

The Engineering and Mining Journal

VOL. LXXXV.

NEW YORK, MAY 30, 1908.

NO. 22

Gold-dredging Practice in California

A Description of the Construction of the Hull, the Machinery Required, the Designs Most in Favor and Methods of Operation

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Recently I had occasion to study the methods of dredging for gold as practiced at Oroville and Yuba City, Cal., and in the course of a few weeks to visit 40 different dredges operated by 16 different companies. The unvarying courtesy with which I was received, both on the field of operations and among the dredge builders in San Francisco, gave me an opportunity to compare different opinions concerning

had its origin in New Zealand, but California really did the pioneer work in the industry nearly a half century ago. These early efforts, futile as they were, so far as giving dividends to shareholders was concerned, prepared the way for the successful dredge engineer of today. The first successful endless-chain bucket dredge in the United States was built in 1894 at Grasshopper creek, in Montana. Many at

was due primarily to the fact that suction will not lift any appreciable amount of gold; nor will it clean uneven and hard bedrock. In the dipper or clam-shell types the joints in the buckets could not be made water-tight; consequently most of the gold was lost with the rush of water through these joints; besides, the excavators of these types deposit the material in large quantities at intervals, whereas a



CLOSE-CONNECTED DREDGE ON YUBA RIVER, CALIFORNIA

the latest practice, and to form my own estimate of the advantages and disadvantages of the various details from information freely given me by those actually engaged in solving the difficult problems to be met upon the ground. The following notes represent the prevailing opinion in regard to the merits of the various designs and the modes of procedure, and are presented as far as possible without bias or prejudice.

The elevator or bucket type of dredge

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tempts to dredge for gold had been made on the Pacific coast, but it was not until 1897 that a dredge of the present type was built in California. This first successful dredge was built by the Risdon Iron Works in San Francisco, and was wrecked during the heavy floods of last spring after years of successful operation.

In the experimental periods of dredge construction there were many unsuccessful attempts to use the hydraulic, or suction, and the dipper, or clam-shell, types of dredges. Failure of the suction dredge

continuous feed is most essential to the saving of gold. The Garden dredge, near Oroville, built by the Marion Steam Shovel Company, is the only dipper dredge now operating in the vicinity. The intermittent supply of material upon the washing machinery seems to be the greatest disadvantage under which this dredge is operating.

The elevator or endless chain type is now uniformly recognized as the most effective and best commercial machine for handling a maximum quantity of material at a minimum cost.

POWER REQUIRED AND COST

In order to give an estimate as to the probable cost of a dredge the manufacturer should have the following data: (1) Depth to bedrock from water level; (2) height of bank (if any) above water level; (3) depth of water; (4) character of gravel or wash dirt; (5) character of bedrock; (6) character of gold to be saved; (7) nearest railroad depot, and freight rate from manufacturer's plant; (8) cost of handling from depot to the ground; and, (9) cost of lumber delivered on the ground.

The arrangement of two types of gold dredges is shown in the accompanying sketches. The essential parts are (1) a water-tight hull built of 4-in. timbers with a well so that the ladder can be operated; (2) a bucket line to excavate the gravel; (3) a ladder upon which are supported the (4) upper and (5) lower tumblers, the former being used to drive the bucket line; (6) a hopper or grizzly into which the buckets dump the gravel; (7) a screen, either revolving or shaking, which separates the coarse tailings from the fine, gold-bearing dirt; (8) gold-saving tables upon which are (9) riffles to recover the gold; (10) a stacker in the rear of the boat to deposit the coarse material from the screen; (11) a front gantry to raise and lower the digging ladder; (12) a middle gantry to support the upper tumbler and screen mechanisms; a (13) rear gantry to raise or lower the stacker and also to raise or lower the (14) spuds if there be any; (15) motors and (16) winches to operate the different mechanisms, and to "walk" the dredge ahead.

In regard to the power necessary to operate a dredge there is considerable variation in practice. During my visit I saw some boats greatly handicapped because they did not have sufficient power; other dredges are equipped with ponderous motors that can never be run economically at their highest efficiency. In a paper read before the California Miner's Association L. J. Hohl gives the actual consumption of power as follows, for a 5-cu.ft. close-connected bucket dredge, with shaking screen and belt conveyer: main drive, 42 to 70 h.p.; stacker and screen, 10 to 20 h.p.; water pump, 50 to 75 h.p.; winches, maximum, 27 h.p.; sand pump, not tested. For a 5-cu.ft. open-connected bucket dredge, with revolving screen and bucket conveyer the estimate is as follows: main drive, 60 h.p.; water pump, 52 h.p.; screen and stacker, 18½ h.p.; other motors, not tested.

Concerning the cost of installation and equipment one company reports that a 5-cu.ft. bucket dredge would cost from \$85,000 to \$98,000 on the ground in California; another that a 5-cu.ft. dredge would cost in the neighborhood of \$68,000 f.o.b. New York; another that \$77,000 would erect and complete a dredge of the same size. Two of the best installations which I saw during my sojourn in Cali-

fornia were the Hunter and the Empire dredges near Oroville. These were 5-cu.ft. bucket dredges and cost \$88,000 each. A 5-cu.ft. dredge, El Oro No. 2, was in process of erection in Oroville and was to cost \$102,000. The boat seemed to me too massive, and somewhat extreme as far as the size of motors is concerned.

