlooked is the amount of water encountered in a hole. This one point may determine whether the ground can be profitably worked and should, therefore, receive the closest attention, not only the amount of water, but whether or not it contains corrosive acids, should also be determined. Many mines containing good ore have been obliged to close down in this district, owing to the large amount of acid contained in the water, which rapidly corrodes pipe lines and mill machinery.

*Chief engineer, St. Paul Mining Company, Joplin, Mo.

Sampling the Cuttings

Considering the high standard of intelligence possessed by the average operator and prospector in this district, it is remarkable that no thought has been given to the correct sampling of the cuttings from drill holes.

The common method pursued is to catch as much of the cuttings as possible in an ordinary water bucket, allowing the remainder to go to waste. The amount caught in the bucket is thoroughly washed of all mud and slimes, which introduces another loss of material. In this way only about one-fifteenth of the total amount is caught and a sample for assay taken in this way



Device for Sampling Churn Drill Cuttings, Joplin, Mo.

will give a much higher result than the ground warrants.

The Sludge Sampler

The method pursued by the St. Paul company is a simple one and the apparatus used can be easily made at a small cost. A simple rectangular box 3 ft. long, 18 in. wide and 18 in. deep is used. At one end a hopper 12x18 in. at top and 4x4 in. at bottom and 12 in. deep is fitted into the bottom of the box. In the bottom of the hopper is screwed a 2-in. nipple, 6 in. long, to which is attached a 45-deg. 2-in. Y, and to each arm of the latter is screwed a 2-in. nipple, 5 in. long. On the top of the hopper is placed a piece of screen with ½-in. square holes, which catches any large pieces of rock which would otherwise block the outlet pipes.

On top of the box and 9 in. from the end is placed the rocker *B*. This is made of a piece of 6-in. pipe split in two and

hung to the sides of the box by 1-in. steel pins. The operation of this device, which I will call the "splitter" is as follows: The pump, having been filled and drawn from the hole, is landed on the rocker and contents dumped into the box. The material flows over the screen into the hopper and out through the Y. The two arms of the Y splits the material into two equal parts, one being allowed to go to waste, the other being caught in a tub. When the hole has been completely cleaned out, the cuttings and slime caught in the tub are sent through the splitter again until about a gallon of cuttings and slimes remains. This is then placed in a pan over a fire, dried and sampled. In this manner a fair sample is caught for each 5 ft. of hole.

PRESERVING THE LOCATION OF THE HOLE

It has happened frequently that after a mill has been built on a piece of ground and the tailings spread out over it, several drill holes have been covered up and their situation lost because they were not located by survey and mapped. The St. Paul company takes the following precautions for permanency in the location of drill holes.

After each hole is completed a pole about 10 ft. long and 4½ in. in diameter is placed in the hole, the hole having been first blocked with a large boulder. Stones, mud and dirt are placed around the pole until it is firmly held. It is then cut off square, about two feet above the ground and a brass tag, upon which the number of the hole has been punched, is firmly nailed to the top of the stake with galvanized-iron nails.

When each forty has been sufficiently drilled, an accurate survey is made and the elevation of the collar of the hole is taken. In this way the situation of the hole is permanently kept, and the hole may be found at any time.

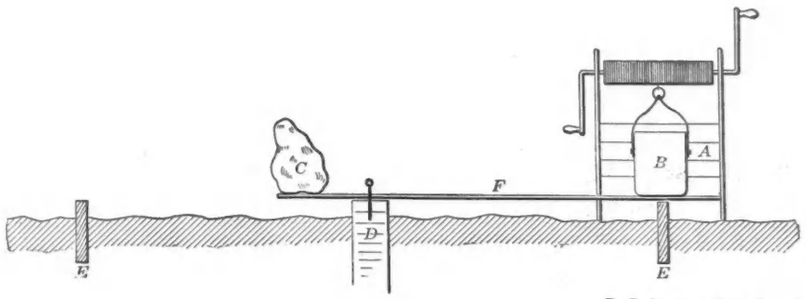
COST OF DRILLING

This company has done several thousand feet of drilling at an average cost of 80c. per ft., including all expenses except assaying and surveying, which adds from two to four cents per foot to the cost of each hole.

Disposal of Waste at a Prospect Shaft

BY ALGERNON DEL MAR*

The accompanying illustration shows a prospecting shaft where the material hoisted is disposed of by swinging in a circle a counterbalanced bucket sliding on a 1- or 2-in. plank bent in the form of a circle. By giving the circle a greater diameter more space can be covered. It is considered to be a better method of disposing of broken ground than emptying a bucket into a wheelbarrow, for the bucket when hoisted rests on the balanced plank and is ready to be dumped at any point within or out the circle. The runners are kept greased with lard or whatever the prospector may have. In the illustration *A* is the shaft; *B*, the bucket; *C*, the counterweight; *D*, pivot; *E*, circular track on which the bucket slides; it is made of 1-in. board set on edge; *F*, a 2-in. plank.



APPARATUS FOR DISPOSAL OF WASTE AT PROSPECT SHAFT

Concentrate Feeder for Tube Mill

At the North Star, Grass Valley, Cal., concentrates from the stamp mills all go to the Central cyanide plant where they are ground in a tube mill before being added to the pulp for cyanide treatment. The concentrates are brought to the plant in small, V-shaped, side-dump cars and discharged into a circular vat from which they are fed to the tube mill. Owing to the dense mass into which the sulphurets tend to pack, they are difficult to handle and several types of feeder were tried before the one now used was evolved.

This apparatus is essentially a disk excavator, suspended over the vat and rotating in it. The blades are set on two arms and are inclined and spaced so as to push the material uniformly toward the center of the vat as the feeder revolves. The arms of the feeder are suspended by a vertical shaft which is provided with a sliding keyway and driven by a worm gear. The upper end of the shaft is attached to a rope which passes over a couple of pulleys to a counterbalance weight. By regulating this weight and the speed of revolution of the feeder, any desired rate of feed can be maintained.

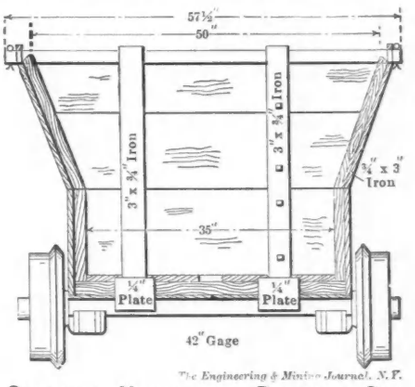
When the vat is being filled with sulphurets, a sectional piece of 6-in. pipe is placed over the central discharge gate of the vat. Thus an opening is maintained through the center of the tank. As the feeder lowers, sections of pipe are removed so that the top of the pipe is always kept below the surface of the concentrates in the vat. The material from the feeder is discharged into a launder and washed directly into the tube mill.

Little power is needed to operate such a feeder, and the only attention it requires is for taking out sections of the central pipe at infrequent intervals. It is easy to control and insures a constant feed.

*Mining engineer, Los Angeles, Cal.

Wooden Ore Car

The accompanying sketch shows the type of ore car to be used by the Sulphur Mining and Railroad Company at its mine near Mineral, Va., as soon as hoisting in cages is adopted in the new vertical shaft. The side, end and bottom boards of the cars are of 1½-in. white oak, braced with ¾x3-in. wrought-iron bars. The cars are designed for a capacity of 41 cu.ft. As the cars will be dumped by a revolving tipple no arrangement is provided for unloading. The car is strong, easily constructed and is to be commended for use at the mine where lumber and labor are cheap. The wheel base is 24 in., length of car, inside, 60 in. and outside dimension 64½ in. The ¼-in. plates are on timbers that extend four inches beyond the end of the car and serve as a bumper.



SULPHUR, MINING AND RAILROAD COMPANY'S ORE CAR

It is stated that there were 61,895,604 tons in the ore reserves of the producing mines of the Rand at the end of 1909, an increase of 7,105,017 tons over the preceding year. The East Rand Proprietary led with 8,490,636 tons.

The Brandy City Hydraulic Mine

BY GEORGE F. TAYLOR*

The Brandy City hydraulic mine is in Sierra county, Cal., on the ridge between Cañon creek and the North Yuba river at an altitude of about 3500 ft. above sea level. It may be reached by wagon road from Nevada City, 39 miles distant, or from Marysville, 66 miles distant. The material mined is old river gravel of the Tertiary period, and is part of the main channel that extends south from Scales. At Scales the two important forks of this ancient river unite. One fork embraces the deposits at Gibsonville, Bellevue tunnel, Laporte and Poverty hill, and the other fork includes the old workings at Howland flat, St. Louis and Portwine. South of Brandy City, remnants of the gravel deposits of this river have been worked at Grizzly hill, Indian hill, Depot hill, Oak valley and Camptonville.

Numerous streams and cañons of the present drainage system cut across the old Tertiary channel, nearly at right angles, leaving the old river deposits in patches on the ridge tops. The Brandy City property covers all of the channel between Cañon creek on the north and Cherokee creek on the south for a length of about two miles.

These deposits were first discovered and worked in the early '50s by the methods then in vogue. Water could only be had in limited quantities and the local supply was soon controlled by a few persons who sold it at high rates. Then the Hoosier flume, 9½ miles long, was built from Cañon creek and water sold for 25c. per miners' inch. Work was carried on under great disadvantages until the Brandy City Mining Company obtained control of the water rights and most of the claims.

The Gravel Deposits

The channel has a width of pay gravel varying from 300 to 700 ft., and there are about 10,000,000 cu.yd. yet to be mined. The bulk of this lies at the northern end of the claims. The gravel here has a thickness of about 150 ft., with an overburden of 60 ft. of cement lava (andesite-breccia). The gravel to the depth of 130 ft. is composed of small quartz pebbles ranging in size from walnuts to 3-in. pebbles. The lower 20 ft. consists of cobbles and boulders of quartz, granite and other rocks up to 2 ft. in diameter, mixed with finer material. The whole of this bottom stratum is so tight and compact as to require blasting to loosen it for washing. The bedrock is slate. Aside from the overlying lava ash, the whole deposit is pay gravel carrying near the surface about 10c. in gold per cu.yd., and near the bedrock as high as $2.50 per cu.yd. In the spring of 1909, about 30,000 cu.yd. of the upper part of the gravel was hydraulicked and 10c. per cu.yd. recovered. This gravel came from the east rim of the channel, 60 ft. above bedrock. The general average of the gravel is estimated, from the old records, as 25c. per cubic yard.

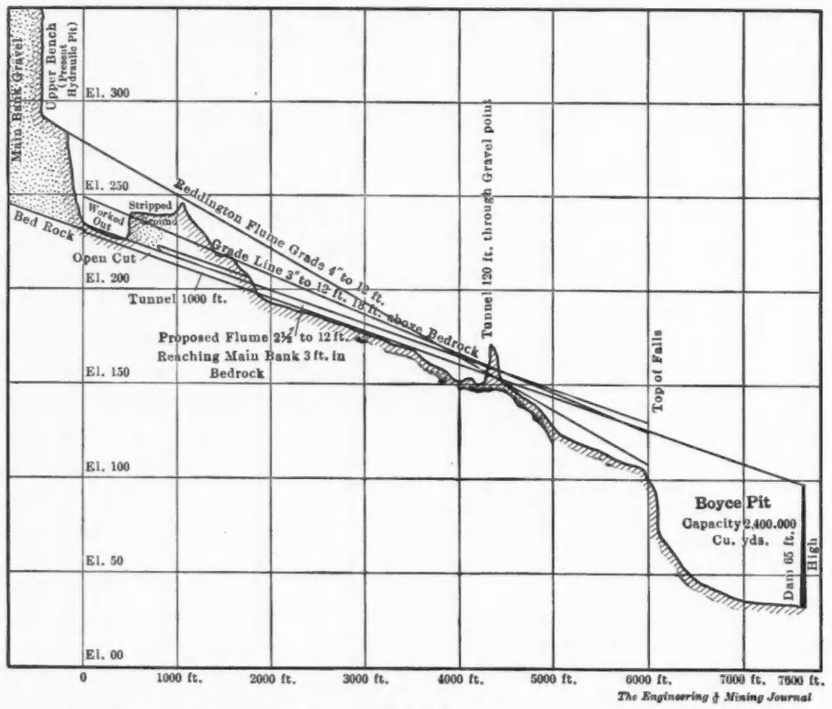
Water Supply

The Brandy City Mining Company owns the entire water supply of Cherokee and Cañon creeks. Two ditches bring water from Cherokee creek to the mine. One ditch is five miles long and has a capacity of 800 miners' inches; the other 3½ miles long, with a capacity of 500 miners' inches. The Cañon creek water is brought to the mine by means of a flume and ditch about nine miles long, with a capacity of 2000 miners' inches.

The flume is 4 ft. wide and 3 ft. deep, with a grade of 7.92 ft. per mile. The sides and bottom are of sugar pine, 1½ in. thick. The substructure is of spruce, with sills 4x6 in; stringers 8x8 in. and side posts 4x4 in. This flume will deliver water at the mine under a 240-ft. head. Logging is done by means of a donkey engine, the company owning its own sawmill. Timber is purchased from the National Forest at the following prices: Sugar pine, $2.50 per 1000 ft.; yellow pine, $2; spruce, $1.50; cedar and fir, $1. The quality of the timber is unsurpassed.

Débris Storage and Drainage

As the company is operating in a field under the supervision of the United States Débris Commission, storage for the débris or tailing from the hydraulic operations must be provided. In this case there are old hydraulic pits which make admirable storage reservoirs for the detritus. These pits with the dams across their outlets, provide storage for 6,000,000 cu.yd. As these pits contain no natural streams, they require but inexpensive dams to hold back the tailings.



PROFILE OF PROPOSED FLUME FROM MAIN BANK TO BOYCE PIT, BRANDY CITY MINE, CALIFORNIA

The mine is provided with an electric plant, and during the coming season it is expected that at least 2000 cu.yd. of gravel per day of 24 hours will be washed. The flume to carry the tailings into the Arnott pit is 900 ft. long, with a grade of 4 in. in 12 ft. It is 4 ft. wide and 4 ft. deep. The Boyce pit will be utilized later. The flume to convey the tailing to this pit is 6000 ft. long, 4x4ft. with a grade of 2½ in. in 12 feet.

*Superintendent, Brandy City Mining Company, San Francisco, Cal.

The cost of mining 500,000 cu.yd. of gravel per year is estimated as follows: Labor: 40 men, 9 mo., $32,400; labor, 10 men, 3 mo., $2600; engineering and superintendent, $3000; powder, $8000; raising and maintaining débris dams, $2000; coal, tools and incidentals, $2000; total, $50,000.

Internal Commerce During April, 1910

Commercial movements within the United States during the month of April, as reported to the Bureau of Statistics of the Department of Commerce and Labor, indicate a rather unsettled condition of trade. While the lumber movement was fairly heavy, in response to the large requirements of the building trade, the movements of bituminous coal and coke showed a check in the upward trend, owing partly to the curtailment of iron production and the partial cessation of operations in the central mining regions pending the settlement of labor disputes. The cotton, wool, and live-stock movements during the month were also light. The grain movement, on the other hand, notwithstanding the slight export demand, proved fairly heavy. As a result the general traffic situation, as measured by the number of surplus cars as well as the total number of cars handled, shows a less favorable picture than for the earlier months of the year.

The volume of building operations during the month, measured by the values of permits granted by municipal authorities of 109 cities in various parts of the country, $93,604,514, shows a gain of 4.3 per cent. over the total for the preceding month and of 7.3 per cent. over April, 1909, although some of the largest cities, such as Chicago, Philadelphia, Boston and San Francisco, show smaller activities in that field than a year ago.

The general freight situation reflects somewhat the unsettled state of affairs in the industrial field. The number of surplus cars reported by the American Railway Association for the 27th of April, was 102,085 cars and a fortnight later, 127,148 cars—a total larger than any reported since August, 1909. Reports from 27 car-service associations and demurrage bureaus in various parts of the country show a total of 2,069,769 cars handled during the month, compared with 2,226,352 cars handled by the some organizations during March and 1,753,048 cars during April, 1909. The number of cars handled during the four months of the year, 8,166,178, was about 19 per cent. in excess of the corresponding 1909 figures and about 35 per cent. in excess of the number reported for the corresponding period two years ago.

Anthracite-coal shipments during the month from eastern producing territory, 6,224,396 gross tons, were exceeded only once in the history of the trade. The four months' total was 21,736,964 gross tons, compared with 21,982,999 and 20,875,474 gross tons for the corresponding periods in 1909 and 1908. Owing to unsettled labor conditions, the monthly traffic of soft coal over eight leading eastern coal-carrying roads shows a considerable shrinkage as compared with the corresponding totals for the earlier months of the year, the monthly total, 6,253,214 tons, being even below the corresponding 1909 total of 6,664,684 tons. The monthly coke traffic over the same roads, 2,052,423 tons, owing to the decreased demand of iron producers, was also lighter than during the earlier part of the year, though 43 per cent. in excess of the April, 1909, total.

The estimated coke output at Connellsville for the four weeks of April, 1,683,837 net tons, likewise shows some abatement when compared with the record output for the earlier months of the year. The production during the first four months of the year, 7,710,208 net tons, however, exceeded the corresponding 1909 total by almost 80 per cent. The pig-iron production for the month, 2,483,763 gross tons, though 43 per cent. larger than the corresponding 1909 total, also indicates a check in industrial activity, when compared with the earlier months of the year. The output of the four months of the year, 10,107,571 gross tons, was over three million tons larger than the year before.

Prospecting Ontario Silver Properties

Prospecting for veins in northern Ontario is usually done by means of trenches, dug over the surface of the properties. This method is advisable on account of the large amount of ground that can be explored at low cost, and also because of the narrowness and comparatively short length of the veins. The Nipissing mine in Cobalt is the best exponent of this system as it has obtained the greatest results. Already this season five veins carrying silver have been uncovered by surface prospecting. The latest discovery is a vein in the Keewatin formation near the boundary of the Gillies Limit, which carries about 3 in. of high-grade ore. This find was made in territory that had been partially explored. This company believes that it will miss many veins unless the overburden is entirely removed and as a consequence a couple of large pumps are being installed that will be used in cleaning the hill above Cobalt lake. As the ground is washed off it will be carefully examined for any signs of veins and when the examination is complete the spoil from the higher ground will be washed down on it again, as this is the only available way to dispose of it.

Surveys in Alaska in 1910

In accordance with the appropriation made by Congress for the continuation of the investigation of the Alaskan mineral resources by the U. S. Geological Survey, 12 parties have been organized for work in Alaska during the season of 1910. As in previous years, the work will consist of explorations, reconnaissance and detailed surveys, a study of the geology and mineral resources and stream gaging in the placer districts.

Districts to be Surveyed

The surveys and investigations of Seward peninsula are more or less complete, and no work will be done there this year other than keeping a record of the flow of a number of streams. J. W. Bagley is at the head of a party detailed to topographic work of the Eagle river district. It is proposed to complete the survey of the gold-bearing belt, which lies between Juneau and Berners bay. His work will be used as the basis for a detailed study of the geology and mineral resources under the direction of Adolph Knopf.

The Matanuska coalfield is included in the work to be done this season. For this work, the topographic map completed in 1909 will be used. The survey will be made under the direction of G. C. Martin.

The most extensive survey undertaken this year will embrace the region lying between the Gulkana and the upper Susitna in the Copper river region. Placer gold has been found in commercial quantities on Valdez creek, and has been reported to occur on other streams in this field. Except for the work of the prospector, this region is practically unknown. The plans for this season also contemplate a topographic and geologic reconnaissance map of the area lying between the Valdez-Fairbanks trail and the upper Susitna river. The work is under the direction of F. H. Moffit. The same party will also make a supplementary study of the Chistochina placer district.

Water Resources of Yukon-Tanana Region

The water resources available for placer mining in the Yukon-Tanana region will be further determined by C. E. Ellsworth and G. L. Parker, who began work in the Fairbanks district in April, and later extended it into the Circle district. The Innoko district is also to be included in the work for this year under the direction of A. G. Maddern.

A party with P. S. Smith in charge, will, this year, undertake work northward from the bend of the Koyukuk to the Kobuk river, and thence southwestward to Candle in Seward peninsula. The Kobuk river section was surveyed in 1901, but has not since been visited by any members of the Survey.

The Corbin District, Jefferson County, Montana

Much Silver Produced before 1893; Companies now Developing Copper Ores; Two Concentrators Proposed; Electric Railway Projected

BY FLOYD BUSHNELL*

One of the busiest mining camps in Montana is the Corbin district, covering an area of approximately 20 square miles in the northern part of Jefferson county. For many years, until 1893, it was one of the most active mining camps in Montana and several of the more prominent properties, such as the Gregory, Alta and Elkhorn, made a large production of gold and silver. The decline in the price of silver caused many of the producers to close their properties. Only those mining the highest-grade ores remained active.

Four years ago, when the price of copper began to rise, many of these abandoned mines in the Corbin district were prospected for the red metal, and during the last three years a number of new companies have been formed. The interest in this district has increased gradually until at the present time more mines are being worked than at any time in the history of the camp.

Geology Similar to Butte

E. P. Jennings has the following to say regarding the geology of the district around Corbin, which is claimed to be similar to that of Butte:

"Extending from near Helena at the north to beyond Butte at the south and for a width of 40 miles, the country is underlaid by granite which in places is covered by later eruptives, mostly andesites and rhyolites. This great granite mass contains the lodes at Butte and also the copper district around Corbin.

"It is described by the U. S. Geological Survey as a basic, hornblendic granite, containing considerable biotite mica and approaching a quartz-diorite in composition. It is known locally as the 'Butte Granite.' Associated with the granite are many intrusions of aplite, or fine grained silicious granite, in the form of dikes and sheets. Quartz-porphyry dikes occur in connection with some of the veins at Butte and also in the Corbin district. This porphyry is mineralized in the latter district with pyrite, chalcopyrite and bornite.

"In the mineralized area of Butte and Corbin the granite has been disintegrated and decomposed and is easily distinguished from the undecomposed rock by the smooth surfaces and contours of the hills, in sharp comparison with the rugged topography and boulder-covered surface of the surrounding country.

*Butte, Mont.

Ores Occur in Replacement Veins

"The mineral lodes of Butte, and also of Corbin, consist of zones of closely spaced, sheeted fractures, which have been subsequently mineralized by quartz and copper minerals. They are replacement veins; the shattered granite in the fractured zone being more or less replaced by vein minerals, the resulting mass showing innumerable veinlets of quartz and the granite between the veinlets also being silicified and mineralized, often to so great an extent that it has become a solid mass of copper ore. The inclosing walls are not sharply defined, as the mineralization gradually shades from the lode proper into the walls. The width of the lodes in both districts is from 10 to 100 feet.

"The Butte veins differ from ordinary fissure veins inasmuch as they have been reopened after the first fissure had been filled with copper-bearing pyrite, and this secondary fissuring resulted in shattering both the walls and the lode, making them more permeable to the leaching action of surface water and the subsequent enrichment of the original orebodies by the precipitation of the copper leached from the zone of oxidation by these waters. This enrichment is common in all copper-bearing lodes, but in those cases where the ground is 'tight' the effects of the secondary enrichment extend but a comparatively short distance below the leached zone. At Butte, where the ground has been greatly shattered, the enrichment zone extends downward many hundred feet. The reopening of the Butte fissures has also resulted in another form of enrichment in the deep levels, from the precipitation of copper from ascending waters from below, and the formation of rich bodies of arsenical copper in the deep levels. The subject has been fully entered into by W. H. Weed in his Butte report.

"The conditions required for both classes of enrichment are; (1) A reopening of the fissures; (2) the presence of a later eruptive rock. The latter is furnished at Butte by a flow of rhyolite, and conditions are similar at Corbin. The fissures have been reopened and also intersected by many cross veins. The later eruptions are andesite and probably the copper-bearing porphyry dikes are later than the fissures; these are the conditions essential for secondary enrichment for both ascending and descending waters."

Boston & Corbin Is Most Important Company

The Boston & Corbin Copper Mining Company, the principal holding of which is the Bertha mine a mile west of Corbin, is regarded as the criterion of practically all the mining operations of the Corbin district. The company is incorporated for 100,000 shares of a par value of $5. Ore was shipped from the Bertha during nine months in 1907, when shipments were suspended on account of the panic. Since that time attention has been paid strictly to development work. A three-compartment shaft has been sunk to the 700-ft. level, and 16,000 ft. of development work has been done.

The ore is said to average 5 per cent. copper and carry 1½ oz. silver to each per cent. of copper. However, peacock ore averaging 30 per cent. copper and from 20 to 30 oz. silver per ton was recently uncovered on the 700-ft. level. This is the first time bornite ore has been struck in large quantity in the Corbin camp, and is taken as proof of the argument that the Corbin camp is similar in its geology to Butte.

The Boston & Corbin is installing an electrical equipment, the power to be furnished by the Missouri River Power Company. It is estimated that this improvement will effect a saving of 35 per cent. in the running expenses. The electric hoist will lift 11,000 lb. from a depth of 2000 ft. at the rate of 900 ft. per min. The Ingersoll-Rand compressor, driven by a 100-h.p. motor, develops 1441 cu.ft. of air per min. The hoisting engine is run direct by an electric motor of 100 h.p. A 30-h.p. motor furnishes power for the carpenter shop. The company's engineers are planning the erection of a 300-ton concentrator, and no shipments will be made until the concentrator is finished. There are 50 men employed under the management of H. E. Emerson.

Rapid Sinking at Boston & Alta

The Boston & Alta Copper Company ranks probably second in point of size and number of men employed. It is incorporated for $3,000,000, par value $10. During the six months the company has been working under the recent incorporation, a double-compartment shaft has been sunk to a depth of 650 ft. and a station has been cut at the 300-ft. level. The company claims the record for rapid shaft sinking. At a depth of 657 ft. in the new shaft, or 100 ft. below the old

workings, a tunnel will be run 350 ft. to the vein in the old workings. A station will be built and a 400-gal pump will probably be installed.

Under former managements, when silver and smelting charges were both high, much low-grade ore was thrown aside in the workings. Now, because of better concentrating and smelting facilities, it is hoped that this ore will be found valuable.

The Boston & Alta is planning to rebuild the old concentrator in Corbin, which, when reconstructed, will have a daily capacity of 400 tons. The company has its own electric-power plant capable of generating 300 h.p.; later the capacity will be increased to 680 h.p. The generating plant is in old Jefferson City and is connected with Prickly Pear creek by a flume seven miles long.

Like all the other companies, the Boston & Alta is waiting for the construction of the Butte & Helena electric railway. If the line is completed as planned it will go directly through the Corbin camp, and spurs will be built to the mines. A spur is planned from the Alta mine to the old concentrator in Corbin.

The company is financed by Dick Brothers, of New York, and employs 30 men in and about the mine. The officers are William B. Joyce, president; Elliott R. Fowler, treasurer; Marcus L. Hewitt, vice-president and general manager; James Madden, superintendent; Alvin Berry, assistant manager.

Other Companies

The Calumet & Corbin Company, operating the Minnesota mine, has sunk a 500-ft. shaft during the last five months, and has also done 3000 ft. of development work. While the assays show only 3 per cent. copper, the company is prospecting with the hope of finding higher grade ore in the veins that have been uncovered. This company is also depending on the Butte & Helena electric line to carry its ore. The officers are J. M. Wilcox, president; S. O. Arnold, vice-president; Olin H. Espry, secretary-treasurer; W. C. Hosking, superintendent.

The Corbin Copper Company is driving six tunnels to develop a large area of ground about two miles east of Wickes. The company is giving most of its attention to developing the Dewey tunnel, near the center of the property, which has been driven a distance of 800 ft.. On the Rosalie claim, where the tunnel is in more than 600 ft., the ore averages 5 per cent. copper. At the western end of this property a vein was cut that assayed 7 per cent. copper. The company owns and has options on 900 acres of ground, and on the strike of the veins which appear on the surface has about 3¼ miles. The mining operations are in charge of Frank E. Richards.

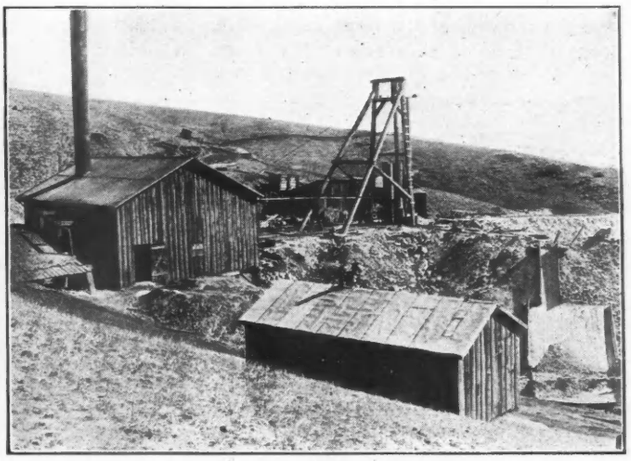
The Montana-Corbin Copper Company, operating the old Hidden Treasure mine a mile west of Corbin, has been developing the mine for the last three years and recently made its first shipment to the Pittsmont smeltery at Butte. The returns were 14.1 per cent. copper, 19 oz. silver, $1.50 gold, 27 per cent. iron and 19 per cent. silica. The company owns 115 acres of patented ground and is capitalized at $750,000, par value $5; 100,000 shares have been issued. Twenty-two men are employed on the two shifts. Max Schultz, of New York, is president, E. L. Mayo, of Butte, secretary and treasurer and William Gibson, superintendent.

Under the direction of John Hoy, the Corbin Metals Mining Company is developing the old Baldwin property, which has a record of having produced more than $150,000 in silver and lead ores. The ore also carried 3 per cent. copper, but there was no revenue from this, as the smelters did not pay for copper below 5 per cent. at that time. An inclined shaft has been sunk 350 ft. and will be carried to a depth of 700 ft., after which underground development will be undertaken. The vein widens with depth, and measures from 50 to 60 ft. between the walls. In the old workings ore has been uncovered running as high as 50 per cent. lead and 80 oz. silver. The indication for a higher grade copper ore improves daily with depth. The mine is operated by an electric hoist and air for the drills is supplied by an electrically driven compressor. John H. Foye, of Pittsburg, is president of the company.

The Bird properties, a mile and a half south of Corbin, consist of 36 claims, and according to P. A. Bell, in charge, it is expected that operations will be commenced this summer. It is said that Boston and Pittsburg capitalists have become interested. The ground has been proved to a considerable extent.

The London-Corbin Exploration Company, which started operations a short time ago, has uncovered ore in running a 200-ft. tunnel. The breast of the tunnel is in oxidized formation carrying stringers of ore. Thomas Paull is superintending the work on this company's properties.

Surface Plant at the Boston & Alta Copper Company, Corbin, Mont.



Hidden Treasure Mine of Montana-Corbin Copper Company

The recent death of Captain John Mullan, retired, in Washington, at the age of 82 years, recalls the fact that he was one of the first explorers of the territory now included in the States of Montana, Idaho and Washington. In 1853, as a lieutenant of artillery in the United States Army, he was a member of the party under Gen. Isaac I. Stevens sent to survey a route from St. Paul to Puget Sound. Later he was detailed to make surveys for the wagon road from Fort Benton on the Missouri to Fort Walla Walla on the Columbia, which was finally built in 1859-60. When he first undertook this work his only guide was the map made by Lewis and Clark in 1805, with such additions as could be gathered from fur traders and Hudson Bay Company men.

Use of the Terry Core Drill in Mine Operations

First Cost Less Than Diamond Drills. Large Holes Used for Mine Ventilation and Ore Chutes. Ten-inch 2000-ft. Hole Cost $5.50 per Foot

CORES 30-IN. DIAMETER OBTAINED

A number of 20-in. bore holes are being sunk through various parts of the pyrite orebody of the Stella mine, Hermon, N. Y., in place of winzes and raises. These holes are to be enlarged by carrying the stopes up alongside them and later will be used as mill holes. The cost of the boreholes is the same as for a raise, $6 per foot. Three holes have been completed, each one being about 50 ft. deep.

Drilling the 20-inch Holes

In drilling the first two holes there was some delay, due to lack of head room and the removal of the large cores. The longest piece of core removed was six feet. Hole No. 1 was started Jan. 25 and completed March 1, to a depth of 51.5 ft. Thirteen days were lost due to repairs and removing cores.

Hole No. 2 was started March 2 and finished April 30, at a depth of 50.8 ft. Seven shifts were consumed in moving and setting up the drill; 13 shifts were lost on account of broken coupling and gear; three for lack of power; two on account of sickness, and 14 to remove core; actual drilling time 15 shifts.

Hole No. 3 was at a place where there was ample head room. It required only three days to move and set up the drill, including the cementing of the uneven floor and a few repairs to the machine. This hole was put down 50 ft. in eight drilling shifts including the removal of cores. The greatest advance in a single shift was 13 ft., and the least 18 in.; the average drilling was over 6 ft. per shift. The good results obtained at hole No. 3 show that the principle of the drill is such as to meet the demand for large bore holes. By constructing a heavier and stronger machine 30-in. holes may be cut and used for ore chutes.

Prospect Work at the Stella Mine

The 2-in. core drill at the Stella mine has done good work in prospecting, and as shown in an accompanying table delivers a larger percentage of core than does the diamond drill. The rate of cutting is practically the same as with the diamond. During a period of four months one diamond drill bored 1071 ft. of holes. Two, and part of the time three, core drills have also been in use at the Stella mine, drilling 1200 ft. of holes. The diamond core was ⅞ in. and the shot core 2 in. in diameter. The diamond drill was working under ground, while the shot drills were on the surface and had to contend with much cold weather, often 20 deg. or more below zero. For this reason comparison is hardly just.

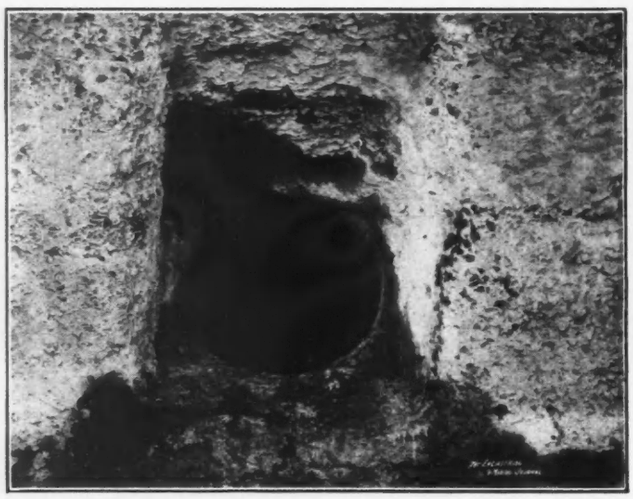
Advantages of Large Cores

In all friable formations, such as coal, it is absolutely necessary to bore a large hole in order to produce a perfect core. Frequently, a diamond drill boring the usual small hole does not produce a core of sufficient diameter to give the strength needed to prevent it from breaking to pieces. The sample of the formation thus obtained is not as satisfactory as that which is produced by larger cores, which remain intact.

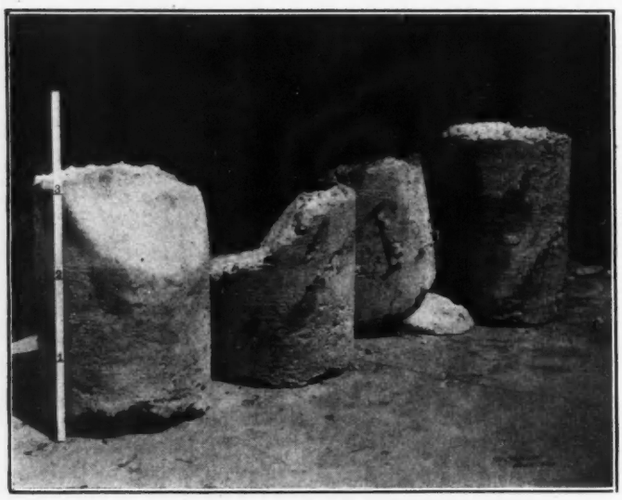
Advantages over Diamond Drills

The first cost of the shot-drilling machine is no more than that of a diamond bit. Hence less installation cost. The cost for shot and the wear on bits per foot drilled is about one-half of the cost for wear on diamonds. With shot tools the number of feet cut per day is about the same as with diamonds.

Diamond bits often get caught and a stone is torn out of its setting, requiring much labor in the effort to recover them. Occasionally the drill rods will become filled with a foreign substance preventing the water from passing through them, and before the operator is aware the bit has been grinding in a dry hole and by frictional heat fused into an unrecogniz-



A 30-inch Core Drill Hole in Trap Rock Concrete



Core From 30-inch Hole, Showing Pipe and I-Beam Cut in Two

CORES RECOVERED AT STELLA MINE.

Hole.	Drill.	Ft. of Rock.	Ft. of Core Recovered.	Per Cent. of Core Recovered.
A	Diamond drill, ⅞ in. core	280	223	79.8
B	Diamond drill, ¾-in. core	97	82.8	89.5
C	Diamond drill, ¾-in. core	101	93.3	92.6
D	Diamond drill, ⅞-in. core	113	92.4	81.8
E	Shot drill, 2-in. core	182.7	177.2	96.5
F	Shot drill, 2-in. core	230	226.5	98.5
G	Shot drill, 2-in. core	155.4	118.8	76.4[a]

[a] Hole in soft decomposed schist, ferruginous quartzite and conglomerate. All others in hard gneiss and quartzite.

able mass and the diamonds gone. This same thing has happened in drilling with shot tools, but the loss of a shot bit is only a small item.

How the Shot Cuts the Rock

A groove is cut on the inside of the bit which serves as a passage way between the rock core and the wall of the bit, down which the shot can freely travel. At the bottom of the bit an opening is cut for a water way. The quantity of shot fed to the bit should be enough to cover the bottom of the annular passage it is cutting.

The actual cutting is performed by breaking of the shot, which being of chilled steel embed themselves in the softer material of which the bit is composed. This action produces hundreds of minute pockets, or cavities, into which the small particles of shot are constantly caught, each time presenting a new facet, which mills away the rock. This action continues until the shot becomes so small that the flow of water forces them out of the bore hole above the drilling tool, at which point the water pressure is diminished and the shot fall back and settle in the sludge. When working properly the cutting edge of the bit will assume a half-round form, which keeps some of the shot off the bottom of the hole and thus produces sufficient space for clearance, both inside and outside the bit.

Peripheral Speed of Bit

The small drills up to 5 in. in diameter revolve at approximately 350 r.p.m. The speed of the larger machines is not so great. For instance, in drilling a 10-in. hole, 2000 ft. deep, an approximate speed of 175 r.p.m. was maintained. In boring a 29-in. hole the bit revolved at the rate of 125 r.p.m. With a higher peripheral speed it is possible to drill large diameters at a flatter angle, as the shot by centrifugal force and friction are carried up to the top of the bit.

Types of Drills

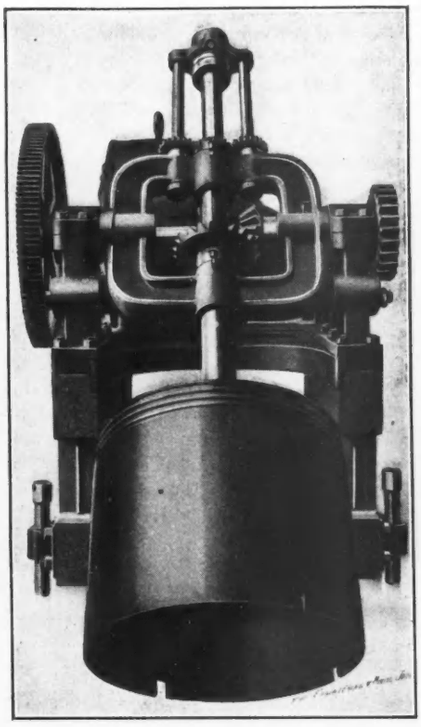
Three standard sizes of core drills are made. Special drills are also constructed for certain classes of work. The Class A drill, operated by steam power, is a direct-connected machine. Both the drill tools and the hoist may be operated together if it is necessary to do so, or they may be operated independently of one another, which is the usual practice. It is used largely by railroad companies, contractors, and miners for all conceivable purposes when the depth to be drilled does not exceed 500 ft. Classes B and C are enlargements of the Class A machine and intended for boring holes of larger diameters and to greater depths.

Mine Ventilation

The ventilation of coal mines may be improved by bore holes from the surface into the mine workings, as well as into the so called "riders" overlying the coal seams. This would allow the accumulated explosive gas in the mine to find its way to the surface. At each opening could be installed an electrically driven fan, which would force air into the workings, or exhaust air from the mine. Large bore holes could be used also as passages for pipe and cables, and would in many cases shorten the distance to which such lines must be carried.

Drill Holes Valuable in Rescue Work

There would be less difficulty in reaching and extinguishing mine fires, which under present conditions are often inaccessible. But few have thus far given any consideration to it as a device, by the aid



A 30-inch Terry Core Drill

of which present conditions may be improved and life within our mines protected. The accompanying illustrations show what can be accomplished in the way of drilling holes sufficiently large to admit a man. The size of these holes would be ample for the installation of permanent ladders, which would serve as exits from the workings in case of accident, and as such they would be of the greatest assistance in rescue work.

Drilling through Concrete and Steel

Work recently performed by the War Department with a Terry core drill has established the practicability of drilling bore holes 30 in. or more in diameter, vertically or at an angle, and to any reasonable depth. The drill used was of the class D type and the material bored through was a trap-rock concrete embankment. Some of the drilling was done in places where the bore holes penetrated concrete reinforced by steel beams, and elsewhere iron drain pipes intersected the line of the bore hole. In the illustrations are shown parts of some of the core removed from a hole drilled at an angle of 55 deg. from the vertical. In one of these cores there is embedded a section of an 8-in. I-beam, and in another an iron pipe 2 in. in diameter. Both the steel beam and iron pipe were severed without any appreciable reduction in the speed of cutting.