EQUIPMENT OF A DREDGE

Detailed specifications submitted by manufacturers give a fair idea of the practice near Oroville. The following details are from a set of specifications for the machinery for a 5-cu.ft. placer dredge of the continuous-bucket type:

The machinery is designed to enable the dredge to cut its own flotation through a bank 10 ft. above and to dig to a depth of 30 ft. below the surface of the water. The material as excavated by the buckets is delivered into a hopper, from which it passes into a revolving screen, where the material is thoroughly washed, the fine gold-bearing material passing through the screen upon the gold-saving tables, while the coarser material passes on over the screen and is discharged by gravity upon an endless belt or stacker, which delivers the tailings well behind the dredge. The machinery here described is furnished by the Bucyrus company.

Buckets—The bottom or link portion of the bucket is a single casting of specially treated high-carbon open-hearth steel. The pitch, center to center of pins, is about 28 in. The horizontal part of the bottom is 2 in. thick, the inclined part 1¼ in. thick, and a wearing flange on each side on the bottom is 2 in. thick. The flange to which the hood is riveted above the single eye is about 1⅞ in. thick at the top, tapering to 2¼ in. at the bottom. The longitudinal side flanges to which the hood is riveted has a thickness of 1⅞ in. at the bottom, the top tapering from 1 in. at the ends of the single eye to ¾ in. at the end over the double eye. The hood is made of ¾-in. steel plate pressed to shape. All rivets have button heads on both ends, except those fastening the bottom of the hood to the flange above the single eye; these are countersunk on the outside.

The lip is of Manard manganese steel 12 in. wide and 1¼ in. thick at the cutting edge, and the corners have raised projections 1 in. high and 1½ in. thick. The lip is attached to the bottom by six rivets at each end.

The bucket pins are of forged high-carbon steel, 3⅞ in. in diameter, with a lug on one end, fitting into a machined recess in the bucket bottom to prevent the pin from turning in the double eyes. A rivet passing through this lug and the side of the bucket bottom holds the pin in place. Each bucket has a single Manard manganese-steel bushing about ⅝ in. shorter than the single eyes.

Upper Tumbler—The upper tumbler is six-sided and is made of a specially

treated open-hearth steel casting in one piece, each face being provided with a patent renewable sprocket plate. Upon the forward end of this plate is formed a positive driving sprocket, while each side is provided with a sloping lug to guide the bucket to its seat. All three of these projections are faced with Manard manganese-steel wearing plates riveted in place. These sprocket plates are attached to the tumbler by fitted bolts and are prevented from slipping backward by planed transverse tongues fitting planed grooves in the tumbler. The upper tumbler shaft is of forged open-hearth steel, 14 in. in diameter in the tumbler and 12 in. in diameter in the bearings. The upper tumbler is securely keyed to this shaft by four large gib-head keys.

Lower Tumbler—The lower tumbler is six-sided, made in right- and left-hand halves, securely coupled together by means of links to prevent their spreading on the shaft, each half being a specially treated open-hearth casting. The tumbler has sprockets of the latest design and the faces are lined with Manard manganese-steel wearing plates fastened by countersunk rivets. The insides of the flanges opposite the eyes of the buckets are lined with Manard manganese-steel wearing plates tapering in thickness from ⅝ in. to 1¼ in. The lower tumbler shaft is 10½ in. in diameter in the middle between the tumbler halves, 10¼ in. in diameter where the tumbler halves fit, and 9 in. in diameter in the journals, made of forged open-hearth steel, bored hollow. The shaft is keyed into the tumbler, the journals running in self-aligning, renewable bearings held in steel-casting boxes riveted to the ladder. The caps on these boxes are bolted against planed joints, and a heavy tie-rod extends from one ladder and casting to the other, a finished head on each end of this rod being rigidly held in a machined recess between the ladder and casting and its cap.

Ladder Frame—The ladder is of steel, of the plate-girder type, and of a length sufficient to enable the dredge to dig to a depth of 30 ft. with the ladder at an angle of 45 deg. from the horizontal, and has on its timber rubbing-strips faced with ¾-in. steel plate. The lower end of the ladder is fitted with steel-casting brackets with renewable self-aligning boxes, the brackets being tied together with a steel tie-rod extending through the lower tumbler shaft. The upper end of the ladder frame is fitted with cast-steel bearings, by which it is hung from the ladder-suspension shaft supported on the main gantry.

For supporting the chain of buckets, the ladder is furnished with rollers 14 in. in diameter. These rollers are high-carbon steel castings. The upper roller is flanged. The roller bearings above water are lined with cast-iron bushings. The bearings below water have no bushings.

Upper Tumbler Drive—The upper tum-

bler is driven by cast-steel gearing situated on the headframe and driven by a belt from a jack shaft on the main deck, which shaft also drives the ladder-hoist machinery.

MACHINERY FOR TREATING THE GRAVEL

Hopper.—A structural-steel hopper receives the discharge of the buckets and conducts it to the screens. It is lined on the back, where it is subject to abrasion, with 1/4-in. steel plate. The spout is lined with 3/4-in. plate and is provided with a door of 3/8-in. plate having a 3/8-in. plate liner. A "saveall" is furnished, but no stone chute. The bottom of the hopper is of the rock-dump type, so constructed as to retain the gravel as a wearing surface.

Revolving Screen.—The revolving

ing its hight, are also furnished. The stacker ladder is provided with a running board for convenience in oiling. The conveyer is driven by an independent engine.

OPERATING MACHINERY

Winch Machinery.—The winch machinery includes six similar drums for operating two forward swinging-lines, two lines for raising and lowering the spuds and two stern breasting lines, besides a head-line drum and a drum for hoisting the stacker. The gears of this machinery are all of steel, and the shafting is forged steel. There are three gear reductions, the gears for the first of which have cut teeth. This winch machinery is driven by an independent engine, and is mounted on

grease cups, one cup to each sheave. The ladder and spud-hoist sheaves are bushed with bronze; the other sheaves are not bushed.

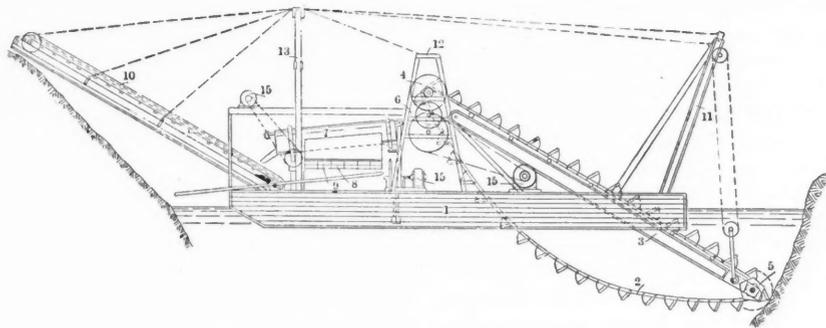
Spuds.—One steel spud 36 in. deep, 24 in. wide and 45 ft. long is provided, also metal fittings for a wooden spud for moving ahead. The steel spud is made of two webs and two flanges joined by four angles, which are inclosed by the four plates, giving a rectangular cross-section, smooth on all its exterior faces, all rivets being driven countersunk on the outside.

Both spuds are hoisted from the top by means of sheaves and wire ropes, and in order to accomplish this a suitable gantry is provided at the stern of the dredge, fittings for which are furnished.

Gantry Fittings.—Suitable metal fittings are furnished for both front and stern gantries for attaching the ladder-suspension and spud and stacker-hoist blocks, and for connecting the gantry caps with their supporting timbers.

Operating Levers.—The different operations of the machinery are controlled by levers so arranged in the pilot house that the movements of the dredge may be controlled by one man.

Engines.—For the main drive and ladder hoist there is a 10x14-in. double-horizontal engine; for the winch machinery a 7x7-in. double-horizontal engine; for the



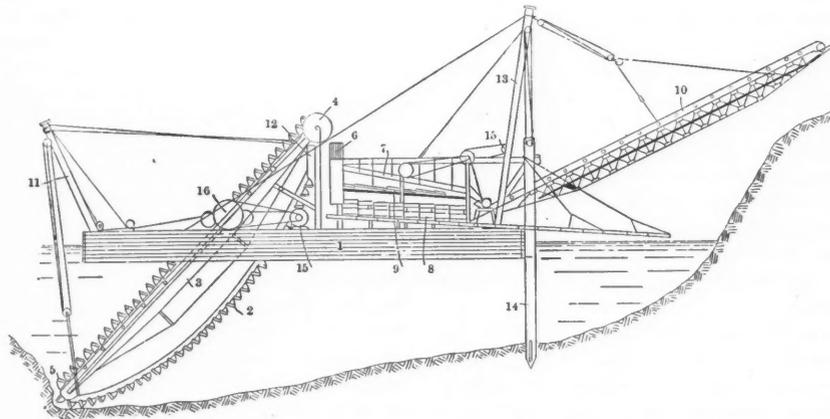
ESSENTIAL PARTS OF OPEN-CONNECTED BUCKET DREDGE

screen is 6 ft. in diameter and 20 ft. long over all. The screen is carried on two cast-steel friction tires, one near each end of the screen riveted to 3/8-in. shell plates connected by six pairs of angles running longitudinally, to which the perforated screen plates are bolted. The shell plates have liner plates 1/2 in. thick. The screen plates are of 1/2-in. rolled steel plate, perforated as agreed upon between the purchaser and manufacturer.

The screen is carried on the tires by four friction rollers on longitudinal shafts, two rollers being on each side of the screen. The two rollers at the lower end of the screen are driven through bevel gearing by an independent engine. A screen casing of steel plate is also furnished.

Gold-saving Tables and Sluices.—Angle-iron riffles are furnished for the gold-saving tables, which are built of wood by the purchaser. A steel-plate distributor is provided to take the discharge of the screen and feed it to the tables. Plate-steel tail sluices to extend well behind the dredge are furnished.

Tailings Stacker.—A 32-in. belt conveyer, 90 ft. long between centers of end pulleys, is furnished, together with the structural-steel ladder for supporting it; also the hopper on the lower end for receiving the tailings and the chute from the end of the screen to this stacker hopper. The necessary yokes and slings, and wire-rope tackle blocks for supporting the stacker from the stern gantry, and adjust-



SPUD-ANCHORED, CLOSE-CONNECTED DREDGE

a timber base, plate-steel bars being provided for the bearings to rest upon.

Ladder Hoist.—A suitable drum is provided for raising and lowering the ladder. This drum is driven by a friction clutch and gearing from the engine used for driving the upper tumbler. All gears and pinions used on this drive are of steel. The high-speed gears have cut teeth. The ladder hoist machinery is mounted on a timber base, plate-steel bars being furnished for the bearings to rest upon.