Wear on Shot Bits

The wear on the bit was ¼ in. per ft. cut and 10 lb. of shot were used in drilling the same distance. Numerous seams and openings caused by imperfect setting of the cement, as well as severed pipes large enough to drain in a few minutes the water from an ordinary bore hole, did not hinder the work. The detritus or sludge is sufficient to close all save large seams or crevices and through which the heavy tools under a high momentum advance rapidly.

Bit Cost per Foot

In cutting a total of 14 ft. the wear on the bit was reported by the Government engineers at $5.25. The consumption of oil, waste, grease and shot for drilling is reported at a cost of $2. In a similar hole only 6-ft. in length, a wear on the bit valued at $6 was reported, and the consumption of shot, oil, waste, etc., valued at $1. L. L. Ryan, superintendent of the Manhattan Drilling Company states that in drilling through gneiss and quartz at the Stella mine, with a 20-in. shot bit, the wear on the bit in drilling 100 ft. was 12 in. A 20-in. shot bit is 24 in. long, of which length 18 in. are available for cutting. The cost of such a bit is $30 or $1.55 for each wearing inch. The cost therefore for wear on bit in drilling 100 ft. of rock was $19.80, or 19.8c. per foot.

Drilling Cost

The cost of any drilling operation is governed by the size of the hole, the nature of the rock, and the expertness of the operator. One railroad company drilled 50 three-inch holes, the average depth of which was 50 ft., for a total cost of $1.15 per ft. The cost of a 6-in. hole drilled in hard rock in New York, including all charges was $3.20 per ft. Generally speaking the cost for the average run of drilling for different purposes of one sort or another varies from 75c. to $3.50 per foot.

A 2000-ft. 10-in. artesian well was drilled in New York with the class C machine. The formation was granite and gneiss and the average progress per shift was 9 ft. The actual cost for drilling this hole was $5.50 per ft. including all labor, fuel supply, and replacement charges. The cost for labor per day was $11, which was high, owing to the fact that the work was done in New York City.

COLLIERY NOTES

The strike of coal miners at Frank, Alberta, Canada, has been settled. The Canadian Consolidated Coal Company's mines, where the strike occurred, had been inoperative for six weeks.

During the year 1909 approximately 700,000 men were employed in the coal mines of the United States. Of this total number of miners, about 180,000 were employed in the anthracite region of Pennsylvania.

From 1885 to 1909 the production of anthracite coal increased 80 per cent., while that of bituminous coal increased 450 per cent. In other words, bituminous coal made up 65 per cent. of the total mineral fuel consumed 25 years ago, while now the percentage is 85 per cent.

The battery used with an electric mine lamp should give at least 18 hours' service without any appreciable falling off in the brilliancy of the lamp. As to the switch, it should be mounted deep in a block of hard rubber, and opened and closed by a thumb screw, screwing into the block, thus eliminating any possibility of the air penetrating into the switch.

By a unanimous vote, the joint scale committee of the Iowa Coal operators and miners has put its stamp of approval on the plan outlined by a special sub-committee, for the creation of a commission for the improvement of living conditions among the miners. The commission will be composed of 10 men and will have the coöperation of each coal company and each local union in the State.

The Mineral Mining Company of Shamokin has constructed three concrete hospitals in its Cameron mine. Each hospital is 15 ft. in length, 12 ft. wide and 8 ft. high. They have sheet-iron doors, electric light and are painted white inside. The furnishings consist of wash basins, tables, chairs, cots and medical supplies. Hydrants are placed in the rooms and plenty of fresh water is available.

The work of recovering the bodies of the victims of the last explosion (about a year ago) in the Leiter mines at Zeigler, Ill., began May 17, under the direction of engineers attached to the State mine-rescue station at Champaign, Ill. The members of the rescue party were provided with oxygen helmets, and encountered little difficulty in entering the mine. One decapitated body has been found.

Recently compiled statistics place the coal output of the State of Coahuila, Mexico, for the year 1909, at about 920,000 tons. From this coal output, approximately 150,000 tons of coke were produced. Because of the many installations of modern mining machinery recently put in, it is estimated that this year's coal output will reach a total of 1,200,000 tons, and the coke output will exceed 250,000 tons.

The Canadian Northern Railway will be extended 150 miles to the Brazeau coalfield, a new bituminous coal-bearing area in Alberta, Canada, in the foothills of the Rocky mountains west of Edmonton. British and German capital has been obtained, and 10,000 acres of coal land purchased. The amount provided for purchase and development of coal lands is stated at $10,000,000. Both development and railway building are to be energetically proceeded with.

Several coal companies operating in Allegheny county, Penn., have decided to enter into the manufacture of coke. This change of policy on the part of the Allegheny Coal Company, the Superior Coal and Coke Company, and other adjacent operators, is of special interest because these companies mine in the Freeport seam. The Freeport coal in this district has not been considered a coking coal until the present extensive tests have shown that with proper washing the coal will produce a fair quality of coke.

Natural coke from the Barranca coalfields of the Southern Pacific Railroad, in Mexico, will be tried at the Toledo customs smelter of the Yaqui River Mining and Smelting Company, soon to be blown in. The smelter is near the present terminus of the Yaqui river extension of the Southern Pacific Railroad. The coalfields are being opened by a branch line connecting with the Yaqui river line. The natural coke deposits are extensive, and if the coke proves satisfactory in smelting, there will be a big demand for it from Sonora plants.

The Carbon coalfields, Montana, are producing their normal tonnage. The mines of the Northwestern Improvement Company at Red Lodge are producing about 80,000 tons per month under the direction of Supt. C. C. Anderson. In the Bear Creek district the Bear Creek, the Montana Coal and Iron, the Washoe, the Smokeless and Sootless, and the International companies are all producing. The Northern Pacific has recently bought a right-of-way into the district and the Montana, Wyoming & Southern Cross has been handling business there for some time.

The cost of labor should be distinguished from the rate of wages. The cost of labor may be high, though the rate of wages is low, and a high rate of wages may be followed by a low cost of labor. It is often the case that a high rate of wages causes irregular and lessened employment, and a man's actual earnings may be less than they would have been with a lower rate of wages. In the coal mines of Belgium and France, where the rate of wages is lower, the cost of labor is higher than in Great Britain and the United States. This is due to the fact that the cost of labor depends on the production per man, as well as on the rate of wages. It is also true that in some mines and in certain districts, there are greater natural difficulties.

Recent experiments carried on in England with reference to spontaneous combustion of coal proved that the temperature of coal freshly stored rises in two or three days from 70 to 85 deg. F. and thereafter continues between 85 and 100 deg. F. This rise in temperature is accelerated by the presence of water, which brings oxygen in solution. Dry coal should not be deposited upon any large quantity of damp coal. Wet coal should be spread in layers 8 in. thick and allowed to dry 24 hours before being covered with a new layer. Sulphur compounds do not play an important part in the spontaneous ignition. If ventilation is attempted, it should be mechanical and very energetic, in order to produce a refrigeration which will counterbalance the oxidizing effect of the air.

As to the cost of equipping a plant for the production of coal, one English engineer making a broad estimate, says, that the amount of money required to sink a couple of shafts to an average depth, and to equip a colliery in an uptodate manner for an output of 1000 tons a day —or about 300,000 tons a year—would probably be about $750,000, or $2.50 a ton of yearly output. He further adds that the larger the output, the less will be the proportionate expenditure. Allowing 3 per cent. for the redemption of capital—or a period of about 33 years for redeeming it—3 per cent. on $2.50 is 7½c. Consequently, in the cost of producing coal, therefore, the charge per ton for the repayment of the capital invested, without allowing any interest for the use of the capital, may be placed at about 7½c. a ton of gross output.

The high price of mules is giving the Pennsylvania anthracite-mining companies unusual trouble. It is practically impossible to obtain the animals in the East, and one of the largest companies has recently sent agents through the West, to make a tour in search of good strong mules. Despite the introduction of mechanical haulage underground, there will always be certain gangways and entries in mines where it will never be economical to employ mechanical power. In the last nine years the price of mules has advanced more than 100 per cent. In 1901, a first-class mule could be bought for $145; in 1907 the price had risen to $210, and it is now about $300. Only exceptionally strong animals are wanted, and these are well housed and are cared for by experienced men working under the direction of the company veterinary. It costs about 40 per cent. more to feed the mules at the present time than it did in 1901.

The Kansas State Coal Mine

Convicts at Penitentiary Are Employed to Mine Coal for State Institutions. Safety and Sanitation More Sought Than Commercial Success

BY C. M. YOUNG*

The State of Kansas owns a coal mine which is operated in connection with the State penitentiary at Lansing. While the point of greatest interest is probably the fact that the mine is worked by convict labor, there are some things of interest about the mine itself, and a short description of the mine and the method of operating it will make the conditions of labor more readily understood.

The mine is situated near the penitentiary at Lansing, in Leavenworth county. It has railroad connections with the Union Pacific, Atchison, Topeka & Santa Fe, and Missouri Pacific.

The coal is found at a depth of 720 ft. in the Cherokee shales of the Lower Carboniferous. It is called a 22-in. seam, but varies in thickness from 19 to 27 in. In all questions at law concerning the amount of coal within a certain area, the bed is assumed to produce 70,000 bu. per acre.

Below the coal, is from 2½ to 3 ft. of clay, which makes a convenient mining. In the State mine about 14 in. of this clay is mined, though in other mines in the same district somewhat less clay is taken out. Below the clay is 3 ft. of limestone.

Above the coal is 45 ft. of shale, which forms an excellent top. Above the shale is a thin layer of limestone and above this is a bed of coal about 10 in. thick. This latter coal is interesting principally as being the probable source of the gas which is found in small quantities in the mine. A little water also finds its way into the mine through fissures in the roof, but the quantity of water is small and it gives very little trouble.

The Coal Has High Ash Content

The coal is not of high quality, having a large amount of ash and a considerable amount of sulphur. An average analysis of this coal is as follows:

ANALYSIS OF COAL.

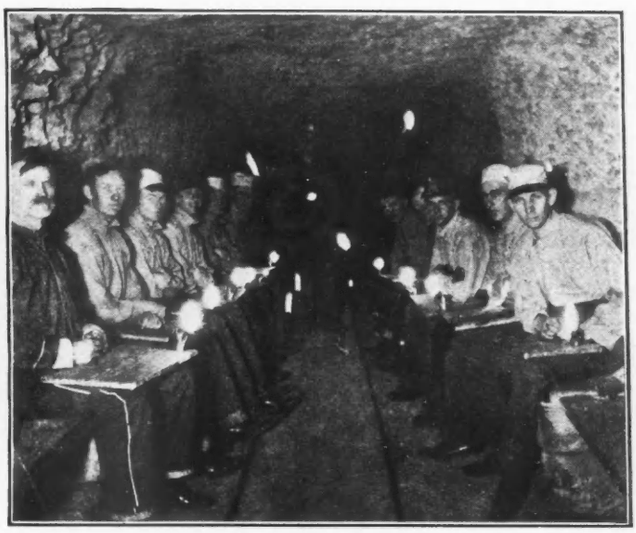
	Per Cent.
Moisture	8.58
Volatile matter	33.62
Fixed carbon	44.5
Ash	13.28

The ash is so high that it gives considerable trouble on the grates and an attempt is to be made at the State University to wash the coal. For the purpose of determining the advisability of installing a washing plant, and also to give students an opportunity to study coal-washing methods and apparatus, a washer of rather small capacity will soon be installed in the laboratory of the mining department. The work done with this equipment will not be confined to the washing of the so called Leavenworth coal, but experiments will be made with all of the other coals of the State which give promise of being benefited by washing.

The mine is reached by means of a shaft 9x16 ft. in size, having three compartments, two used for hoisting and one for pipe and wire. Another shaft about 200 ft. from the main shaft serves as an upcast airway and an escape shaft. The main shaft is equipped with a Litchfield first-motion hoist with a 12-ft. drum and cylinders 24x48 in. The rope is 1½ in. At each trip, two cars holding 1000 lb. each are raised. The engine is rated at 500 h.p. and steam is raised at 60 lb. pressure.

The mine is worked on the longwall system, as indeed might be considered necessary. With a depth of over 700 ft. it would be very difficult to operate the room-and-pillar system, even if there were any advantage in doing so; in this case the advantage is all with the longwall method. The coal is only 22 in. thick and there is plenty of material for filling. If the longwall method could not be used, the possibility of profitable operation would be doubtful.

SHOWING THE LONGWALL FACE UNDERCUT AND READY TO BE WEDGED DOWN



PARTY OF STUDENTS FROM UNIVERSITY OF KANSAS VISITING THE STATE MINE

The Main Object is Not Commercial Success

In fact, very little attempt is made to make the mine a commercial success. This does not mean that the mine is poorly managed, but that more attention is paid to cleanliness, sanitation, safety and convenience than to cheapness of operation. The State employs the labor of convicts and furnishes the coal to the various State institutions free, each institution merely paying the freight on the coal consumed. Operating under these conditions, with no necessity for the most

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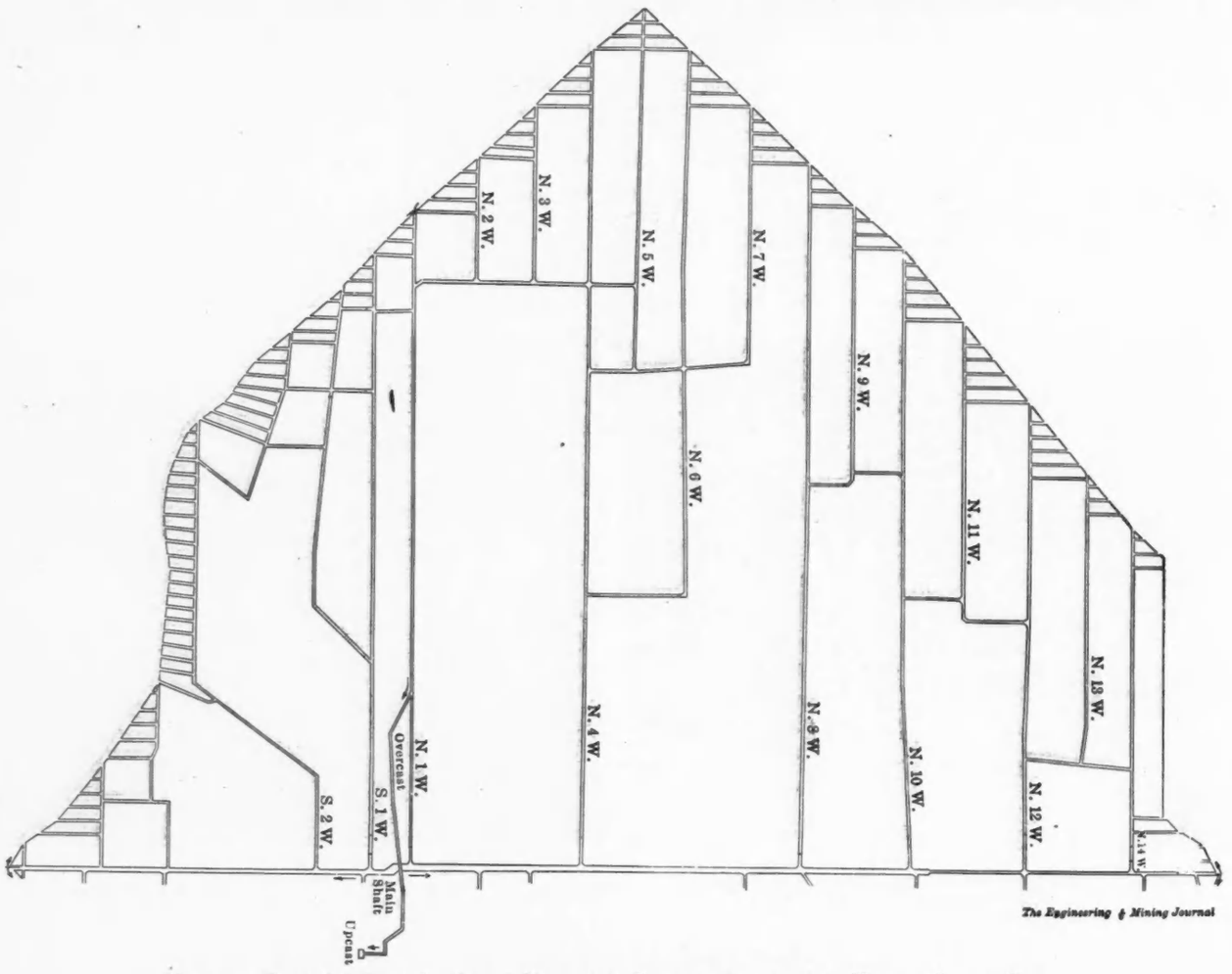
rigid economy, the penetentiary authorities are able to make the conditions underground much less unpleasant than they would otherwise be. Other mines in the immediate vicinity have been operated continuously for a long time by private capital and have apparently been able to show a profit. But an attempt to operate the State mine with as close attention to economy would undoubtedly result in so great an increase in the hardships of the miners that it would not be considered wise to require the labor of convicts.

Explosives Are Used Only in Breaking Roof

The coal is undercut by hand and generally parts easily from the roof. In some places, however, a dark-colored, impure limestone occurs immediately above the coal and as the coal does not part easily from this, wedging is necessary. This limestone has the local name of "sulphur rock." The coal is passed along the face to a road-head where it is loaded onto cars and hauled to the shaft. As the entries are 200 ft. apart, it is evident that the maximum length of a road is 200 ft. Explosives are used only in breaking down roof. A considerable amount of dynamite is stored in a powder room near the bottom of the shaft and this is very carefully guarded. About 600 acres have been mined. The working face is now about three miles long, but not all of this is being worked. The east road extends about one mile from the shaft and the ordinary rate of advance is about 200 ft. per year. It is planned to extend the mine considerably farther to the east, where the State owns something more than 1000 acres of coal underlying an island in the Missouri river.

As the roads are spaced 50 ft. apart and are run due north and south and the working face is at an angle of 45 deg. with the roads, it is evident that the distance between roads along the face is a little more than 70 ft. This space is called a room and is commonly worked by two men, each miner thus having a space of about 35 ft. to work. This makes probably the most convenient arrangement as it leaves roads sufficiently close together for convenience in getting out the coal without having them so close as to interfere with packing the waste. Somewhat more waste is produced than is necessary for filling and this is hoisted and used for grading on the surface.



General Plan Showing System of Longwall Development in the Kansas State Mine

Haulage Is Done by Mules

The main roads run due north and south from the shaft and at right angles to these, spaced 200 ft. apart, are the entries. These are kept open for only a short distance from the face, with the exception of such as are necessary for haulage and ventilation. The so called roads are run at right angles with the entries and are spaced 50 ft. apart. The working face is kept at an angle of 45 deg. with the roads and entries and therefore takes the form of a square whose diagonals are the main roads. As the seam is nearly level and the coal has no important cleat, this shape can be adopted without disadvantage and it gives the advantage of perfect regularity of working face and roads.

Roof is brushed on the main roads only and tramming from the rooms is done by men. The haulage is done entirely by mules which remain in the mine as long as they are serviceable, being hoisted only in case of sickness or when the mine is shut down. The mules are in excellent condition and apparently fare

much better than the ordinary mine mule. The stalls are clean and well ventilated. Near the stable is a roll hole, a large room with the bottom covered deep with sawdust, in which two mules at a time can roll. Each mule hauls a trip of 10 cars weighing about 500 lb. each and holding 1000 lb. There is a slight grade toward the shaft.

The main entries are brushed to a hight of about 7 ft. and are lighted by electricity for some distance from the shaft. As the timbers are whitewashed, these entries present a pleasing appearance of cleanliness.

The small shaft previously mentioned as an escape shaft, is used for working a shale mine. This shale lies with its bottom 120 ft. below the surface. It is 23 ft. thick, but only about 8 ft. is taken out. This mine is operated on the room-and-pillar system with rooms 18 to 20 ft. wide. The pillars were formerly 20 ft. wide, but this width proved insufficient and they are now made 40 ft. wide.

The clay is hoisted to the surface through the ventilating shaft which is an upcast. This shaft is closed by a door which is raised by the ascending cage. As not very much clay is taken out, this opening of the shaft does not seriously interfere with ventilation. This shaft is connected with the fan by a tunnel about 200 ft. long. This permits the fan to be located near the main shaft. This would be unimportant in most mines, but it is important in a mine worked by convict labor, as this is.

The clay is made into brick and the brick, like the coal, is used by State institutions.

No Coal is Sold

As before stated, no coal is sold, but all is used at State institutions and in winter months the mine finds difficulty in supplying the demand. This fact is due to lack of labor and not to difficulty in getting coal from the mine. Until recently, the State prisoners of Oklahoma were kept at this prison and the large number of prisoners made it possible to produce a considerable amount of coal. The mine now produces about 2000 tons per week and there is used at the penetentiary about 2500 tons per month.

The fan was made at the prison. It has 4-ft. straight wooden blades, is 18 ft. in diameter and runs at 70 r.p.m. It is run as an exhaust fan, taking air through the tunnel from the shale-mine shaft.

The point of greatest interest about the mine is the fact that it is worked by convict labor. This fact makes the conditions of operation considerably different from those of a free mine. The men are taken from the cell house to the dining room for breakfast in the morning, then they are conducted by guards to the shaft. The shaft is within the prison walls, though the waste dump is not. The latter is, of course, within the prison fence. The men are sent down the shaft and conducted to their working places. Here they work until noon, when they eat a dinner sent down to them. This meal is good in quality and abundant in quantity. It consists of a soup, meat, potatoes, bread and butter. It is sent down in large boxes and cans. The men eat in small groups in places not far from their working places. Benches placed along the wall of the entry serve as seats. Each man has a board about one foot long and two feet wide which he holds on his knees. He places his lamp on one corner of the board and is served with what food he desires. At the end of the meal the boards are scraped clean and left at the benches until the next noon meal. After this dinner the men work until about three o'clock. They then go to the shaft and are hoisted to the surface. Here they go to the wash room where they cleanse themselves and then amuse themselves in any harmless way until supper time. This play time is greatly appreciated by the men, who spend the time in playing ball and similar amusements. This is the program of the men employed in the mine for five days of the week. On Saturdays they quit work at noon and on Sundays no work is done.

Each Man Must Produce a Specified Tonnage

Each miner is required to mine a certain amount of coal each day. If he works alone in a room, his task is 9 tons per week. If two men are in a room they mine 15 tons, and three men in a room mine 21 tons. This requirement is not severe. The amount required is supposed to be that which an untrained man can produce. In other words, the men are not treated as experienced miners, but as inexperienced men. When they come to the prison, most of them are, in fact, untrained. Each new man is placed for two weeks with an experienced man and is supposed to learn his work in this time. During these two weeks his task is only half that of the experienced men, or 4½ tons per week.

As might be expected, the men are not equal in intelligence and ability to the free miner. Most of them are sent to the prison for minor crimes, such as theft, and those of the prisoners who seem better fitted for other work are not required to work in the mine. Nor is anyone employed in the mine whose health and strength are not equal to the work.

The task of 9 tons per week is not difficult to accomplish. In the free mines of the same district, in which the conditions of mining are the same, the miners produce from two to three times the amount required at the prison. It is recognized both that the men may not be the equals of the free miners and that the work should not be made so severe as to be considered a daily punishment. The conditions of mining are such that any able-bodied man can easily mine the required amount of coal. He has the privilege of doing his work in less than 5½ days if he wishes. Many of the men do this and spend the remainder of their time in reading or in simple idleness. They are not required to do more work, but are required to go into the mine. As the ventilation is good, this is not a great hardship. It is probable, however, that the time might be better spent in school work or in some other employment.

The Working Face Is Kept Straight

One reason for the requirement of a definite task lies in the fact that the mine is worked on the longwall system. It is necessary that the working face be kept approximately straight. If the face at one portion of the mine is not advanced as rapidly as that on both sides of it, the coal left behind is partly crushed by the pressure of the roof and is so pressed into the underlying clay that mining becomes difficult. At the same time the roof is prevented from descending properly over the coal at the sides of this lagging portion of the face, and the coal is thus deprived of the proper pressure and is not broken down as it should be. It therefore becomes necessary to carry the face forward at approximately the same rate at all neighboring points. In a free mine this is accomplished voluntarily by the miners who find it to their advantage to work the mine properly. But in a mine worked by convict labor it becomes necessary to impose a definite task.

A night school is conducted at which the men can make good some of the deficiencies of their education. To most of them this is a real benefit, as they are largely men who have had little training in school. Some few of the prisoners are men of good education and some of them are fitted for work requiring training and intelligence. Such men are given work fitted to their ability as far as possible. For example, the surveying and mapping of the mine, together with a considerable amount of the planning of small structures about the prison, is done by the prisoners.

The Propriety of Employing Convict Labor in Mines

Whether a State should employ its prisoners in any way in which profit to the State can be derived from their work is a question which I make no pretense of answering. If it is answered in the affirmative, as most, if not all States are now answering it, the question still remains whether the State should employ them in mining. This industry has associated with it some danger. In some mines this is great, but in such a mine

as that at Lansing it is very small. Almost no gas is found. That which is found is carefully removed before men are allowed to enter workings where it occurred.

The longwall method of mining makes it easy to supply a sufficient amount of air and the mine is certainly well ventilated. The roof is good and gives almost no trouble. It seems hardly possible that any mine could have conditions less dangerous than this. In fact, it would be difficult to find any employment more free from danger. I do not pretend to answer the abstract question of the desirability or propriety of employing convict labor for the advantage of the State, but I believe that it can be said that the miners of this State mine are subjected to very little, if any greater hardship than the prisoners working on the surface and their lot is certainly very much easier than that of the prisoners of some States who are farmed out to contractors.

The Production and Use of Coke

BY W. HARTMAN *

Though the use of coke for heating purposes has been rapidly increasing during the last few years, it has, however, not attained that degree which has been reached in Europe. This may be due largely to our greater production of anthracite, but the fact remains that there is hardly a more useful fuel for house-heating purposes than coke.

All fuel is of organic, i.e., vegetable origin. The original plants were either ligneous, shrub-like or moss, and consisted partly of pure carbon and partly of combinations of carbon, hydrogen and oxygen. The transformation of these plants into the mined fuel of today consisted solely in the loss of these combinations.

In the course of time these products turned into lignite, then into bituminous coal and later anthracite. Therefore anthracite represents the most advanced form of coal in the transformation of vegetable matter.

The output of anthracite is not sufficient to cover the market and the places where it is found are limited. On account of this realtive scarcity, it is rather expensive. For this reason, an effort was made to produce anthracite artificially by driving out the volatile constituents from a less carbonaceous fuel. This object is reached by the use of a direct fire, as in the manufacture of charcoal for instance, or by shutting off the air in retorts heated from the outside (dry distillation). A good coke, therefore, often surpasses the natural anthracite in purity of carbon, which explains why coke is especially adapted as a fuel, smokeless and sootless.

Capacity For Coking Increases With Age

For the production of a technically useful coke, only such grades of coal can be used which do not crumble in retorts, but form a homogeneous mass, baked together. Anthracite and lignite when ignited neither bake nor melt, but some coals formed during an age between these two products are cokable. It has been found that the capacity for baking increases with the age. It is present in the so called gas coals and reaches its highest effect in those qualities containing about 25 per cent. volatile matter. All grades of coal above this line, being of greater age, generally show a decrease in coking qualities until they disappear entirely in anthracite.

Suitable Coals

Depending upon the purpose for which a coke is intended, various qualities of coal will be used. When the manufacture of illuminating gas is the object desired, a young coal rich in gases is selected. To recover the volatile matter, such as illuminating gas, tar and ammonia, this coal is carbureted in a retort by dry distillation, gaining at the same time, gas coke as the most valuable byproduct; figuring on the weight of raw material used, this process yields a coke output up to 60 per cent., according to the percentage of water and ash contained in the raw material.

Gas and Coke Production

The retorts used in the production of illuminating gas consist of single tubes of an oval cross-section. They are heated from the outside by generator gas. Special gas producers are necessary to generate the gas required for heating the retorts. Depending upon the construction of the ovens, the retorts, of which a larger or smaller number can be used, are arranged either horizontally, slantingly or vertically. In newer plants the retorts are fed mechanically, but all devices allow a loose filling of the retorts.

If the operator's main object is solely the production of coke, then an older coal has to be selected which is richer in carbon and correspondingly poorer in gas, but, of course, still of a baking character. When such a coal is brought into the ovens, the main product is coke, and the byproducts are coke-oven gas, benzole, tuluol, etc. The average coke production rises up to 80 per cent., varying more or less according to the water and ash contents of the raw material.

In producing coke through the distillation of coal, the form of the retorts has changed; we now have retorts in the form of chambers built of masonry, the walls of which are tunneled by heating channels. The necessary heat is produced by the gases obtained from the distillation itself; for this purpose, mostly those gases are used that are richer in hydrogen, and which are produced toward the end of the coking process. The volatile products of distillation, especially the so called coke-oven gases of the first coking period, are caught and are used as power for gas engines, etc. The feeding of the retorts with raw material, when coke is being manufactured, differs from the illuminating-gas process. When the production of coke is the main object sought, the coal that is charged must be as fine and pure as possible; this condition is reached by washing and crushing, which treatment also gives the coke an even, hard structure. The raw material should be jammed tightly into the ovens.

Qualities of the Different Cokes

As before mentioned, it is necessary to use a special heating material in the production of illuminating gas. For this reason, the coking process is continued to a certain degree only. Because of this difference in the time of burning, and as a result of different methods of charging the oven, the structure of the two qualities of coke is entirely different. Gas coke has a looser structure, that is, greater porosity, a lower weight and less strength of body.

When coke is burned on an ordinary grate, the oxygen of the air unites with the carbon of the fuel to form carbonic oxide (CO_2). In this way heat is produced. It is evident, therefore, that the more surface the coke offers to the air, the quicker will the oxygen be used up, and carbonic oxide be formed. It is necessary, therefore, to use much care in determining the hight of fire-bed that will give the most perfect combustion. When the hight of fire bed is properly determined, both qualities of coke are equally well adapted for getting complete combustion. It must be understood, however, that when a coke is to carry a heavy weight,

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as is the case when coke is used in the blast furnace, the coke must be very strong, and for this reason the ordinary mine coke is best adapted. This same quality of coke, because of its higher temperature of combustion, is especially adapted for melting purposes. It may be mentioned in this connection that in Germany recently a new process has been discovered through which the smaller sizes of gas coke are briquetted and have shown good results in cupolas.

Rules to Determine the Quality of Coke

In order to ascertain the quality of a coke, the following suggestions may be helpful: A high ash content is indicated (1) by extraordinarily heavy weight; (2) the edges of the pores have a metallic brilliancy; (3) a dark, sandy appearance without porosity.

A high percentage of volatile matter is indicated by (1) small brown-black spots in a fragment originating from uncoked coal; (2) a dull sound when dropped on a hard object; (3) deep black interior to the pores and a tar-like luster to their edges; (4) a black appearance without brilliancy; (5) big lumps without structure and easily crumbling.

A high percentage of water can be determined by (1) examining with a magnifying glass to see whether or not the pores are filled with water; (2) by simply clasping an oblong piece of coke in the hand; if the coke is wet, a cool feeling will result. A moisture content up to 5 per cent. of water is hard to detect, as the pores absorb it entirely.

No matter by which process coke originates, its heat value, as well as its temperature of combustion, is naturally impeded by high ash and water content. As already explained, the gas works extend their coking only so far as the profit on illuminating gas and byproducts covers the expense resulting from the use of a special fuel for heating the retorts. In consequence, the gas coke is usually less coked and can, therefore, produce more gas. For this reason gas coke has a longer flame than the ordinary mine coke, and consequently is preferable where a long flame is necessary. On the other hand, mine coke possesses a greater heating value and a higher temperature of combustion.

It is evident, therefore, that the question of whether to use mine or gas coke depends almost entirely on the construction of the plant and the difference in the price between these two grades of coke.

Where Gas Coke Should Be Used

Where the boilers installed at a plant have no contact heating surface and are constructed with the fire-box underneath, or protruding, a coke with a long flame should be used. When such boilers are heated with a short-flame fuel, the temperature of combustion is developed on the grate bar and, therefore, is expended on the masonry without favorably affecting the boiler. Under such circumstances, only gas coke should be considered.

When the boilers at a plant have a contact heating surface, and the fire-box consists of water-cooled hollow bodies connected with the boiler and adding to the production of steam, instead of having a masonry fire-box, fine coke is undoubtedly the best fuel to use. In such a boiler, the coke having the higher temperature of combustion acts with the greatest efficiency. Naturally, in this connection, it should be remembered that the degree of usage of a combustion chamber constantly changes; during mild weather, and especially during the night time, the conveyance of air to the fire is restricted to a minimum. In such a boiler the consumption of gas coke is considerably greater than of mine coke. It is certainly true that when the unjust antipathy against coke, resulting from ignorance, has been overcome, its greatest enemy will become its best friend. Coke is smokeless, dustless, and gives but little breakage. It can be stored away in the summer time without deteriorating and can even be exposed to rain without any very bad after effects.

Coal Mining in Alabama

BY HENRY M. PAYNE *

There is no coalfield in the United States which presents a more interesting field for the student of mining than the State of Alabama. Coal mining is carried on in 12 counties of the State, and in seven of these 12, coke ovens are also operated.

Alabama's Annual Production

For the last four years, the annual output of coal in Alabama has ranged from 11,000,000 to 15,000,000 tons, and the production of coke has been approximately 3,000,000 tons per year.

Jefferson county leads all other counties in the number of operations (81 out of 215); coke ovens in operation (7496 out of 9823); total output (50 per cent. of whole); men employed (9039 out of 18,783); and has 29 out of the 58 gaseous mines in the State.

Of the total 215 operations in the State, only nine have shafts, while 96 have drifts and 110 have slopes.

The Seams Vary from 2 to 10 Feet in Thickness

On account of the great difference in the thickness and pitch of the seams, the price paid for mining varies greatly, the minimum paid being 35c. per ton, and the maximum, $1.10. The thinnest seam operated is the Montevallo seam, at Straven, which in some places is only 1 ft. 8 in. thick; the thickest seams are the Blocton No. 1, at Blocton, and the Mary Lee, at Porter, which are each about 10 ft. thick. The average number of days worked in the whole State last year was 200. The mines in Marion county led the list with an average of 248 days, while Blout county only averaged 144 days.

The State as a whole is not organized, and some of the mines use convict labor, the principal advantage from this policy being a continuous output, rather than any reduction in the cost of production.

Because of the coking of about one-third of the total output of the State, in many districts the coal is loaded on a mine-run basis; but in all the other districts, careful attention is paid to the production of lump coal through improved methods of mining and the avoidance of the shattering effects of explosives.

Sentiment Now Favors Safety Measures

A serious change in sentiment has recently taken place in Alabama, and the majority of operators are urging the abolition of "shooting on the solid," and the use of black powder. On the other hand, there is a movement toward the introduction of undercutting machines, permissible explosives in connection with electric shot-firing devices, and also of the hydraulic mining cartridge with which several mines have been recently equipped.

The late Mulga and Palos explosions have emphasized the value of such rescue equipment as the hospital car of the Tennessee Coal, Iron and Railroad Company, and the Draeger oxygen apparatus with which nearly all the prominent companies are equipped. At all the larger

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mines, a first-aid corps is maintained, and in addition to the regular mine inspection by the State, a company inspector is usually employed.

The reports of the inspectors and experts at the Mulga mine, indicate the absolute necessity for continuous examination of all working places, a more extended use of the safety lamp, and the constant removal of all dust as fast as it accumulates, in any mine where gas has ever been discovered, or where the location is such that it may be expected.

The greatest damage to this mine was at the foot of the main shaft, and fortunately the escape shaft was so slightly injured as to be almost immediately available.

The power plants and general equipment of all the mines in the State are above the average, and the local conditions are such that almost every method of mining, timbering, haulage and ventilation may be seen in practical use. One of the longest slopes in the State, and worthy of special mention is at the Blocton mine of the Tennessee Coal, Iron and Railroad Company. This haulway is perfect in alinement and grade for its entire length, and is a model of entry timbering and roadway maintenance.

Verdict in the Cherry Mine Disaster

The coroner's jury which began last November to investigate the cause of the Cherry mine disaster, which resulted in the death of 265 miners in the St. Paul mine, has reached an agreement, and 250 separate verdicts have been returned. The jury says the mining laws were broken with the knowledge and consent of the mine inspectors.

The verdicts were in three sets, one set fixing the cause of the death of the 12 men in the rescue party who perished on the cage in the mine shaft; another set for the 187 men who were suffocated in the second seam; the third set is for the 51 men who were trapped in the third seam and died of exposure and suffocation. The verdict of the coroner's jury vindicates John Cowley, the engineer who was in charge of the cage. The verdict blames "a confusion of signals" for the tragedy.

The following verdict was brought in for each of the 187 men who lost their lives in the second seam:

"We find that they came to their death by suffocation and that the fire was caused by a load of baled hay coming in contact with an oil torch. And we further find that there was great delay in notifying the men of their danger."

The verdict giving the cause of the death of the men in the third seam says:

"We find that they came to their death by exposure and suffocation. We further find that the mining laws of the State of Illinois in relation to means of escape were violated with the full knowledge and consent of the mine inspectors for district No. 2."

Atmospheric Pressure and Mine Explosions

By W. Hartman *

Each time a mine catastrophe occurs the question is raised: "Are there no visible signs which indicate or at least predict such a disaster, and thus enable the mine authorities to take steps in time toward its prevention?" Certain observations caused many engineers to believe that mine-gas explosions were more or less connected with variations in outside atmospheric pressure.

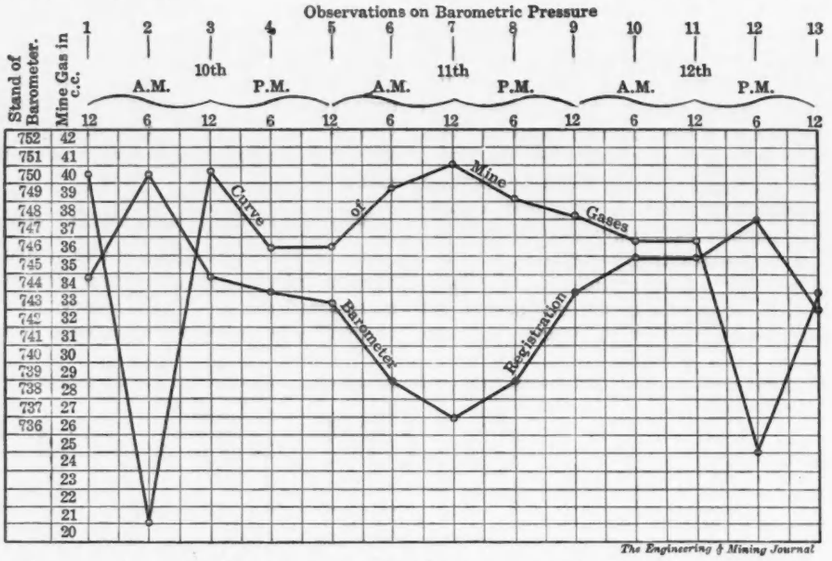


Fig. 1. Showing Relation Between Variations in Atmospheric Pressure, and Outflow of Gas in Mines

This question was of tremendous importance and the utmost care was taken when gathering the information. To get data which could be relied upon, it was, of course, necessary to stretch these observations over several years. For this purpose uniform schedules were issued, fitting into indicators which automatically registered every day the varying conditions prevailing in the air shaft of a mine.

One of the sheets illustrating the results obtained by this method is shown in Fig. 1.

Observations on Atmospheric Pressure and Outflow of Gas in Mines

This observation was taken in the suction channel of the fan, and it must be considered that the variation in atmospheric pressure was partly due to the number of revolutions of the fan. To render the varying pressure more conspicuous, the revolutions of the fan had been increased, which action, however, does not affect the general result.

Along with these observations went others, determining carefully the stand of the barometer at the time of various explosions in mines. When these reports were compared at the end of a few years, it was shown for a certainty that a connection between the atmospheric pressure and the frequency of gas explosions could not be established. At the time of some accidents, it seemed as if there was a link between these two factors. But this coincidence was so uncertain and so small in comparison to the bulk of the observations, that it is safe to say that explosions occur independently from the oscillations of atmospherical pressure. The barometer, being high or low, explosions were equally distributed. And this outcome was to be foreseen for it is only natural that explosions should occur independently.

Causes of Methane Accumulations and Its Ignition

Methane (CH_4) is the trouble maker in most gaseous mines, but it is hard to understand how a little of this gas can be of such importance in a well ventilated mine.

Even the gathering of dangerous quantities of gas must generally be credited to some mishap; for instance, breaking down of the fan or as a result of the caving in of old workings, rather than to atmospherical conditions. There is another matter which is still harder to solve; the connection between a variation in atmospheric pressure, and an ignition of gas. The firing of a body of gas may be due to any one of many unhappy circumstances, or to the inexperience of a miner. However, this only shows more plainly that the cause of such ignition is generally independent of atmospheric changes.

*With Whitney & Kemmerer, 143 Liberty street, New York.

Safety Precautions in Alabama Coal Mines

In Addition to First Aid Corps and Emergency Car, the Electric Shot Firing System and Mechanical Means for Getting Coal Are Being Adopted

BY E. H. COXE*

The Tennesee Coal, Iron and Railroad Company has taken a leading part in the State of Alabama in adopting measures for the safety and benefit of its employees. Particularly in its coal mines, where the most hazardous work is carried on, has the Tennessee company specially pushed the establishment of safety precautions.

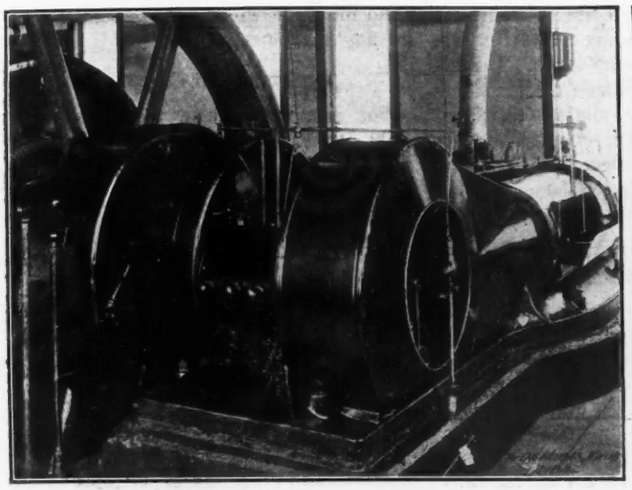


FIG. 1. SHOWING HOW THE CRANK PIN ON THE ENGINES ARE GUARDED

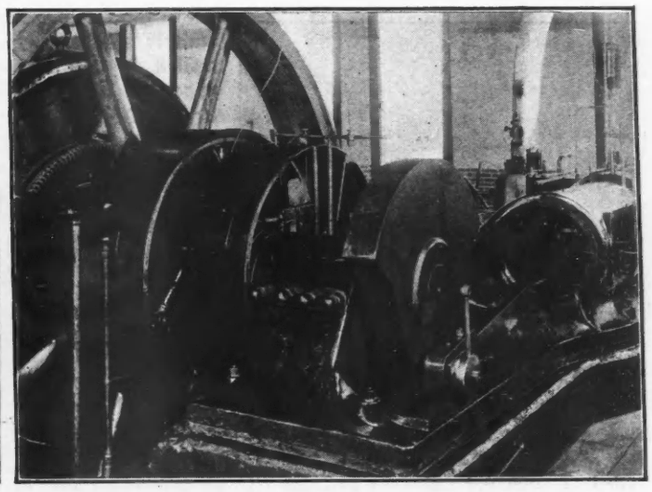


FIG. 2. SHOWING THE ENGINE WITH CRANK-PIN GUARD REMOVED

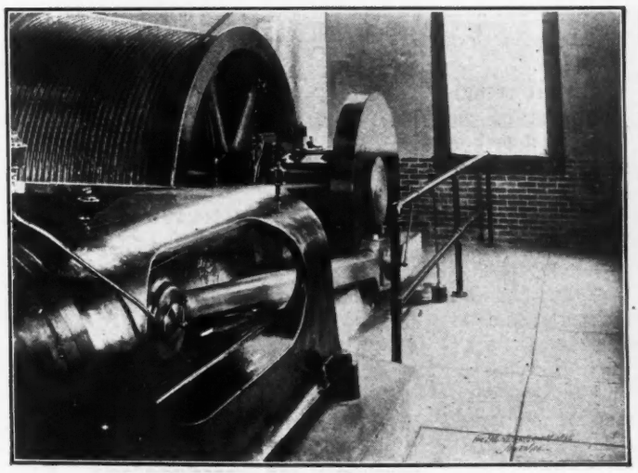


FIG. 3. SHOWING HOW SOME OF THE ENGINES ARE GUARDED WITH RAILINGS

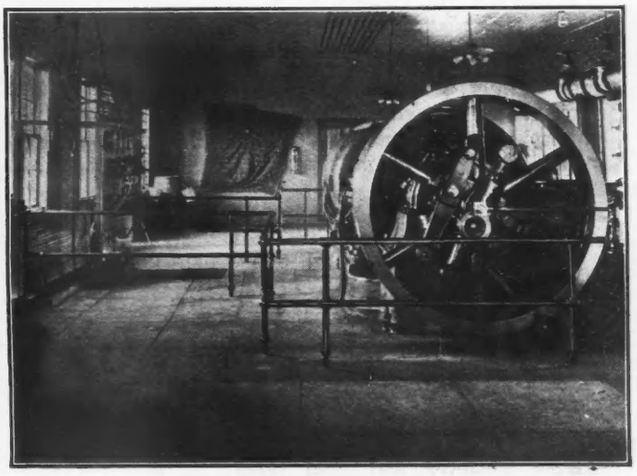


FIG. 4. THE DYNAMOS AND ELECTRIC SWITCH PARTS ARE ALSO GUARDED WITH RAILINGS

TENNESSEE COMPANY'S SAFETY MEASURES

All machinery operated by this company, both on the surface and in the mines, is guarded in every possible manner to prevent employees from coming in contact with any moving parts. Figs. 1 and 2 show how the crankpins on some of the engines are guarded; Fig. 1 showing the engine with the guard on, and Fig. 2 with the guard removed. Figs. 3 and 4 show how some of the engines, dynamos and electric-switch parts are guarded with railings. All engines operated by the company are protected in one of the two ways mentioned above.

All gear wheels on pumps or other machinery, both in and out of the mines, are shielded to prevent employees getting their limbs or clothing caught in the wheels, while oiling or working about the same. All sprocket wheels and sprocket chains are properly protected where it is possible to do so. Where set screws are required on revolving shafts or pulleys, they are either countersunk, or hollow set screws are used; the heads of these screws are made flush with the face of the revolving piece so that the operator's clothing cannot become caught.

All platforms or stairs are supplied with hand rails, and where there is any opportunity for objects to fall on persons working or passing beneath, footboards are placed around such platforms so that small objects cannot be knocked off.

In order that none of the above mentioned precautions may be neglected by

*General superintendent of coal mines, Tennessee Coal, Iron and Railroad Company, Birmingham, Ala.

any of the operating force, a separate department known as the safety department is maintained and the head of this department, or competent inspectors in his employ, make frequent periodical inspections of all the safety appliances at all of the works, submitting reports of their inspections to the general manager and also to the head of the department inspected. Inside of the mines every possible precaution is taken to prevent explosions of any description.

Coal Dust Is Sprinkled

At some of the coal mines steam is introduced into the air at the intake and

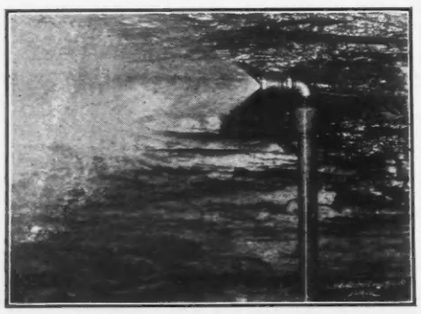


Fig. 5. Showing One of the Sprays in Operation Underground

inside of the mines, sprays of the American Moistening Company type are installed at sufficient intervals to keep all coal dust thoroughly wetted down. Fig. 5 is a flash-light photograph of one of sprays in operation in one of the company's coal mines. Hundreds of these sprays are in use all the time. In addition to this, where the results therefrom are not entirely satisfactory, they are supplemented by sprinkling with a hose. In the machine mines, the machine cuttings are loaded out before any shots are fired.

Safety explosives are used in all mines where it is possible to shoot the coal with them, the explosives used being bituminite, manufactured by the Jefferson Powder Company, and carbonite and monabel, manufactured by the du Pont Powder Company, the two former being used for coal and the latter for rock. Dynamite is not allowed in any of the coal mines of this company under any circumstances whatever and rigid rules have been adopted to prevent this.

The use of coal dust, or coal in any form for tamping is strictly prohibited and a supply of clay for tamping purposes is kept in the mines at all times and the miners required to use the same. Where a place is dry and dusty it is required to be sprinkled before being shot.

Will Install Either Electric Shot-firing or Hydraulic Mining Cartridges

In one of the coal mines, known as No. 5 Pratt mine, in addition to the use of bituminite and the mining of all the coal in the clear, an electric shot-firing system was installed about a year ago, whereby all the shots in the mine are fired by electricity from the outside after everyone has come out, and there is absolutely no one underground when these shots are fired. This system was described in a paper read before a meeting of superintendents, mine foremen, assistant mine foremen, gas men, etc., held at East Lake Park, Alabama, July 17, 1909, under the auspices of the Alabama Coal Operators' Association, which paper was published in this Journal on Aug. 28, 1909. In connection with this system an absolute check is had on all men going in and out of the mines. The system has proved entirely successful and is now being installed in this company's No. 8 Pratt mine, and will be installed in other mines unless the hydraulic mining cartridge, which is now being experimented with by this company, proves successful, in which case this latter machine will be installed instead.

Special Inspections

In all coal mines of the company generating gas, a sufficient number of gas men are employed to examine all working faces at least once, and sometimes twice daily, and where gas is discovered, to see that same is properly cleared before an employee is allowed to enter that place. In addition to this, a sufficient number of inspectors are employed to examine every working place at least twice a week with particular reference to proper timbering; where a place is not properly timbered, the occupant thereof is not given any cars to load until he makes his working place safe.

All the doors in the mines are so hung as to be self-closing, so that no employee can carelessly leave a door open and thus disturb the ventilation, and these doors are required to be kept in that condition.

In addition to the State mine inspector, this company employs a competent inspector of coal mines, whose duty it is to examine all the inside workings of the mines and report to the general superintendent and division superintendent the conditions existing therein, with special reference to the safety of the employees.

Improved Construction

The old mines are being gone over with an idea of duplicating the driving mechanism of the ventilating fans, and of fireproofing the fan houses and engine buildings and the air shafts leading thereto. The fans are being set to one side of the shaft with fireproof conduits conducting the air from the shaft to the fan, and the shafts themselves are being made fireproof and equipped at the top with self-closing explosion doors, so that in case there should be an explosion, the doors would simply be blown open and would close themselves, doing no damage to the ventilating apparatus itself.

The last mine opened by this company, known as No. 12 Pratt mine, is substantially built, all the buildings being of fireproof construction. Fig. 6 is a photograph of the steel tipple at this mine. At another mine, known as No. 13 Pratt mine, now being opened, not only the buildings will be fireproof, but the shafts themselves will be concrete lined with steel guides and brick arches for a considerable distance from the bottom of the shafts, so that there will be absolutely no wood at all used in or about the shaft. There will also be at this mine a slope manway concrete lined so that egress from the mine will not be dependent upon any machinery.

First Aid Corps

For a month during the summer of 1909, Dr. M. J. Shields, at that time first-aid organizer for a number of anthracite

Fig. 6. The Headframe and Steel Tipple at No. 12 Pratt Mine

coal companies in Pennsylvania, now national organizer for the American Red Cross Society, was employed by this company organizing first-aid corps at all their mines. Since that time this work has been carried on at all the company's mines under the direction of the local physicians and superintendents. Figs. 7, 8 and 9 show some of the different first-aid corps at practice work around the mines. Fig. 10 shows two of the first-aid men practicing artificial respiration in the mine. This work has resulted in great benefit to the men, three lives having been saved by inducing artificial respiration upon victims of electric shock from 500-volt current, and, in addition to this, all the doctors report that victims of injury are coming to them in much better condition since the first-aid corps have been trained and on these

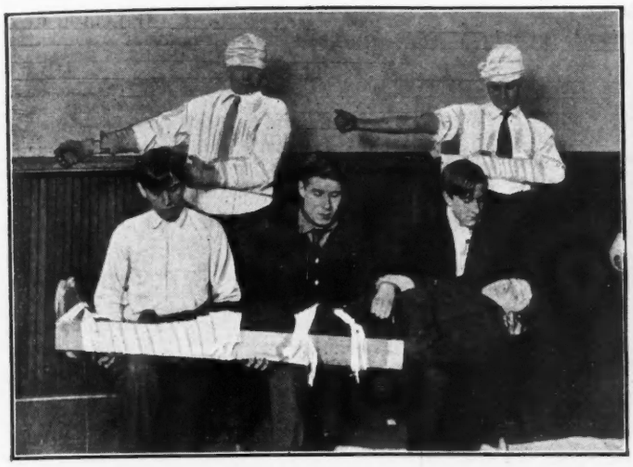


FIG. 7. FIRST-AID CORPS AT PRACTICE WORK AROUND THE MINES

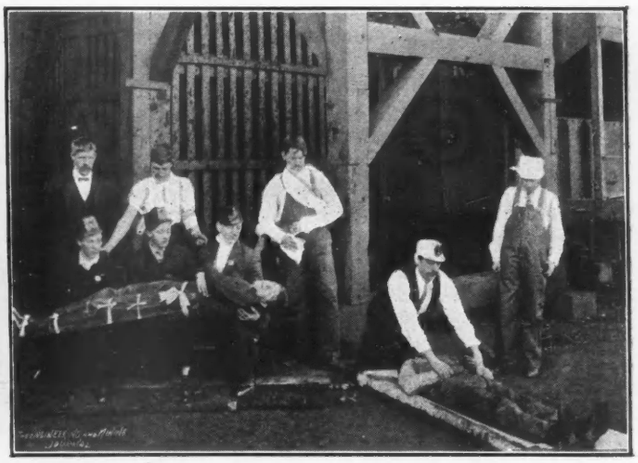


FIG. 8. FIRST-AID CORPS ARE ORGANIZED AT ALL THE COMPANY'S MINES

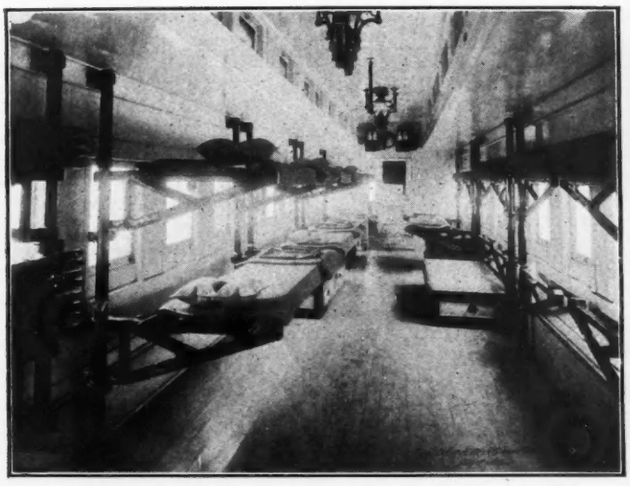


FIG. 11. THE INTERIOR OF ONE END OF THE EMERGENCY-HOSPITAL CAR

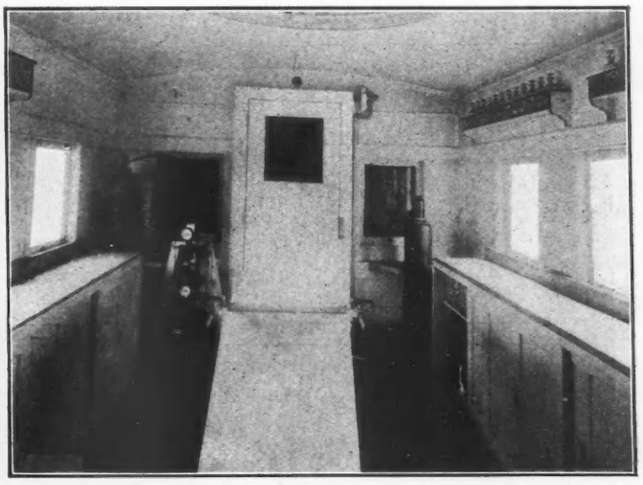


FIG. 12. SHOWING ONE VIEW OF OPERATING ROOM IN THE HOSPITAL CAR

FIG. 9. THE FIRST-AID WORK IS CARRIED ON UNDER THE DIRECTION OF THE LOCAL PHYSICIAN

FIG. 10. SHOWING TWO FIRST-AID MEN PRACTICING ARTIFICIAL RESPIRATION IN THE MINE

men recovery is frequently much more rapid.

A Hospital Emergency Car

This company has also equipped a hospital emergency car. This car is furnished with six sets of Draeger rescue apparatus, together with necessary electric storage-battery lamps, oxygen tanks for recharging oxygen resuscitating devices, and two pulmotors, which is the latest oxygen resuscitating device gotten out by the Draeger company. The car is also equipped with an operating table and necessary bandages, medicines, oils and sterilized water, stretchers, air pillows, blankets, etc., for caring for and transporting injured men in case of a serious mine disaster. Fig. 11 shows the interior of one end of the car, showing the arrangement of the brackets for holding stretchers when occupied, with boxes containing the resuscitating apparatus and supplies underneath. Fig. 12 shows one view of the operating room in the car, showing the operating table and the oxygen tanks and pump. Fig. 13 shows another view of the operating room, showing the operating table with hot water and sterilizing arrangements. Arrangements have been made with all connecting lines on which the company is operating coal mines for the prompt handling of this car in case of any mine disaster at any time, either day or night. At the time of the recent mine explosions at Mulga and Palos, Alabama, although these mines did not belong to this company, the car was offered and promptly rushed to the mine in each case. Fig. 14 shows rescue men, equipped with the Draeger apparatus, doing practice work in the mines.

At those mining divisions located some distance from the emergency car, four additional sets of the rescue apparatus, with necessary supplies and electric storage-battery lamps, and a pulmotor are being purchased for practice use and for use in case of emergency before the car could arrive.

This car is kept on a convenient sidetrack connected with one of the electric plants of the company, so that the storage batteries for the lamps are kept charged at all times, and the car is in charge of a competent man, so that all the apparatus and supplies are at all times in proper condition for immediate use.

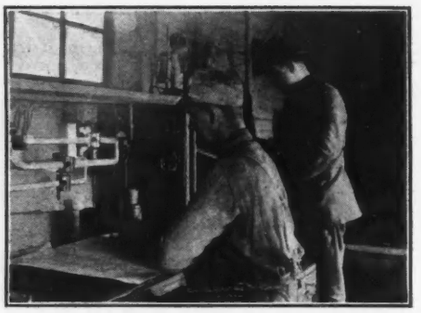


Fig. 15. Showing Company Weighman and Miners' Check Weighman at Work in Weigh Office on One of the Tipples

On all the mining divisions, hospitals are arranged for, and are in charge of the local company physicians; medical treatment is covered by the regular monthly assessment.

A Check Weighman is Appointed

In order that there can be no question of the fair and proper weighing of the coal, the miners at each mine, except the very smallest operations, are required to meet each six months and elect a check weighman from among the employees; it is the duty of this weighman to stay in the weigh house with the company weighman and see that the coal is fairly and properly weighed. Furthermore, the empty mine cars are weighed once each month, and as many miners as desire are invited to witness this weighing.

Free Lectures are Given

In addition to all of the above, the company has just employed a lecturer to give free lectures at convenient points on the different coal-mining divisions to the employees on questions of mining, dealing particularly with safety provisions, avoidance of accidents, proper handling of explosives, the causes of mine explosions, and proper methods to be adopted for preventing same.

A number of colored missionaries are employed by the company to conduct and promote reading classes among the colored employees and to endeavor to improve their general welfare, particularly their moral character and method of living.

Improvement of Homes

The Tennessee company is also engaged in putting fences around all of their employees' dwellings, so that they may not only have vegetable gardens, but keep their premises in neater and cleaner conditions; and, in order to promote the vegetable garden idea, prizes for the best, second best and third best vegetable garden, for both white and colored employees, have been offered, and seeds furnished by the company at cost, as set forth in the following notice:

"To Employees
Tennessee Coal, Iron and Railroad Company:

"As an incentive to cultivate truck gardens on the yards surrounding the homes of the employees of the mining departments, it has been decided to offer six prizes at each division, three prizes for the white employees, and three for the colored employees, offering for inspection the best garden of the season. The first prize of $25 will be awarded in each case for the best garden. For the second

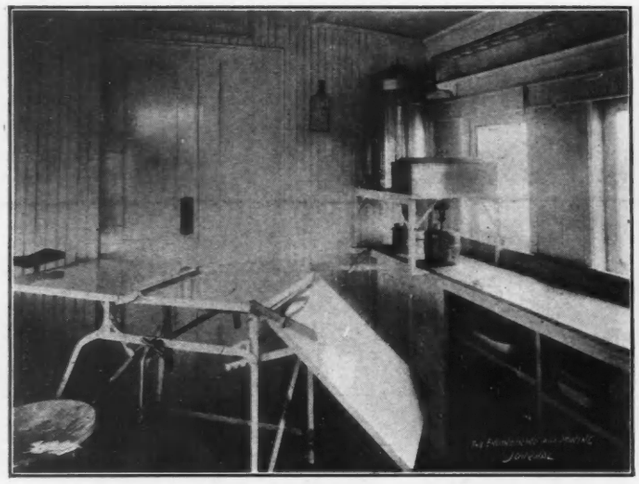


Fig. 13. The Operating Table with Hot-water and Sterilizing Arrangements in Hospital Car

Fig. 14. Rescue Men Equipped with Draeger Apparatus Doing Practice Work in the Mines

best garden, $15 will be awarded, and for the third best, $10.

"These awards will be made only to those employees occupying company houses.

"The awards will be made upon the recommendation of O. L. Ayers, chief agriculturist of this company, and a committee consisting of the chief clerks.

"There will be four inspections, occurring in May, June, July and August. The prizes will be awarded after the last inspection.

"The right is reserved to withhold the award in case there is not sufficient competition or in case the character of the gardens is such that they are not entitled to consideration.

"The commissaries will supply seed for use in this competition at cost.

"Salaried employees are not eligible.

"FRANK H. CROCKARD,

"Vice-president and general manager."

It is surprising to see the interest taken by the employees in this work and the vegetable gardens now surrounding the employees' dwellings. This has also had the effect of making the employees take a pride in their surroundings and keep their homes and yards in a much cleaner and more sanitary condition.

Ignition of Coal Dust by Single Electric Flashes

Dr. W. M. Thornton and E. Bowden, of the Armstrong college, Newcastle-on-Tyne, are jointly responsible for a paper bearing the above title which was considered at the April meeting of the North of England Institute of Mining and Mechanical Engineers. Taking the point of view of the electrical engineer, the paper constitutes an examination of the properties of coal dust under electrification, and an investigation of the conditions under which a cloud of dust can be ignited by single electric flashes. The authors experimented with a mixture of three typical dusts from different seams, and by mixing these dusts they claim that the uncertainty of depending upon any one dust has been averaged. They did not sieve the dust before use, and it contained 10 per cent. of ash chiefly calcareous.

Coal in bulk, or dust, is not a conductor of electricity, but it is mentioned that if a paste made of coal dust and water is placed between terminals 1 in. apart on a marble base, and electrified either by direct or alternating pressure at 480 volts, a remarkable change takes place. Sparks pass through the substance of the paste, and eventually a large flash strikes across, short circuiting the terminals. The result is probably due to the establishment of a line of carbonized particles of the dust short-circuiting the terminals, but while venturing this suggestion the authors say the cause has not yet been determined.

THE RESULTS OF ACTUAL TESTS

Trials were made to examine the effect of changing the percentage of volatile matter in mixtures placed between terminals ¾ in. apart at 480 volts direct current with the following results:

Mixtures.	Effect
(a) Mixture of coal dust and pentane	No effect.
(b) Mixture of coal dust and methylated spirits	Slight sparking.
(c) Dry powdered shale	No effect.
(d) Wet powdered shale	Steamed and sparked slightly.
(e) Powdered coke; loosely sprinkled	No effect.
(f) Powdered coke, pressed together	Sparked, flamed and flashed over.
(g) Wet coke dust	Steamed, but did not spark or flash.
(h) Powdered arc-lamp carbon	Sparked and flashed over.
(i) Powdered carbon brushes	Sparked and flashed over.
(j) Damp, wet or very wet sand	Steamed, and dried but did not flash.

To produce a coal-dust explosion experimentally, the cloud of dust must not be too thin or too dense. In the former case a local ignition is extinguished by the cooling action of the air, in the latter by the products of combustion. The space also in which ignition occurs must not be too confined. Electric flashes can be produced by the mechanical breaking of the circuit or by the fusing of a wire, but the latter is not very likely to occur in a dangerous place in coal mining. Concentrating attention upon flashes produced by the quick breaking of circuits under different conditions of voltage and current, the object of the authors was to find the smallest current which would fire dust and if possible that which always caused ignition. As a result they show that the increase in percentage of ignitions is proportional to the increase in current. It is not proportional to the power of the flash, but to the product of this and the voltage. For a given voltage it has a definite relation to the current; so that the risk of ignition is proportional to the volume of the flash.

COMMUTATORS MUST BE KEPT CLEAN

The necessity for keeping commutators clean, especially the small gap between live copper and the frame, is emphasized, while distributing boxes should be dust and flame tight and in compartments so arranged that the main terminals cannot be short circuited by a flash. The use of cartridge fuzes where possible is recommended, the authors say that once used, these latter should not be replaced by bare wire or by running wire through an empty tube.

The conclusion is arrived at that momentary arcs produced by break of cables or conductors can ignite dust, but the current required to do so is very much greater when the voltage is low, and at moderate voltages is greater for alternating than for direct current. This suggests to the authors that the arrangement most satisfactory from the point of view of safety, both for flashes and for shocks, is high-tension transmission to a substation or transformer house. Probably with cables well enough armored to prevent any external flash, and quite low-tension local transmission for power and lighting. Series lighting with incandescent lamps is not recommended.

WHEN CAREFULLY USED ELECTRICITY IS NOT DANGEROUS

In concluding their paper, Messrs. Thornton and Bowden say that although it has been shown that a cloud of coal dust can be ignited by small single flashes, and the degree of probability has been found for most cases likely to occur in practice, it does not follow that the use of electricity in collieries is dangerous. Electricity is no more dangerous than the supply for domestic use of highly poisonous and explosive coal gas. An efficient leakage-indicator is equally necessary for both. No indicator will prevent risk from sudden breakage of either pipes or cables, but in the electrical case there is the advantage that the main supply can, if desired, be cut off by a small leakage of current.

The risk that any user of electricity is willing to take must be based on his own view of the chance that conditions favorable to ignition may not occur at his plant. To a great extent this is a question of suitable design and of revision of obsolete designs. It is equally one of efficient supervision by skilled men, and of regular attention to the machinery and transmission system.

The authors do not profess that their paper covers the whole ground, not that the results can be regarded as absolute, for although they have been made with standard dusts for the North of England, lower percentage of ignition would probably be obtained with anthracite and higher with brown coal.

Coal Output of Missouri for 1909

The output of coal for Missouri during 1909 shows an increase of 386,787 tons over 1908. Macon county, which, for a number of years ranked first in the production of coal, shows a decrease of 34,224 tons for 1909. Lafayette county, the second largest coal producing county in the State, reports an increase of 152,020 tons, while Adair county, which in 1908 was practically on a par with Lafayette county, produced 114,814 tons less in 1909 than in 1908.

Beside the big increase in production reported by Lafayette county, other counties showing substantial gains in production are: Barton, Clay, Henry, Howard, Linn, Montgomery, Platte, Ray and Sullivan. The selling price of the coal at the mines will probably show a slight increase over the price received in 1908.

Lessons from Coal Dust Explosions

Summary of Conclusions of British Mine Inspectors on the Explosion at Darran Colliery in the Cardiff Inspection District, October 29, 1909

RESCUERS USELESSLY SACRIFICED

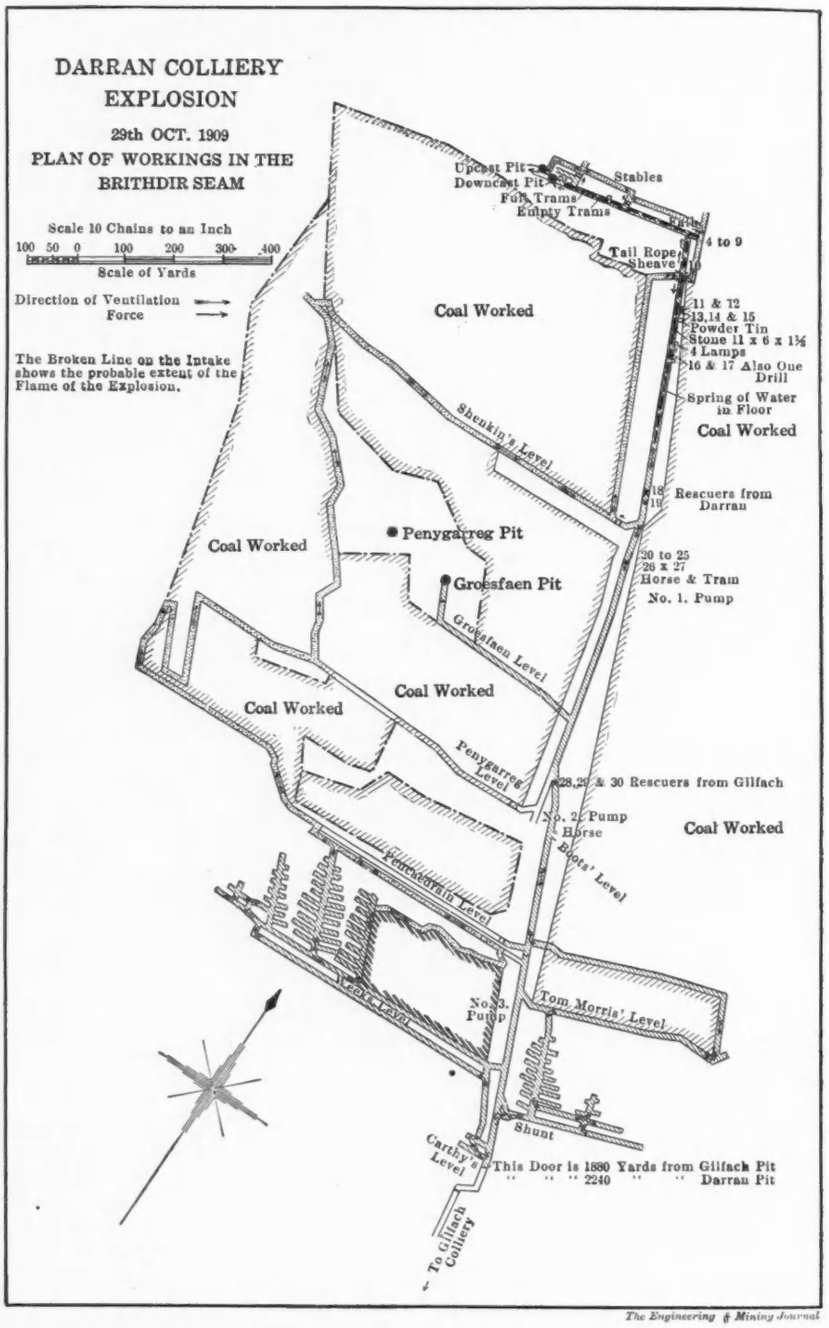
The report on the Darran explosion has been prepared by W. N. Atkinson, and Fred A. Gray, inspectors of mines in the South Wales coal-mining district.

The Darran colliery, situated at Deri, in the Bargoed Rhymney valley, has a working staff of 272 men and a coal output averaging 400 tons per day. The shafts, of which there are two, are about 17 yd. apart and go down 111 yd. to the Brithdir or No. 2 Rhondda seam. There is also an underground connection with two other shafts belonging to the Rhymney Iron Company, Ltd., which is the owner. One of the latter shafts is at Gilfach colliery, to the south of Darran, and 24 of the men working at Darran at the time of the explosion escaped from Gilfach; however, further efforts to rescue others from this shaft were unsuccessful, and indeed resulted in the loss of three of the explorers. Notwithstanding the loss of these three lives, the inspectors indicate that the explosion furnishes an instance where the connection of the workings of two collieries enabled a number of men to escape who would otherwise probably have lost their lives.

The Brithdir seam is about 3 ft. 10 in. thick with a good roof of strong shale or sandstone rock, the workings in operation being all to the dip and at a considerable distance from the shaft. These workings were reached by an engine plane, called the drift, driven in the seam for 1940 yd. from the pit level. The seam was worked by a modification of the room-and-pillar system. Levels were driven to the east and west from the engine plane at intervals of 220 to 300 yd., and headings were driven off the levels to the rise about 100 yd. apart. To the east and west of these rise headings, rooms were driven, and the pillars (about 10 yd. wide) were secured through a subsequent operation.

Firedamp Was Never Detected

The colliery was ventilated by a Schiele fan 6 ft. in diameter, fixed near the top of the upcast shaft and driven by a steam engine. It ran at 300 r.p.m., and produced about 20,000 cu.ft. of air per minute, with a water gage of 12 in. The mine produced a considerable quantity of water which was drained to three pumps worked by compressed air, and by them forced to the shaft, where it was raised by a pumping engine on the surface. Naked lights were used throughout the mine, and during the whole life of the colliery, firedamp had never been detected, while none was observed after the explosion. Blackdamp was found in old workings and unventilated places.



The Engineering & Mining Journal

PLAN OF DARRAN COLLIERY, SHOWING DIRECTION OF AIR CURRENT, INDICATIONS OF FORCE AND POSITIONS OF BODIES

Attached to the report, which, of course, has been submitted to the secretary of State for the Home Department, is a plan (see accompanying figure), showing the shafts, roads and workings, the direction of the air current and of indications of force, and the positions (denoted by numbers) in which the bodies were found. The plan also shows the road leading to Gilfach colliery.

The inspectors say that the major portion of the roads and workings were wet

or damp, but portions of the main intake and haulage road were dry and dusty, and it was on this road the explosion occurred. In the vicinity of the downcast shaft the road was wet and from the shaft to the top of the drift, the floor was partly wet and partly dry and dusty. The main drift was dry and moderately dusty for about 300 yd. from the top, and from that point the floor was wet for a considerable distance; the roof and sides gradually became damp also. The return airways and workings generally were damp and free from coal dust.

Coal Is Dropped from Cars

On the dry portion of a haulage road, the coal dust was produced from dust and coal which was blown and fell from the cars. The ordinary cars in South Wales drop much coal and dust all the way from the face to the shaft. Comparatively speaking, however, no part of the road was excessively dusty nor was the dust of a particularly fine and dry nature. The following is an analysis of the coal producing the dust:

ANALYSIS OF COAL.

Volatile hydrocarbons	21.64
Fixed carbon	70.13
Sulphur	2.01
Ash	4.92
Moisture	1.30

The rescue operations are surveyed in detail by the inspectors, which they say add another to the many previous examples of the great danger of advancing into air contaminated with afterdamp. The five would-be rescuers who lost their lives were not afforded the protection of breathing appliances, a manager, an undermanager, two firemen and a contractor sacrificing themselves in consequence. The report says that such hasty procedure not only endangers the lives of the explorers, but may delay and derange the course of properly conducted rescue operations.

The Danger of Carbon Monoxide

It should be remembered that carbon monoxide may be present in dangerous proportion without affecting lights, and that inexperienced persons are therefore liable to run into danger. As pointed out by Doctor Haldane, the eminent British authority, the only practicable indicator of this gas is a small animal such as a mouse or canary, the suggestion seeming to be that one should be taken down by persons responsible for exploration and rescue operation after explosions and fires.

Besides, the effect of carbon monoxide is cumulative, and if the rescuers advance until only slightly affected, the difficulty in retracing their steps to pure air is often very great; in some cases disablement comes on suddenly. The inspectors are emphatic in their declaration that in the Darran explosion, when it was seen that the men at the top of the drift were killed and the air bridge destroyed, no further advance should have been made until the ventilation was restored.

Explosion Caused by Misplaced Short

Regarding the cause of the explosion, a fall had occurred on the main drift, and a fireman seems to have fired four charges of powder on the stone to break it up, thus firing the dust. This stone, which had fallen from the roof, was found on the main drift about 200 yd. below the turn. It was irregular in shape, but 11 ft. 6 in. on the longest side by 6 ft. 6 in. at the widest part, and about 2 ft. thick on one side tapering to thinner edges on the other side and ends. The positions of the men above and below this fall of stone, and of the tools near the stone, were consistent with the firing of a shot, and in the absence of any other probable means of ignition, the inspectors think there is no reasonable doubt that the explosion was caused by the firing of an explosive on the fallen stone.

They say that apprehension of the dangers of coal dust has not become general among miners. The fireman no doubt knew that it was contrary to rules to fire explosives except in a shot hole, but it is probable he did not realize that the result might be a disastrous explosion. The practice of breaking falling stones by explosives, even when in shot holes, is a dangerous proceeding when dry coal dust is present, and in such cases should never be undertaken without copious watering.

Moral Revolution in Anthracite Mining

BY P. M. GREER

There may be a moral as well as a mechanical revolution in mining, and of the two it is probable the moral revolution will be more important in the end than the mechanical. When I came to the anthracite regions 10 or 12 years ago, the moral conditions throughout the entire field were about as bad as they could be. I could walk into any street in the vicinity of the breakers in the city of Scranton, Penn., and discover without trouble that every fourth house in the place was a "speakeasy," an unlicensed bar for the sale of intoxicating drink to miners.

These places were entirely patronized by miners, and so long as a man was working he obtained credit for as much drink as he was able to consume. The result of this open and flagrant traffic in drink seven days in the week was that the mortality at the mines increased by leaps and bounds. Scarcely a day passed in which any particular mine did not pay its tribute to the "speakeasy" in the death of a miner or his laborer, usually a man in the prime of life, and frequently with a family dependent upon him.

But this was not all; while death claimed its toll, disabling accidents, accidents that did not end fatally, became so common that they were scarcely noticed. The homes of the miners also were quite unsightly. If a miner built his home, that too often was as far as his thrift extended. He took no pride in his homestead or its surroundings. To live in a "shack" seemed to be the climax of his ambition and of his esthetic susceptibilities. I am not discriminating between the foreigner and the English-speaking miner. One was nearly as bad as the other. There were conspicuous exceptions as there always are, but these only accentuated general conditions.

Conditions Were Painted Black

During the period of the great strike in 1902, the anthracite regions were invaded by hordes of special artists, photographers and writers who depicted the social condition of the anthracite miners "at home" as black as pen and ink could make them. I am aware, of course, that they exaggerated, that they selected the particular and salient features that suited the exigencies of the magazines or newspapers that they represented; but allowing for this, I do not think they consciously exaggerated things as they stood, for they had absolutely no need to do so.

Now all this is changed, changed from top to bottom. I think that I am correct in saying that there is not a "speakeasy" in the city of Scranton. Certainly, if there is, it is not patronized by the miner. There are any number of licensed saloons, more or less reputable, but as far as I can discover, except where foreigners mostly congregate, their patronage is general, not particular.

The average miner within the past decade of years is morally metamorphosed and he not only shows it himself, but it is demonstrated even more fully and happily in his environment. He pays as he goes along. He is not in debt to the "company store" or the "speakeasy" proprietor. He is master of his own destiny in this as in so many other respects which consequentially follow from it. He

has his bank account. He does not put his vote up to auction for any man. He is now a good citizen. He has a genuine appreciation of the marketable as well as the social value of morality and individual character. He despises a grafter as much as a professional reformer pretends to do.

The Foreign Miner Has Also Improved

While in some respects the foreign miner has not kept pace with the English-speaking miner in this moral revolution, he is by no means unaffected by it. He is receiving the full benefit of the abolition of the "speakeasy." Although he drinks far too much as it is, he is drinking less than he used to do. His children are the peers of any of any nationality in the country in intelligence, vivacity and receptivity. The reaction of the child's culture is apparent on the parent to an astonishing degree. The children have set their faces against many of the proclivities of the parents, and the alderman's court and its deeply demoralizing concomitants are becoming happily a thing of the past, or at least to a considerable extent. These statements are not theoretical generalizations; they are observable facts.

The moral pulsations of a revolution in any manifestation of human life are, when all is said and done, its reality. But in the mining field, this moral revolution of which I speak has had its tangible economic effects. In the first place, a sober, self-respecting miner is altogether a different economic factor than when he is the reverse. He accomplishes more work; he does it better, and in the mines and out of them, he is infinitely less a danger to himself and a menace to his fellows. Although fatalities in the anthracite mines are still much larger than they should be, it is an unquestionable fact that the loss of life per thousand tons, or whatever the unit of measurement taken, has sensibly decreased during the past 10 or 12 years. I refer, of course, to preventable accidents, the accidents which many designate the "will of God" for want of a more scientific system of terminology.

Fatalities Are Result of Ignorance and Carelessness

Accidents in mines, or at least in our mines, that are preventable, arise from ignorance, carelessness and any predisposing cause that produces these factors. No drunken miner would, at present, be permitted to enter a mine under any circumstances if the fact were known to the mine foreman or any other official responsible for allowing him on the cage. It is unquestionably a fact that in days gone by, after the monthly pay day, thousands of miners were carried to the foot of the shaft who were no more in a condition to enter a mine than they were to enter paradise, and their one anxiety when they got underground was to fire their shots and get out again to obtain an "eye opener."

Now miners in this condition invariably neglected the most eleme tary precautions, such as securing the roof and rendering their chambers safe. At present, the gradual diminution of drunkenness among miners is bringing to the front a class of men in the mines who are realizing their responsibility as workmen and acting on their appreciation of the fact. This is a matter of first-rate importance to the operator from an economic standpoint. A fall of roof in a chamber handicaps the place to a considerable extent. It generally takes days to place the room in a fit position for a man to enter again.

There is an unfortunate tendency among mining men only to look at the broad effects, technical, scientific or commercial, of particular incidents or policies when discussing industrial problems in public. But, after all, as in other walks of life or work, it is the small and relatively unimportant details that tell most surely by their cumulative effects in the end.

I attribute a good deal of the moral revolution that has been effected in the mining communities in the anthracite regions to the disappearance of the "company store." It was an unmitigated curse, worse in my judgment than either the "speakeasy" or the licensed saloon. During the time that the "company store" was an existing institution in the mining regions, the average miner, who was of a spendthrift, happy-go-lucky disposition, was from one payday to another actually a pauper. He knew that he could obtain the essential provisions for himself and his family from the "company store," that he had to get them there or starve, and for the rest, what did it matter? He had no incentive to save, for the bill of the company store practically ate up his pay, and any ready cash that he handled went for the most part to "pay his grog bills."

The Breaker Boy

The breaker boy has participated in this moral revolution as largely, if not more so, than his father. He no longer enters the breaker at the age of eight or nine, and works there until he graduates as a mule driver and later a full-fledged miner. The commonwealth has taken him under its wing. He cannot enter a breaker to work until he is 14, or enter a mine until he is 16. The mine inspector sees to it that before he enters one or the other that he is not only able to read and write, but able to do so with facility. We shall have no more young men, who began life as boys in the mines, having to confess when the occasion required that they could neither read nor write. The breaker boy is having his chance in the progress of this moral revolution and he is availing himself of it to the limit of his opportunity.