Sheaves and Fairleads.—All the sheaves and fairleads necessary for guiding the ropes are furnished, and include two shore sheaves for use of the breasting lines. The necessary sheaves for raising and lowering the spuds are also provided. All blocks are provided with compression

screen drive a 7x7-in. double-horizontal engine, and for the stacker a 6x6-in. double-cylinder horizontal engine.

Boilers.—Two locomotive boilers, 66 in. in diameter by 18 ft. long, for 100-lb. steam pressure, are furnished by the manufacturer, together with all the usual and necessary fixtures and fittings, saddles, stacks, fire tools and magnesia non-conducting covering material. Structural-steel ash pans beneath the boilers are provided for the protection of the deck. Boiler-feed pump and injector are also furnished.

Pumps.—A 6-in. centrifugal pump, direct-connected to a 7x5-in. steam engine, and an 8-in. centrifugal pump, direct-connected to a 9x5-in. engine supplies water for the hopper, screen and tables.

Steam and Water Piping.—The necessary steam and water piping with all necessary fittings and valves for properly connecting up the engines, boilers and pumps and distributing the water supply, are furnished ready for erection.

Wire Ropes.—The following wire ropes are included in the equipment: Two ¾-in. flexible plow-steel ladder-hoist lines; one ¾-in. flexible plow-steel steel spud hoist line; one ⅝-in. flexible plow-steel wooden spud hoist line; one ¾-in. flexible plow-steel stacker-hoist line; one 1-in. flexible plow-steel head-line, 350 ft. long; two ¾-in. crucible cast-steel bow-swing lines, each 600 ft. long; two ⅝-in. crucible cast-steel stern breasting lines, each 500 ft. long. The guys for the front and stern gantries and the necessary belting are also provided.

General.—The necessary foundation bolts and bolts for fastening the machinery and fittings to the hull or woodwork are provided by the manufacturers, but no bolts, spikes or irons for the construction of the hull proper.

CONSTRUCTION OF THE HULL

The construction of the hull of a dredge has been reduced to a definite order of procedure. After a pond about 100x100 ft. has been excavated, posts are driven into the ground until they project about 4 ft. above the bottom of the pond. These posts are about 10 ft. apart and follow the line where the outside bottom planks of the dredge and outside bottom planks of the well are to be placed. The planks (4x12 in.) are then toe-nailed to the posts. The extreme rib frames are now constructed, and beginning at the stern of the boat the rib frames are transferred from a platform constructed in the bow of the boat. This transfer is made by a "dolly" which runs on the well planks.

The bottom boards (4x12 in.) are now spiked into place. Each board has a 3/16x1-in. taper for oakum or calking. The keelsons are then bolted into place, the bolts passing outward and downward through each panel or rib. Every alternate rib frame extends outward for the upper frame support. The gantry framework is bolted into place, after which the floor is spiked down. The bottom of the dredge is thoroughly calked with oakum twisted and pounded in, after which the entire hull is thoroughly painted with pitch and the seams of the floor covered with the same material. As the outer keelsons are put into place they are sawed longitudinally to take the proper radius after having been thoroughly steamed. The machinery is installed beginning first with the upper tumbler, the buckets being installed last.

One large unit is preferable to two small units because operating expense on the larger dredge is just about half of that required to operate two smaller units. A ¾-cu.ft. bucket is the smallest that is

practically operated nowadays. One eminent dredge expert advises the 5-cu.ft. bucket dredge and no larger, for he feels that the design for the 5-cu.ft. bucket dredge has been very economically developed, while the 7-cu.ft. and especially the 13-cu.ft. bucket machine is still in the experimental stage.

INSTALLING MACHINERY

The time consumed in building the dredge from the final signing of the papers until the boat is ready to operate is usually about six months, although the Victor and the Hunter, two of the most up-to-date boats at Oroville required eight months for erection. The following firms manufacture dredges and dredge machinery: Bucyrus Steam Shovel Company, Milwaukee, Wis.; Marion Steam Shovel Company, Milwaukee, Wis.; Risdon Iron Works, San Francisco, Cal.; The Link Belt Company, Chicago, Ill., and Philadelphia, Penn., and the New York Engineering Company, New York. These firms contract for dredge machinery alone or also attend to the installation. The Western Engineering and Construction Company, of San Francisco, Cal., erects dredges, but does not manufacture machinery. Most firms seem to prefer to sell machinery alone and let the buyer engage a first-class construction company to build the dredge. Many of the big dredge companies in and about Oroville build their own dredges to suit their own peculiar needs.

OPERATING FORCE AND ACCESSORIES

From 20 to 30 men, a scow-boss, and two marine carpenters are usually employed in handling a dredge. The scow-boss commonly gets \$7 a day. Among the accessories usually required in the way of tools, shops, etc., is a set of small tools which is generally acquired from the contractor after he turns the dredge over to the owners. According to a prominent dredge engineer \$8000 ought to furnish an out-of-the-way dredge with practically everything needed. Some California companies maintain elaborate shops. At the shops owned and operated by the Lava Beds Dredge Company, I found a monster drill press with revolving frame, a large shaper and a lathe for handling heavy work, such as tumblers, shafts and buckets. A large supply of buckets, pins and tumblers were kept on hand for emergencies. At the shops of the Boston & California Dredge Company, I saw lathes of several types, an immense shaper and drill presses of two types.

Generally speaking, the hull of a dredge is designed to last 10 years; the machinery is, however, replaced from time to time as occasion demands. The annual cost of repairs on a dredge varies with circumstances. One company finds that the average loss of time on a 5-cu.ft. dredge three years old during 12 months is 18.8 per cent. and the cost of the re-

pair parts is distributed as shown in the accompanying table:

COST AND TIME LOST IN REPAIRING A GOLD DREDGE.		
	Per Cent. Time Lost.	Cost of Material.
Ladder and buckets	5.77	\$9,557.81
Stone elevator.....	1.77	972.07
Winches.....	1.24	378.16
Screen.....	0.86	113.39
Pumps.....	1.00	63.42
Power line.....	1.48	.....
Operating line.....	1.87	401.15
Clean-ups.....	1.44	80.90
Other causes.....	3.37	2,188.65
Total.....	18.8	\$13,755.55

A dredge may be made to climb a 2-per cent. grade up a cañon without trouble if the tailings are properly handled, banking the rear as the dredge moves forward. While at Oroville I visited the Central dredge. This dredge is of the Bucyrus type and has 3½-cu.ft. buckets. Although it is rather old and somewhat out of date, it still gives good service. Shortly before my visit it had climbed the face of a hill and was at that time operating upon the summit.

DETAILS OF OPERATION

The season for operating a dredge in a cold climate is determined by the conditions. A dredge could probably be operated at any temperature provided that the ground could be thawed out. This is accomplished in the Klondike by steam-piping operating ahead of the digging ladder, but this adds materially to the cost of operation. In cold climates the stacker is usually jacketed with steam pipes to insure against interference by frost. The gold-saving tables never give trouble, for they are always inclosed, and the temperature can be easily controlled.

In regard to the relative merits of steam and electric current for operating dredges, a condenser on a steam-operated dredge will heat the water in the pond slightly, which is an advantage in a cold climate. Cheap electric power is, however, always much to be desired, for by reason of its use the dredge can be made much lighter, and operating expenses are reduced by the absence of boilers. The constant loading of fuel on steam dredges also requires extra men.

As a rule, dredge buckets can safely handle rocks up to one ton in weight. If the buckets are properly designed, there should be no clinching effect between them and the rocks as the bucket clears the turn on the lower tumbler. It may be necessary to handle a few very large rocks by means of a derrick constructed for that purpose on the bow of the boat.

The hardness and toughness of the material determines whether or not the bed-rock can be dredged. Karl Krug, a prominent dredge man in California, says that any bedrock may be dredged if it can be broken loose with a pick, and that even harder bedrock may be dredged under certain circumstances.

A cemented gravel and a gravel mixed with considerable clay seems to be most

feared by dredge men. A dredge at work upon a clay formation during my visit near Oroville recovered very little gold; the screens merely puddled the clay into round balls 2 to 4 in. in diameter without washing and disintegrating it at all. In fact, I am of the opinion that the clay balls even gathered up the loose gold in the gravel which otherwise would easily have been saved.

The most satisfactory depth for dredging with some of the newer dredges now in use is 60 ft. or less, but these machines will work down to 70 ft. In order to work to a greater depth than 70 ft., some changes in the digger, stacker, and power would be required.

PROSPECTING DREDGING GROUND

Nearly all prospecting of dredging ground in the Sacramento valley districts of California has been done with Keystone No. 3 traction drills. Owing to the presence of water in the gravel it has in most cases been found impracticable to sink shafts. The cost of a drill complete, including freight, etc., is about \$1900. Three men are required to operate it, with wages from \$2 to \$4 per day. The total cost per day to run the drill and do the sampling varies from \$15 to \$30. About 12 to 15 ft. per day is a good average speed for sinking in the gravel.

Errors in sampling frequently occur from the squeezing in of material around the bottom of the casing, so that more gravel is lifted than is called for by the size of the hole. In order to obtain a check on the quantity of material it is a common practice to drill and pump in a section of a foot or so, and to weigh each lot of material. The casing should be kept driven below the point of drilling, whenever possible. The pond should be about 100 ft. wide in order that the dredge may clear itself as it operates forward. From 60 to 80 miner's inches or from 1½ to 2 cu.ft. of water per second is plenty for operating a dredge in ordinary gravel. Should the gravel be loose more water would be required.

QUESTIONS OF DESIGN

The best shape for the tumbler which carries the bucket chain has not yet been determined. The square tumbler gives a better speed relation, but with this shape the strains are excessive. In the latest patterns the tumblers are pentagonal or hexagonal in shape.

Concerning the merits of close-connected and open-connected buckets, there is still a division of opinion. One authority prefers open-connected buckets because they handle boulders more easily. Another would never use them because of the intermittent motion which imparts a considerable vibration to the dredge. I feel that this last criticism is well taken, for I noticed this difference in the vibration in going from one kind of a dredge to the other. I am, furthermore, of the

opinion that a close-connected bucket, if correctly designed, will handle boulders fully as easily and safely as the open-connected system. The open-connected arrangement can never get the same leverage in handling gravel as the close-connected system.

The question of the best size of buckets to be used in dredging promises to be solved before long by practical experience. Early types of dredges mostly carried 3- and 3½-cu.ft. buckets; the later type of installation uses nothing smaller than 5 cu.ft. The 5-cu.ft. bucket dredge has been thoroughly and scientifically worked out in all its details; the 7-cu.ft. dredge is still somewhat experimental in certain parts of its make-up. Hence most authorities advise the 5-cu.ft. bucket for dredges in new country.

Most authorities agreed that the cast bucket is much better than the built-up type, but admit that the built-up bucket would be excellent if the shearing off of the bucket bottom could be prevented. This tendency to shear off seems to be fatal in the built-up type. One dredge operator has designed a toe-nail type of rivet which he claims permits a bucket form to be removed in nine minutes, while ordinarily an hour is required.