This moral revolution that we see going on around the anthracite mines is not of equal intensity all through, but is in progress everywhere. Moreover, it has only begun. The inertia has given way to a movement actual and potential. It needs direction and should receive more of it than it has done in the past from the official operator.

Anthracite Breaker Fires

Special Correspondence

During the last twelve months, an unusually large number of anthracite breakers and washeries have been destroyed by fire. The financial losses involved in the destruction of this property must have amounted to millions of dollars, while the loss in wages to the miners thrown out of employment amounted to an equally large sum.

The question arises, how far were these fires inevitable in the accepted sense of that term; how far were they due to sheer carelessness, and how far were they attributable to incendiarism? A certain number of breaker fires were, and will be, unavoidable, so long as breakers are an integral part of mining machinery. It may also be assumed that a few, a very few, were attributable to incendiarism. But by far the larger number of the fires that have occurred in breakers were entirely preventable.

A breaker is a complicated structure. It contains a large amount of valuable machinery. It is lighted invariably by electricity. It is built of wood. Many of the breakers were erected years ago. They are saturated with oil and coal dust. Boys or young men are hastily employed in them. The watchmen are not as they should be, selected for any special aptitude that they possess as wakeful and watchful guardians. Boiler houses, engine houses, blacksmith shops, clerical offices and powder shanties are frequently in the immediate proximity of the breakers. All these factors are a menace to the life of the breaker, and one or the other of them eventually bring about its destruction by fire.

The Breaker Should Be Isolated

It is necessary, of course, that the breaker should be in the immediate vicinity of the shaft. Is it necessary, however, that the other buildings should be so close to it that for all practical purposes they are associated with it as if on one foundation? There is no question but that it is better to have the breaker building isolated, so that if any of the neighboring buildings catch fire, the destruction of one would not endanger or involve the destruction of the breaker.

Concrete Too Expensive

Although lumber is not yet as expensive as other building materials, the time is coming, if it has not already arrived, when a modification in the design and building material of breakers must be adopted. It seems at least that the more vulnerable portions of a breaker could be sheathed with sheet iron or lined with brick. This is never done. The materials used in the newest and most elaborately equipped breakers is still unprotected lumber in the body of the building. There have been some suggestions made by mining engineers that breakers should be built of concrete, however, unless new and extensive coal seams are discovered the expense of concrete breakers will be almost prohibitive.

At any rate, to secure breakers from periodical destruction by fire should not be beyond the elementary resources of architecture and mining engineering. Every breaker burned involves a loss to the mine proprietor of from one-half to three-fourths its value, as well as the value of the machinery which it contains. Insurance companies are very chary in issuing polices on breakers, and they cannot be blamed for this precaution. The average life of a breaker probably does not exceed 10 years. The insurance risk taken, therefore, is out of all proportion to the value of the property on which the policy is issued.

Partially lining the more exposed points in a breaker, that is, those places most exposed to sparks or the carelessness of those employed in them, with sheet-iron or brick or fireproof varnish, would largely minimize those risks without involving any great expense.

At the present time, a concrete breaker is in course of construction for the Lackawanna company at Taylor, near Scranton, Penn. This is an experiment. When the breaker is finished, it will be the only one of the kind in the anthracite region, although the mine shafts are now invariably lined with concrete and have proved satisfactory. The Lackawanna can afford the experiment; few other operators can.

A New Type of English Safety Mine Lamp

In view of the number of explosions in coal mines, Consul Benjamin F. Chase, of Leeds, England, has investigated a British safety lamp for miners, which cannot be relighted except under conditions which make it free from dangers. The consul witnessed practical demonstrations of the lamp, and describes it:

The body of the lamp is cast from brass and the globe-holding ring is made in the same way. The safety gauze, which is of the regulation gauze or perforated copper, is shielded from accident by a steel hood. The lamp is so constructed that the absence of any material part prevents its locking, and it is therefore unlikely that it would be lighted and delivered to the miner unless it is in proper condition, i.e., has the gauze in place. The lock is composed of two pieces of iron with a coil spring connecting and can only be released by using an electro-magnet much more powerful than an ordinary hand magnet.

By the testing process through which each lamp is put, any defects which take away the safety are exposed. The lamps are tested by a machine which produces a mixture of gas and if there is any defect in the gauze which would produce an explosion it is disclosed. This appliance is also simple of operation and is made for use at the mine. The oil-filling machine works semi-automatically.

The lamp can be lighted instantly on the machine which goes with a complete outfit, and a relighting machine for use underground is so arranged that it cannot be operated until all danger of contact with outside gases is removed.

A Magnetic Lock is Provided

The lamp has the general appearance of other safety lamps, but has some special features, to wit, a magnetic lock which cannot be opened without the use of an electro-magnet so that men cannot open it in the mines and it does not require lead locks or keys; a wick tube which makes the process of examining the wick or rewicking simple and easy; an electric lighting pin, which makes it easy to light the lamp, after being put together on one of the lighting machines which are for installation at the mines; also a simple device for snuffing the wick. It also has a spring valve on the oil bowl which makes filling an easy process. With these conveniences the lamp, when cleaned and put away, needs no attention until the man is ready to go to his work, when it can be instantly lighted and is secure.

Unlocking and Lighting Devices

The unlocking machine is composed of an electro-magnet, which is put in contact with the bolt at the base of the lock and presses it until contact is made with the lock bolt and the lock is released, and by a turn the globe and gauzes are removed.

The lamp-lighting machine for use in the office or lamp room is so arranged that by placing the lamp on a plate provided for it and depressing the same, a current is formed and the lamp is lighted ready for use. A relighter for use in the mine is so constructed that before the contact can come the receptacle is closed and flame tight.

This relighter can be operated by the men underground with perfect safety. It is composed of a lamp chamber over the generator and coil chambers. The lamp is placed in position, the door closed, and the body of the chamber has to be revolved to a point which takes away all danger of gas connection before the electric current will act.

While many of these lamps are in use in England and other parts of the world, no attempt has yet been made to introduce them into America. The makers claim that no disaster from gas explosion has ever occurred in a mine fitted up and using their appliances, and an examination of the process of manufacturing and the safety appliances in use in connection with these lamps would cause one to believe that this claim is well founded.

The important feature of these lamps is the fact that when lighted and locked, which is the work of an instant, the miner has no means of exposure to danger by thoughtlessness or inquisitiveness, and no companion can furnish a key by which the lamp can be unlocked. They seem to be made with the object of perfect safety and to meet that requirement.

Demonstrations to be Made in a Number of Gaseous Mines

In addition to the foregoing, the Bureau of Manufactures has a letter from Ackroyd & Best requesting that the firm be placed in communication with owners of mines in the United States, and especially of "gassy" mines, with a view to making practical demonstrations of their safety lamps. It is proposed by the firm to send several sets of the devices in charge of their representatives.

Mining authorities of Pennsylvania and West Virginia have been notified of the desire of Ackroyd & Best, and it is probable arrangements will be made to have the lamps tested in May. The United States Geological Survey is engaged in a special investigation of safety devices for mines, and Director Smith will include the Ackroyd & Best lamps in this inquiry. Consul Chase furnished the Bureau of Manufactures with several of the safety lamps and appliances, and also a number of photographs, which have been turned over to the Geological Survey.

Modern Method of Plumbing a Shaft

Details of System Employed in Anthracite Field, where Steel Wires Are Preferred to Copper, and the Plummets Immersed in an Oil Bath

BY JOHN P. DAVIS

When an outside survey is to be connected with an inside mine survey, it should be connected to all the corners of the boundary lines of the property and should also be closed within a reasonable limit. The stations used in plumbing a shaft are usually located within a few hundred feet of the shaft and are generally put in with car axles or iron pins, 1 to 2 in. in diameter.

Fig. 1 shows the plan of a typical method of plumbing used in the anthracite coalfield of Pennsylvania. The set-up is made on station x, which is from 10 to 25 ft. from the shaft, according to local conditions. The letter s indicates a spad placed obliquely on the near side of the shaft so that when the wire is hung, it may be sighted under the spad from the set-up at x. Then by raising the objective glass of the telescope, a spad s is put in in the same straight line, and station $x\,s$ is produced. These spads are usually placed as far apart as practicable so as to get a maximum distance between the two wires. Then sights to A and B are repeated so as to secure as great accuracy of the azimuth as is possible. Measure the distances $X\,A$ and $A\,B$ at least twice, each time by a different party to eliminate the personal equation. Then coördinate values for the points A and B are determined, and the azimuth of the plane formed by them is known.

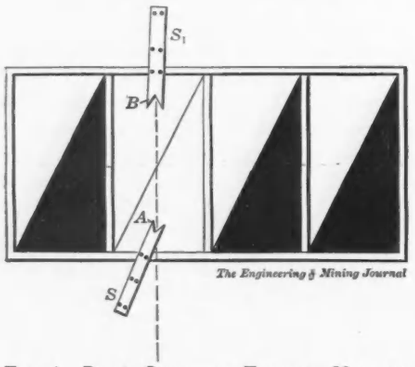


FIG. 1. PLAN SHOWING TYPICAL METHOD OF PLUMBING

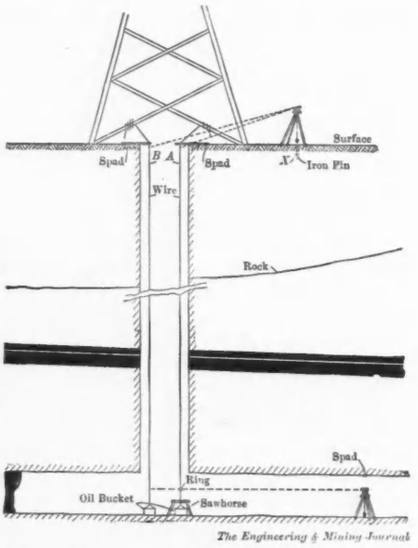


FIG. 2. SECTION OF SHAFT AND ARRANGEMENT OF PLUMBING APPARATUS

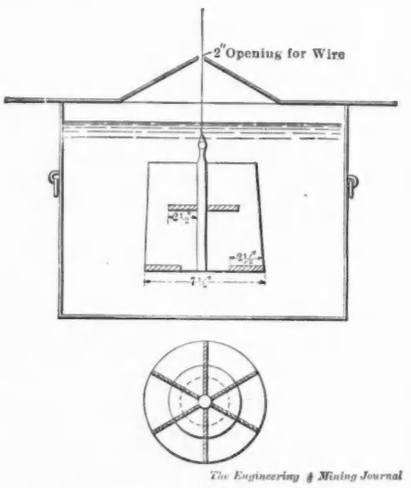


FIG. 3. SHOWING DETAILS OF PLUMMET ATTACHED TO END OF WIRE

THE PARTY GOES UNDERGROUND

Now the cage is slowly lowered with the party which consists of at least four men, while a man at each spad on the surface holds the reel end of the wire. Occasionally the wires are hung on the spads to see that they hang without interference.

Heretofore copper wires were used for this purpose, but on account of its elastic nature and low tensile strength, steel wires are used for shafts over 400 ft. deep.

Fig. 2 shows a section of the shaft and the general arrangements of the plumbing apparatus. The plummets shown on Fig. 3 are attached to the end of the wires. They are immersed in a liquid, either water or oil, the latter preferred on account of its viscosity. The plummet is made of cast iron, 7½ in. diameter at the bottom and 6½ in. at the top, and 12 in. high. The wibs are ¼ in. thick and 2½ in. wide. The spiders are ¼ in. thick and 9½ in. high. Its weight is about 18 lb. Fig. 4 shows an ordinary light sawhorse, 3½ ft. high and 3 ft. long at the top. On one side of it a foot rule is attached, as shown in the sketch. The use of the sawhorse will be described later. Fig. 5 is a spad upon which the wire is hung on the surface. It is usually made of ¼-in. iron plate, about 3 ft. long and 3 to 4 in. wide, and is provided with 6 holes for nails.

SETTING THE PLUMMET

The plummets are attached to the wires A and B and placed in the buckets, as shown at the bottom of the sketch, Fig. 2. At the end of the wire A, a ring is attached and the plummet is fastened to this ring by means of a string. The use of this ring will be described later.

The next move is to adjust the plummet and bucket carefully so that the former is free to swing in the latter. Now place the bucket directly under the moving plummet. When the latter begins to swing back and forth, steady it with the hand. In the meantime set the transit about 50 ft. from the wire in the plane of the wires A and B. Now place the sawhorse within ¼ in. of the wire and note the swing on the foot rule and bisect the swing about as follows:

Left.	Center.	Right.
3½ in.		7¾ in.
3¼ "		7½ "
3⅛ "		7⅛ "
3 "		7 "
2⅞ "		6⅞ "
	4⅞ in.	

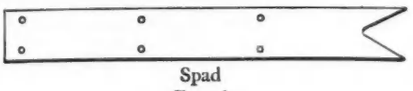
From the above observations the final resting place of the "bob" is 4⅞ in. Now bring the wire slowly and carefully to 4⅞ in. and let it hang and swing. If it remains stationary, we have accomplished our desire. If it swings again, it is due to the vibration of the wire. In the same way the plummet on the wire B is adjusted. Now sight to wire A and then focus to wire B. If the set-up is not in the plane of the wire, then note the angle between the two wires, say, the wire B is 30 min. left of the wire A. Since the set-up is about 50 ft. from the wire, the transit will have to be moved to the right 0.44 ft. Make a point on the floor at the transit and measure off 0.44 ft. to the right at right angles to the plane of the wires and set the transit up on the new point.

ADJUSTING THE TRANSITS

Adjust the transit and sight to wires A and B as before. The instrument is

then nearly in the plane of the wires. Now move the head of the transit to the right and left until it is in the line of the wires. When a sight to the wire *A* is taken, it will be noted that *B* cannot be seen. This indicates that the wire *B* is just behind *A*, so the sight will have to be taken through the ring, as shown in Fig. 2. After securing the observations on the wires, the distance between the two wires is measured to check up the measurement taken at the surface and also from the set-up to the wire *A*. Now cut at least two stations in the roof, each at least 50 ft. apart, and sights and measurements are taken as usual.

After these observations are noted, drill a hole about 1½ in. deep over the transit, then drive a plug into it. The plug is centered by an ordinary spad and hang the plumb-bob in the spad so that it hangs directly over the center of the transit. Now move the transit to station 1 and backsight on the spad and foresight on station 2. In the same way the instrument is set up at station 2, and backsight is taken on station 1 with foresight on the spad. Stations 1, 2 and the spad form a triangle, and the sum of the interior angles of the triangle equals 180 deg. The plumbing of the shaft is completed and the plumbing apparatus should be disconnected.



Spad

FIG. 5

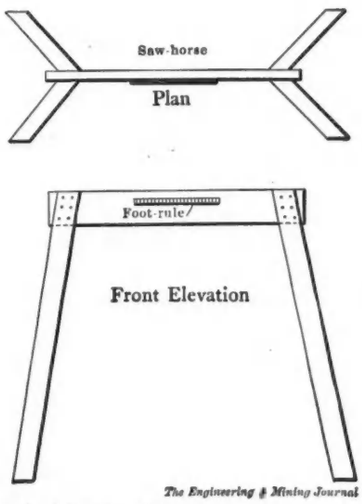


FIG. 4. SKETCH SHOWING ORDINARY LIGHT SAWHORSE

CARRYING THE ELEVATIONS UNDERGROUND

Now measure the depth of the shaft from the top of the rail outside to the top of the rail inside. If the depth of the shaft thus obtained is 395.75 ft., also assuming that the bottom elevation at the set-up under the spad is 1 ft. higher than the rail at the foot of the shaft, and further that the roof distance from the rail to the spad is 6.25 ft., then the elevation of the spad is 111.50 ft., if the elevation of the outside rail at the shaft is 500 ft. The elevations of station 1, 2, etc., can be calculated as usual. The inside surveys are then extended from these stations.

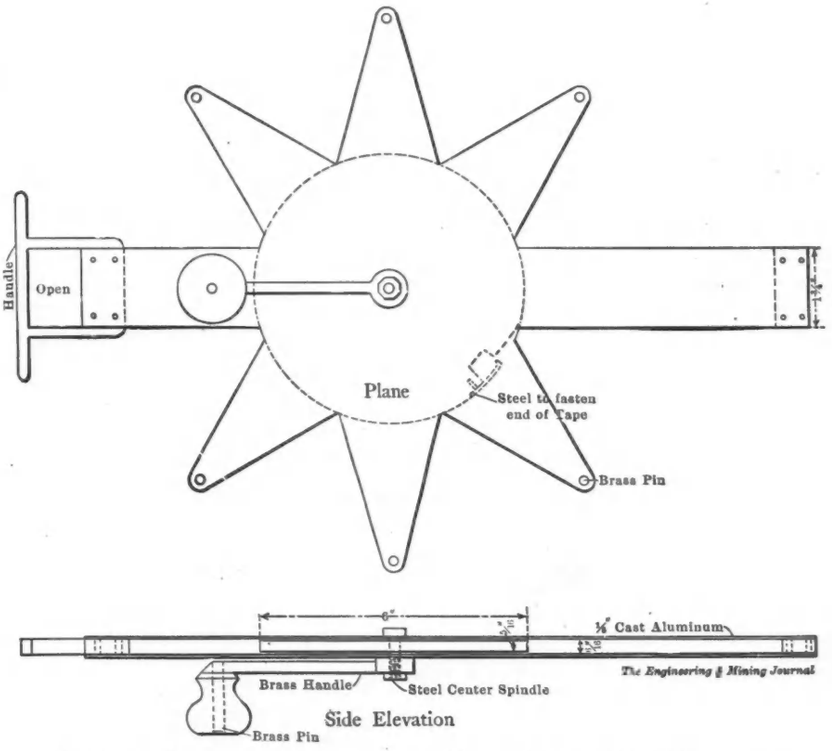
ONLY ONE WIRE IS REQUIRED IN SECOND PLUMBING

Since the azimuth and coördinate values of the wires are known, the coördinate values of the spad stations 1 and 2 can be calculated as usual. This concludes the first plumbing. When the underground workings are connected with a second opening or an air shaft, another plumbing is necessary to check up the first one. In this case only one wire is required. So far as the general method is concerned the second plumbing is identically the same as the first one. The outside survey should be connected to the former plumbing.

The station upon which the instrument is set up should be within 50 ft. of the shaft; from this set-up it is advisable to sight to the wire which is hung on a spad as previously described and then measure the distance from the set-up to the wire. Next, calculate the coördinate values of the wire. In the same way determine the coördinate values of the same wire underground. If the outside and inside values do not check up, it is necessary to make two calculations to determine the course and distance between the last wire and the wire *A* of the former plumbing, one using the outside values and the other all the inside values. If there is more than 3 min. difference in the courses—outside and inside—the survey should be repeated.

A New Reel for Mine Surveying

The accompanying sketch illustrates an aluminum reel manufactured by the American Safety Lamp and Supply Company, Scranton, Penn., for use with steel tapes, such as are used in surveying in the anthracite mines of Pennsylvania. The advantage of this reel over many other forms, is that it is light, its weight is only 2½ to 3 lb. It is also compact, so that it is easily carried up a steep pitching place. It is designed in such a way, that the wear and tear and injury to the tape is reduced to a minimum. The side pieces of the reel are ⅛-in. cast aluminum and are riveted together by brass. The drum is also made of aluminum, being 6 in. in diameter and having a face 5/16 in. in width. On the circumference an arrangement for fastening the end of the tape is provided, with a steel strip and screw, as shown in the plan. The drum revolves about a spindle ¼ in. in diameter. The arm and handle of the drum are made of brass. This arrangement of the reel allows the tape to wind one wrap on top of the other. The reel holds a 300-ft. tape.



SKETCH OF ALUMINUM REEL FOR STEEL TAPES USED IN MINE SURVEYING

Methods of Mining Lignite in Italy

The Principal Steel Works of Italy at Terni, Producing Armor Plates for the Italian Navy, Depends Almost Entirely on Lignite for Fuel

BY CHARLES R. KING*

The small amount of coal produced in Italy, although not thus detailed in the usual lists of the world's production of black coals, is practically all lignite. This lignite comprises vegetable fibers in all stages of fossilification—some even but slightly metamorphosed from their primitive structure. An examination of many truck loads of Italian lignite in transit from mines to consumers shows that it is often indistinguishable from pieces of old riven oak. When completely fossilized or mineralized, it may be properly called brown coal (*braunkohle*).

Generally speaking, the Italian lignite is of low calorific value, averaging 2500 cal. per kg., as compared with the *braunkohle* of Bohemia and Hungary, which has a general average of 3500 cal. per kg. It is, in fact, only suited for lean gas making in industrial establishments, or for firing stationary steam boilers. In Austria, Bohemia, Hungary and Saxony, its superior steam-raising power enables it to be used in locomotive boilers. In Bohemia it is used with great economy in the boilers of even the express locomotives hauling important international trains, and I have had several occasions of observing how well the furnace fires are fed with this Bohemian lignite exclusively and without any admixture with the poor black coal of Austria; the fire, when half burnt through, closely resembling one of cannel coke. It is, of course, rather soiling, the locomotive and cars being sprinkled with the yellow dust.

Lignite Used in Steel Manufacture

The principal steel works of Italy, producing armor plates for the Italian navy, depends almost entirely upon lignite for fuel, as do those of Hungary also; the steel company mines its own lignite close to the works at Terni, in Umbria.

During visits to all the principal metallurgical works of Europe, I inspected the lignite mines near Terni. These mines cover an area of 10,000,000 sq.m., the coalfield being represented almost totally by one seam, varying from 4 to 9 m. in thickness (13 to 30 ft.), with an average of 6 m. (20 ft.). At a hight of about 8 m. above this seam is another occurring in places, but of only a few cm. thickness and unimportant in value for mining purposes. The estimated area of the ligniferous strata is 3,500,000 sq.m., and this multiplied by the thickness of 6 m. represents a volume of 21,000,000 cu.m. or metric tons. Allowance being made for walls and pillars to be left unmined for the support of water courses, roads, villages, and also for the considerable faults which have divided the seams into as many different parts, the actual cubic volume of lignite has been estimated by one authority to be only one-third of the total ligniferous area, that is 7,000,000 cu.m. or tons.

In actual working, the experience of 10 years' operation has, however, shown that every square meter of surface worked has yielded on an average about 4½ tons of lignite, from which it would appear that the coefficient of reduction for the greatest unknown factor, that is, the one due to structural faults, would be only three-quarters. The average production of the mines is 1,000,000 tons in 10 years.

The lignite is employed only for gas making and for the firing of forge furnaces at the Terni blast furnaces and steel works, because the whole of the motive power of that establishment is derived from the water falls of the Marmora, the energy being transmitted by means of electric current, compressed air, etc. The production of lignite is, therefore, limited to the requirements of the heating furnaces alone, and the total value of fossil coals used yearly is supplemented by the coke for the blast furnaces, this latter being the only fuel which has to be imported from abroad, since Italy has no coking coal.

Reducing the Moisture Content

Freshly mined, the lignite from the Spoleto mines contains 35 per cent. of hygroscopic water and its calorific power is then about 2560 cal. per kg. weight, on an average. By dessication, this quantity of humidity may be reduced 20 per cent., but this process not only increases the proportion of small coal but it also drives off hydrocarbons of considerable thermic value, that is, the most volatile of them, so it has been found best, by long experience, to burn the lignite while still humid, particularly as the principal center of its consumption is not far distant from the mines.

The fixed carbon content of the lignite varies, according as the fuel is ligneous or peaty, between 35 per cent. and 31 per cent., and the volatile matters vary in content from 64 per cent. to 61 per cent.

The product of the Spoleto mines, near Terni, is subdivided into four classes, as follows:

1. Big lumps, as mined, selected in the place.
2. Nobs, obtained by screening all which remains from the first selection.
3. Smalls, the product of a second screening, composed of pieces of 1 in. to ¼ in. in size.
4. Slack or dust, remains of the second screening, containing the largest proportion of argillaceous matters, generally in the proportion of 50 per cent.

The two first qualities are used almost wholly for gasification at the steel works of Terni; the third quality is used for steam raising at the mines and also sold for the same purpose, baking bricks, etc. The fourth quality is bought by agriculturists for lightening heavy clay soils and to mix with stable manure of which it absorbs the ammoniacal gases, so forming a valuable fertilizer.

The seams worked comprise two varieties of lignite, the one of a peaty nature, of a deep chocolate hue, opaque, and with a schistic structure, very often containing ligneous elements visible in the brown mass as stripes of yellow hue more or less intense; density, 1.24. The other variety consists of arborescent plants, of which the structure and color are still retained, often revealing the family to which they belonged mostly coniferæ; average density, 1.20.

Method of Development

The method of working the lignite beds is shown by the accompanying illustrations, for which I am indebted to the steel-works director. The system employed is longwall, that is, the seams are completely worked out and abandoned to goaf at once. The plan of the work is shown in Fig. 7. Here on each side of the main (inclined) shaft *A A*, see Figs. 1 and 7, a number of roads *b b* are headed off in the seam, each one distant 16 m. (53 ft.) from the other, measured along the inclination, and all laid with tracks running toward the inclined shaft *A A*. This shaft is equipped with tracks and a balanced-cable haulage system by means of which the trucks loaded with lignite are raised to the principal levels —as shown in Fig. 19—which in turn communicate with the main shaft of the pit. The seam being set out with roads and cross roads, or gates, as shown

*Engineer, Staple Hill Park, near Bristol, England.

in Fig. 7, the attack is then made at the limit of the district or panel *c c*, which is a gate, termed in Italian *galleriozzo*—presumably a combine of "gallery" and *pozzo*, a pit—which ascends from the upper haulage road *b b*.

This gate, of reduced section, is commenced at 2 m. distance from the end of the panel and is, as shown by the dimensioned plan, Fig. 7, 16 m. or 53 ft. in length, and terminates at its highest point in the old goaf or abandoned levels, at which point understoping is commenced in the *place, a*, which is 4 m. or a little over 13 ft. square; in consequence of its shape this *place* is termed in Italian *camera*, or chamber, and upon the roof of this chamber, understoping is then begun.

The length of the gate or *galleriozzo* is subdivided into 4 *places* or *camera*, that is $4 \times 4 = 16$, as illustrated in Fig. 9. The *camera a* is excavated to the full depth of the lignite seam and *goafed*, followed up by the *camera a* in the same manner. While one gang is mining out the band from *a* down to *a"*, see Fig. 9, another gang is driving a second and parallel *galleriozzo*, 4 m. distant from the first; this latter gang proceeds to understope the *places b b'* by the time that the first gang is nearly down on the tributary road *b*.

Under normal conditions of working, stoping proceeds in 4 *places*, or *camera*, simultaneously, and on both sides of the inclined shaft *B A* in Fig. 8, as indicated by the varying lengths of the gates shown below the goaf. By subdividing the main level into as many secondary levels as are required, the necessary number of working places may be laid out for any predetermined rate of production.

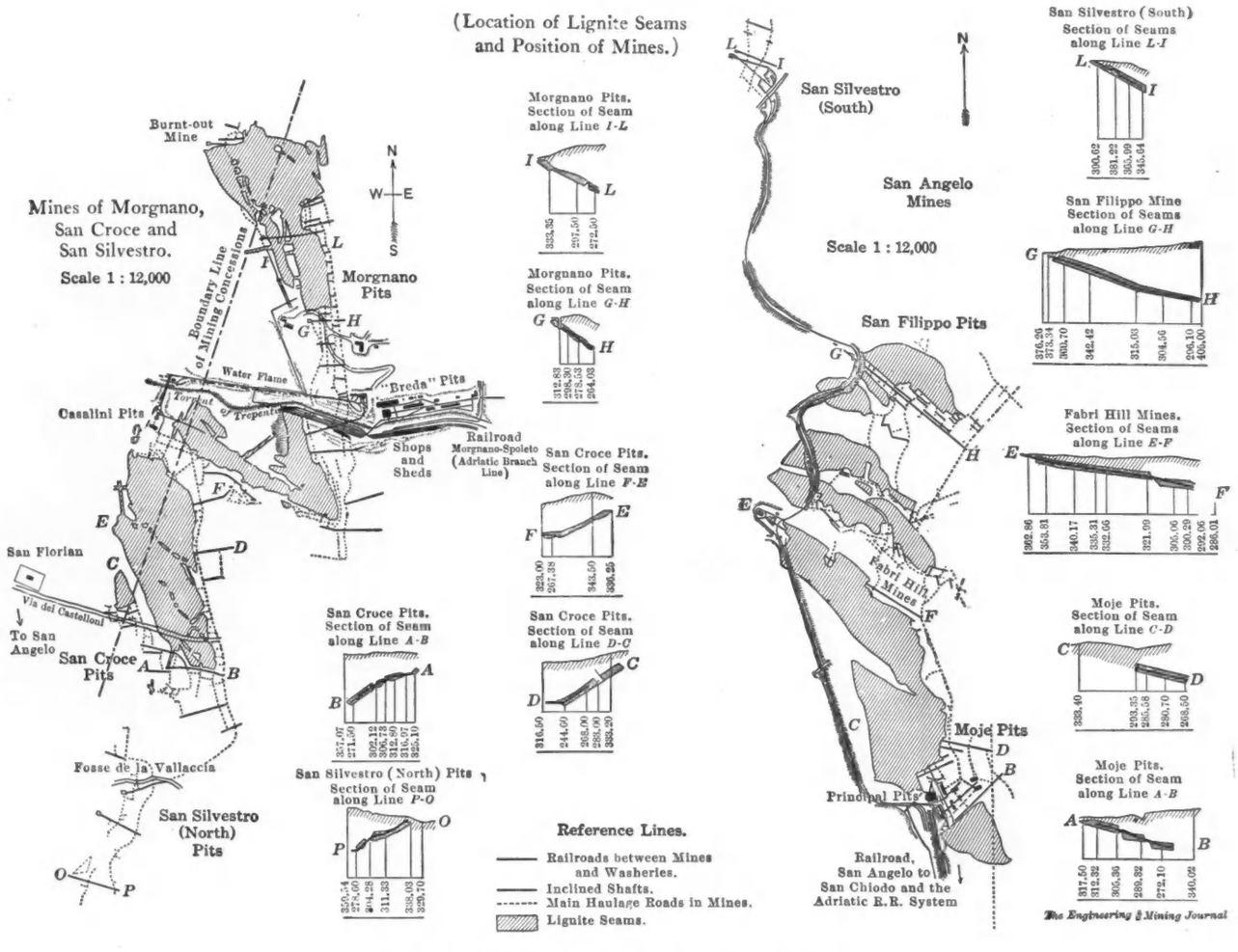
A vertical section of the plan, Fig. 8, at *B A*, is given in Fig. 10, showing the inclined road *A B* provided with a balanced wire-rope haulage system and with short landing roads; these landings are provided at the end of each level road, for the switching of loaded trucks which are to be raised, and of empty ones coming down as balance. The working is controlled by compressed-air winches of about 12 h.p. These level crossings are avoided, or become unnecessary, when the special form of hoisting truck, or truck-carrier shown in Fig. 19, is employed.

The Method of Understoping

The actual process of understoping the lignite seams will be understood by reference to the groups of Figs. 11 to 18, showing the details of operation in plan and section side by side. The collapse of the roof fills the goafed or worked part as fast as the back of the level is reached.

The seam to be stoped is represented in plan, Fig. 11, comprised within the area *a b c d*, the work commencing by means of a hand level about 5 ft. 3 in. high from the thill, or floor, and having as working faces the roof and two walls in the lignite, as shown developed in Fig. 13. From the two other walls the goafed material which rolls into the *camera* consists of blocks of marl which gradually form a talus of about 45 deg. Gradually the scarp advances, reducing by about 5 ft. the level floor of the *place* and extending along the gate or *galleriozzo* to a distance of 8 feet.

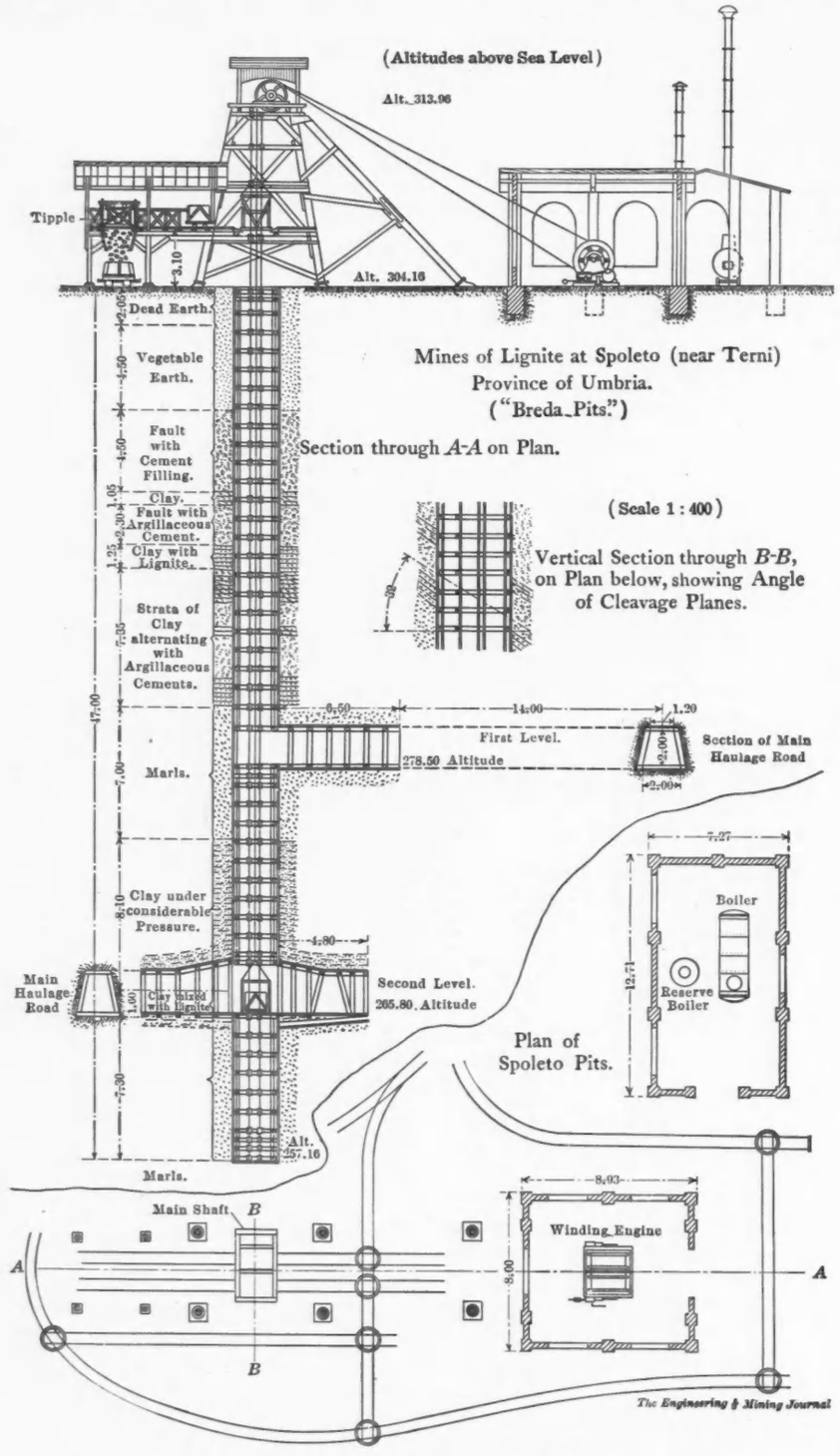
At this stage the miner prepares to



EXAMPLE OF LIGNITE MINING LAYOUT NEAR SPOLETO, ITALY

stope, or sump, about 30 in. from the back of the seam by means of a kirvel, or undercut channel, in the mass which is to be brought down, usually by means of a shot. This channel is hewn out by means of a pick having an ax at one end and a gouge at the other, termed a *mal-impeggio* ("bad to worse"). When the *sump* is brought down, and the lignite product removed, the miner uses his pick to glide the spoil or gob into the goafed *camera* or *place*. In this way the floor is covered to a depth of about 30 in., upon which raised level the miner has again brought the roof to within a distance of 5 ft. 3 in. from his footing.

To prevent this filling, and the successive fillings which raise the floor level, from invading the cross gate or *galleriozzo*, the miner bars the entrance to the latter by means of timbers placed one above the other in measure as the level rises during successive operations of stoping (see plans through *P Q*, Figs. 11 to 17). However, as the working passage or gate would eventually become obstructed by these timbers, without possibility of the miner getting out or in again, he hews out of the lignite, and near the barrage, a small shaft, or preferably a manhole half-round in section and serving as a passage. By this method, in successively stoping the roof and raising the floor level, the back of the seam is reached at hights of 20 and 23 ft. from the thill. Some care is necessary in bringing down the last 3 ft. thickness of the seam, but the miner has always a safe retreat in his manhole, where there is no danger during collapse of the roof or walls.



SECTION THROUGH SHAFT AND ENGINE HOUSE
(Figures represent meters)

In some of the pits, as at San Angelo, the *places* or *camera* are always made, as described, 4 m. in length and width; but at other pits, Morgnano for instance, it is necessary, on account of the nature of the deposits, to make them of only 3 m. (10 ft.) rectangular section. In the latter case the gates or *galleriozzo* cave in rapidly, and under the effect of heavy pressure, the walls and roof of the *places* are always fissured and subject to movement, often presenting to the view great masses of lignite strata broken and jumbled, necessitating considerable outlay for propping and lagging, or entirely lining with steel girders, but entailing scarcely any expense for explosives.

There are, however, comparatively few accidents to deplore in spite of the instability of the strata cut through by the various access galleries, and this for the reason that the swelling of the clay enveloping the seams is slow in action, giving always a certain indication of its movement, in due time, and never subject to sudden collapse as in the case of friable strata.

THERE IS NO SYSTEM OF MECHANICAL VENTILATION

During stoping operations in the places or "chambers," the air arrives through the haulageways by diffusion, there being no regularly installed system of forced or mechanical ventilation; however, as the "gates" have only to carry the air a short distance to the working places, the air is sufficiently respirable.

A regular system of forced ventilation has not been found necessary in these lignite mines, since lignite does not, like coal, continually throw off inflammable gases requiring to be diluted with an abundance of air forced in from the outside.

At the Spoleto mines the ventilation of the levels and secondary galleries is effected by natural draft through shafts having orifices situated at different altitudes and sufficing to circulate the air.

At Morgnano there are two shafts, the mouth of one being on the hill of Morg-

nano at an altitude of 375.8 m. above sea level, and the other on the hill of San Croce at 350.5 m. altitude. The lowest outlets of the two shafts respectively are, 298.7 m. at Morgnano, and 312 m. at San Croce. These differences of level of 77 m. at Morgnano and 38.4 m. at San Croce suffice to create the necessary flow of the air in the different pits named. At the mines of St. Angelo, the draft is induced by means of an air-return shaft in the pit of San Fillipo, which is situated at the highest level of all the pits, with its mouth and 50 m. higher than the pits of Moje, which have the lowest level of the group.

This natural air current is due to the difference in weight of the air at different temperatures. For instance, in summer, when the outside air is warmest, it centers, as a rule, at the highest elevation, traverses the shafts and levels, and escapes at the lowest level. When the air is coldest outside (as in winter or at night) the current is inverted and the air usually enters at the lowest level. These inversions of current occur not only with change of season, but with the diurnal changes.

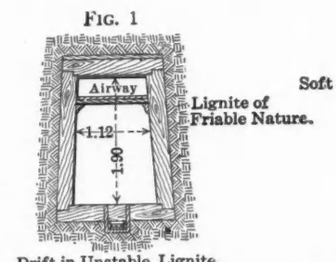


FIG. 1. Drift in Unstable Lignite. Exploration Drift, All-timbered, with Drain Channel and Air Return-way.

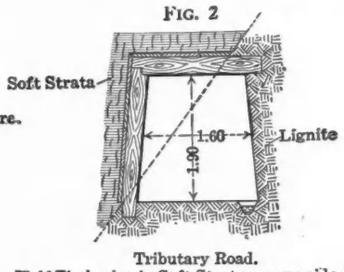


FIG. 2. Tributary Road. Half Timbering in Soft Strata on one side only, and omitted in Compact Lignite on other side.

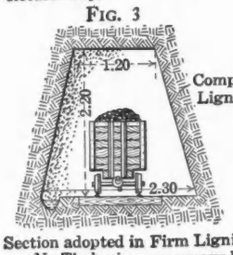


FIG. 3. Section adopted in Firm Lignite Seam, No Timbering necessary here.

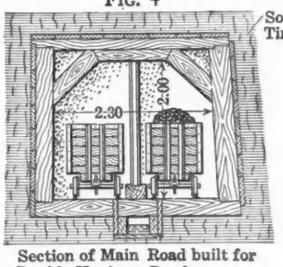


FIG. 4. Section of Main Road built for Double Haulage Road, Heavy Timbering supported on center by I-Section Beams in Unstable Soils.

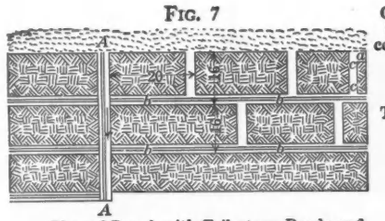


FIG. 7. Plan of Panel with Tributary Roads and Cross Gates, preparatory to Stoping.