The essential duty of the screen is to classify the material before concentration; it also serves to disintegrate or break up the material passing over or through it, so that the particles of gold may not be carried away in lumps of clay or cemented gravel. The aim also, of course, is to prevent the larger gravel and boulders from being washed over the sluices. As to the choice between the revolving trommel and the shaking screen, those who use the former claim that when constructed as it usually is, with flanges and rods across it, it turns over lumps and exposes them to the action of the water jets on all sides. On the contrary, those who advocate the shaking screen contend that the jets have a thinner surface to play upon, that the actual screening surface is larger and that the material is deposited on a wider surface. The first cost of the revolving screen and repairs are usually greater than those of the shaking type.

By far the greater number of authorities favor the revolving type. After seeing both types in operation, I have become an enthusiastic convert to the revolving type.

One authority stated that he had originally used cocoa matting on his gold-saving tables for riffles, but later had installed Hungarian riffles and quicksilver, thus increasing the gold saving area 85 sq.ft. by utilizing the space in the distributing box directly under the screen. The great trouble with cocoa matting seems to be that it wears out quickly and must be cleaned at too frequent intervals. Under the screens on the first tables quicksilver in large quantities held in place by riffles is used with a view to

bringing the fine gold into contact as it drops from the screens. In this respect shaking screens do better work than the revolving type, because they let the material down over a larger surface. Gold-saving tables arranged lengthwise with respect to the hull seem to be preferred by most authorities, because the unsteadiness of the boat is less pronounced in that direction.

The inclosed padlocked gold-saving apparatus prevents the operator from getting at the riffles when accidents occur. One authority says that he is convinced that by using the open type a small amount of gold is stolen, but he obviates this in a great measure by doing his best to get only honest men.

PROBLEMS IN OPERATION

The presence of arsenic or other substances which prevent free amalgamation makes quicksilver and riffles of little use; cocoa matting, push, or other similar means must then be adopted to save the gold, especially when it is in fine particles.

In most cases at Oroville and Folsom, the tailings are sampled in order to determine how much gold is lost. This sampling is, however, of no value except to show that the sluice-boxes and tables save a large per cent. of the gold which could be found by panning or rocking. I have been told that if some of the finest gold saved at Oroville were shaken up in a bottle of clear water it would take two hours to settle. One authority estimates that perhaps 2½c. to the yard would be a fair allowance for the entire amount not recovered by a dredge.

The steel gantry is generally considered to be far superior to the wooden structure. The cost of steel is, however, high, and wood answers the purpose fairly satisfactorily.

In a discussion of the Risdon and the Bucyrus types of pilot box one engineer who had supervision of dredges carrying both types, said that the winch machinery requires very little attention, and that, therefore, it makes no difference whether the winchman can see his machinery or not. In one case electric ammeters are used in the pilot box so that the winchman can tell immediately when something is wrong.

The prevailing opinion seems to be that tall gantries such as are used on the Ophir near Oroville are entirely unnecessary. They weaken the boat by making its equilibrium somewhat unstable.

The belt conveyer and the endless chain of buckets, both have advantage in performing the work of the stacker. Belt conveyers do not work effectively at a higher grade than 18 or 20 per cent.; the bucket conveyer, on the other hand, operates at any angle, 35 deg. being the usual inclination. Conveyer belts must be renewed every six or nine months; this makes the cost of repairs considerably more than for the bucket conveyer. However, to offset this the loss of time is con-

siderably less from this cause with the belt conveyer, for practically the only wearing part is the belt and this can be replaced in a few hours.

For keeping the dredge in place, moving it about and holding it against the bank, two methods are used. In the first method two spuds, one of steel and one of wood are placed at the stern of the boat, the wooden spud being used when the steel spud is lifted and it is desired to "walk" the boat ahead. At the forward end of the boat are two steel wire-rope lines fastened to the shore to move the boat to right and left through an arc of a circle, and two at the stern. In the second method instead of spuds and lines, five lines or guys are used, two at the stern, two forward and one ahead to hold the boat against the bank. In the lighter and softer ground in New Zealand the guy method seems to be preferred, but in Oroville both methods are in vogue. My own personal opinion is that spuds are preferable, especially if heavy gravel is encountered or hard bedrock must be cleaned.

The waste sand piles up so near the stern of the boat that it frequently hinders manipulation. Hence a pump is usually employed to suck this sand up and throw it over the tailings pile. On boats using head-lines instead of spuds, no sand pump is required, for the stern of the hull is beveled under water, thus forming what is known as a "rake" which clears the sand heap.

Most of the dredge companies in California have issued statements showing the approximate cost of dredging per cubic yard. According to the tabulated statements, the cost varies from 2.36 and 3c. to as much as 8½c. Cost statements of 3c. or less represent operations with new dredges with all the advantages of the latest ideas as to strengthening the parts of machinery, and indicate that there have been no breakdowns and consequently very little, if any expense for repairs. The labor costs have been very light, for the running time has been full. In the operation of eight dredges, the entire expense from the time of beginning work years ago to date, repairs and everything included, has averaged less than 4c. per cubic yard.

A New Spanish Zinc Smeltery

Echo des Mines announces that the Sociedad Minera y Metallurgica de Penarroja is about to begin construction of a plant at Penarroja for the roasting and distillation of zinc blende. It is planned to have the works in operation next autumn, and they are expected to treat about 5000 tons of ore annually, making between 1600 and 1700 tons of zinc. After the zinc smelter shall have proved successful the company is considering the erection of a sulphuric acid plant in connection with it, and possibly also of a superphosphate works.

The Clays and Ochers of Alabama

BY EUGENE A. SMITH*

Along the line which divides the mineral from the agricultural districts, are some important deposits of clay, having the same physical characteristics as well as the same geological position as the New Jersey clays, which have a world-wide reputation. Development work has been prosecuted only in the vicinity of Bibbville and Woodstock, in Bibb county, near Coosada, in Elmore county, near Tuscaloosa and at one or two points along the Kansas City Railroad in Fayette and Lamar counties. At best very little has been done toward showing up the qualities of the clays. Those taken from near Woodstock are sent to Bessemer, where they are mixed with imported clays and used in the manufacture of fire-brick.

At Bibbville, on the Alabama Great Southern Railroad, there was for many years a manufactory of fire-brick, the material being obtained from pits in the immediate vicinity of the kilns. At this time the clay from Bibbville is shipped to Bessemer. Several years ago the clays from the vicinity of Tuscaloosa were used in the manufacture of wares of various kinds. There are also similar pottery works in Fayette and Lamar counties, but a systematic and thorough demonstration of the capabilities of these clays remains yet to be made.

In Marion county, in the neighborhood of Pearce's Mill and more especially near Chalk Bluff, there is a deposit of white china clay several feet in thickness and apparently underlying a very large area. This clay has nearly the chemical composition of kaolin, and the occurrence is well worth the attention of anyone interested in clay products. Near Coosada station, in Elmore county, are potteries which have been in operation for many years. A large amount of yellow ocher has also been obtained from this vicinity. Good ochers are also known to occur at many localities in the Coastal Plain region, but nothing is being done with them in a commercial way.

A preliminary report on the clays of the State, by Dr. H. Ries, has been published by the U. S. Geological Survey. In this report it is shown that the clay resources of Alabama are very great; but the clay manufacturers have hardly yet begun to avail themselves of the opportunities held out to them.

To what extent electric mining machinery has been introduced from the United States into Mexico may be estimated from the fact that in one of the mining camps at Guanajuato, the Pinguico mines, no less than 250 Westinghouse electric motors are being operated ranging from 5 to 200 h.p. in capacity.

*State geologist, University, Ala.

Chrome Ore in Asia Minor

Consul Ernest L. Harris, of Smyrna, reports that chrome ore has dropped so much in price that there is scarcely any profit in mining it, and certainly not in districts far distant from the railways. As much as \$100 per ton was paid for chrome ore 20 years ago, but the same quantity and quality cannot be sold delivered today, f.o.b. Smyrna, for more than \$17 per ton; often it brings only \$15.

The most important mines formerly worked were those of Daghardi, in Broussa. The district which has produced and exported the greatest quantity of chrome ore in Asia Minor is that termed the basin of Macri, of which the port of that name was the chief point of shipment. This port is in the vilayet of Smyrna, on the southern coast of the peninsula. Considerable chrome was also shipped through the port of Smyrna. The mines are situated in the mountains near Sarakeui, on the Aidin railway line. There are also many other chrome pits which have been left unworked on account of the difficulties connected with transportation.

Chrome ore in Asia Minor is usually found on mountains from 4000 to 5000 ft. high. It is removed from the pit to the railroad station, or market, on the backs of donkeys and camels, the surer-footed donkeys being used in the higher altitudes and the camels for the plains. This method usually involved two or three transfers between the point of origin and the port of Smyrna. It usually takes one donkey a week to carry 400 lb. of chrome ore from the pits on the mountain-tops to the camel stations below; it then takes five camels one day to transport a ton of chrome ore over a distance of 15 miles. The last shipments of chrome ore made from Smyrna were 1500 tons in 1906. None of the mines has ever been worked with up-to-date machinery. As the chrome ore of other countries comes on the world's market in increasing quantities, that of Turkey must necessarily decline in the face of keen competition, not on account of the quality of the ore, but from the difficulties of internal transportation, if for no other reason. The largest firm which ever handled chrome at Smyrna has returned all its mines to the Turkish government, as the annual tax upon the ownership of these mines amounted to more than they could be worked for at a profit.

The first silver sent to Europe from the mines of Mexico was obtained from those at Tasco which were discovered by the Spaniards in 1522 the year after the conquest. These mines and those at Pachuca are considered the oldest in Mexico, for they had been worked by the Aztecs long before the arrival of the Spaniards.