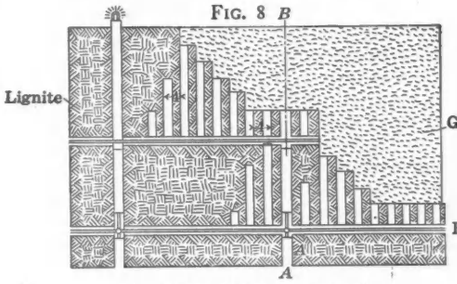


FIG. 8 B. Fig. 8. Plan of Stoping Operations. (Figures indicate Meters)

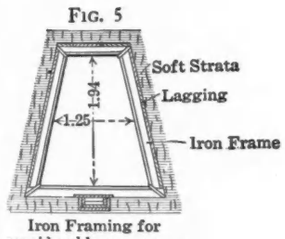


FIG. 5. Iron Framing for considerable pressures.

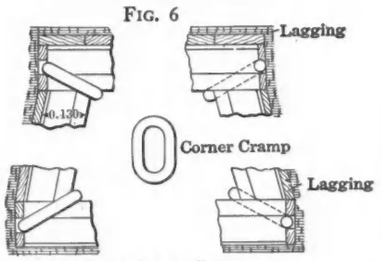


FIG. 6. Details of Corner Cramps & Iron Frames in Fig. 5.

FIG. 9. Plan of Three Working Chambers at End of Panel.

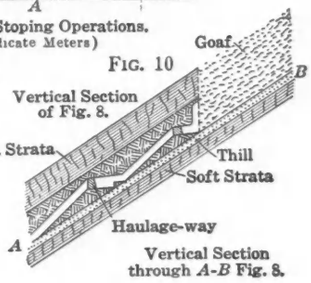


FIG. 10. Vertical Section through A-B Fig. 8.

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DETAILS OF TIMBERING AND PLAN SHOWING METHOD OF DEVELOPMENT
(All figures represent meters)

NATURAL VENTILATION

In Italy, as in fact in all neighboring regions, including the French Riviera, the daily temperature variations touch the extremes of cold and heat, and these variations are marked, at certain hours of the day, by a change in the direction of the underground currents coursing through the lignite mines of Spoleto. The change is preceded by a calm, or standstill, of the natural air currents in the mines, and this state is also normal for whole days whenever the seasons themselves are changing and when the outside air is balmy without the characteristic "continental" transitions from the heat of midday to the extreme cold of midnight—"English" weather, in fact.

At such periods the equability of the atmosphere results in an outside temperature approaching the mean temperature of the "levels" in the mines; and this equilibrium of the temperatures suspends the natural movement of the air through the galleries and shafts. The general supposition that heated air always rises into the cold air above it is frequently mistaken under different barometric and meteorological conditions; cold air will, in fact, descend to warmer and lower levels with as much facility as cold air will rise into warmer air prevailing above. Thus, when the outside air is clear and dry, at freezing temperature, and a trap in the roof of a warm chamber is opened, the outer cold air descends and repels the warm air in a strong, continuous wind; if the weather then changes to rain and the temperature runs up to 46 deg. F. while leaving the inside temperature unaltered at 40 deg. F., then the current through the trap becomes inverted and the cold, inside air flows freely outward in ascending into the warmer and moist air above. This natural phenomenon of cold air thus rushing toward air of a higher temperature, whether the latter is at higher or lower levels, is sometimes available for the application in the natural ventilation of underground passages.

When the natural air currents are insufficient, it has been customary at certain Spoleto mines, notably at the San Croce pits, which are shallowest, to start fires near the base of the air shaft, thus warming the ambient into which the colder air, lower down, will more freely rise, so inducing an upward current. Resort is also sometimes made to fans, but the conditions are not, or were not at the time of my visit, considered to be such as would justify the installation of regular ventilating plants.

Compressed air is often used for winches on the inclined planes in the

mines and for other tools, and is also employed in some cases to ventilate the workings; it is utilized in the long exploring drifts of the San Angelo mines where there is no natural air current.

The methods of coal getting previously described are found to be suited to thick seams whose inclination does not exceed 35 deg. and where the lignite is of a light brown color, entirely free from any firedamp.

Mine Fires Frequently Occur

Mine fires are of frequent occurrence, probably by reason of the amount of slack unavoidably lost in the goaf during stoping, and it is rare to work a thickness of above 2 or 3 m. without starting a fire, which can never be extinguished but will usually go on smoldering for years once it has taken firm hold. These fires occasion no other inconvenience than the loss of the lignite which had not been won, provided the works have been well laid out, so as to limit their effects. There is no danger of fire whenever, for any reason, a mine is laid out with numerous levels, sublevels, headingways, gates, cross gates and other drifts. It is only where the lignite walls are actually broken by stoping operations, that is, no longer intact and swept by the air currents, that combustion is generated; as a consequence, fires are usually limited to the portions already partly worked.

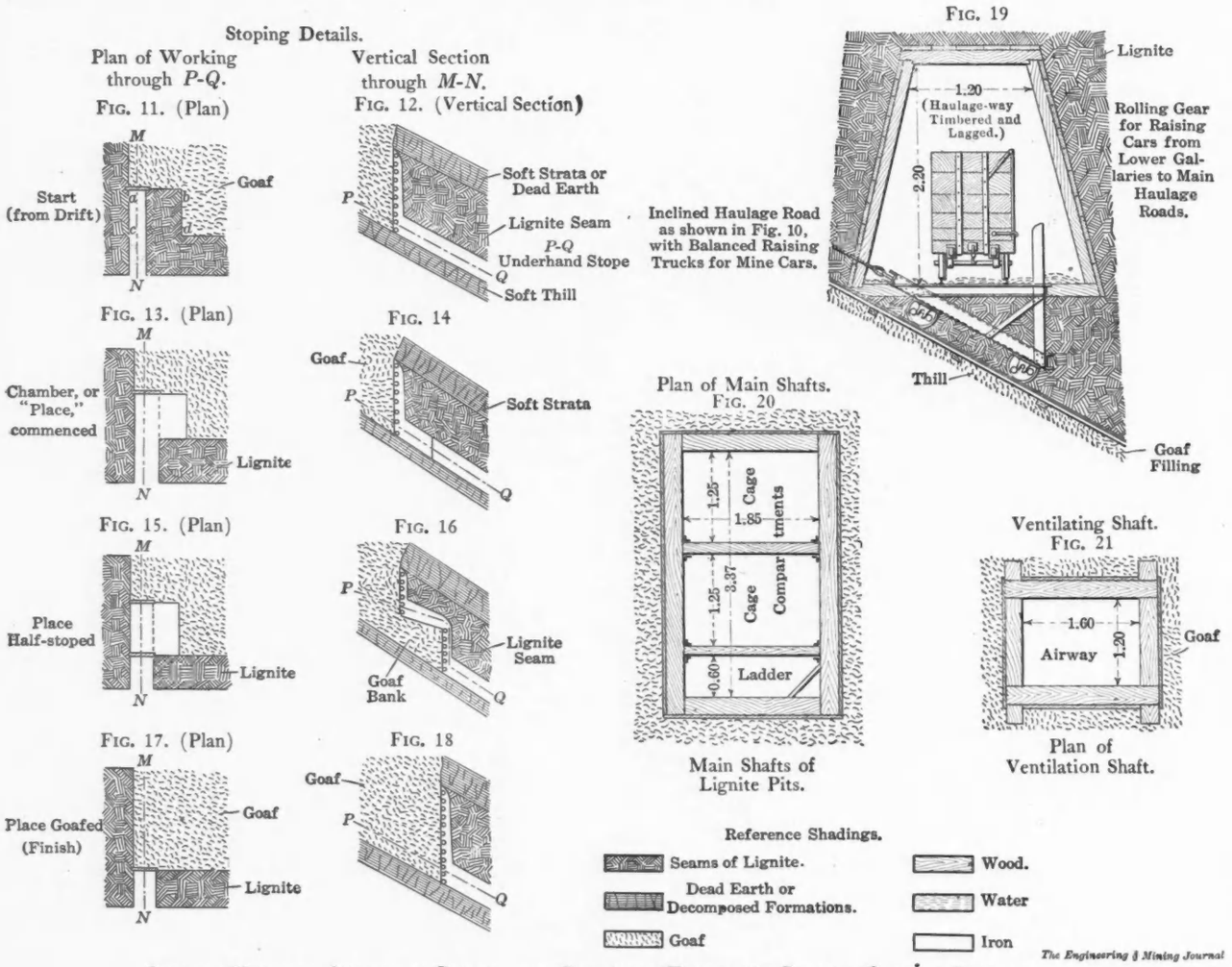
No instance occurs of a fire in unbroken walls having contact with the air. Where a pit, partly worked, has to be abandoned for a time, it is usual to take all precautions against fire in the stopings by excluding the air. If, nevertheless, a fire breaks out and spreads, the practice is to cut out, or isolate, the burning zone by building up earthen walls, from thill to roof, in all galleries approaching the locality of the fire, which district thenceforth becomes lost for further cropping.

In the lignite mines of Spoleto, the fires never give rise to very serious consequences because, to begin with, the longwall system is employed and the lignite is completely stoped from thill to roof, and this goafed area is never entered again; secondly, because the stoping always proceeds at the extreme limits or periphery of a panel or district, that is, on the fringe of the goaf field, so that fires are readily shut off, and the locked-in combustion gases are forced to expend themselves in creeping through the interstices of the goaf instead of seeking an outlet through the dirt walls built up and barring them from the other parts of the mine.

But Little Water Has to Be Handled

Drainage of the lignite mines of Spoleto is light, for the inflows are small, the greatest volume being due to rain water filtered through the goaf and variable in quantity according to the season of the year. If the season is wet, the inflows are in proportion; if dry, the inflows gradually cease. The proportion of water entering by percolation is not in ratio to the areas goafed, for the reason that the goaf gradually consolidates under the effect of pressure and filtrations, and the interstices then disappear, giving no longer free passage to surface waters. The water is removed from the mines by pumping into cisterns which, in turn, are raised to the surface by means of the usual hoist gear and cages.

The mines of Spoleto, near the town of Spoleto, are divided into two prin-



Stoping Methods Shown in Detail, and Balanced Truck for Raising Cars up Incline

cipal divisions, one named Morgnano, with pits at Morgnano, San Croce and San Silvestro, and another named San Angelo, with pits at Silvestro South, San Fillipo, Fabri and Moje. The mined and screened lignite is transported from the lignite fields over an ordinary-gage railroad, 15 km. in length, connecting the two collieries with the station of Morgnano, which is on a branch from Spoleto. The great steel works of Terni lie between Orte and Spoleto and take the largest consignments of lignite.

Handling the Output

The main shafts of the mines are rectangular, being 66 ft. one way by 6 ft. the other; they are divided into two hoisting compartments and one division for pit ladders, signal tackle, etc.; see Fig. 20. The shafts at the various pits have winding engines of from 50 to 70 h.p. and Cornish-type steam boilers. The arrangements differ at the different pits. Fig. 1 shows the general disposition of the plant at the Breda pits. The cars are hoisted to the landing stage, about 10 ft. above the mouth of the pit, run onto the tumbler and there tipped into two hoppers—one for large lignite and one for smalls. From here, the trucks are despatched to the washeries situated at a lower level on the side of the hill. The center of the winding drum to center of the shaft is, in this example, about 18 meters.

The shaft cages weigh 1760 lb. and are guided by four steel rails of about 18 lb. to the yard; the mine cars weigh about 100 lb. and hold approximately 1300 lb. The outside or surface cars have a capacity of 2600 lb. All are of the well known Koeppel (Berlin) type.

The Moje pit—not illustrated—is run with a 70-h.p. winding engine and here the cars are hoisted to a top stage landing upon a platform carried by the connecting span or bridge of the headframes, 10 ft. above the shaft's mouth, and there dumped by a tumbler into a trommel run by a 12-h.p. motor. The cages weigh about 1300 lb.; the cable pulley, at a hight of about 33 ft. above the pit, is 40 in. diameter, and the winding drums are 80 in. diameter. The weight of the mine cars when loaded, is 1300 pounds.

The various pits of the different mines are situated at a higher elevation than the washeries and the car sidings, and to utilize the force of gravity of the descending trains, there is a complete system of automotor planes and counterplanes controlled by double-drum winches fitted with powerful brakes by means of which one train, with 10 to 15 Koeppel cars, is hauled in a direction opposed to that of another proceeding on the adjoining track.

The declivity and its length are variable. As an example of one surface line, connecting the pits together and to the cleaning sheds, the San Angelo mines may be mentioned. Between the pits of San Fillipo and the Fabri hill, the grade is 2.4 per cent. to 2.6 per cent. in a length of 1600 ft., after which there is a drop of 130 ft. in a distance of only 1300 ft., which is worked by means of the automotor planes referred to under the control of a powerful double-drum braking attachment. The system is planned to permit of a number of switching operations being performed on different inclined planes and without resort to other motive power than gravity.

At the first level on the hillside are situated the screening or washing plants, and from which the cars of small lignite then descend (and past which the cars with large lignite descend direct from the mines) to a lower level where the whole lignite product of the mines is passed over the weigh-bridges, previous to proceeding a quarter mile farther on to the large broad-gage trucks or coal cars of the Italian railroads. The gage of the mine railways is 23½ inches.

At the washery, the small lignite from the mines is passed through bumping screens fixed to stagings 6½ ft. high, and from which the products descend through chutes into the cars below, the large sizes into cars outside the staging and the small sizes into cars beneath the staging itself. The system of ordinary tracks and inclined tracks with automotor haulage, braking apparatus, turn-tables, etc., for the special needs of the mines and washeries comprises about 10 km. of line, as compared with the 11 km. of underground lines in the mines themselves, for the operation of which there are, in all, about 700 cars.

Not Much Machinery Required

The nature of the fuel and conditions under which the exploitation is effected do not call for much important machinery. The product is principally for one consumer—the steel works of Terni—and the situation is in Italy where labor is cheap and the question of time is also of comparatively small importance. But considering Italy's dearth of mineral treasures, its lignite mines are of considerable interest and are perhaps not yet appraised at their full potential value.

The State railway, which is one of the largest coal consumers, is experimenting with oil fuel as a means of reducing the heavy toll which it pays to England and Germany for black coal. Even America has been tried for Italy's coal supplies. An Italian railway official at Venice told me recently how near America once came to being one of the greatest coal suppliers to Italy. An American multi-millionaire, whose name is universal, was combining business with pleasure in a sojourn at Venice, which would have been the future discharge port for American coal. The prices to be paid were always expressed in "L." and the millionaire thought there was really a good field for harvesting. At some point in the negotiations he learned that the sign "L." stood for "lira" and not the English libra "£"—or only one twenty-fifth the value of the latter. At this stage the millionaire became inarticulate and the proposed contract was nevermore heard of.

The problem of fuel remains still a most important one for Italy, for the fabulous tales of Italy's wealth of "white coal," i.e., water power, appear to be as far from practical realization as 10 years ago. The Steel Works of Terni are run almost wholly by water power, but coal and coke are still urgently necessary for their furnaces.

The Palos Explosion

The explosion in the mine of the Palos Coal and Coke Company, May 5, caused the death of 83 men. Every man in the mine at the time of the explosion perished. The State mine inspectors have decided that the explosion was caused by a pocket of gas being ignited by a naked lamp. Dust played a part in carrying the fatal explosion through the mine. It has also been decided that gas caused the explosion in the Mulga mine of the Birmingham Coal and Iron Company, April 20. As a result of this latter explosion, 40 miners were killed.

The coal-mining industry in Alabama has been greatly stirred by these two recent explosions, and as a consequence, the Alabama Coal Operators' Association will name a committee to figure on some new mining laws to be sought from the next legislature. Extraordinary care is being taken in the inspections of mines throughout Alabama at the present time, and sprinkling of all dust is being carried on in many places. Considerable difficulty is being experienced in persuading the colored miners to continue working in the gaseous mines.

Explosion Caused by Defective Ventilation

In the report of his investigation of the explosion in one of the mines of the Youghiogheny & Ohio Coal Company, near Amsterdam, O., State Mine Inspector Harrison says that defective ventilation caused the disaster. The Youghiogheny explosion was the most disastrous mining accident that has occurred in Ohio in recent years. Inspector Harrison says: "Indications show that one of the machine runners went into the left entry for some purpose which can only be surmised, and that he came in contact with and ignited a body of gas which had accumulated from defective ventilation." Mr. Harrison further says that "the opening of a door, thus deflecting the current of air from that portion of the mine where the explosion occurred, caused the gas to accumulate."

Sinking the Woodward No. 3 Shaft

Unusual Methods Were Required to Sink through Gravel and Quicksand Saturated with Water, and Make a Water-tight Connection with Rock

BY R. V. NORRIS*

The Woodward Colliery of the Delaware, Lackawanna & Western Railroad Company, located in the Wyoming valley near Wilkes-Barre, Penn., is the largest colliery of this company, and its record production of 908,168 tons in 1907 is probably the largest of any anthracite colliery to date.

The total coal area tributary to this colliery is a little over 1000 acres, of which about 300 acres is on the slope of the Kingston mountain, and the balance on the Susquehanna river flats and under the bed of the river. All this flat area is covered by a heavy wash, ranging from 60 to over 200 ft. in depth, and is subject to overflow during floods.

The coal is hoisted through two shafts and a slope, all on the high land, and in 1907 the workings had extended in the Baltimore bed about 4000 ft. southerly toward the Susquehanna river from the nearest shaft, where further advance was interfered with on account of the difficulties of ventilation. The colliery is essentially a gaseous one, and even the four fans in operation were insufficient to keep the faces clear of gas at all times.

It was decided in the spring of 1907 to sink another shaft, to provide adequate ventilation for the southerly portion of the property, and to work upper beds which could not be safely reached from the old shafts on account of the great depth of wash close to the hillside, but which by their dip to the southward, and by the decreasing depth of cover in that direction were workable in the southerly portion of the property.

The final location of the new shaft, known as the Woodward No. 3 was made about 1000 ft. southerly from the face of the workings, at a point where borings had shown the depth of wash to be a minimum.

Unusual Methods Required in Sinking

As the surface on the flats is but a few feet above the river, and the wash of clay, gravel and quicksand is fully saturated with a water level varying with the rise and fall of the Susquehanna river, it was at once recognized that unusual methods would be required in sinking to make a water-tight connection with the rock.

The only previous shafts which have been successfully sunk through this heavy wash, are at the Mt. Lookout Colliery of Simpson & Watkins, now the Temple Iron Company, where after many failures, wooden caissons sunk with compressed air were finally successful, but at very great cost, and the Pettebone colliery of the Delaware, Lackawanna & Western Railroad Company, where timber cribs were sunk open in ground partly drained by heavy pumping, and from which the ground water was largely cut off by trenches packed with clay.

As a preliminary to selecting a method for sinking the Woodward No. 2 shaft, five test holes were bored, one in the center and one 25 ft. beyond each proposed corner of the shaft. These were drive pipes to rock, and in each a diamond drill hole was continued into solid measures. The holes, as shown on the shaft drawing, showed the wash to vary from 68 to 72 ft. in depth, and to consist of sand and gravel, with over 30 ft. of blue clay in the bottom. While the records of the holes indicated that the clay was continuous to the rock it was recognized that there was a possibility of some sand at the bottom of the holes having been missed by the pipes plugging with clay while driving. This actually proved to be the case, but had but little effect on the work.

The size of the shaft inside the concrete was fixed at 14 ft. x 48 ft. 10 in., as shown on the drawing, Fig. 3, and to stiffen the caisson, concrete cross walls were provided between the hoisting and pumping compartments, as well as between the pumpway and airway. The latter wall is to be extended to the bottom of the shaft to permanently separate the airway from the hoistways by a fire and explosion-proof brattice, which is necessary in view of the expected use of the shaft for some time at least as both an intake and outlet airway.

Decided to Sink a Reinforced Concrete Caisson to Rock

After full consideration of the many methods proposed, the proposal of "The Foundation Company of New York," to

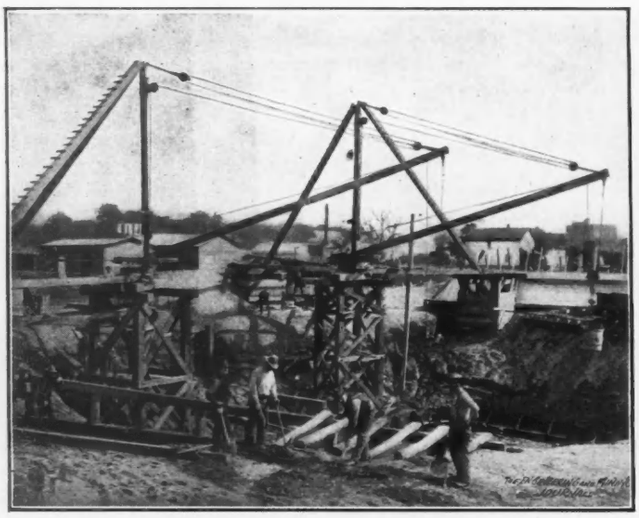


Fig. 1. Showing Derricks Used to Complete the Steep Sloping Sides of the Excavation

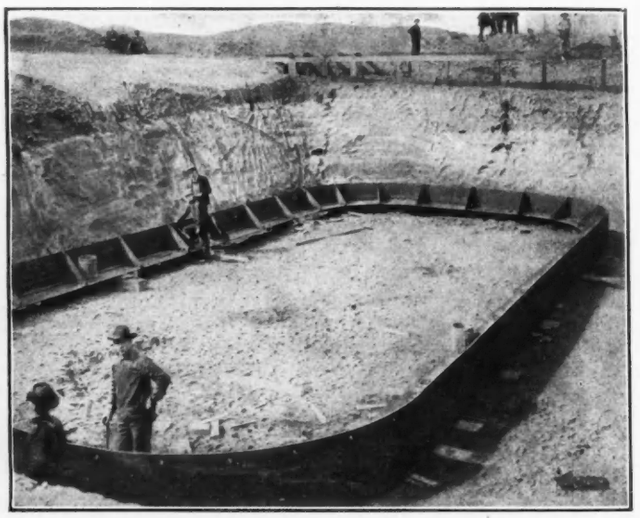
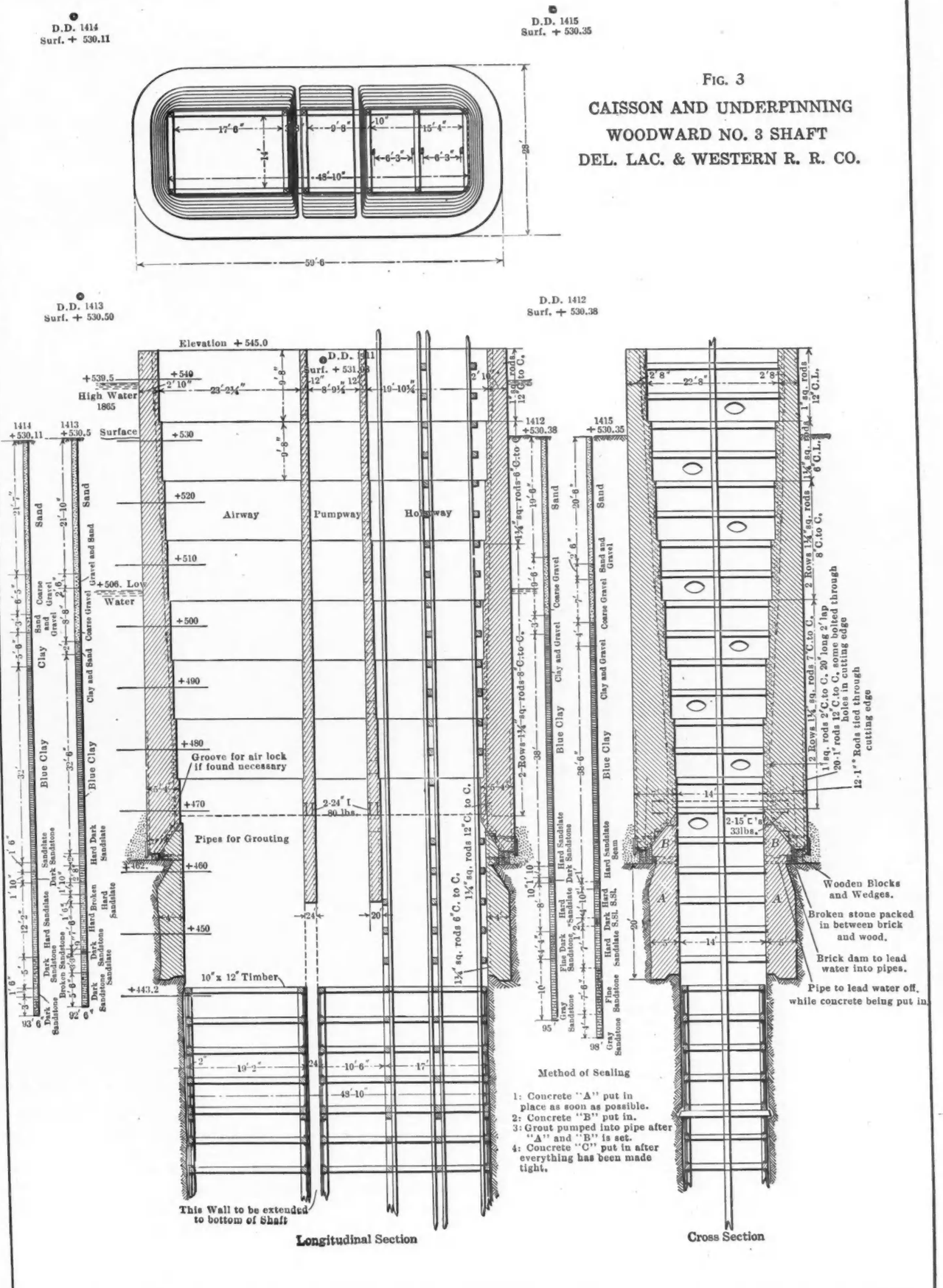


Fig. 2. On Oct. 14, Work Was Started Putting the Cutting Edge in Place

*Consulting engineer, Wilkes-Barre, Penn.

FIG. 3

CAISSON AND UNDERPINNING
WOODWARD NO. 3 SHAFT
DEL. LAC. & WESTERN R. R. CO.



sink a reinforced-concrete caisson to rock and to continue the reinforced-concrete lining in rock to firm strata was accepted. The specifications required the caisson itself and its connection with the rock to be practically impervious to water, to show no pronounced leakage, and no seepage exceeding 25 gal. per minute. It may be stated here that the measured seepage on the finished work was but one and one-half gallons per minute, and that the shaft is now practically dry as far as surface water is concerned.

Estimate of Ground Pressure

The location on the "flats" of the Susquehanna river involved extending the walling to above the flood level, the record flood of 1865 reached an elevation of +539.5, as compared with a surface elevation at the shaft of +530, and low water in the river of +506. Considering that at a flood of +540, the river is nearly two miles broad, it was believed that 5 ft. above the flood record would be absolutely safe, and the top of the concrete was fixed at an elevation of +545.

In calculating the strength of the caisson required, the assumption was made that the wash might be or become fully saturated, and it was specified that "the reinforced concrete walling be proportioned to stand fluid pressure of saturated clay weighing 130 lb. per cubic foot to elevation +530, and water pressure only from +530 to +545, allowing 16,000 lb. per square inch safe load on reinforcing steel, and 750 lb. per square inch on concrete in compression, no allowance to be made for strength of concrete in tension."

To further strengthen the caisson, the corners were rounded, but even with this and with the two cross walls, the bottom of the caisson was 7 ft. thick on the sides, and 5 ft. on the ends, reinforced as shown on the drawing. Besides the circumferential reinforcement required to resist the pressure, vertical reinforcing rods were freely used to insure the solidity of the caisson during sinking.

The operation of sinking was started Sept. 13, 1907, by excavating an open pit about 15 ft. deep to a point just above the then level of the ground water. This level fluctuates with the rise and fall of the Susquehanna river, and at the time of starting, the river was within a foot of low water. The pit was largely excavated by horse scrapers and the spoil placed as an embankment around the shaft as a partial protection against floods. During the process of excavation the derricks were erected and the final steep sloping of the sides of the excavation accomplished by the use of these (Fig. 1).

On Oct. 14, the pit was completed and work was started putting the cutting edge in place (Fig. 2). This was built of steel plates and angles securely bolted together and carefully leveled up, this work was completed Oct. 17, when the lower forms, already built outside the pit, were lowered into place and concreting started Oct. 21.

The Beveled Portion Was Heavily Reinforced

The lower part of the caisson rested on the steel cutting edge and was beveled inside for the lower 7 ft., in to the full thickness of the caisson walls. This beveled portion was very heavily reinforced (Fig. 4), 78 of the inner and 32 of the outer vertical rods passed through and were secured to the bottom plate of the shoe; to further strengthen the cutting edge 78 extra 1-in. round rods, 6 ft. long, were riveted in countersunk holes in the vertical member of the cutting edge, and laid parallel to the beveled inner surface of the bottom of the caisson.

Besides the beveled form which was built outside of the pit and lowered into place, two sets of inner and outer forms were built of 3-in. surfaced plank, strengthened by angle iron. These were used for the entire caisson by removing the lower set of forms and placing them on top of the other set as the concreting progressed; the step enlargement of the interior was accomplished by the use of distance pieces as required. The forms, besides being rigidly built, were thoroughly braced and tied during the progress of the work, so that there was no trouble at any time from their springing or moving.

As well to save concrete as to allow for possible inaccuracy in vertical sinking the walls were reduced in thickness by steps on the inside as the caisson was built, the side and end walls being thus reduced from 7 ft. and 5 ft. respectively, to 2 ft. 8 in. and 2 ft. 10 in. thick, and the two partition walls from 20 and 24 in. to 12 inches.

Further, the two partition walls each rest on two 24-in. 80-lb. I-beams, anchored top and bottom to 15-in. channels in the side walls. The wall between the hoistway and pumpway only extends to the bottom of the caisson, but the wall between the airway and the pumpway will be extended to the bottom of the shaft, to entirely separate the upcast airway from the hoist and pumpways which will be used as a downcast.

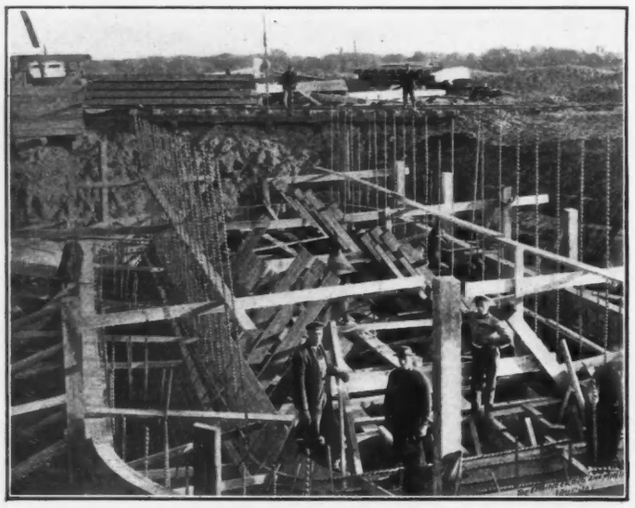


Fig. 4. Lower Forms and Reinforced Rods of Beveled Cutting Edge

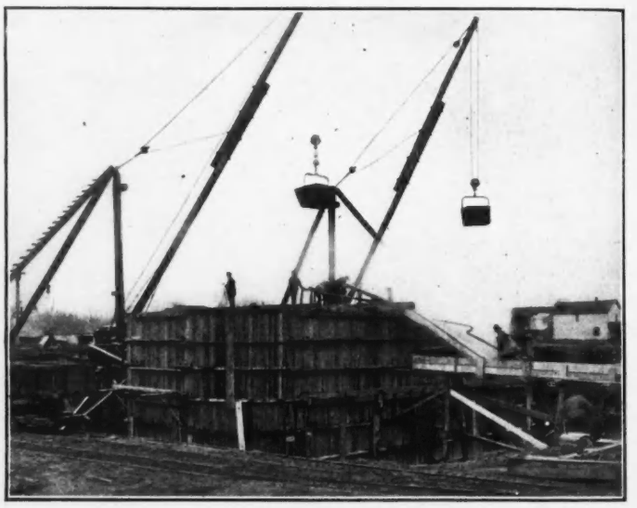


Fig. 5. Showing Caisson During Process of Sinking.

Great Care Was Necessary in Excavating

In building the caisson, pockets were left to take the timbers necessary to support the guides for the cage in the hoistway, and similar pockets in the airway for the possible future construction of platforms, should any work be required on the separating wall between this and the pumpway. To save space, the guide next the pumpway was bolted directly to the concrete separating wall, which was pierced at intervals to permit access to the pumpway from the cage.

By Oct. 26 the wall of the caisson had

reached a hight of about 20 ft. when sinking was started by excavating from the shaft and allowing the caisson to settle. The concrete being built up as the settlement progressed; with the very large size of the shaft it was inevitable that the ends would not be constantly in ground of the same bearing capacity, and great care was necessary in excavating to keep the caisson plumb and level during sinking. Levels in both directions were constantly used and any tendency to tip was corrected by more rapid excavations in portions of the shaft, and to some extent by hastening the deposit of concrete on the high end or side (see Fig. 5).

The work was pushed day and night until on Dec. 5, 66 days after starting, the westerly corner of the caisson sunk practically plumb, landed on rock at a depth of about 68 ft. below the surface, or 83 ft. below the final top of walling.

The excavation, as shown by the bore holes on drawing, Fig. 3, which average 20 ft. 10 in. sand, 12 ft. 2 in. gravel, 36 ft. 7 in. clay to rock, started from the surface in sand, and as it will be remembered that the pit was excavated to within 1 ft. of the ground water level, pumping was necessary almost from the start, the quantity of water handled increased gradually up to 1200 gal. per minute until the clay was penetrated for a short distance when this settled around the caisson and practically cut off the inflow of water. This clay reached in places to the rock, but in patches was underlaid by about 18 in. of peaty gravel.

Water from River Forced Its Way through

It was known from the borings that the surface of the rock was not level and it had been planned to sink the caisson a minimum of 5 ft. into the soft surface rock, secure by grouting through pipes which were built into the beveled portion of the caisson, and then sink to firm rock, about 20 ft., and underpin with a reinforced concrete wall. One corner of the caisson having reached rock, work was at once started to excavate in this as planned; meanwhile a number of 12x 12-in. blocks were placed under the opposite end; which was still about 3 ft. above the rock surface; unfortunately, at this juncture, the Susquehanna river rose in an 18-ft. flood, and the additional pressure of the water, probably aggravated by the light blasting which was being done, broke the clay seal, and on Dec. 12, water in large quantities forced its way under the cutting edge and through the peaty gravel in the bottom of the shaft, so that by 10 a.m. on that date, the pumps with a proved capacity of over 1200 gal. per minute, were unable to cope with the inflow, and the shaft was flooded to the flood level of the river.

It was hoped that with the recession of the flood, the clay would again settle

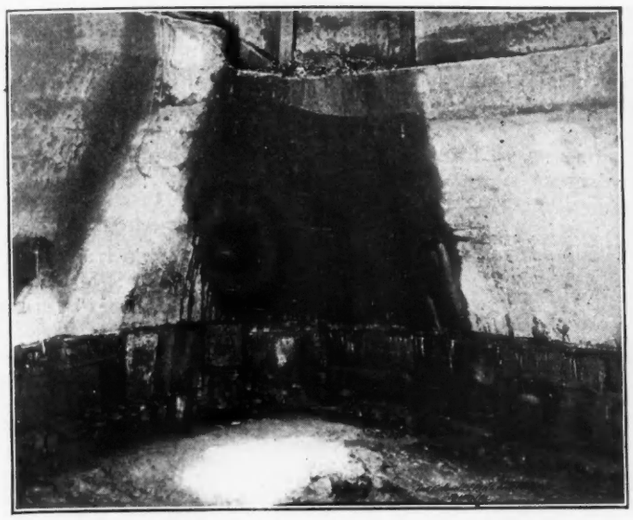


Fig. 6. Wedging at Northwesterly Corner of Shaft

Fig. 7. Excavation in Rock Before Underpinning, Showing Channeling Under Caisson

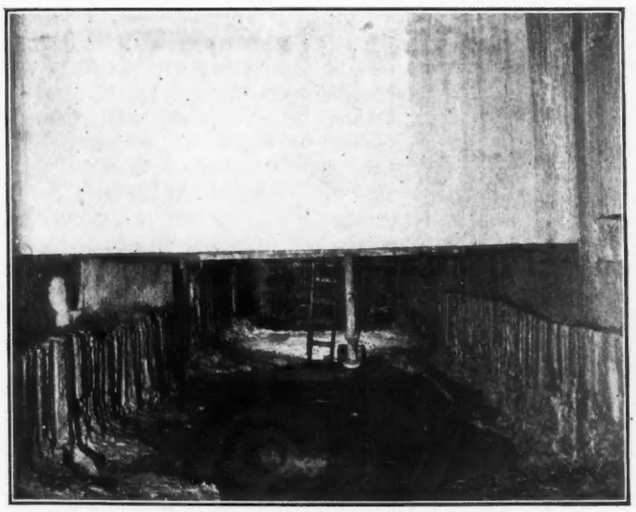


Fig. 8. Bottom of Shaft Showing Completed Underpinning and Channeling

Fig. 9. Top of Completed Shaft, Showing Farm Lands, Susquehanna River, and Wilkes-Barre, Penn., In Background

around the shaft, and with this in view, no work was done for about 10 days, when the flood having subsided, and further pumps having been procured, an attempt was made to unwater the caisson, which was successful down to a point about 10 ft above the cutting edge, when the water broke in and drowned the pumps, and again refilled the shaft.

This water carried so much sand and clay that it caused very great difficulties with the pump packing and valves, and as the shaft is surrounded by valuable truck gardens (Fig. 9), the water could not be discharged at random, and a box trough 2½ ft. wide and 8 in. high was built from the shaft, nearly a quarter of a mile to a pond hole near the river, where the water could be discharged.

The Water Was Finally Subdued

By the addition of more and more pumps, and finally with the added help of a Jeansville 1000-gal. electrically driven centrifugal, the water was on Jan. 17 lowered so that men working over their waists in the icy water could wedge off the space between the caisson and the rock. This rock occupied the time from Jan. 17 to Feb. 1, 1908. The method finally successfully adopted consisted in building small semicircular dams of cement bags filled with clay, taking in about 10 ft. of the periphery of the shaft, the space thus separated was given special pumping attention and the opening between the cutting edge and the rock closed with 12x12-in. yellow-pine timbers, and tightened with white-pine wedges; 4- and 6-in. pipes were left at short intervals and by allowing these to flow, the water pressure was decreased while sealing was in progress. Fig. 6 shows clearly one corner of the shaft just after sealing was completed.

The pumping plant eventually accumulated, all of which was in use in the final sealing, comprised: Worthington duplex pumps, one 22x10x18 in.; one 10x6x10 in.; one 16x9x12 in.; Knowles single pumps, one 16x10x24 in.; two 14x8x12 in.; one 18x14x20 in.; one 14x6x12 in., all steam operated; also one 1000-gal. Jeansville centrifugal pump electrically operated.

From the size of the shaft it is apparent that practically all available space was taken up with this huge pumping plant, and had the inflow been but little larger it would have been necessary to use compressed air to make possible the joint at the rock.

In the original plans this contingency was considered, and grooves were left in the caisson above the beveled portion, so arranged that a deck of double 12x12-in. timbers calked and made airtight, could have been readily installed, to which deck air locks would be secured and the work finished under compressed air if necessary. The timber for this deck was kept actually on the ground, and its use was being seriously considered when final success in wedging off the water was achieved.

During this long fight with the water, lasting from Dec. 12 to Feb. 1, the caisson had settled out of plumb a maximum of 1 47/100 ft. endwise, and 1 17/100 ft. sidewise. Owing to the precaution of making the inside tapered, it was practicable to timber the hoistways vertical, as originally planned, and the only inconvenience resulting was the necessity of leveling up the top. This leveling was done with a bevel form, a maximum of 21 in. high at the level of the bottom of the last step next the top; the caisson at this time had only been completed to this step, and it was necessary, therefore, to build counterforts to support a portion of the head frame and do some

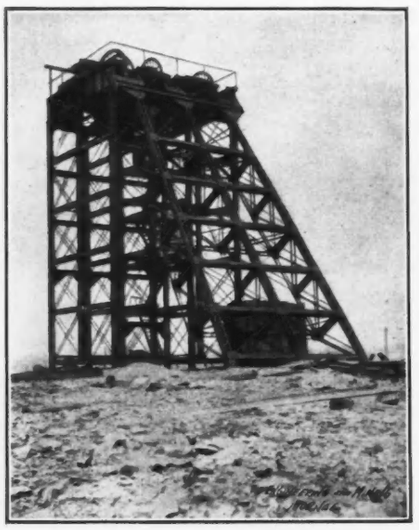


Fig. 10. Steel Headframe Woodward No. 3 Shaft

cutting in the timber hitches which were left as the concrete was built and which were thrown out of line by the settling.

Sinking to Rock By Channeling a Groove

The wedging completed, so that the inflow of water could be easily handled, sinking to firm rock was started by channeling a groove 5 ft. deep all around the bottom of the shaft as close as possible to the wedging, and removing the first 5 ft. of rock by careful blasting. While the channeling was in progress, about 100 barrels of cement grout was pumped by 80-lb. air pressure through the pipes left in the tapered portion of the casing, in the expectation that this would settle around the outside of the wedging and assist in cutting off the water. This grout did much good in reducing the flow to about the equivalent of a flow through a 2-in. pipe, and undoubtedly greatly reinforced the wedging.

After removing the first 5 ft., the balance of the rock excavation was completed, using two shaft bars and four compressed-air rock drills in the usual manner, but with great care, working in 5-ft. benches, using light charges until on April 18 firm, solid sandstone was reached at an elevation of +443.2 ft., 101 ft. 10 in. below the top of the caisson and about 87 ft. below the surface (see Fig. 7). On this a further channeled groove, 5 ft. deep, of the desired inside size of the shaft was cut; the bench was left approximately 4 ft. wide. The cut, as shown on the drawing, was used to form a base for the underpinning with a strong toe to assist in holding the walls.

During the sinking, the beveled bottom of the caisson had been roughened by chipping, and a notch cut out all around, exposing the reinforcing rods to assist in making a firm connection between the underpinning wall and the caisson.

The wall averaging a little over 4 ft. thick, and heavily reinforced as shown, was then built up to the level of the bottom of the wedging. A number of seams admitting water had been encountered in sinking, and these were trapped by wooden boxes, and the water from them conducted by pipes through the wall; after the wall had fully hardened these were treated by forcing in grout under heavy air pressure, the pipes closed and the wall openings to them concreted.

In closing the main joint with the original caisson, a few inches of broken stone was packed against the wedging and retained by a thin brick wall; into this stone pipes were left at frequent intervals, passing out into the shaft. The concrete was brought up in three operations; first, the main wall *A*, Fig. 3; second, the connecting section *B*, which was allowed to harden, and lastly, the stone-filled space was grouted solidly, through the pipes left in for this purpose. The triangular section *C* was left open for the purpose of calking off all possible flow along the joint, when this was finally made tight, the space *C* was filled and all the pipe ends (which were in recesses in the concrete) were covered over, making a clean and watertight connection. This connection was finally completed May 14, 1908, and the shaft turned over to the rock-sinking contractors, who were paid an extra price for the first 50 ft. below the concrete for extraordinarily careful sinking, and the use of shallow holes and light charges.

Estimate of Quantities Handled

The quantities handled by the Foundation Company under their contract, were: Earth, open pit, 3900 cu.yd.; earth in caisson, 3049; rock, 1049; concrete in caisson, 2229; concrete in underpinning, 619 cu. yd.; reinforcing steel in caisson, 250,045 lb.; reinforcing steel in underpinning, 29,560 lb., or a little over 10½ miles of 1¼-in. and 1-in. twisted rods; earth backfill, 2300 cubic yards.

The shaft has now been sunk to the bottom of the Baltimore bed at an elevation

of 255.6 ft. This point is 800.6 ft. below the top of the caisson. A steel headframe has been erected, and inside connection with the Woodward colliery workings has been established. The caisson work has remained tight, despite a severe test, when, during the sinking, a gas explosion took place in the shaft, of such severity that I felt the shock in Wilkes-Barre, nearly a mile away. This explosion wrecked a large amount of timbering, raised the temporary headframe, destroyed the temporary ventilating fans, but had absolutely no effect on the caisson or underpinning or on their connection with the rock. The gas was fired on the surface during a cessation of work, so that beyond severe, but not fatal burns to the man whose carelessness and disobedience of orders caused the explosion, the damage was only to property.

The work on the part of the contractors was under the superintendence of Alexander Allaire, with the supervision and advice of L. L. Brown, general superintendent, and D. E. Moran, vice-president and chief engineer of the company. For the railroad company, I had the benefit of the advice and assistance of R. A. Phillips, general superintendent, H. G. Davis, superintendent fourth district, and A. C. LaMonte, chief engineer of the coal department.

The balance of the sinking of the shaft to the Baltimore bed was contracted to John Pugh & Sons, of Kingston, Penn. The work was entirely satisfactory, and while accomplished under great difficulties, was completed inside the estimated cost, and considering the size of the opening, at very much lower cost than any previous shaft sunk in the region through the heavy wash of the Susquehanna valley.

New Explosives Placed on Permissible List

The following explosives are announced as acceptable for use in coal mines:

Ætna coal powder, D, Ætna Powder Company, Chicago, Ill.

Coal special No. 3-B and Coal Special No. 3-C, Keystone Powder Company, Emporium, Penn.

Eureka No. 2-L. F., Tunnelite No. 6-L. F., and Tunnelite No. 8-L. F., G. R. McAbee Powder and Oil Company, Pittsburg, Penn.

Titanite No. 3-P, Waclark Titanite Explosive Company, Corry, Penn.

Trojan coal powder A, Trojan Powder Company, Allentown, Penn.

Detonite special, Detonite Company, Cincinnati, Ohio.

Monobel No. 2, Monobel No. 3, Carbonite No. 4, and Hecla No. 2, E. I. du Pont de Nemours Powder Company, Wilmington, Del.

Kanite A, W. H. Blumenstein Chemical Works, Pottsville, Penn.

New Compressed Air Locomotive

The accompanying illustrations represent two compressed-air locomotives recently built by the Baldwin Locomotive Works. Both these engines are of the four-coupled type, but they differ considerably in constructive details.

Lehigh Locomotive for Mining Service

The locomotive for the Lehigh Valley Coal Company is built with a width limit of 5 ft. 6 in. and a hight limit of 5 ft. 7 in. The length over the bumpers is 14 ft. The frames are of forged iron and have a slab section ahead of the leading driving pedestals. This construction provides a ready means for supporting the cylinders, which are placed between the frames and securely bolted to them. The cylinders are set on an incline of 1 in 10, so that the main rods will clear the leading axle. The driving axle is, of course, cranked, and is a steel forging, made in one piece.

The air tanks are two in number, with a combined capacity of 95 cu.ft. Air is stored at an initial pressure of 800 lb. per sq.in., and after being reduced to 140 lb. is passed into an auxiliary reservoir. From this reservoir the supply for the cylinders is drawn. Safety valves are mounted on both the main and auxiliary reservoirs.

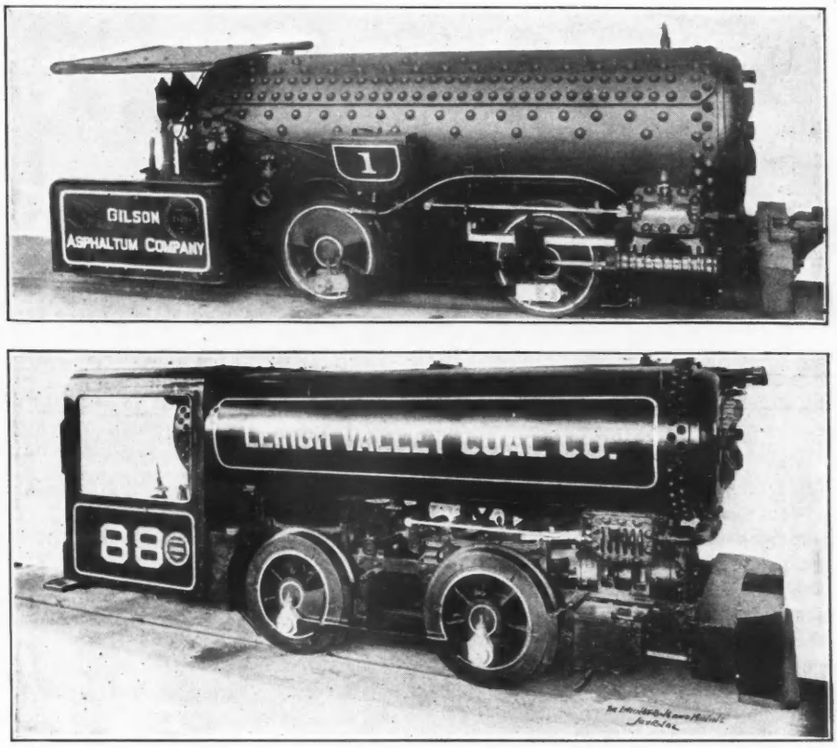
This locomotive is in mining service. The leading dimensions are: Gage, 4 ft.; cylinders, 8x12 in.; driving wheels, diameter, 28 in.; wheel base, 4 ft.; weight, 18,000, lb.; tractive force, 3260 lb. The equipment includes air brakes, also four sand boxes with spouts to all the wheels.

A More Compact Type

The locomotive for the Gilson Asphaltum Company, of Mack, Colo., is also in mine service. The atmosphere in this mine is charged with gilsonite dust which is very explosive; hence compressed-air haulage has been adopted in order to eliminate fire risks. This locomotive is considerably lighter and more compact than the one for the Lehigh Valley Coal Company.

The air supply is stored in a single tank of 39-cu.ft. capacity. The initial pressure is 800 lb. per sq. in., and the working pressure 140 pounds. The cylinders are placed outside the frames, in a horizontal position. The frames are of plate steel and are supported on coiled springs. The air tank rests directly on the frames, the points of support being over the springs.

This engine is provided with a sand box on each side, and sand can be blown under either the front or back wheels by means of air sanders. Air-brake equipment is also provided, with shoes on all the wheels. The auxiliary air tank is placed on the left side and is fitted with a safety valve, as is also the main tank. The principal dimensions are: Gage, 2 ft.; cylinders, 5½x10 in.; driving wheels, diameter, 20 in.; wheel base, 3 ft. 6 in.; weight, 8650 lb.; tractive force, 1800 pounds.



Two New Compressed Air Engines

A Safe Working Rock Cover Limit

Anthracite Companies Use Great Care in Calculating the Depth and Strength of Overlying Strata, so as to Prevent Cave-ins and Protect Life

BY FRANK LYNDE

To work a shallow seam of anthracite coal, it is necessary to prove the thickness of the strata overlying the seam by means of test holes, in order to secure the maximum safety for the workmen, as well as to protect the property from a serious cave-in. Most of the seams found in the Northern anthracite fields are far below the elevation of rivers and streams. economical mining will not permit such extensive provings; however, when the workings in the mines are approaching a body of water, such as a river, lake, pond, etc., it is always well to put down the provings to the seam at each corner of the squares and cement the holes. The squares in this case should be as small as possible.

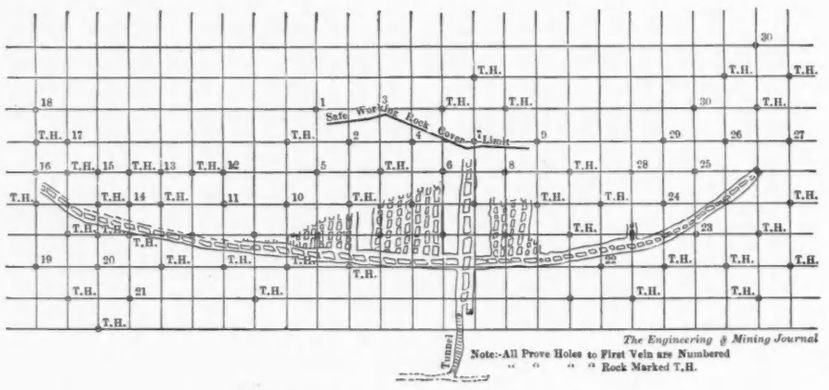


FIG. 1. SHOWING TYPICAL WORKING OF A SURFACE SEAM IN NORTHERN ANTHRACITE FIELD

Fig. 1 shows the typical working of a surface seam in the Northern anthracite field. In developing such a bed, the area is usually divided into a number of squares, whose sides vary from 100 to 400 ft., depending upon the following conditions:

1. Character of the rock overlying the seam.
2. Depth of wash over the rock which varies from 10 to 150 feet.
3. Thickness of safe working rock-cover limit, which varies from 20 to 100 feet.

At each or every other corner of the square, a prove hole is put down, which may be to the rock or to the first seam, depending upon the character of the information required. In some instances, the companies put most of the holes to the rock and very few to the seam; others prefer to drill every other hole to the vein, while still other operators advocate putting the majority of the holes to the first seam.

THE HOLES SHOULD BE SUNK TO THE SEAMS

When the holes are put down to the rock, we get very little information as to the nature and condition of the strata above the seam. On the other hand, putting the majority of the holes down to the first seam is very expensive, and

side of the squares 200 ft.; for 60 ft. rock cover, 300 ft. squares, and for 80 ft. rock cover, 400 ft. squares, etc. In other works, the sides of the squares should equal five times the thickness of the safe working rock-cover limit.

In case of a soft rock, such as "soapstone," "fireclay," and other rocks, which disintegrate readily when exposed to the atmosphere, the side of the squares may be taken as three times the thickness of the safe working rock-cover limit, the least thickness of which should be 50 ft. The width of the workings should not exceed 40 per cent. of the chamber centers. This is done not only to avoid cave-ins, but also it lessens timbering as well.

DETERMINING A ROCK-COVER LIMIT GRAPHICALLY

It is an easy matter to determine a given thickness of safe working rock-cover limit graphically, when the bore-hole data are available. Fig. 3 shows a method by which a safe working limit is usually established. In this sketch

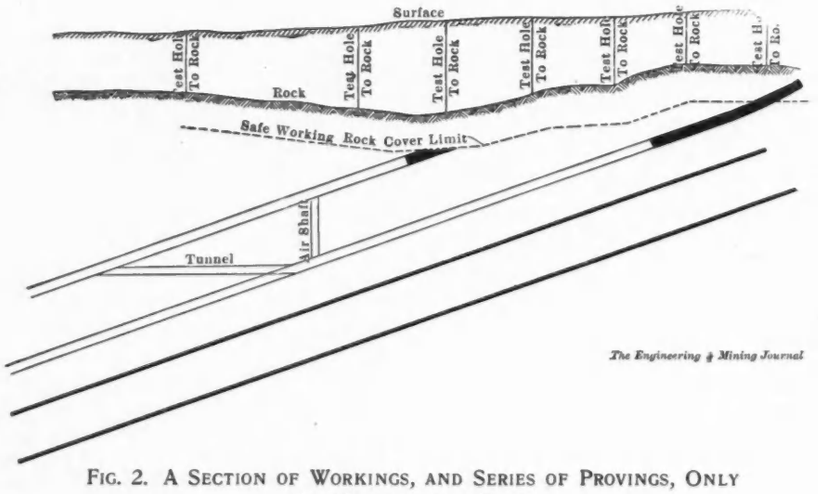


FIG. 2. A SECTION OF WORKINGS, AND SERIES OF PROVINGS, ONLY PUT DOWN TO THE ROCK

The sides of the squares should be roughly proportional to the thickness of the safe working rock-cover limit. This proportion depends upon the hardness and condition of the rock overlying the seam. For a medium hardness of rock with wash less than 75 ft. thick, the relation between the thickness of a safe working rock cover and the sides of the squares, in practice, is as follows: For 20-ft. rock cover, the side of the squares should be 100 ft.; for 40 ft. rock cover, the location of the bore holes and sections of two consecutive holes are plotted. Each hole is numbered with its surface, rock and seam elevations. The line connecting any two holes is taken as a datum line for the section. From the datum line, which is taken as plus 400, measure off the elevations of surface at the two holes and connect them by a straight line. In the same way the two rock elevations and the elevations of the seam are connected. Then measure a de-

sired thickness of the safe working rock-cover limit from the elevation of the rock; when this line cuts the roof of the seam, as at *A* between the bore holes 8 and 9, it is the point where it has just the desired thickness of the rock and beyond which it is not safe to work.

Then continue by projecting point *A* upon its datum line, as at *B*. In the same way, point *C* between the bore holes 7 and 8 is established. Project *C* to *D* and connect *B* and *D*, *D* and *F*, etc. The regular lines connecting these points fix and establish the safe working rock-cover limit. Fig. 2 shows a section of workings and series of provings, which are only put down to the rock; in this case the safe working limit cannot be determined beforehand. But frequent surveys of the workings must be made as the faces advance, so as to get the elevation of each face. Then the actual thickness of the rock over any given face is the difference between the rock elevation and the elevation of the roof and the face of the workings. The dotted line on Fig. 2 shows 50 ft. safe working rock-cover limit.

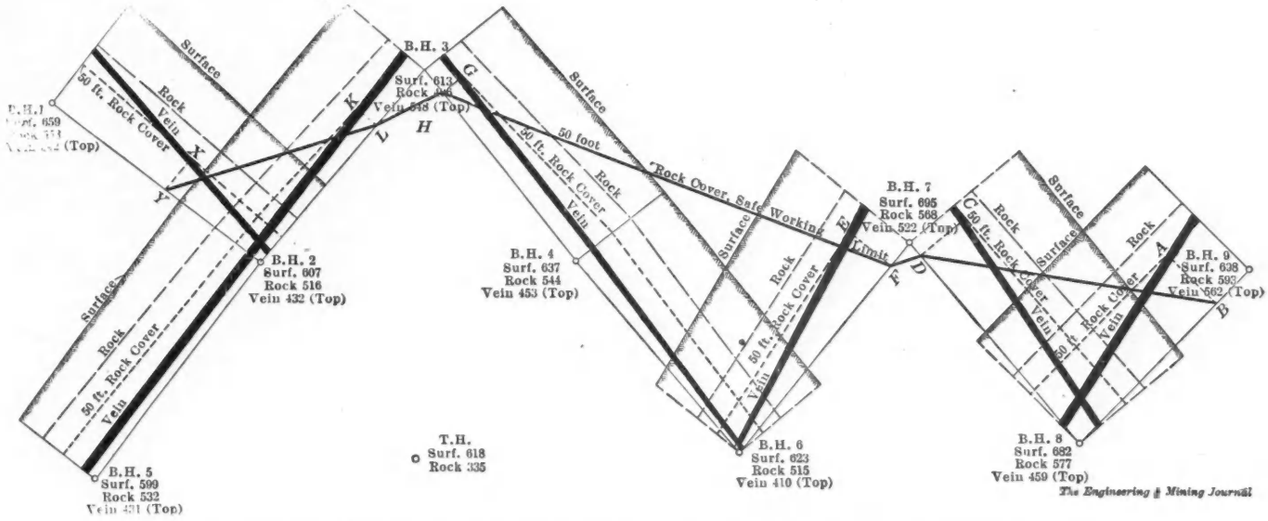
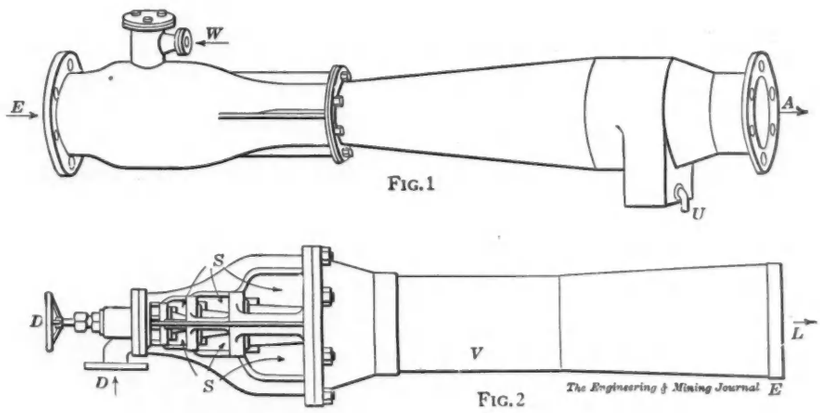


FIG. 3. SKETCH SHOWING METHOD BY WHICH A SAFE WORKING LIMIT IS USUALLY ESTABLISHED



APPARATUS FOR WATER-JET AND AIR-JET VENTILATION

Mine Ventilation

BY OSKAR NAGEL*

The system of ventilation best suited for a certain mine depends upon local conditions. With a large surplus of power, mechanical ventilators or fans will be used to advantage; where high-pressure water is inexpensive, water-spray ventilators are convenient, while the air-jet ventilator will be the proper apparatus wherever compressed air is obtained at low cost. The operation of the water-spray and air-jet types is based upon the sucking force of a jet.

Ernst Koerting, who has devoted a life time to the development of jet apparatus and its various applications, has succeeded in constructing a successful mine ventilator which is widely used in European collieries. Fig. 1 shows a Koerting water-spray ventilator in which *W* is the water inlet; *E*, the air inlet; *A*, the air discharge, and *U*, the water overflow. The motive power in this apparatus is a water spray produced by water being forced through a nozzle under pressure. The water issues from the nozzle in the form of a cone and strikes against the inner walls of the apparatus. The efficiency of the apparatus is as high as 50 per cent., which is greater than that obtained from fans. The air is cooled in its passage through the cone of spray, and at the same time is moistened and washed. These features of the apparatus are of considerable value. As an example of the cooling effect of the water-spray ventilators, I may mention that in the case of an apparatus supplied for an underground engine room the temperature of the room was reduced from 96 deg. F. to 76 deg. F., the temperature of the water being 63 deg. Reliability, simplicity and low first cost are some of the advantageous features of this type.

The compressed-air jet ventilator is shown in Fig. 2. In this type the quantity of air to be delivered is easily regulated, a feature which will be appreciated by coal operators. The air ventilators can be arranged either to blow the air forward or to exhaust it. The efficiency is the same in both cases.

*Consulting chemical engineer, New York, N. Y.

Texas, the only State which has been an iron manufacturer, has gone out of the business and leased its property. This consisted of a blast furnace and pipe foundry at Rusk, several small iron-ore mines, and about 45 miles of railroad connecting the furnace with the mines and extending to Palestine. The furnace and foundry were built to give employment to the convicts in the prison at Rusk, but they have never paid, showing a large deficit yearly. Now the furnace needs repairs, and it has been decided to lease it to private parties.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

W. E. Reppy, of Carthage, Mo., has gone to Cobalt, Ont., to examine some mines.

Max Wardall, of Seattle, Wash., has been appointed receiver of the Clallam Coal Company.

Theodore Gross, resident manager of the Hirsch Syndicate, Ltd., has returned to New York, from London.

Alfred James, of London, has been visiting and inspecting mines at Real del Monte and Pachuca, Mexico.

John Knox, Jr., assistant superintendent of the Calumet & Hecla, is recovering from an operation for appendicitis.

H. Kenyon Burch, mechanical engineer for the Miami Copper Company, has just returned from a 900-mile automobile trip through Arizona and the northern part of Mexico.

Myron K. Rodgers, of Seattle, Wash., has been spending two months in Mexico, examining and reporting on mines near Guadalaja, at Etzatlan, and in the Ameca district.

Algernon Del Mar has established an office in the Union Trust building, Los Angeles, Cal. His specialty is stamp milling and cyanide treatment of gold and silver ores.

W. C. B. Alien is geologist for the Kansas City Southern Railway Company, with headquarters at Kansas City, Mo. He has done much exploration work along the line of that road.

John M. Nicol is now representative in Mexico for the Hammond Iron Works and the Hendryx Cyanide Company, in place of Francis E. Pratt, resigned. His office is in the City of Mexico.

George E. Farish, of Denver, Colo., sailed from Seattle, Wash., May 21, to examine some placer properties in southern Alaska. His address will be, until Aug. 1, care Postmaster, Juneau, Alaska.

Dr. G. B. Waterhouse, of Buffalo, N. Y., has been appointed metallurgist to the Lackawanna Steel Company, in place of H. Cook, resigned. Dr. Waterhouse has conducted some experimental work in metallography and other special lines for the company in the past few years.

William K. Field has been elected president of the Pittsburg Coal Company, in place of M. H. Taylor, who becomes chairman of the board of directors. Mr. Field was at one time president of the New Pittsburg Coal Company, of Ohio, but for several years past has been president of the Sunday Creek Coal Company.

Maximillian Herrmann, professor of the Royal College of Mines, Hungary; Francis Vnutsko and Francis Bohm, mining engineers connected with the Hungarian Government, are now in this country studying the natural gasfields. They constitute a commission appointed by the government for that purpose, in consequence of the recent discovery of natural gas in Transylvania.

Dr. R. B. Owens, until recently electrical engineer with the Southern Power Company, at Charlotte, N. C., has accepted the appointment of secretary of the Franklin Institute, Philadelphia, made at a recent meeting of the board of managers. He is a graduate of Johns Hopkins University, and has been instructor at the University of Nebraska and at McGill University besides engaging in practical work.

A committee has been appointed to arrange for the centennial celebration at Pachuca, Mexico, in September, which includes the following representatives of the mining interests: C. W. Van Law, general manager Real del Monte; Hugh Rose, general manager Santa Gertrudis; H. A. Barker, Blaisdel Reduction Company; Frederick P. Jaggi, Consolidated Smelting and Refining Company; Francisco H. Rule, La Blanca Mining Company.

J. Obalski and E. Dulieux, under the firm name of Obalski & Dulieux, have opened offices as mining engineers in the Quebec Bank building, No. 11 Place d'Armes, Montreal. Mr. Obalski was for many years head of the Bureau of Mines, of the Province of Quebec, and is widely known in Canada from his long experience in the mining industry and his extensive explorations of the northern territory. Mr. Dulieux is at present in charge of the mining department at Laval University, and is a graduate of the High School of Mines in Paris.

OBITUARY

Franklin C. Robinson died at Brunswick, Me., May 25, aged 58 years. He had been professor of chemistry and mineralogy in Bowdoin College for over 30 years. He was well known for his various chemical investigations and was a vice-president of the American Chemical Society.

August Rische died in Denver, Colo., May 13. He was well known formerly as a miner and prospector in Colorado. Together with George Hook, who is now in Germany, he discovered and located the famous Little Pittsburg mine at Leadville, on a grubstake furnished by the late H. A. W. Tabor. He made a large profit from his share in the mine, which he afterward sold. He had lived in Denver ever since, but lost much of his money in unfortunate investments.

Warner Arms died at Youngstown, O., May 18, aged 58 years. He was known for years as president of the Falcon Iron and Nail Company, Niles, Ohio, which was established in 1867. In 1886 the Falcon Tin Plate and Sheet Company at Niles was taken over, its principal product being Russia iron sheets. The company in 1892 built a mill to roll black plates, and in March, 1895, it produced tin and terne plates. This latter plant was taken over by the American Tin Plate Company; later, on the organization of the American Sheet Steel Company, the latter took over the original sheet mill plant of the Falcon company. Mr. Arms was third vice-president of the American Tin Plate Company, and later was made first vice-president. He retired from sheet and tin-plate manufacture in 1903.

SOCIETIES and TECHNICAL SCHOOLS

University of Kansas—The present Geology and Mining building, which was completed last year, is three stories high, 60x110 ft., with an annex for mining and ore-dressing laboratories, 40x80 ft. The first floor of the building provides two offices, one private laboratory for advanced quantitative work, one large general blowpipe laboratory for mineralogy, one classroom; a drafting room, a fireproof vault for preserving drawings, manuscripts, etc., a museum room for storing mining machinery, and other lesser rooms. The annex provides laboratory facilities.

West Virginia Coal Mining Institute—The summer meeting will be held at Bluefield, W. Va., June 7-9. The program includes a visit to the mines of the United States Coal and Coke Company, with an address by E. O'Toole, general superintendent of those mines. Papers to be presented are as follows:

1. "Mine Water Softening and Purification for Coal Mine Operations," J. C. W. Greth, Pittsburg.
2. "Safety Chambers in Mines," George S. Rice, Pittsburg.
3. "Coal Mine Equipment," W. S. Mayers, Fairmont, W. Va.
4. "Relation of the Deep Waterways of the Mississippi to the Waterways of West Virginia," Col. John Luther Vance, Columbus, Ohio.
5. "Allotment of Cars for Coal Mines," J. W. Heron, Huntington, W. Va.
6. "Languages, a Factor of Safety and Profit in Relation to Coal Mines," Charlton Dixon, Lowmoor, Va., and Dr. Peter Roberts.
7. "Geology of the Bluefield Region and the Pocahontas Coal Series," Dr. I. C. White, Morgantown, W. Va.

In addition, A. C. Morse, Elmira, N. Y., will give a demonstration of methods of extinguishing fires in coal mines. Mayor Charles Lynch, Medical Corps, U. S. A., will be present with a fully equipped hospital car and apparatus for first aid to the injured.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

May 30—The strike in the Kate Hardy mine at Forest, Sierra county, where good ore was found close to the surface, has induced a number of owners of adjoining properties to work the surface dirt. In the districts of Alleghany, Forest, Scott's flat and vicinity, 300 men are now working for wages in addition to the number who are working for themselves. Mines long idle are being developed. The Phœnix quartz mine at Sierra City is being put in shape again and a 3-mile flume is being rebuilt to bring in water. At Gibsonville, three recently incorporated companies are planning mills. At Forest the gravel channel has, after six years' work, been intersected in the Rio Antigua mine at the end of the mile-long tunnel. It is thought that this is the old Bald Mountain channel, which yielded largely when worked years ago. At Sierra City, where the Swastika mine, formerly the Chipps, has a 12-stamp mill, ten stamps are being added by superintendent L. H. Holly. The reopening of the Irelan mines at Minnesota, Alleghany district, is at last well under way, and important development work is going on in the Dreadnaught, Gold King, Sierra Wonder, Sherman, Balsam Flat, Kenton and other mines.

Plumas, the adjoining county, is also experiencing a distinct revival, largely owing to the advent of the Western Pacific railway. Steps are being taken to build a wagon road from Mohawk valley to the Gold Lake section of Sierra county, and this road, when completed, will make the business of the Downieville and Sierra sections dependent on eastern Plumas county. Passenger traffic on the Western Pacific has not yet been started, but soon will be. In the vicinity of Genesee, extensive developments are being made on the copper belt. A small furnace is being put up on the Engel claim in that section, and the Walker Mining Company will soon commence production on a large scale and ship its ores. For several years more or less work has been done on the copper claims in Plumas county, and now that the new railroad is operating, there is a chance to ship the ores for treatment at smelteries elsewhere.

The Keystone Dredging Company, operating in Butte county, has increased its capital from $250,000 to $2,500,000.

The Otter Bar Placer Company was incorporated at Stockton, capital, $15,000, to do mining in Calaveras and Tuolumne counties. William Hendsch is director.

Denver

May 29—Apparently the Silverton mines will become heavy producers of zinc ores. Ten carloads of zinc concentrates from the Aspen mine were shipped during May. Another carload was shipped from the Silver Lake, and the Silver Ledge mine, on Mineral creek will soon be a large zinc producer.

The Oak Creek coal mines, in the Yampa coalfield, on the Moffat road, 195 miles from Denver, are outputting about 800 tons per day, a great deal of which is being shipped to Missouri River points. At the same time, if it were not for the lack of cars during the cold season on the Missouri River roads, there would be a market for 5000 tons per diem for the above points from the mines of the Oak Hills, Juniper and Routt County companies in the Oak Creek district.

The Roosevelt deep drainage tunnel in the Cripple Creek district, from the results of which so much is expected, is within 1000 ft. of the El Paso shaft, on Beacon hill, and as several rich strikes have lately been made in that section, more than usual interest attaches to the work. The principal discoveries of rich ore have been made in the Prince Albert and Black Belle properties, on the south slope, by the Union Leasing Company. These mines are developed at 600 ft. by the Iland tunnel, which has been driven 1650 ft. Raymond S. Husted is the manager. The ore encountered in the tunnel is at the contact of the big phonolite dike which has its course through Beacon hill and the granite, and is 4 ft. in width. On the same hill, Dr. Buckmaster and associates, leasing on the Home, of the Commonwealth company, have opened an oreshoot at the 300 level. At the Mable M. shaft, of the Gold Dollar company, under lease to Albert Campbell, a shoot of ore 4 ft. in width has been opened at the fourth level, and an initial shipment has returned over 2 oz. gold per ton. Macdonald & Co., leasing in the Gold Dollar tunnel, is shipping ore that runs from $15 to $30 per ton. So that Beacon hill is at present the center of interest in the Cripple Creek mines.

The Beacon Hill orebodies are found at the contact between the granite of the hill and what has been called a dike, but is, more properly speaking, according to the U. S. Geological Survey, "an eruptive plug filling an elliptical conduit in the Pike's Peak granite." But there are minor dikes in the hill which are apparently offshoots from the main mass or plug, and along these are also found rich orebodies, notably one of these, which is known as "the El Paso dike."

Much interest centers in the new Portland mill on Battle mountain, and its success will mean much to the district. The Portland has three 6-ft. chilian mills, one of which is now running, and the other two will start up as soon as the adjustments and changes incidental to the starting of a new plant are made. The process in use consists of first concentrating out the sulpho-tellurides, and then cyaniding the tailings, with the adding in this case of an additional salt, which designates it as "the Portland process." The mill is operating on mine ore. F. B. Crowe is the metallurgist, Mr. Taylor, general manager.

Adjoining Beacon hill is Raven hill, and there the Elkton mine, the gross production of which is now close to $10,000,000, is to be benefited greatly by the completion of the Roosevelt tunnel, which is expected to drain the workings at a depth of 1600 ft., or 700 ft. below the lowest level. This mine has paid to date $2,554,460 in dividends.

Butte

May 29—The annual meeting of stockholders of the Anaconda Copper Mining Company was held in Anaconda on May 18 and the following directors elected: B. B. Thayer, William Rockefeller, John D. Ryan, H. H. Rogers, F. P. Addicks, Urban H. Broughton and George H. Church. A detailed report was also made by the president, giving the conditions existing at the different mines of the company. At the Anaconda mine the gases have seriously interfered with operations. From September, 1908, to May, 1909, the gases rendered the shaft useless but at that time abated sufficiently to allow repairs, which were made down to the 800-ft. level and some ore hoisted from that depth. The shaft will shortly be repaired from the 1200-ft. level to the 800-ft. level, after which, since the shaft below that point is in good repair, hoisting will be resumed. The Neversweat has hoisted considerable of the Anaconda ore. At the St. Lawrence shipments are being made from the 700-ft. level. The Mountain Consolidated shaft was sunk an additional 160 ft. At the High Ore in April, 1909, a crosscut on the 1400-ft. level encountered an orebody of considerable size and high value, the existence of which had been unsuspected. The same orebody has since been found on the 1200-, 1600- and 1800-ft. levels and a crosscut is now being run to it on the

2200-ft. level. From the 2800-ft. level a crosscut has been driven to a point underneath the Anaconda shaft to which a raise will be run, thus making the latter shaft 2800 ft. deep. At the Diamond, the shaft has been sunk to the 2956-ft. mark. The Belmont shaft, down 1400 ft., will be sunk an additional 600 ft. Connections have been made with the Anaconda 1400-, 1600- and 1800-ft. levels. At the Right Bower the shaft is 534 ft. deep and some exploration work has been done but it is thought that greater depth must be attained before higher values are encountered. The report states that the hopeless conflict of extralateral rights in the Butte mines made necessary the consolidation of the several companies.

Salt Lake City

May 26—Active work has been started on the new Snake Creek drainage tunnel, which is being driven to develop the southern part of the Park City district. A concrete compressor house has been built, and a Sullivan two-stage compressor with a capacity of 680 cu.ft. of free air per minute has been installed. This is belt driven by a 100-h.p. General Electric motor, power being furnished by the Snake Creek Power Company. The current is reduced from 6600 to 440 volts at the transformers, which are just outside of the compressor building. Two 3¼-in. drills are being worked abreast in the 6½x9-ft. tunnel, and the face is advanced about 12 ft. per day. The contract calls for 370 ft. per month. The tunnel, which was started by hand, is now in a distance of over 200 ft. At present 26 men are employed on three shifts. This force will be increased.

The taking of testimony in chief of the plaintiff in the case of the Silver King Consolidated vs. the Silver King Coalition was concluded May 25. On May 27, testimony in rebuttal began. The hearing has already occupied about six months.

Goldfield

May 26—The jury in the case of L. H. Dresser, charged with "high grading" in the Consolidated mill where he formerly worked on the concentrating tables, has been dismissed for failure to reach a verdict. The vote stood seven for acquittal and five for conviction. The defendant was arrested as he was coming off night shift at the mill. It is alleged that in his pockets were found several pounds of concentrates valued at $200. A second trial will follow within a couple of months, although it is common talk in Goldfield that a jury cannot be secured that will convict a man of robbing the Consolidated.

It is expected that by June 15, the Consolidated mill will again be in operation at its full capacity. The rubber conveyer belt which was made to order in the East is on the ground and will be put in place as soon as the steel work is completed. Foundations for the new storehouse are in, and the railway spur to the new site is completed.

Scranton, Penn.

May 29—Over 10,000 miners in the collieries of the Pennsylvania Coal Company between Old Forge and Wilkes-Barre went on strike last week, alleging grievances to which they said they were subjected contrary to the award of the Anthracite Commission. The men did not come out in a body, nor were they called out by the officers of the miners' union, to which, as a matter of fact, the majority of them did not belong. The strike was started by 300 men in a mine at Old Forge, followed next day by the same number of men coming out at Pittston, and these two isolated strikes were followed by others until the whole number of men were idle.

The 12 grievances are formulated. The men say that at the collieries at which the coal is weighed, the cars were run so fast on the scales, seven a minute, that the weighmaster could not obtain an accurate weight and that he seldom or never conscientiously tried to do so. They also said that the dockage was excessive; that they were paid less than at other mines for rock work and yardage. They also complained of tardiness in the delivery of cars and mining props, and other matters of the kind.

When the men began going out on strike, the officers of the union of the First district got to work and enrolled a large number of the men in their organization. The majority of the men working for the Pennsylvania company are foreigners, and at Midvale there was some rioting, one of the rioters being shot by a State trooper, that force having been called out to protect property in the neighborhood of the mine where the rioting occurred.

On May 26, Capt. W. A. May, general manager of the Pennsylvania Coal Company, and W. W. Inglis, general superintendent, representing the Erie railroad, to which the Pennsylvania company belongs, W. L. Connell, president of the Conciliation Board, and Pres. Benjamin McEnaney and Secretary John T. Dempsey, representing the striking miners as officials of the miners' union, met at Scranton to reach a settlement, or at least a method of adjusting the difficulties. It was announced that the company was willing to submit all the grievances the men allege to the Conciliation Board and that they would adhere loyally to the decision of the board, whatever it may be, after the men had returned to work. On the other hand, President McEnaney said that he would call a convention of the miners, and try to persuade them to accept this solution.

On May 27 there was a mass meeting of the miners of the company held at Pittston, at which President W. L. Connell, of the Conciliation board, and President McEnanney, of the miners' union, attended. They advised the men to return to work and to place their grievances before the Conciliation Board. The strikers then retired and took a vote on the reference of the matters in dispute to the Conciliation Board. After a few minutes' deliberation, they decided by a unanimous vote that they would not return to work until the grievances of which they complained were redressed. There is every possibility now that all the miners employed by the company, some 20,000 men, will be on strike within the next few days.

A committee representing the strikers of the several collieries of the Pennsylvania Coal Company had an interview, May 28, with Capt. W. A. May, general manager of the company. After some discussion on the points in dispute, the committee declared that the 10,000 men whom they represented would not return to work until all the grievances of which they complain were redressed.

The company has collieries at Forest City, Mayfield and Dunmore; none of the men at these mines have struck yet. The employees of the Consolidated mine of the Hillside Coal Company at North Avoca went on strike May 29, alleging the same grievances as the men at the other collieries.

Cobalt

May 30—Last year there were 105,416 tons of coal used under the boilers, but now the amount used in this district is almost negligible. The Mines Power Company has repaired the generators at Matabitchowan, and the entire system is working satisfactorily. The pressure of the air is remarkably constant at 105 lb. and is practically free from moisture. The plant of the Hydraulic company is also giving satisfaction. There are now 13 concentrators in the district, all operating by electricity, and this number will shortly be augmented. A Pittsburg syndicate will erect a custom mill near Kerr lake, and the Hudson Bay company has also decided to build a concentrator. It is stated that the Crown Reserve is also planning one.

Mexico

May 29—In northern Mexico the zinc ore situation is unchanged. The European buyers decline to take any ore except on long contract. The Calera company, of Chihuahua, is shipping to the United States, as are also the Chihuahua and Potosi mines of the Sta. Eulalia district of Chihuahua, both of which have long contracts at good prices.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alaska

A New York company under the direction of A. J. Scheur, has secured the right-of-way for a railroad to be known as the Alaska Short Line, to run from Illimna to the Kuskokwim, touching the Innoko and Haiditarod countries.

Joseph Houston and associates have given a bond on 2500 acres of placer along the Alaska Northern railroad at mile 24 to Victoria investors represented by T. Ford Hopkins.

Arctic—This company will start operations at Teller, May 20. Ten acres of gravel will be run through the boxes the first thing. Max Hirschberg is manager.

Chena—This company has been incorporated at Chena for the purpose of building a 10-stamp mill for custom work.

Reliance—These mines will be equipped with the first 20-stamp unit of a 200-stamp mill.

Eagle River—This company expects to make the properties formerly owned by the Nowell company, Berner Bay, produce within the year. Bert Thane has charge.

Alaska Treadwell—The crushing for the month ended April 15 was 19,315 tons, yielding $55,712. The net operating profit was $19,818; yield per ton, $3.01.

Alaska United—The total yield for month ended April 15 was $73,944. The ore in the Ready Bullion averaged $2.40 per ton and in the "700," $2.

Lost River Tin—The company is making preparations for working the property 28 miles north of Teller. H. F. Peterson, of Seattle, is manager. About 1100 ft. of development has been done, and a number of veins of tin have been opened up.

Beatson Bonanza—This copper mine on Latouche island has been sold to the Guggenheim interests. It is reported that a smeltery may be built in connection with the deal.

Alabama

Joseph H. Hoadley, president of the Alabama Consolidated Coal and Iron Company, has disposed of a majority of his holdings to Scranton, Penn., coal men and a new president will be elected soon. The Baltimore interests on the board of directors tendered their hesignations last week. It is given out that the new interests will make heavy expenditures looking to development of the properties of the company, which consist of coal and ore lands, blast furnaces and coke ovens.

In all probability the United States Steel Corporation will make a contract for the use of natural gas at its plants in and around Ensley, Ala., provided the pipe-line is constructed from the Fayette, Ala., gasfields. The pipe-line is now under consideration. The four wells flowing gas are now showing a strong pressure.

The Southern Iron and Steel Company will probably operate the plant of the Weller Rolling Mills Company at Alabama City, near Gadsden. The creditors of the bankrupt Weller concern expressed fears that the use of the plant by the Southern company might cause a deterioration in the value of the plant, but this has been arranged and the plant will likely be operated shortly.

Arizona

Gila County

Ray Consolidated—Formal notice of the proposal to exchange Gila copper shares for Ray Consolidated on the basis of three shares of the former for one of the latter has been issued.

Miami—All the interior work in the orebody at the Miami mine above the 420-ft. haulage level is completed, and the putting up of the raises which will be used as chutes in mining is far enough advanced so that production could be commenced at once if necessary. On the second haulage level, 570 ft. from the surface, the main drift which will eventually connect shaft No. 4 with the orebody 700 ft. distant has been driven 40 ft. from the station. This level will be designed and equipped in exactly the same manner as the haulage level above. The construction of the concentrator, power house and new hoisting plant is being carried forward rapidly, so that all should be in readiness for production by the end of this year. About 950 ft. of drifting and raising is being done weekly.

Arizona Commercial—On the seventh level a crosscut is being driven northward to open the Old Dominion fault. The installation of a 1000-gal. pump on the seventh level is now completed, preparatory to resuming shaft sinking.

Live Oak—The third churn drill struck chalcocite 300 ft. from the surface and has since passed continuously through sulphide ore for 55 ft. Drift No. 208, driven eastward on the second level, has passed through ore of similar character for 161 ft. As the third drill hole is 700 ft. west of the shaft, the ore belt is shown to extend 861 ft. in an east and west line, with an average vertical thickness of from 150 to 200 ft. M. E. McCarthy is manager.

Graham County

Detroit—The company has been absolved from liability for damages from the floods of 1906 by a decision of the Pima county court.

Pinal County

Mammoth—This gold property in the Superstition mountain district on the Maricopa county border, east of Mesa, has been acquired by George U. Young, who will install ten stamps and make tests for cyanidation while continuing development.

California

Amador County

Kennedy—The orebody on the 3300-ft. level is as large as it was on the level above. The ore extracted keeps the 100-stamp mill busy. The shaft will be sunk to the 3400-ft. level making it the deepest in the State.

Levaggi—This mine, Plymouth, has been placed under bond to Eastern men who are putting up a 10-stamp mill and starting to sink.

South Eureka—A new retort building has been erected and other improvements made.

Nevada County

Cassidy—L. H. Armstrong and associates have raised the money to start up this Grass Valley mine.

Double Diamond—This property near Moores Flat, D. Edwards manager, will resume.

Excelsior—The mines, Meadow Lake district, will be started under management of Charles Chambers.

Ancho—This mine at Graniteville, George Mainhart, manager, has been reopened.

Canada Hill—This mine has been unwatered and new compressors and drills have been ordered.

Placer County

Good Friday—Nevada county men have organized to work this mine at Ophir, and have obtained control also of the Green, Hilltop and Enterprise mines in the same district.

Plumas County

Bushman—This mine, near Quincy, has been bonded.

Gold Leaf—E. Arundel Smith has secured for English capital a bond on this

group near Quincy and will begin work. The Gobert mill has been leased.

SAN BENITO COUNTY

Aurora—This quicksilver property will have the new furnaces running in about three months.

Black Warrior—C. Davis and F. O. Richardson have paid the first installment on the bond on this property, which joins the Standard on the north and has a vein on the same contact. Men are at work developing.

SIERRA COUNTY

Swastika—This mine near Sierra City, will add 10 stamps, doubling the mill.

Kate Hardy—A strike has been made in this mine near Forest. Power drills and a mill will be installed. William Beggs, of San Jose, is one of the owners.

TRINITY COUNTY

Trinity—This new company at Carville is erecting a 40-stamp cyanide mill and installing a 500-h.p. hydroëlectric plant. D. W. Shanks, of Chihuahua, is manager.

Colorado

CLEAR CREEK COUNTY

Lucania—Jesse J. May has started on a contract to advance the tunnel 500 ft. and expects to have the work completed by Aug. 1. Another similar contract will then be let by John McCall, manager. The first 500 ft. will reach the Specie Payment vein.

GUNNISON COUNTY

United Colorado—The 200-ton mill at Dorchester is operating.

LEADVILLE—LAKE COUNTY

Brattleboro—One of the best gold strikes made in the district is on the Valley property of this company, in South Evans gulch. It is under lease to the Luema mining Company, Warren F. Page, manager.

Matchless—This mine on Fryer hill, owned by the Tabor estate, and under lease to T. M. Raney, is outputting 40 tons per diem of iron-silver ore from 365 ft., the silver contents increasing with depth.

SAN JUAN DISTRICT

Camp Bird—The April output was $166,765, and the net profit, $121,355.

TELLER COUNTY—CRIPPLE CREEK

Isabella—In May, the company's Bull Hill mine shipped 24 cars from the Lee shaft, which yielded 1 oz. gold per ton. The Empire shaft, under lease to the Western Investment Company, has shipped 12 cars, which it is said, ran $34 to $40 per ton; and from the Maloney shaft, on the Orphan Belle, 55 tons of $25 ore have been shipped by Lessee Dailey.

Eclipse—Work has been resumed on this mine, in Eclipse gulch, west of Battle and Squaw mountains. This was one of the first producers in Cripple Creek, and 900 ft. of drifts and shafts were done on it in the early day. It was credited with a production of $50,000. An electric hoist has been installed, and the lessees are unwatering.

City View—A shoot of ore 50 ft. in length and yielding from 1 to 2 oz. gold per ton, nas been opened by Frederick Schaeffer, lessee, on the City View basalt dike, Gold hill.

Requa-Savage—Two carloads of ore from this Beacon Hill mine were shipped recently, estimated to carry 1 oz. gold per ton.

Ajax—Leasers are sending out from 1200 to 1500 tons per month of $20 average grade, the ore coming from all parts of the mine from surface to the 1300-ft. level.

Granite—Several hundred tons per month are being produced by this property, the average grade being a little over $20 per ton.

Vindicator—Four to six carloads per month are being shipped by John Sharpe, leasing on the dump of this mine, and it is said the returns are better than those obtained from some of the mine ore.

Stratton Estate—The American Eagle mine of this concern, under lease to the Colorado Mines Investment Company, Paul Hines, superintendent, during April produced 350 tons of ore averaging $50 per ton. Sublessees shipped carload lots of very much higher grade than the above, some of it yielding as high as $1000 per ton. Todd & Co., sublessees, have made a strike of 18 in. of ore carrying free gold, which is being sacked underground.

Idaho

COEUR D'ALENE DISTRICT

Mineral Point—This mine, which is especially rich in silver, has resumed prospecting by diamond drill and will work actively.

Rex—Regular shipments will begin July 15 by which time the second compressor and hoist will be in place.

Trail Gulch—This gold-quartz property, located in 1884, has been purchased for $70,000 by W. J. Peck and William Lotze, of New Haven, Conn., and by F. W. Isham, of Spokane, and $36,000 paid. The property was owned by A. B. Ward, of Delta. It was formerly owned by Charles Sweeny, of New York.

Bunker Hill & Sullivan—The tailing mill with a capacity of 1000 tons daily, is operating satisfactorily and is adding greatly to the output.

Iron Mountain Tunnel Company—This company has completed the 1650-ft. tunnel and is operating under direction of Robert C. Davis. Preparations are being made to commence zinc shipments from above the 1600 level, and to recover the silver-lead ore developed.

Indiana

GIBSON COUNTY

Ayrshire Coal Company—This company has leased a large tract south of Oakland City, and will open a new mine. The mine is on the Evansville & Indianapolis railroad. Pittsburg men are also making coal tests south of Oakland City, with a view of developing their leases.

GREENE COUNTY

Sullivan Coal Company—This company, operating a large mine at Dugger, has filed a petition with the Indiana Railroad Commission, asking that the Indianapolis Southern railroad be compelled to establish a 60c. rate on coal to points in the gas belt. The petition alleges that a 60c. rate is enjoyed by competitors on other lines, but that the Indianapolis charges 75c. to the complaining company.

SULLIVAN COUNTY

Consolidated Indiana Coal Company—This company is drilling at Keller. The drill has reached No. 5 vein and other holes have been started.

VIGO COUNTY

Every mine in the Terre Haute district is in operation on full time, to meet the demand for coal in the northwestern market. The railroads are taxed to supply cars. The price of steam coal at the mines closed at $1.75 a ton, against $1.25 earlier.

Michigan

COPPER

Keweenaw—The shaft on the Kearsarge lode is 200 ft. and the lode being exposed is nearly 40 ft. wide, with about 25 ft. of it uniformly charged with copper. A drill in line with the shaft cut the formation at 1400 ft. and the core showed the formation to be about 28 ft. wide and proved the continuity of the mineralization.

Phœnix—At this property, the drill has penetrated the ashbed lode, showing it about 65 ft. wide, with copper.

La Salle—No 1 Tecumseh shaft is down to the 22d level, with the openings from the 14th to 17th levels inclusive revealing stamp rock. Shipments of 350 tons of rock are being made daily to the stamp mills, most of it from the stock pile.

Contact Copper Company—This company has been organized to acquire the Elm River property and the tract of land comprising about 800 acres in sections 13 and 12, now held under option by the Elm River Company. Among the incorporators are Harry F. Ray and Steven R. Dow, of Boston, and John G. Stone, of Houghton. It is planned to begin drilling on section 13 at once.

Ahmeek—The first head in the new stamp mill is ready and will be followed within a few days by the second. In the near future this property will be taking care of its own rock.

Oneco—The company has discontinued its No. 7 hole after penetrating the Oneco lode and has moved it to No. 9 hole, which, together with No. 8, will go down vertical to expose the mineralization underlying the southeastern portion of the tract.

Twin Lakes—The company has discontinued driving its sand pipe for the first hole on section 23. This pipe was started at an angle of 45 deg. and was put down 485 ft. when boulders were encountered. Another attempt to get this pipe down was started at the same point vertically. The second hole will be started on section 27, going down vertical.

New Arcadian—Surface trenching has been started on the trend of the lode exposed in the No. 4 hole of the New Baltic company.

IRON

Munro Mining Company—This company, controlled by the Buffalo & Susquehanna interests, is developing an iron deposit between Crystal Falls and Iron River. The company has an exploration under way on the Schiebler tract on the Western Marquette range.

Swallow & Hopkins—This firm is interested in an option on the Gustafson land on the western Marquette range, north of the Chicago mine.

Cleveland Cliffs—The company has awarded contracts for a power house at the Smith mine and a crusher and ore-sampling house at the Austin mine, both in the Swanzey district of the Marquette range. The steel for a shaft house is on the ground at the Barnes property. This mine will be one of the largest on the range. The shaft is being put down rapidly.

Montana

BUTTE DISTRICT

Anaconda—Stockholders of the Alice Mining Company have voted to accept the merger agreement. The exchange gives the Alice shareholders 30,000 shares of Anaconda, or at the ratio of 15 shares of Alice for one of Anaconda. A court petition has been filed by six Parrot stockholders, who oppose the Anaconda merger, and ask to have their stock appraised.

Butte & Superior—The rumor that all work on the new concentrator had been stopped and that President Wolvin and Manager Atwater had been called to New York is apparently without foundation in so far as suspension of work is concerned. About 350 tons of ore are being shipped daily to the Basin concentrator and between 150 and 300 tons are being shipped each week direct to the Bartlesville plant of the American Metals Company.

East Butte—President Gross states that development is being confined exclusively to the Pittsmont mine from which 2086 tons are hoisted weekly, which average 5 per cent. in copper. An additional blast furnace will soon be started to treat ore from the Butte & Ballaklava mine which will be handled on a custom basis.

North Butte—George Bartlett states that the management during the last three years has evidently devoted most of its energies to getting out ore and that the development has not kept progress with the actual mining. This, however, will be remedied. Mr. Bartlett was unable to obtain any confirmation of the rumor that a diamond-drill hole was being run from the 2800-ft. level of the Diamond mine into the North Butte property. The shaft, he states will be sunk from the 2200-ft. level, its present depth, to the 2600-ft. level.

JEFFERSON COUNTY

Cascade and Eastern Star—W. J. Stephens, owner of the Hidden Treasure, has purchased from W. H. H. Dickinson the properties for $40,000. The claims contain a continuation of the copper vein in the Hidden Treasure.

London-Corbin—The gallows frame has been completed and a hoist will be installed. The shaft, down 60 ft., will be sunk 300 ft. before any other development is done.

Corbin-Pennsylvania—The company has been incorporated with a capital of $500,000. H. E. Emmerson is president, W. D. Gibson, and H. N. Brooks, secretary and treasurer. The property consists of six claims adjoining the Boston & Alta. On the Flambeau claim a shaft is down 120 ft., and on the Alta mine Extension claim there is a 150-ft. shaft.

Montana-Corbin—Two cars of ore have been shipped. One car from the 150-ft. level averaged 8.97 per cent. copper and one from the 400-ft. level averaged 12.6 per cent. copper.

MISSOULA COUNTY

Copper Hill Mining Company—The company has been organized by Morton Webster, A. T. Ryan, P. L. Eberhardt, Howard K. Welch and James Howarth to operate seven claims, several miles west of Quartz. A crosscut tunnel is in 500 ft. A second tunnel will be driven giving a depth of 1000 feet.

Nevada

CHURCHILL COUNTY

Nevada Hills—The reduction plant of the recently consolidated Nevada Hills-Fairview Eagle is nearing completion. As soon as the power company can supply electricity, the property will be operated at full capacity.

ESMERALDA COUNTY

The purchase of the Rawhide water system by Los Angeles capital means the erection of another custom mill in the Rawhide camp.

Florence—Interest centers in progress at northern extremity of the property in territory formerly in the Reilly lease, which produced nearly $1,000,000 in 90 days. The old lease workings will be tapped on the 350-ft. level, where rich ore is in sight.

Combination Fraction—The orebody exposed on the 500-ft. level, in virgin ground northeast of the main shaft, is being sought on levels below and above. The Fraction will start milling June 1.

Merger—High-grade ore from the shoot recently exposed on the Ford lease is being sacked and shipped.

Goldfield Annex—Sinking has commenced from the 800-ft. level.

HUMBOLDT COUNTY

There has been a new camp established in Lowery cañon, above National.

Work has begun on the mines of the Dike district, in the Pine Forest mountains.

Much work is being done at the Red Buttes copper camp Jackson Mountain region, about 60 miles northwest of Winnemucca.

The placer mines near American cañon, Humboldt range, are being worked again as are also the placers 18 miles south of Winnemucca.

Nevada Sulphur Company—The company has commenced operations on the property in the oil region 60 miles west of Winnemucca.

Equity—W. H. Hammond with Boston interests is developing this property at Mountain City.

Imlay—Robert Kirk, superintendent, reports the mill has been running steadily several months, treating 46 tons daily of $7 gold-silver ore. Sinking to the 250 level in ore is in progress.

Ohio—This group of three claims with five adjoining claims, has been purchased by a Milwaukee syndicate for $200,000. An additional $100,000 will be invested in a mill for treating the ore exposed in the mine and on the dumps.

Seven Troughs—The company is having tests made on the mine tailings, with a view to installing a cyanide plant.

NYE COUNTY

Tonopah shipments for week are: Tonopah, 3150 tons; Belmont, 1400; Montana-Tonopah, 971; MacNamara, 175; West End, 200; Tonopah Extension, 800; Midway, 50; total, 6746 tons.

Midway—Work will be resumed im-

mediately on the 1035-ft. level, the deepest in the mine.

Montana-Tonopah—The April report is the best for a year. 4303 tons were mined and milled, with an average extraction above 91 per cent.

Tonopah-Belmont—The Belmont shaft, which encountered ore at 1160 ft., is now 20 ft. deeper with the bottom still full of high-grade milling ore. The new vein promises to prove equal to the main Belmont vein from which it appears to be entirely distinct.

Tonopah—The mill during week ended May 15, treated 3400 tons, averaging $21. Bullion shipments included 76 bars of bullion and 40 tons of concentrates, total $86,000.

Bullfrog-Mohawk—A plunger pump, with a 20-h.p. gasolene engine, capable of 2500 gal. per hour, is being installed preparatory to sinking.

Montgomery Mountain—The company, owning a large acreage adjoining the Montgomery-Shoshone, has been incorporated with a capital of $1,500,000 by Utah operators.

Rex—The Rex mill at Gold Circle is running smoothly at maximum capacity.

New Mexico

Following its recent action in withdrawing from entry the newly discovered oilfield near Alamogordo, the general land office has withdrawn a tract 24 miles square, including all of the newly discovered oil and gas field of Eddy county, in the vicinity of Dayton. Nearly all of the artesian district of the county is included. Development of the Dayton oil district has just started on a large scale.

Sierra County

Lake Valley—The company is planning to place the smeltery in repair and treat the low-grade silicious ores on the dumps and in the stopes. The sulphide ores of Las Animas district, 25 miles north, afford a flux.

Good Luck—This company, operating the Dude mine eight miles south of Lake Valley, has opened up low-grade silver ore and lead. The shaft is down 300 ft. with drifts of 355 ft. on the 200-ft. level, and 190 ft. on the 300-ft. level.

Log Cabin—An examination is being made of these properties, Tierra Blanca.

Oklahoma

The Quapaw Gas Company may not be able to furnish gas for the Oklahoma mining camps owing to an Oklahoma law that prevents a company which receives gas out of the State from selling it in the State. The mains are laid and the gas is being piped to Missouri.

Queen City-Joplin—This mine will resume, the deeper mines in the camp having controlled the water.

Oregon

Josephine County

Brantner—This group has been purchased by Moy Jin Munn, a wealthy Chinaman, of San Francisco, who will operate the mines on a larger scale.

Sumpter County

North Pole and E. & E.—Alexander Baring, of London, is at Baker City on a deal which involves the consolidation of these properties.

South Dakota

The Lundberg, Dorr & Wilson mill, at Plumas, will resume soon.

Gold Mountain—This new company will sink a shaft 600 ft. to the quartzite and crosscut. The property is three miles east of Deadwood. John R. Russel is secretary.

Utah

The local United States land office has received notice that a part of the lands which were included in temporary petroleum withdrawals have been restored to entry. The restoration is made upon the recommendation of the director of the United States Geological Survey on the ground that the lands are more valuable for agricultural uses than as oil lands. A small part of this land lying south of the 37th parallel north latitude is governed by the Salt Lake meridian, Arizona. The land restored is for the most part in Washington county.

Box Elder County

Black Warrior—This property in the Lucin district was recently taken under bond and lease by J. B. Simpson and Frank Williams.

Emery County

Castle Valley Coal Company—The railroad to the mine is completed, and track is being laid on the tramway between the mine and tipple. Several thousand feet of development have been done. From 50 to 100 tons of coal are being mined daily, and preparations are being made to increase this to 500 tons.

Juab County

May Day—Leasers are mining from the 1000-ft. level. The ore was developed by the company on the 1000-ft. level, and was looked for on the 1100, but missed owing to the flat dip. A lease was granted to some of the employees. The company is shipping enough ore to meet expenses, and in addition to pay off some indebtedness.

Yankee Consolidated—Arrangements have been made with the Knight companies to furnish electric power and air for this mine.

Murray Hill—At this property north of the Yankee Consolidated, joining the Godiva claims on the northeast, a double-compartment shaft has been sunk 70 ft. Development will be continued in search of the Colorado orechannel.

Iron Blossom—Work is being done on the 600-, 700- and 1100-ft. levels. Copper ore has been developed on both the 700- and 1100-ft. levels, and a car is shipped every two weeks. On the 600 level, work is being done on the gold vein, which carried about $15 in gold and 30 oz. of silver. This orebody is reported to be headed southwest for the Governor property which is also owned by the Knights, and is about 200 ft. from the Governor north claim lines. In the north workings, No. 3 shaft, silver-lead ore is being mined from the stope on the 500-ft. level. Most of the shipments are from this part of the mine.

Carisa—Two feet of lead ore has been opened on the 500-ft. level, and development is being carried on.

Eagle & Blue Bell—The 200-ft. shaft has been retimbered for 50 ft., and is being put in shape for sinking. Timbering will be continued to the bottom. The new hoisting plant is expected in July.

Sioux Consolidated—The last 34 cars of ore brought $11,829.

Lower Mammoth—Development on the 2000-ft. level has not opened large orebodies, though some ore has been encountered. The drift is being driven south for the contact. The leasers are shipping ore from old workings between the 1100 and 1200 levels. What appeared to be a wall on the 1100 was broken through, and exposed ore.

Tooele County

Cliff—Ore is being hauled from the mine at Ophir to the railroad at St. John by a traction engine. The cost for hauling is stated to be 42c. per ton, as compared to $1.50 for hauling by teams. Regular shipments are being made.

Washington

Okanogan County

Q. S.—This mine will be developed by A. M. Dewey, of Spokane, and the improvements will include an electric power plant.

Snohomish County

Eclipse—The Independent mill building and water-power equipment has been purchased.

Stevens County

First Thought—Daily shipments are being made. The vein is over 30 ft. wide.

Canada

British Columbia

Consolidated—The plant smelted 41,933 tons in April, which yielded gold, 10,419; silver, 187,976 oz.; copper, 489,923 lb.; lead, 3,653,182 lb.; total value, $447,735. The company will explore the

Sullivan lead-zinc mine near Marysville, with drills.

Canada Zinc Company—The electric zinc-smelting plant at Nelson will be used by the Dominion department of mines for experimenting with electro-thermic processes for the reduction of complex zinc-lead ores.

Queen Victoria—Work will be resumed at the mine, near Nelson, now under bond to the Consolidated company.

Granby—An extensive exploratory campaign with diamond drills has been inaugurated.

ONTARIO

The shipments from Cobalt for the week ended May 20, are: McKinley-Darragh, 201,408 pounds; Crown Reserve, 84,000; Nipissing, 120,400; Buffalo, 66,000; O'Brien, 64,100; Chambers-Ferland, 64,260; Trethewey, 63,700; Coniagas, 52,400; Silver Cliff, 51,500; Cobalt Central, 46,300; total, 814,068 pounds.

Temiskaming—The new mill is treating 100 tons of dump and mine ore. Magnificent ore is being found on the 400-ft. level, and the shaft is being sunk to 500 ft., to open it.

Hudson Bay—This company has taken a working option on the O'Gorman & Sweet properties in Gowganda, and has started work.

King Edward—This company is shipping on an average of a car of concentrates per month, and producing between 12,000 and 14,000 oz. The output is from the Watts. The company operates a small concentrator and the production is from the milling ore.

Leroy Lake Syndicate—In drifting in this property, Gowganda, at the 110-ft. level, five good veins have been encountered—one 12 in. wide, the other ranging from 2 to 5 in. The ore runs between 1000 and 2000 oz. silver per ton and there is good milling rock in the wall.

Buffalo—The production for the past fiscal year was approximately 1,500,000 ounces. In April, the mill recovered 117,004 oz. from mill rock of an average assay of 48.66 oz. Labor costs were $4711 and power cost $973.

Brydge—A new high-grade vein has been discovered on the 200-ft. level of this Peterson Lake lease.

Crown Reserve—Another high-grade vein about 4 in. wide has been opened up south of the Carson vein on the 100-ft. level.

Miller Lake-O'Brien—A small high-grade shipment has been made by boat from this property at Gowganda.

Provincial—The second high-grade vein in the shaft near the Savage property was opened up at 120 feet.

Orizaba—This property, Barr township, Montreal river, has a shaft down 100 ft. and will be sunk to 125 ft. At 13 ft., an assay showed 139 oz. silver and $12 gold, but the vein dipped from the shaft at 40 ft. It will be sought by crosscutting at 125 ft. The vein has been traced for about 1½ miles.

Thompson—A vein 8 to 10 in. wide, with a good showing of silver has been found, and stripped for 300 ft. at this Gowganda mine.

Amalgamated Asbestos—One-half of the new mill at Black Lake is in operation with double shifts, treating 500 tons of rock per day, furnished from the Union and Southwark properties. Within a month the mill will be working to full capacity, handling 1000 tons of rock daily. The tramway connecting the Southwark quarries with the mill, which, with the sidings, contains a trackage of one mile, is in full operation. Five derricks with electric hoists, are operating on the Southwark, and six derricks in the other pits. The rock now being extracted is of good quality and the production of asbestos is up to the original estimates. About $300,000 has been expended on the mill, tramways, derricks and boarding houses, and 200 men are employed.

Moose Mountain Mining Company—This iron property developed by Charles S. Osborne, of Sault Ste. Marie, has let a contract for installing an electric plant, the power to be transmitted 31 miles. A 1000-ton mill is in operation. About 1,000,000 tons are reported developed. Lifting magnets will be employed in handling the ore.

Mexico

BAJA CALIFORNIA

Progreso—This mine at Triunfo, is installing a concentrator and a slime plant to treat the complex ore. Arthur C. Nahl is manager.

CHIHUAHUA

Dolores—For the first quarter of 1910 the revenue amounted to $279,634; expenses, $181,679; profits, $97,954. On the new Bohemian vein where the shaft has reached 193 ft., stoping has been begun. From present indications this new vein may prove as valuable as the Alma or main vein. The new workings are developing favorably. In the No. 3 shoot, the ore from the winze, 88 ft. below the tunnel, averaged $100. The third level north drift driven to cut No. 3 shoot is showing $30 to $40 ore.

DURANGO

Corralejo—This company in the El Oro district is shipping. About 800 ft. of work has been done and a 10-stamp mill is in commission. The company's Monte Cristo gold mine has been acquired by a new company organized in France by Felix Kahn, and is being developed. N. C. Thompson is in charge of the Corralejo.

SINALOA

Choix Consolidated—The company will open two groups near the Orient railroad. E. A. Thomas, Los Angeles, is president.

SONORA

Calumet & Sonora—The additions, making this company's mill capable of treating 110 tons daily, have been completed.

Santa Fe Consolidated—Stock has been put on the market for funds for a mill.

San Antonio—This silver-lead property in the Arizpe district, is prosecuting development under S. B. Gregory.

Altar Placer—This concern is launched by Douglas, Ariz., people to acquire holdings in the Altar district and operate with dry-washing machines.

North Tigre—Much tunnel work has been outlined. The company has funds to meet requirements.

Rosales—This mine, which yielded shipping ore in 1907, is being reopened, and a 200-ft. shaft will be sunk.

Black Mountain—This company, which has worked the Cerro Prieto mines, west of Magdalena, has closed down indefinitely, with the exception of some final work at the main shaft. Nearly all the miners and millmen have left.

Greene-Cananea—Owing to the increased supply of first-grade ore from the Sierra de Cobre mine, the production at some of the smaller mines has been curtailed, converter lining only being drawn from the America.

Waldorf—Recent work on a 7-ft. fissure has disclosed gold and tellurium in promising quantities.

Sonora Copper Smelting Company—The erection of the smelting plant at Noria has begun. The ore will be conveyed from the tunnel 3200 ft. by an aërial tramway.

Veta Tierra—These placers, near Llano, have been purchased by George D. Stonestreet, and the erection of machinery is under way.

South America

BOLIVIA

Phuyo-Phuyo—Maurice E. Rosewater of the firm of Rosewater & Rist, New York, owners of this mine at Pelechuco, has bought the whole section of Phuyo-Phuyo. There are extensive Inca and Spanish workings there. Some of the ditches are eight and 10 miles long. The purchase includes five lakes, with ample water rights and two hydraulic mines in Suchez and Phuyo-Phuyo. Hydraulic power is available. The gold found is coarse.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, June 1—The coal trade in the East is in fair condition and shows little change. Car shortage and delays in transportation are making some trouble for operators. The demand for coal is good, but Eastern buyers run chiefly to the lower-priced kinds, and trade is best in those sorts.

The anthracite market is quiet and steady as usual, with no considerable changes to be reported.

In the West, there are still troubles over the mining rate in Illinois and the Southwest. An important change has taken place in southern Illinois, where the operators last week met and decided to break away from the State association and form a new association of their own. They also decided to grant the miners the advance asked in the wage rate. The terms offered have been accepted, and many of the mines are starting up this week. The break with the State association is based on its refusal to continue the differential between southern and northern Illinois. The district covered by this partial settlement is that which trades chiefly with the St. Louis market.

In the Southwest, there has been no approach to a settlement with the striking miners. It is reported that the operators are preparing to give up all negotiations and to open their mines on the open-shop plan. They believe that in that case many miners will return to work.

Meantime, the mines in Indiana, Ohio and the Pittsburg district, which have resumed work, report a very good business.

Coal Rates to the Lakes and Tidewater—Going rates from various districts to the Lake ports and to tidewater are as follows, in cents per ton:

Pittsburg District:	Commercial.	Cargo.	Bunker.
Buffalo	125.00	.....	.....
Lake Erie ports	100.00	88.00	98.00
Chicago	190.00	.....	.....
Detroit	140.00	.....	.....
Philadelphia	185.00	.....	.....
New York	220.00	.....	.....
Eastern Ohio:			
Lake Erie ports	90.00	85.00	85.00
Detroit	115.00	.....	.....
Chicago	165.00	.....	.....
West Virginia:			
Fairmont to Lake	.....	97.75	107.75
Fairmont to Chicago	190.00	.....	.....
Fairmont to Tidewater	180.00	.....	.....
Pocahontas & New River to Lake	.....	97.00	107.00
Pocahontas to Chicago	190.00	.....	.....
Pocahontas to Tidewater	140.00	.....	.....

The rates from Handley and Thurmond, the central basing points for the Pocahontas and New River regions, to tidewater at Norfolk and Newport News work out, respectively, to 0.373c. and 0.387c. per ton-mile.

Coal Freight Rates—The Illinois Railroad and Warehouse Commission has made an order suspending for 60 days, or until Aug. 1, the proposed increase in freight rates on Illinois railroads.

Coal Traffic Notes

Coal tonnage of the Norfolk & Western railway, 10 months of fiscal year, from July 1 to April 30, short tons:

Field:	Commercial.	Company.	Total.
Pocahontas	7,974,141	1,012,732	8,986,873
Tug River	1,229,350	177,449	1,406,799
Thacker	1,223,601	569,244	1,792,845
Kenova	545,072	151,422	696,494
Clinch Valley	555,830	44,856	600,686
Total	11,527,994	1,955,703	13,483,697

As compared with the corresponding period in 1908-9 there was an increase of 3,191,051 tons, or 31 per cent.

New York

Anthracite

June 1—Trade is about as usual. There was some extra business done in anticipation of the rise in prices, but not enough to disturb the trade.

Today 10c. per ton comes off the regular summer discounts. Schedule prices for domestic sizes are now $4.45 for broken and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor points. For steam sizes current quotations are: Pea, $3@3.25; buckwheat, $2.20@2.50; No. 2 buckwheat or rice, $1.65@2; barley, $1.35@1.50; all according to quality, f.o.b. New York harbor. The lower prices are usually for washery coals.

Bituminous

The seaboard bituminous trade shows some improvement, but orders still come in quite irregularly. A considerable business is being done, but it is not as well distributed as it might be. New England territory is waking up a little, but it is there that the variations are most apparent. Some dealers are inclined to charge West Virginia with this uncertainty. New York harbor trade is apparently better.

Prices continue about the same. Good Miller vein steam coal can be had at $2.65@2.70, f.o.b. New York harbor; and there is a range of 20c. below this and 25c. above for coals of lower or better quality. Gas coal is in good demand, but prices are low. Buyers still show a marked preference for the lower-priced coals.

Car supply is still below par, and there are many complaints from mines on this account. Transportation is a little better, but there is occasionally delay in getting coal through on time. As usual, there is considerable difference in the supply and movement on different roads.

In the coastwise-vessel market the call for boats is quite up to the supply—perhaps a little above it. The rate of 70c. from New York to points around Cape Cod holds, and vessel owners seem to be pretty firm in asking at least that figure.

Birmingham

May 31—There is a better demand for coal in the South. Alabama coal operators have received some healthy contracts by reason of the strike in the Middle West, several railroads making contracts for their needs for the next few weeks. The mines at Mulga, property of the Birmingham Coal and Iron Company, in which an explosion occurred April 20, will resume operations this week, the last inspection having been made by the State mine inspector. It will be several weeks yet before the mines at Palos, in which an explosion occurred on May 5, can resume. The official report of the chief mine inspector was issued last week. A close inspection is being made of every mine in the State and operators are receiving instructions to watch the dust accumulations. The railroads are furnishing all assistance possible in handling the increased production of coal in Alabama. So far there has been no delay in the moving of coal.

Coke is not so strong. The production is being kept up right along and whatever is not being used immediately is being stacked for future use.

Chicago

May 30—Under the pressure of continued consumption on a large scale and no resumption of mining in Illinois, the large users of coal are beginning to place large orders for their fuel supply with sales agents of coal from other States. Their storage piles are giving out. Indiana coals especially profit from the situation, but prices are so high that many manufacturers are striving to burn as little fuel as possible; others even contemplate shutting down wholly or in part, saying they cannot meet competition if compelled to buy at current prices. Under reports of labor agreements being reached, prices fluctuate considerably. Smokeless, the other principal source of supply now, is

more constant, holding its customary users and making increased sales slowly because of its higher price. Yet smokeless is firm and probably will weaken considerably as soon as fresh supplies are in the market from Illinois. Buying by small concerns increases steadily.

Lump from Indiana, and the little Illinois coal available, bring $2.65@2.75; run-of-mine from the same source sells for $2.40@2.60, and screenings are in demand at $2.50@2.75. Smokeless holds firmly to $3.55 for lump and $3.15 for run-of-mine, list prices. Hocking finds large sale at $3.15. No coal is in too large supply and none seems likely to be under a continuance of present general conditions. The anthracite market is quiet, showing hardly any increased demand in the closing days of May.

Cleveland

May 30—The market is gradually working back to its usual basis, as Ohio mines are getting down to steady work. Lake shipments are larger, and there is, in consequence, a better supply of slack on the markets.

For Middle district quotations are, f.o.b. Cleveland, $2 for 1¼-in., $1.85 for ¾-in., $1.75 for run-of-mine and $1.60 for slack; No. 8 district, $2.20 for 1¼-in., $2 for ¾-in. $1.90 for run-of-mine and $1.75@1.85 for slack; Youghiogheny, $2.60 for lump, $2.30 for run-of-mine and $2.05 for slack; Pocahontas, $2.85 for lump and $2.45 for run-of-mine.

Indianapolis

May 30—The Indiana Manufacturers' and Shippers' Association is seeking to solve the problem presented by the rising price of coal and the demand upon the part of the carriers for increased rates. A petition has been filed with the Railroad Commission against 23 railroads to prevent them from increasing their coal rates June 1. The petitioners maintain that the rates now in existence are fair both to the shipper and to the carriers, and that the proposed increase would work a hardship. A hearing on the petition will be had by the commission June 10.

The movement of coal to this city from Indiana mines is considerably larger than usual for this time of year, and the situation would be satisfactory to the operators, dealers and consumers, but for the uncertainty of prices.

The national executive board of the United Mine Workers, in session at headquarters in this city, has approved the features of the proposed insurance bill in Congress.

Pittsburg

May 31—The coal market presents no new features. The car supply is good, Lake shipments are heavy, local demand is fair, and prices are maintained: mine-run and nut, $1.20@1.25; ¾-in., $1.30@1.35; domestic, 1½-in., $1.50; slack, 80@85c. per ton.

Connellsville Coke—Several good contracts for furnace coke have been placed in the past fortnight, and the tone of the market shows a material improvement, on the theory that most of the cheap coke has found a market, while the feeling in pig iron is undoubtedly better, and it is found that some furnaces are going to run next quarter when it was expected they would be idle.

The Cambria Steel Company has bought 6000 tons of furnace coke monthly, seven months, June to December, inclusive, at $1.70 and has made a contract with the Tower Connellsville Coke Company, through Matthew Addy & Co., the coke company's selling agents for the East, for 15,000 to 20,000 tons of furnace coke for two years beginning Jan. 1, next, with an option on a third year, at a flat price, not stated. Not counting this last contract, there have been made in about a fortnight contracts aggregating 55,000 tons of coke monthly, chiefly at flat prices, $1.70@1.85. Corrigan, McKinney & Co., who inquired for 25,000 tons monthly for second half, suggesting that they expected to do $1.55, did not obtain prices approaching their idea, and are holding off. Occasional lots of prompt furnace coke have been sold at $1.60, and possibly at 5c. less, but such figures cannot be done regularly.

We quote standard grades of Connellsville coke: Prompt furnace, $1.65@1.70; contract furnace, $1.80@1.90; prompt foundry, $2.15@2.25; contract foundry, $2.25@2.50 per ton.

The *Courier* reports the production in the Connellsville and lower Connellsville regions in the week ended May 21, at 393,185 tons, a drop of 3000 tons; shipments at 3945 cars to Pittsburg, 6381 cars to points west, and 1034 cars to points east, a total of 11,360 cars.

St. Louis

May 30—The strike as far as this district is concerned is at an end. This was brought about by two unexpected incidents. The decision on the part of miners to allow any independent mine to work until signing the scale was, of course, taken advantage of immediately by a number of smaller independent mines and on May 24 at least a dozen of these mines started operations. The operators of the Fifth and Ninth districts realized from this the miners had practically gained their point. They immediately called a meeting at St. Louis. Prior to this time the operators of those districts had felt that the Illinois Operator's Association was not working entirely for their interests and consequently on May 25 they decided to secede from the Illinois Association in a body and form a separate organization of their own to be known as the Operators of the Fifth and Ninth districts of Illinois. These operators then decided to sign the scale and go to work. Most of these mines started on May 26. The Fifth and Ninth districts of Illinois represent all the mines within a radius of 40 miles of St. Louis, known as the Standard district. There are about 75 mines in this district and they represent a total of over 30,000 tons per day, about one-third of the tonnage of the State.

The operators in those districts were aggrieved at the refusal of the Illinois Operators' Association to countenance any abolition of the differential which exists in favor of Southern Illinois. The rest of Illinois—the Carterville and northern districts—are still out. Prices, of course, are not as high as they were last week, though they remain firm at $1.75 per ton at mines for mine-run coal and it looks very much as if this figure will hold until the rest of the State signs up and goes to work. All the coal that is being produced is being snapped up.

The anthracite market continues to be good and all coal which is coming forward is being readily absorbed.

Current prices are as follows for the St. Louis market.

	Mine.	St. Louis.
Kentucky mine-run	.....	$2.40
Indiana mine-run	.....	2.35
Kentucky lump	.....	2.60
Indiana lump	.....	2.55
Illinois, Standard:		
Mine-run	$1.75	2.27
2-in. lump	2.00	2.50
2-in. screenings	1.60	2.12
Pocahontas and New River:		
Lump or egg	1.50	4.00
Mine-run	1.10	3.65
Pennsylvania Anthracite:		
Nut, stove or egg	.....	6.55
Grate	.....	6.30
Arkansas Anthracite:		
Egg or grate	3.35	5.35
Coke:		
Connellsville foundry	.....	5.40
Gas house	.....	4.50
Smithing	.....	4.15

Prices for Kentucky and Indiana coals are on track, East St. Louis.

FOREIGN·COAL·TRADE

Russian Coal Production—Coal production in Russia for the full year is reported as below, in metric tons:

District:	1908.	1909.	Changes.
Donetz	17,982,000	17,499,000	D. 483,000
Poland	5,555,000	5,605,000	I. 50,000
Ural	771,000	689,000	D. 72,000
Moscow	315,000	249,000	D. 66,000
Caucasus	52,000	41,000	D. 11,000
Total	24,675,000	24,083,000	D. 592,000

The total decrease last year, as compared with 1908, was 2.4 per cent.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of Welsh coal as follows, on May 20; Best Welsh steam, $4.02; seconds, $3.81; thirds, $3.66; dry coals, $3.72; best Monmouthshire, $3.60; seconds, $3.48; best steam smalls, $2.16; seconds, $1.92. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, June 1—The iron and steel markets continue to improve; there is rather more buying of material and generally a better tone, and a feeling that the waiting condition is approaching an end.

In pig iron there have been some good orders for foundry iron placed in the East, with others under negotiation. It is understood that most of these are taking the lowest prices recently quoted. It seems to be evident that buyers have made up their minds that prices have reached the lowest probable level, and that little or nothing is to be gained by further holding back. In the Central West a similar condition exists, but there the demand is chiefly for basic pig, though some bessemer iron is also called for by buyers.

In finished material something of the same condition exists. Structural contracts are coming forward in considerable quantity, both in Eastern and Western territory. There has also been a fair business coming forward in bars and plates, while sheets and tinplates are being well sold; the market indications, in fact, are more encouraging than have been reported for a number of weeks past.

A report comes from Pittsburg that the Steel Corporation is planning to place warehouses in a number of distributing centers, with a view to selling iron and steel products directly to consumers, and thus eliminating, as far as possible, the iron brokers and jobbers who now handle most part of the small trade. Such a change, however, will take some time, as it is always a slow and difficult matter to change established trade custom, and the iron brokers and jobbers are numerous and influential. It is doubtful, moreover, whether the independent companies will be ready to unite with the Steel Corporation in such a movement.

Baltimore

May 30—Imports for the week included 1378 tons ferromanganese from Liverpool; 4460 tons cupreous pyrites from Huelva, Spain; 14,900 tons iron ore from Cuba.

Birmingham

May 31—The iron trade in Southern territory continues to improve, and it is expected that before another fortnight passes there will be considerable activity. The price of iron has taken on additional strength, though $12 per ton, No. 2 foundry, appears to be the common figure in this section. Some few orders have been placed here for iron to be delivered during the last half of the year but there remains much of the probable make to be covered. The curtailment in production is being kept up. So far no further reduction is announced here.

The demand for basic iron continues a little active, taking up about all of that class of metal that is being manufactured. Charcoal iron is holding a high price.

Steel products are in good demand. The Southern Iron and Steel Company has all of its new plant at Alabama City in operation now.

Brass foundries are busy making tuyeres, jackets and other appurtenances for furnaces undergoing repairs. The cast-iron pipe plates are still busy. Foundries and machine shops appear to be enjoying a better patronage.

Chicago

May 31—The pig-iron market shows a maintenance of the stronger tendencies of last week, with melters more and more inclined to contract for their last-half needs. Most of the business now done, however, consists of sales for third-quarter requirements. Some inquiry on business running into 1911 has developed no willingness of furnaces to make low prices so far ahead. Nearly all foundries are now figuring on last-half requirements and watching the market closely. It is safe to say they are prepared to contract liberally for pig iron the moment the upward tendency is shown to have started in earnest. Meantime they buy 30 to 90 days ahead, in small lots. Neither Southern nor Northern agents display anxiety to sell, and both predict a rising market. Prices continue practically as last week—$12 Birmingham, or $16.35 Chicago, on most of the Southern No. 2 contracted for, with perhaps some sold as low as $11.50 Birmingham; and $16.50@17 on Northern No. 2. The melt of pig iron continues large. General conditions in iron and steel products are good. Some apprehension is manifested in manufacturing lines over the lack of coal from Illinois mines, and some sales are held back by this, but not many. Sales of coke are large at $5 for the best Connellsville.

Cleveland

May 30—A sale of 80,000 tons of ore to an eastern furnace interest is reported. Otherwise the ore market is quiet.

Pig Iron—Some good sales of foundry iron are reported; also a number of inquiries for basic pig, but no sales. Quotations current are $17.15 for bessemer; $16@16.25 for No. 2 foundry; $16.10@16.35 for No. 2 Southern; $15.50@15.75 for forge; all Cleveland delivery.

Finished Material—Quite a number of structural contracts are coming in; also some orders for trolley rails. Bars are active; quotations are 1.45c., Pittsburg base for steel, and 1.50@1.55c., Cleveland for iron bars.

Philadelphia

June 1—The fact that so many of the consumers of pig iron in this territory are fairly well supplied in hand or under contract for delivery accounts for the fact that there is very little disturbance and scarcely any change in selling prices. The only sign of weakness is shown in a few offerings of Southern pig at about 25c. less than recent prices. Basic has weakened according to quotations given, but this has not resulted in any sales of consequence. All of the Eastern mills are short of forge. The past week has developed an encouraging amount of business which calls for basic material and steel billets. Foundrymen are buying very little material, even though as low as $16.50 has been named for Northern and $16 has been shaded for Southern. Good gray forge is held at $16 for Northern and $15 is shaded for Southern.

Steel Billets—Some new work into which steel billets enter has started inquiry for supplies and the quotations received show a weakness in prices.

Bars—The bar-iron trade has dropped off; few orders have reached this territory from the large consumers. The ordinary retail trade is more active than it has been. There is inquiry at present for best refined iron in small lots.

Sheets—The sheet mills during the past week have gathered a fresh batch of orders mostly for small lots and chiefly for quickest possible delivery. Retail distribution has been quite active.

Pipes and Tubes—Reports indicate consumption at a maximum with requirements among larger consumers pretty well covered by contract. The purchases of the smaller interests continue at about the same rate and there has been no change in quotations.

Plates—Reports from all plate mills show a vigorous tone to the market with new requirements coming along at a rate which means strong prices throughout the summer. Small lots for immediate delivery still command premiums.

Structural Material—The amount of business in this market has been light. A few railroad requirements which were expected to shape up in June have been again postponed.

Scrap—The scrap market is inactive and only trifling local sales are spoken of. Dealers are not quite as quick in contracting for future supplies. There is very little inquiry and prices point downward.

Pittsburg

May 31—Additional agricultural-implement steel-bar tonnage has been placed, and the great bulk of this business, probably 75 or 80 per cent., is now under contract either for six months or the 12 months beginning July 1. The business was all taken at the regular price of 1.45c., Pittsburg. This is the only trade which is good in the West, the railroads being poor buyers. Locally the signs for heavy consumption at the moment are not particularly good. One of the large

steel-car interests is reported as nearly caught up on its orders, and the current rate of car buying would not carry more than one-half or two-thirds the rate of production it has been having since the first of the year.

The tone of the market is undoubtedly better in coke and pig iron, but apparently altogether because prices close to cost of production have been reached. In finished steel the tone is less satisfactory, and as prices have declined but little there is room, and prospect as well, for some considerable declines.

Pig Iron—At the recession in prices noted in last report there is a stronger belief that the bottom has been reached, as with foundry and basic at $15, Valley, it is held that furnaces which buy their coke and ore are losing money. Of late the lowest prices have been made by ore interests which have a net profit even if losing at the blast furnaces. It is hardly to be expected, however, that consumption will be limited to the iron which ore interests can make. The Babcock & Wilcox Company inquires for 5000 tons for second-half delivery to Barberton, O., prices to be in by next Monday. The Westinghouse Air Brake Company inquires for 1000 tons each of No. 2 foundry and gray forge, for third quarter, but is expected to take 5000 or 10,000 tons. We quote bessemer at $16; basic and No. 2 foundry at $15@15.25, malleable at $15.25@15.50 and forge at $14.50@14.75, at Valley furnaces, freight to Pittsburg being 90c. per ton.

Ferromanganese—The market is quiet and not very steady at $40.50, Baltimore, freight to Pittsburg being $1.95. It is possible this figure could be shaded. On forward delivery 50c. more is asked, but consumers are buying only from hand to mouth.

Steel—Bessemer steel is somewhat easier, while open-hearth continues scarce. It is significant that the basic pig iron made last year was 61½ per cent. of the basic open-hearth steel production, against 52 to 53 per cent. in recent years and 40 per cent. in 1901. This illustrates how the scrap outcome has become insufficient to support the rapidly growing production of open-hearth steel, requiring the use of more pig iron, and increasing the cost of production, as compared with pig-iron prices or the cost of making bessemer steel. We continue to quote: Bessemer billets, $25.50@26; sheet bars, $26.50@27; open-hearth billets, $28@28.50; sheet bars, $29@29.50, all f.o.b. Pittsburg or Youngstown mill.

Sheets—There has been only a moderate turnover, and prices are no firmer, concessions of $2 or $3 per ton being made by a few mills on attractive business. Regular prices are 2.40c. on black, 3.50c. on galvanized, $1.70 on painted corrugated and $3 on galvanized corrugated. Blue annealed sheets continue scarce, bringing 1.85@1.90c. for delivery in the next few weeks, against the regular figure of 1.75c., for indefinite delivery.

Sault Ste. Marie Canal

The total freight carried through the Sault Ste. Marie canals in April was: East-bound 1,325,379; west-bound, 633,534; total, 1,958,913 tons. No comparison can be made with last year, as there was hardly any business in April. The traffic this year was all through the Canadian canal, as the locks on the American side were out of commission. The number of vessel passages was 768, giving an average cargo of 2551 tons.

The mineral freights reported were 937,049 tons iron ore; 539,923 tons coal; 26,683 tons pig and manufactured iron; 5447 tons copper; 46,676 bbl. salt.

The extreme draft for the Poe (American) lock this year is announced at 18 ft., as against 18 ft. 8 in. for the Canadina lock.

FOREIGN IRON TRADE

German Iron Production—The German Iron and Steel Union reports pig-iron production in April at 1,202,117 tons, or 48,067 tons less than in March. For the four months ended April 30, the make was, in metric tons:

	1909.	1910.	Changes.
Foundry iron	744,765	900,065	I. 155,300
Forge iron	232,838	223,087	D. 9,751
Steel pig	359,572	417,253	I. 57,681
Bessemer pig	143,575	165,421	I. 21,846
Thomas(basic)pig	2,610,851	3,015,400	I. 404,549
Total	4,091,601	4,721,226	I. 629,625

The total increase was 15.1 per cent. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

British Steel Production—Steel production in Great Britain for the full years given was as follows, in long tons:

	1908.	1909.	Changes.
Open-hearth	3,817,103	4,148,408	I. 331,305
Bessemer	1,478,539	1,733,220	I. 254,681
Total	5,295,642	5,881,628	I. 585,986

The increase in 1909 over 1908 was 11.1 per cent.; but there was a decrease, as compared with 1907, of 641,120 tons, or 9.8 per cent.

British Iron Trade—Exports and imports of iron and steel and of manufactures thereof, in Great Britain, four months ended April 30, are valued by the Board of Trade returns as follows:

	Exports.	Imports.	Excess.
Iron and steel	£14,020,765	£ 2,878,395	Ex. £11,142,370
Machinery	9,105,864	1,466,855	Ex. 7,639,009
New ships	2,995,993	.....	Ex. 2,995,993
Total	£26,122,622	£ 4,345,250	Ex. £21,777,372
Total, 1908	23,648,841	4,047,369	Ex. 19,601,472

Increase in total exports, £2,473,781, or 10.4 per cent.; increase in imports, £297,881, or 7.4 per cent. The quantities of iron and steel were, in long tons:

	1909.	1910.	Changes.
Exports	1,292,671	1,534,618	I. 241,947
Imports	374,595	434,667	I. 60,072

Exports of scrap iron and steel, not included above, were 53,081 tons in 1909, and 73,119 in 1910; imports were 4433 tons in 1909, and 16,277 this year.

METAL MARKETS

New York, June 1—The metal markets show no marked changes for the week. In some quarters there is an improvement in demand, but there have been no considerable changes in prices.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1910	$36,283,625	$ 2,100,918	Exp. $34,182,707
" 1909	6,337,994	3,345,861	" 2,992,133
Year 1910	47,199,706	11,669,276	" 35,530,430
" 1909	44,316,626	15,504,136	" 28,812,490
Silver:			
April 1910	4,696,534	3,840,495	Exp. 856,039
" 1909	4,952,251	4,222,147	" 730,104
Year 1910	18,336,081	15,238,634	" 3,097,447
" 1909	19,426,181	14,675,365	" 4,750,816

Exports from the port of New York, week ended May 28: Gld, $19,800; silver, $799,590, chiefly to London. Imports: Gold, $43,618: silver, $14,798, from the West Indies, Mexico and South America.

Gold production of Russia in 1909, based on official figures, was $37,455,032; an increase of $6,510,471, or 21 per vent., over the previous year.

Gold and silver movement in Great Britain, four months ended April 30:

	Imports.	Exports.	Excess.
Gold	£17,744,630	£15,814,595	Imp. £1,930,035
Gold, 1909	20,878,859	14,472,579	Imp. 6,406,280
Silver	4,695,856	3,664,236	Imp. 1,031,620
Silver, 1909	4,202,576	4,287,747	Exp. 85,171

Of the imports this year, £2,443,007 gold and £2,823,296 silver came from the United States.

Exports of silver from London to the East from Jan. 1 to May 18, reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India	£1,938,300	£2,632,840	I. £ 694,540
China	1,075,100	1,113,500	I. 38,400
Straits	82,800	.....	D. 82,800
Total	£3,096,200	£3,746,340	I. £ 650,140

India Council bills in London brought an average of 15.94d. per rupee.

Gold—The price of gold on the open market in London has been unchanged at 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin. The Bank of England is still taking gold. In New York no gold was sent to Europe, but about $1,250,000 was taken by Canadian banks.

Platinum—Business is steady and prices are unchanged. Dealers ask $30 per oz. for refined platinum and $35.50@36 per oz. for hard metal—platinum-iridium alloy.

Production of platinum in Russia in 1909 is officially reported at 322 poods, or 169,501 oz. crude metal, 83 per cent.; equal to 142,686 oz. pure platinum.

SILVER AND STERLING EXCHANGE

May-June.	26	27	28	30	31	1
New York....	53⅜	53¾	53⅝	....	53½	53½
London.....	24⅜	24⅜	24⅛	24⅛	24⅝	24⅝
Sterling Ex..	4.8750	4.8735	4.8740	....	4.8730	4.8725

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market has reacted slightly this week, but closes firm at 24⅝d. in London. China banks have been buyers at the decline.

Copper, Tin, Lead and Zinc

May-June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
26	12¾ @13	12½ @12¾	56⅜	33¼	4.30 @4.35	4.17½ @4.20	5.12½ @5.15
27	12¾ @13	12½ @12¾	56¾	33⅜	4.30 @4.35	4.17½ @4.20	5.10 @5.12½
28	12¾ @13	12½ @12¾	....	33	4.30 @4.35	4.17½ @4.20	5.10 @5.12½
30	.....	.....	56⅞	....	.....	.....	.....
31	12¾ @13	12½ @12¾	56⅞	33⅛	4.30 @4.35	4.17½ @4.20	5.07½ @5.10
1	12¾ @13	12½ @12¾	56¾	32⅞	4.30 @4.35	4.17½ @4.20	5.05 @5.07½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—In spite of the holiday break in the week the sales of copper have amounted to upward of 10,000,000 lb., but in view of the quantity that must be marketed daily on the average, the volume of business can be classed only as moderate. Both the European and American buyers have figured in the market. Domestic manufacturers have pursued the hand-to-mouth policy that has characterized them for some time past. It is noteworthy that most of the business has been for prompt shipment. All orders have been the subject of keen competition. Lake copper has been freely offered at 13c. and transactions have been effected at that price. Electrolytic has been freely offered at 12⅞c., delivered, 30 days, corresponding to a little less than 12.75c. net cash, New York, but this price has been shaded in order to consummate business. At the close, Lake copper is quoted at 12⅞@13c., electrolytic copper in cakes, wirebars and ingots at 12⅝@12¾c. Casting copper is quoted nominally at 12¼@12½ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire has been advanced ¼c., and is now 14¼c. base, carload lots at mill.

The London speculative market has been somewhat firmer. The liquidation on the part of tired holders which has been taking place for some time past was not in evidence this week, and the market showed some resiliency. The close is cabled at £56 17s. 6d. for spot, and £57 15s. for three months.

Refined and manufactured sorts we quote: English tough, £59; best selected, £60@60 10s.; strong sheets, £68@69 per ton.

Exports of copper from New York for the week were 7545 long tons. Our special correspondent gives the exports from Baltimore at 1177 tons.

Copper in May—May began with electrolytic copper on the basis of about 12.30c. During the first week in the month there were free sellers at that price, but with the change in sentiment that then became manifest, European buyers came into the market and fairly large sales were made at an advance. The latter did not go far, but during the remainder of the month, the market held its gain with moderate business, and closed at about 12.70 cents.

Tin—The London market ruled fairly steady for the past week. Shipments to the United States were larger than anticipated, and this fact helped to maintain quotations in the face of generally expected unfavorable statistics for the month of May. When the latter became public and showed an increase of 2500 tons, the market turned weak, and closes at £149 2s. 6d. for spot, and £150 7s. 6d. for three months.

The domestic market ruled very dull and transactions were confined to retail business. The close is weak at about 32⅞ cents.

Lead—The market is fairly active and firm at last prices, 4.17½@4.20c., St. Louis, and 4.30@4.35c. New York.

The London market for Spanish lead is cabled at £12 10s., and for English at £12 12s. 6d. per ton.

Spelter—The market is quiet. Manufacturers in some lines are not believed to be well covered, but as their orders are not coming in plentifully, and as the metal is freely offered, they are buying only in a small way. Prices have declined somewhat, and at the close are 5.05@5.07½c. St. Louis, and 5.20@5.22½c. New York.

New York quotations for spelter on May 26 were 5.27½@5.30c.; May 27 and 28, 5.25@5.27½c.; May 31, 5.22½@5.25c.; June 1, 5.20@5.22½ cents.

The London market for good ordinaries is £22 7s. 6d., and for specials £22 12s. 6d. per ton.

Base price of zinc sheets is $7.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, four months ended April 30, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.	
Copper, long tons	45,004	23,552	Imp.	21,452
Copper, 1909....	39,126	24,802	Imp.	14,324
Tin, long tons....	14,195	14,245	Exp.	50
Tin, 1909.....	13,018	13,289	Exp.	271
Lead, long tons..	70,370	16,538	Imp.	54,832
Lead, 1909.....	73,461	14,712	Imp.	58,749
Spelter, l'g tons..	42,083	2,967	Imp.	39,116
Spelter, 1909....	36,492	2,082	Imp.	34,410
Quicksilver, lb...	1,724,654	301,602	Imp.	1,423,052
Quicksilver, '09	1,282,063	356,226	Imp.	925,837
Ores:				
Tin ore and con.	8,704	.....	Imp.	8,704
Tin ore, 1909...	7,445	.....	Imp.	7,445
Pyrites	272,028	.....	Imp.	272,028
Pyrites, 1909...	275,084	.....	Imp.	285,084

Copper totals include metallic contents of ore and matte. Exports include reexports of foreign material. Of the imports in 1910, the United States furnished in all 88 tons copper matte, 15,596 tons fine copper, and 8090 tons lead. This lead was chiefly Mexican, refined in this country.

Spanish Metal Exports

Exports of metal and mineral from Spain, three months ended March 31, reported by *Revista Minera*, in metric tons:

Metals.	1909.	1910.	Changes.	
Pig and manuf. iron	5,569	5,798	I.	229
Copper.....	3,808	4,860	I.	1,052
Copper precipitate..	3,977	3,923	D.	54
Lead.....	34,846	42,633	I.	7,787
Zinc.....	778	250	D.	528
Quicksilver.....	422	420	D.	2
Minerals.				
Iron ore.....	1,740,868	2,200,267	I.	459,399
Manganese ore.....	1,650	446	D.	1,204
Copper ore.....	276,490	251,711	D.	24,779
Lead ore.....	805	963	I.	158
Zinc ore.....	30,347	36,586	I.	6,239
Pyrites, iron.....	275,058	336,854	I.	61,796
Salt.....	138,439	113,682	D.	24,757

Imports of phosphates, 25,128 tons in 1909, and 31,438 in 1910; nitrate of soda 15,771 tons in 1909, and 18,402 this year.

Other Metals

Aluminum—There is little change in the reports. Business continues on a good scale, sales being large, with good inquiries coming in. We quote now 23¾c. per lb. for No. 1 ingots in large lots, New York. The market abroad is reported in improving condition.

Antimony—The market remains dull, and in the absence of large business prices are nominally unchanged. Quotations are 8⅜@8½c. for Cookson's; 7⅞@8c. for U. S.; 7⅜@7½c. for outside brands.

Quicksilver—Business is fair, and prices are unchanged. New York quotations are $47 per flask of 75 lb. for large orders; $48@49 for jobbing lots. San Francisco, $46@46.50 for domestic orders and $2 less for export. The London price is £8 15s. per flask, with £8 13s. 9d. quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots, up to 55c. for 200-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Cadmium—Current quotations are 65@70c. per lb. in 100-lb. lots at Cleveland, Ohio.

Zinc and Lead Ore Markets

Joplin, Mo., May 28—The highest price paid for zinc-sulphide ore was $46 per ton; the highest base price was $43.50 and the lowest in carload lots was $41 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $22@24 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $37.42. The high price for lead ore continues at $48 per ton, with deductions of $1 per ton for grades under 80 per cent. lead. The average price, all grades of lead, was $47.94 per ton of 2000 pounds.

Striking miners are a new element in the local situation, having resulted in closing down a half dozen mines, in addition to the number closed down on account of the low price of ore. The strike relates to the sliding scale of wages to be regulated by the rise and fall in ore prices. The miners contend they have not been given a square deal. Several mining companies have prevented a strike in their mines by meeting the contention of the men.

SHIPMENTS, WEEK ENDED MAY 28.

	Zinc, lb.	Lead lb.	Value.
Webb City-Carterville	3,165,830	695,370	$80,004
Joplin	1,571,520	120,920	36,690
Galena	1,100,290	67,710	23,635
Oronogo	1,128,190	2,430	23,613
Miami	1,241,170	245,240	18,295
Duenweg	871,110	23,000	17,508
Alba-Neck	795,170	.....	17,506
Jackson	302,900	209,140	11,076
Granby	772,570	12,850	10,050
Sarcoxie	270,450	.....	4,950
Carl Junction	224,900	2,350	4,888
Carthage	191,670	.....	4,120
Badger	193,560	.....	4,043
Spurgeon	184,870	49,400	3,178
Aurora	164,250	.....	2,812
Stott City	119,580	.....	2,391
Quapaw	79,240	14,630	1,761
Saginaw	35,270	4,770	461
Totals	12,411,540	1,447,810	$266,981
Five months	241,554,600	35,463,020	$5,804,180

Zinc value, the week, $232,264; 5 months, $4,872,884
Lead value, the week, 34,717; 5 months, 931,296

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	.....	40.35	.....	57.52	.....
July	43.06	.....	41.11	.....	53.74	.....
August	48.25	.....	44.54	.....	57.60	.....
September	47.70	.....	44.87	.....	56.11	.....
October	49.50	.....	45.75	.....	55.02	.....
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
Year	$43.98	.....	$41.20	.....	$54.60	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., May 28—The highest price paid for zinc ore was $43.50 per ton; the base price, 60 per cent. zinc, was $42@43.50 per ton. No sales or shipments of lead ore were reported.

SHIPMENTS, WEEK ENDED MAY 28.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	455,680	.....	545,200
Galena	451,500	.....	.....
Highland	323,400	.....	.....
Cuba City	177,780	.....	110,110
Dubuque	84,000	.....	.....
Linden	.....	.....	124,520
Total	492,360	.....	779,830
Year to date	34,279,911	2,651,689	7,206,720

In addition to the above there was shipped during the week to the separating plants, 2,505,423 lb. zinc concentrates.

CHEMICALS

New York, June 1—The general market is steady, but not specially active, so far as new business is concerned.

Copper Sulphate—No change is reported. On an average business, prices remain at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller orders.

Nitrate of Soda—Business is good for the season and contract deliveries are steady. Quotations continue at 2.15c. per lb. for spot lots; a shade higher is reported for future deliveries, 2.07½@2.12½c. per lb. being asked.

Arsenic—Sales are still light, but prices are unchanged, $2.37½@2.45 per 100 lb. being quoted for white arsenic.

MINING·STOCKS $

New York, June 1—Dullness has characterized the general stock markets, and the trading has been mainly professional and anything but exciting. This condition was rather intensified by a double holiday, the Exchange having adjourned from Friday over to Tuesday. The market could not be called strong, but fluctuations were small.

At the close today there was a burst of activity, but it was accomplished by a bad and general break in all stocks, prices declining heavily.

On the Curb also, matters were quiet for the most part. The copper stocks were traded in only on a small scale, with one or two exceptions, and there were only small changes in quotations. Cobalt stocks were the most active section of the market and were inclined to be stronger than most of the others. The market closed generally dull and weak.

Boston, May 31—There is little to attract attention in the copper-share market. Now and then some specialty is made prominent by a period of activity but there has been no sustained movement in any direction. The market appears to be in a strong technical position, but is waiting developments.

Butte Balaklava has continued to attract attention, although today it broke $1.50 from its high price. Isle Royale has been one of the mainstays of the market, yet it broke $3 to $21 today. Superior & Boston has attracted attention with a strong market price, due to favorable diamond-drill explorations.

Nipissing has held strong with a high at $12. Some inquiry for Yukon is noted on the Curb, as operations in that dis-

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company.	February.	March.	April.
Arizona, Ltd.	2,658,000	2,886,000	2,340,000
Balaklala	989,102	1,263,733	1,109,311
Boleo (Mexico)	2,331,832	2,148,383	2,777,800
Copper Queen	8,927,203	10,809,488	9,920,000
Calumet & Ariz.	2,024,000	2,820,000	2,400,000
Cananea (Mexico)	3,586,000	3,700,000	4,262,000
Detroit	1,486,400	1,698,975	1,930,000
Imperial	750,000	825,000	800,000
Nevada Con. (Est.)	5,115,723	5,339,466	5,500,000
Old Dominion	2,035,000	2,674,000	2,325,000
Shannon	1,526,000	1,468,000	1,288,000
Superior & Pitts.	1,864,000	2,370,000	2,130,000
Utah Copper Co.	5,913,465	7,853,288	7,902,643
Butte District	13,758,620	24,000,000	25,000,000
Lake Superior	18,250,000	19,250,000	16,250,000
Total production.	71,099,622	89,366,867	86,934,754
Imports, bars, etc.	14,093,381	20,178,202	21,180,396
Imp. in ore & matte	6,063,764	6,181,476	12,527,371
Total	91,256,767	115,726,545	120,642,521

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and that part of Copper Queen production which comes from Nacozari. Boleo copper does not come to American refiners. Utah Copper report from February includes the output of the Boston mill.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
V, 1909	118,356,146	61,163,325	70,542,753
VI	116,567,493	60,591,116	70,966,457
VII	118,277,603	75,520,083	75,018,974
VIII	120,597,234	59,614,207	48,382,704
IX	118,023,139	52,105,955	50,077,777
X	124,657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910	116,547,287	78,158,387	81,691,672
II	112,712,493	66,618,322	37,369,518
III	120,067,467	62,344,818	40,585,767
IV	117,477,639	67,985,951	31,392,403

	Visible Stocks. United States.	Europe.	Total.
VI, 1909	169,848,141	127,352,960	297,201,101
VII	154,858,061	150,928,960	305,787,021
VIII	122,596,607	171,492,160	294,088,767
IX	135,196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910	141,766,111	244,204,800	385,970,911
II	98,463,339	248,236,800	346,700,139
III	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	.....	239,142,400	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

trict are now on a full scale. The Contact Copper Company, to take over the Elm River, has been incorporated under Michigan laws. Likely the basis for exchange will be share for share, but this has got to be decided upon yet.

A 50-cent assessment on Rhode Island Copper shares excited comment for a spell, inasmuch as all but a few thousand shares have been turned in for exchange into Franklin mining stock. The Algomah Mining Company has been organized by Boston and Houghton, Mich., parties to take over and develop the old property, situated south of the Lake mine. There are 100,000 shares, par $25, of which 30,000 shares will be retained in the treasury while 60,000 shares go in payment for the property. The balance is to be offered at par for public subscription.

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev.	May 31	June 21	$0.10
Beck Tunnel, Utah	June 14		0.01
Black Jack, Utah			0.01
Blue Bell, Idaho	Mar. 14	June 1	0.002
Brownstone, Utah	Apr. 15	June 10	0.00½
Bullion, Nev	May 8	June 6	0.05
Caledonia, Nev	June 17	July 8	0.10
Con. Imperial, Nev.	Apr. 19	May 12	0.01
Con. Virginia, Nev.	May 9	June 3	0.20
Crown Point, Nev.	June 26	July 20	0.10
Hancock Con., Mich.	Au.Oct.		3.00
Hector, Idaho	Mar. 28	May 26	0.00½
Helvetia, Ariz.			0.50
Mangus Dev., Mich.	May 7		2.50
Mexican, Nev	May 17	June 9	0.15
Ojibway, Mich	Oct.		1.00
Ophir, Nev	Apr. 22	May 16	0.25
Rhode Island Copper, Mich.			0.50
Savage, Nev.	May 2	May 27	0.10
Sierra Nevada, Nev.	June 21	July 12	0.10
Union, Nev.	June 9	July 1	0.10
Utah Con. of Tintic, Utah	May 15		0.01
Yellow Jacket, Nev	June 9	July 11	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538	.....	24.166	.....
July	51.043	.....	23.519	.....
August	51.125	.....	23.588	.....
September	51.440	.....	23.743	.....
October	50 923	.....	23.502	.....
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.706	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

	New York.				London.	
	Electrolytic		Lake.			
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.56⅛	12.733	12.93⅞	13.091	57.363	57.238
May	12.893	12.550	13.238	12.885	59.338	56.313
June	13.214	.....	13.548	.....	59.627	.....
July	12.880	.....	13.363	.....	58.556	.....
August	13.007	.....	13.296	.....	59.393	.....
September	12.870	.....	13.210	.....	59.021	.....
October	12.700	.....	13.030	.....	57.551	.....
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28.060	32.700	July	29.125	.....
February	28.290	32.920	August	29.966	.....
March	28.727	32.403	September	30.293	.....
April	29.445	32.976	October	30.475	.....
May	29.225	33.125	November	30.859	.....
June	29.322	.....	December	32.913	.....
			Av. Year	29.725	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4 307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350	.....	4.291	.....	13.031	.....
July	4.321	.....	4.188	.....	12.563	.....
August	4.363	.....	4.227	.....	12.475	.....
September	4.342	.....	4.215	.....	12.781	.....
October	4.341	.....	4.215	.....	13.175	.....
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402	.....	5.252	.....	22.000	.....
July	5.402	.....	5.252	.....	21.969	.....
August	5.729	.....	5.579	.....	22.125	.....
September	5.796	.....	5.646	.....	22.906	.....
October	6.199	.....	6.043	.....	23.200	.....
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PRICES OF PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$17.18	$19.90	$16.40	$17.98	$16.26	$17.94
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.50	15.02	16.23	15.08	16.18
June	16.13	.....	15.84	.....	15.63	.....
July	16.40	.....	15.90	.....	15.96	.....
August	17.16	.....	16.17	.....	16.20	.....
September	18.44	.....	16.80	.....	17.03	.....
October	19.75	.....	17.84	.....	18.02	.....
November	19.90	.....	18.37	.....	18.09	.....
December	19.90	.....	18.15	.....	17.90	.....
Year	$17.46	.....	$16.46	.....	$16.40	.....

STOCK QUOTATIONS

COLO. SPRINGS June 1

Name of Comp.	Bid.
Listed:	
Acacia	.06½
Cripple Cr'k Con.	.03
C. K. & N.	.15½
Doctor Jack Pot	.10
Elkton Con.	.79½
El Paso	.89½
Fannie Rawlins	.05½
Findlay	.08
Gold Dollar	.14
Gold Sovereign	.03⅝
Isabella	.18½
Mary McKinney	.59
Pharmacist	.02⅞
Portland	1.17
Vindicator	.94⅞
Work	.04½
Unlisted:	
Golden Cycle	1.50
United Gold Mines	.08

SALT LAKE June 1

Name of Comp.	Clg.
Carisa	‡.50
Colorado Mining	.65
Columbus Con	.82
Daly Judge	3.95
Grand Central	1.25
Iron Blossom	.95
Little Bell	1.25
Little Chief	‡.45
Lower Mammoth	.48
Mason Valley	7.00
Maj. Mines	‡2.32½
May Day	.05½
Nevada Hills	.83
New York	.13
Prince Con	.73
Red Warrior	‡6.00
Silver King Coal'n	2.47½
Sioux Con.	.25
Uncle Sam	.35½
Victoria	‡1.07½

SAN FRANCISCO. June 1.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Atlanta	.12
Belcher	.65
Best & Belcher	.25
Caledonia	.45
Challenge Con.	‡.24
Chollar	.12
Confidence	.70
Con. Cal. & Va.	.96
Crown Point	.60
Exchequer	‡.21
Gould & Curry	.18
Hale & Norcross	.32
Mexican	1.05
Ophir	.97
Overman	.85
Potosi	‡ 27
Savage	.23
Sierra Nevada	.19
Union	.19
Yellow Jacket	.70
MISC. NEVADA	
Belmont	3.62½
Daisy	.06
Jim Butler	.25
MacNamara	.25
Midway	.25
North Star	.04
West End Con.	.44
Atlanta	.12
Booth	.13
C.O.D. Con.	.08
Columbia Mt.	‡.06
Comb. Frac.	.51
Great Bend	.02
Jumbo Extension	.20
Oro	.06
Red Hill	.03
Sandstorm	.03
Silver Pick	.07
St. Ives	.15
Tramps Con.	.04

N. Y. EXCH. June 1

Name of Comp.	Clg.
Amalgamated	68⅞
Am. Agri. Chem.	‡46
Am.Sm.&Ref.,com	75⅞
Am. Sm. & Ref., pf.	104
Anaconda	41½
Bethlehem Steel	27⅜
Col. & Hock. C. & I.	6⅛
Colo. Fuel & Iron.	36¼
Du Pont P'd'r, pf.	87½
Federal M. & S.	‡41
Great Nor., ore ctf.	62
Nat'nalLead,com.	75
National Lead, pf.	107½
Nev. Consol.	20¾
Pittsburg Coal	19¾
RepublicI&S,com.	33
Republic I & S, pf.	‡98
SlossSheffi'd,com.	71½
Sloss Sheffield, pf.	‡117½
Tennessee Copper	26
Utah Copper	45¼
U. S. Steel, com.	79⅞
U. S. Steel, pf.	117
Va. Car. Chem.	59¾

N. Y. CURB June 1

Name of Comp.	Clg.
Bonanza Creek	3
Boston Copper	18
Braden Copper	4¼
B. C. Copper	5⅞
Buffalo Mines	‡2½
Butte Coalition	20½
Caledonia	1¼
Chino	12⅜
Cobalt Central	.07
Cobalt Prov.	59
Con. Ariz. Sm.	2
Cumberland Ely.	9
Davis-Daly	1¾
Dominion Cop.	‡7
Ely Con.	.56¼
El Rayo	3¾
Florence	2.22
Gila Copper	6¾
Giroux	7⅝
Gold Hill	‡⅞
Goldfield Con.	8½
Greene Cananea	8
Guanajuato	‡1⅝
Guggen. Exp.	190
Kerr Lake	.09
La Rose	4⅜
McKinley-Dar-Sa.	.93
Miami Copper	21¾
Mines Co. of Am.	61
Mont. Shoshone	‡⅞
Mont.-Tonopah	‡.70
Nev. Utah M. & S.	1
Newhouse M. & S.	3½
Nipissing Mines	11½
Ohio Copper	2½
Pacific Sm. & M.	¾
Ray Central	2 3/16
Silver Queen	.35
Standard Oil	625
Stewart	⅛
Tonopah	8½
Tonopah Ex.	‡.90
Tri-Bullion	⅛
W. Va. Wyo. Cop.	‡2 1/16
Yukon Gold	4 5/16

LONDON June 1

Name of Com	Clg.
Dolores	£1 10s 0d
Stratton's Ind.	0 3 3
Camp Bird	1 8 6
Esperanza	2 13 9
Tomboy	0 19 3
El Oro	1 6 9
Oroville	0 9 6
Mexico Mines	8 8 9

BOSTON EXCH. June 1

Name of Comp.	Clg.
Adventure	6
Allouez	43
Am. Zinc	25¼
Arcadian	5
Arizona Com.	16
Atlantic	7
Boston Con.	‡17
Butte & Balak.	16⅝
Calumet & Ariz.	63¾
Calumet & Hecla.	575
Centennial	18
Con. Mercur	.10
Copper Range	66½
Daly-West	8
East Butte	8½
Franklin	12⅝
Granby	40
Hancock	18
Helvetia	3
Indiana	17
Isle Royale	21
Keweenaw	4
Lake	51
La Salle	12¼
Mass	7
Michigan	5
Mohawk	52
Nevada	20½
North Butte	32
North Lake	11
Ojibway	7⅛
Old Dominion	36
Osceola	136
Parrot	15
Quincy	78
Shannon	11¼
Superior	45⅛
Superior & Bost.	11
Superior & Pitts.	12
Tamarack	52½
Trinity	5⅞
U. S. Smg. & Ref.	42
U.S.Sm. & Re., pd.	50
Utah Apex	3
Utah Con.	23
Victoria	3⅛
Winona	7¾
Wolverine	118
Wyandotte	1¾

BOSTON CURB June 1

Name of Comp.	Clg.
Ahmeek	170
Bingham Mines	3
Boston Ely.	2⅛
Boswycocolo	.08
Cactus	3
Calaveras	5¾
Champion	.06¼
Chemung	9
Chief Cons	1⅛
Cons. Ariz.	2
Corbin	.08
Crown Reserve	3½
First Nat. Cop.	3¾
Indiana	21⅝
Inspiration	7⅛
Mackinaw	.09
Majestic	.60
Nat'l Mine	.31
Nevada-Douglas	2⅝
New Baltic	6¼
Oneco	3⅛
Raven Copper	.44
Ray Con.	18¾
Rhode Island Coal	7¾
San Antonio	17⅛
Shattuck-Ariz.	‡29½
South Lake	5⅛
Superior & Globe	.35
Trethewey	1⅜
Tuolumne Copper	‡3¾
Vulture	9¾
Yuma	.55

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Barbadoes	per ton.	80.00@100.00
West Indies	"	20.00@60.00
Egyptian	lb.	.13@.18
Gilsonite, Utah ordinary	per ton.	32.00@40.00
Trinidad	"	20.00@25.00
California	per ton.	25.00@30.00
BARIUM—		
Carb. Lump. 80@90%	lg. ton.	26.00@35.00
Precipitated, 96@98%	"	34.00@36.00
Powdered, natural	lb.	.02@.02½
Chloride com'l	ton.	33.00@35.00
Nitrate powdered, in casks	lb.	.05@.06½
Blanc Fixe, dry, bbl	per lb.	.02¾@.04
BARYTES—		
Am. Ground	sh. ton.	12.00@15.00
Floated	"	17.00@19.00
Foreign floated	"	20.00@23.00
BLEACHING POWDER—35% 100 lb		1.20@1.25
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.		3.90@4.25
BONE ASH	lb.	.02¾@.04
BORAX, sacks	"	.03¾@.05
CALCIUM—Acetate, gray,	100 lb.	1.75@2.00
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	11.00@14.10
CEMENT—Slag cement	bbl.	.75@1.25
Portland, Am. 500 lb	"	1.50@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb. (in sacks)	"	.85 .65
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton.	14.00@16.00
Bricks, f.o.b. Pittsburg, per M.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton.	8.00@9.00
Foreign	"	11.50@18.00
COBALT—Oxide	lb.	.80@.85
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.80
In bags	"	.60@.75
CRYOLITE (carload)	lb.	.06½@.07
FELDSPAR—Ground	sh. ton.	6.00@14.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20.00@23.00
Special extra	"	30.00@35.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. Pittsburg: Lump	ton.	8.00@10.00
Ground	"	12.00@14.00
Foreign crude ex. dock	"	8.50
FULLER'S EARTH—Lump,	100 lb.	.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02@.04
Dust	"	.02½@.05
Chip	"	.04@.08
Lump	"	.05½@.12
Large lump	"	.08½@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01½@.02½
German	"	.02½@.02¾
LEAD—Acetate (sugar of) brown.	lb.	.07¼@.08
Nitrate, com'l	"	.09@.10
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.50@8.50
Calcined, powdered	sh. ton.	26.00@37.00
Brick, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.90@1.00
MANGANESE—		
Foreign, crude, powdered: 70@75% binoxide	lb.	.01@.01½
75@85% binoxide	"	.01½@.01½
85@90% binoxide	"	.01½@.04
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16.00@32.50
MARBLE—Flour	sh. ton.	7.00@9.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, normal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.10¼@.11
Sulphate, double	"	.05¾@.08
NITRATE OF SODA—		
100 lb. 95%		2.07½@2.15
95% for 1910		2.07½@2.15
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.06½@.06¾
English glassmakers'	"	.08½@.09½
Lithophone	"	.03½@.07
Metallic, brown	sh. ton	16.50@30.00
Red	"	14.00@18.00
Ocher, Am. common	"	10.00@15.00
Best	"	12.00@15.00
Dutch, washed	lb.	.02¾@.03
French, washed	"	.01½@.02
Paris green, pure, bulk	"	.17½@.20½
Red lead, American	"	.06¾@.07
Foreign	"	.08¼@.09½
Turpentine, spirits bbl.,	per gal.	.62½@.63
White lead, Am., dry	lb.	.06@.06½
American, in oil	"	.07@.07¼
Foreign, in oil	"	.09@.09¾
Zinc white, Am. extra dry	"	.05½@.06½
French, proc's, red seal, dry	"	.07½@.08
French, process, green seal, dry	"	.10@.10½
PHOSPHATES—Acid		.55@60c. per unit
*Fla., hard rock 77%		7.00@7.50
land pebble 68%		3.75@4.00
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock 60%		3 50@4.00

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—		
Bicarbonate crystal	lb.	$.07½
Powdered or granulated	"	.08
Bichromate, Am.	"	.07⅞@.08
Scotch	"	.10¼
Bromide	"	.20
Carbonate (80@85%)	"	.03½@.04½
Caustic, ordinary	"	.05½
Elect. (90% KOH)	"	.06@.06½
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.08½@.09½
Crystals	"	.09@.09¾
Cyanide (98@99%) Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons		.19
Kainite, long ton, bulk, 8.50; bags,		.9.25
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13½
Red	"	.29@.32
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. R. R.	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10¾@11c.
Imported, non-arsenical, furnace size, ex-ship, per unit		.12½
Imported, arsenical, furnace size, ex-ship, per unit		.12
Imported fines, arsenical, ex-ship, per unit		.09@.09½
Imported fines, non-arsenical, ex-ship, per unit		10½@11c.

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore for furnace is delivered in large lumps.

SALT—N. Y. com. fine 280 lb.	bbl.	.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals	"	5.00@5.75
SILICA—		
Ground quartz, ord'ry.	lg. ton	7.00@15.00
Silex, ground	"	7.00@15.00
Silex, floated	"	35.00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—Acetate	lb	.04½@.05
"Alkali," per 100 lb., 58/48		.90@.95
Bicarb. soda, per 100 lb		1.00@1.30
Soda, caustic, per 100 lb., 78/60		1.72½@1.85
Soda, caustic, powdered		.02½@.03
Salt cake, per 100 lb., bulk		.50@.60
Salt cake, bbl		.65@.85
Soda, monohydrate, per lb.		1.30@1.75
Bichromate	lb.	.05½@.06½
Bromide	"	.20
Chlorate, com'l	"	.08¼@.09½
Cyanide, 120-130% KCN, per 100% Carloads (30,000 lb.)	lb.	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	.20
Hyposulphite, Am.	"	1.30@1.50
Phosphate	100 lb.	2.10@2.40
Prussiate	"	.08½@.09
Sal soda, f.o.b. N. Y.	"	.60@.75
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.65@1.00
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.80
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07@.08
SULPHUR—Louisiana (prime) to New York	lg. ton.	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1.85@2.15
Flour	"	2.00@2.40
Flowers, sublimed	"	2.20@2.60
Powdered commercial, bags		1.55
Sicilian, extra qual., unmixed seconds, crude brimstone to New York	lg. ton.	$22.00
TERRA ALBA—Fr.&Eng.	100 lb.	.70@1.00
TALC—Domestic	sh. ton.	12.00@20.00
French	"	15.00@25.00
Italian, best	"	30.00@40.00
TIN—Bi-chloride, 50°	lb.	.10
Crystals	"	.22½@.24
Oxide, lb.		.37@.40
URANIUM—Oxide	"	2.20@4.25
ZINC—Chloride sol., com. 20°	"	.02½
Chloride, granular	"	.04@.04½
Dust	"	.06⅝
Sulphate	"	.02@.02½

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output as a matter of private contract.