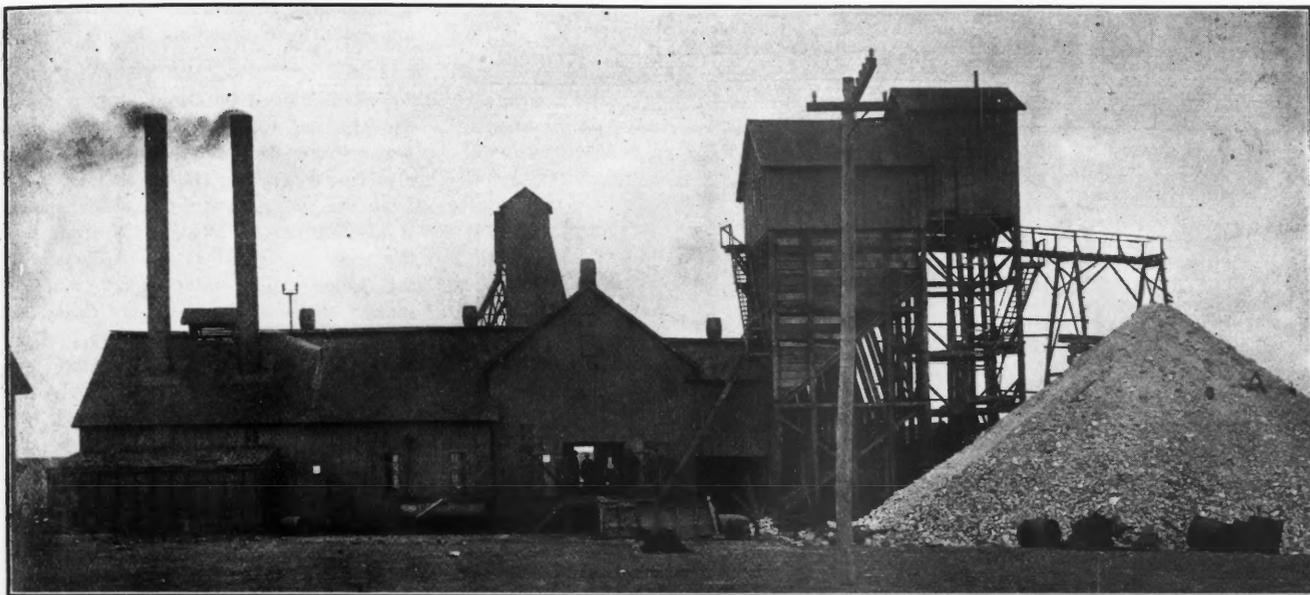
First Practical Application of the Foust Jig

BY DOSS BRITAIN*

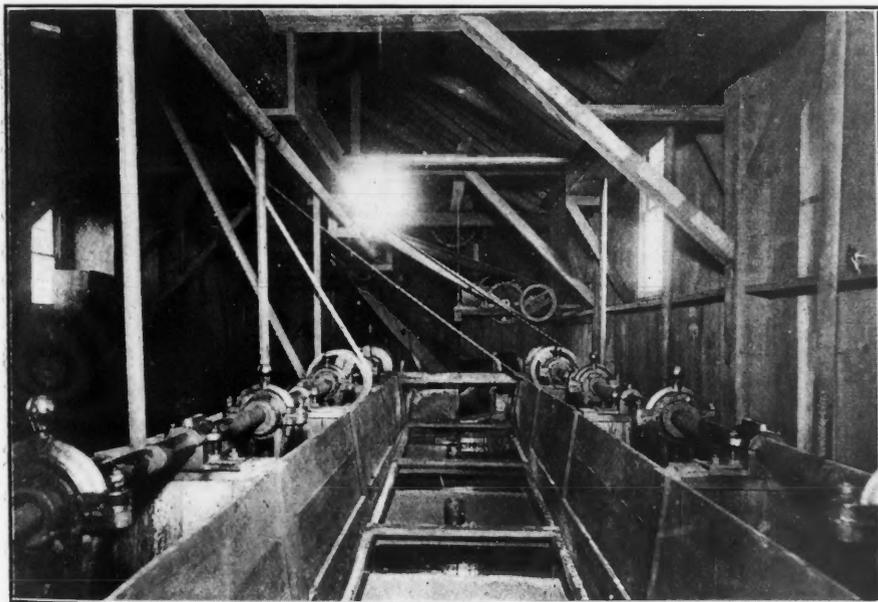
An innovation in the milling practice of the Joplin district has recently been installed in the mill of the Virginia Mining

Company is a new "draw-off" for the discharge of concentrate from the center of the sieve compartment. A curved pipe passing through the side of the jig provides an outlet for the discharge which is regulated by a hollow cylinder surrounding the upper end of the pipe and a cap and adjustable aluminum valve. The body of the jig is of wood, and is divided into

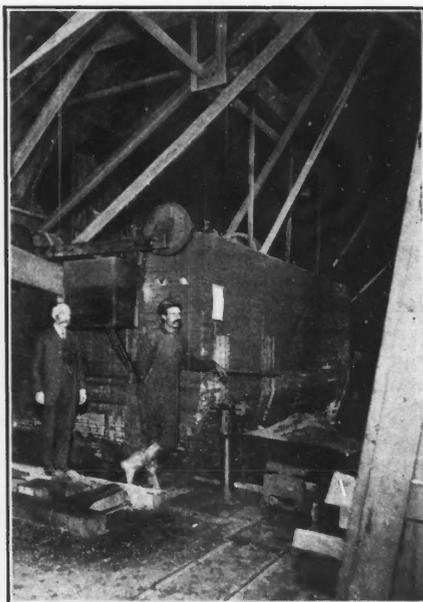
The plungers are actuated by means of eccentrics and eccentric rods, provision being made to keep the plungers in a horizontal position at all periods of the stroke. The motion of the line shafts is balanced by placing the pairs of eccentrics in the various cells at different angles, so that when one pair is ascending another is descending.



SURFACE PLANT, VIRGINIA MINING COMPANY



FOUST JIG, SHOWING CENTER COMPARTMENT AND TWO PLUNGER COMPARTMENTS



EXTERIOR VIEW

Company on the Julius Stafford land six miles south of Baxter Springs, Kan. Instead of employing jigs of the Cooley type throughout the mill, as has been the practice in the district heretofore, a new jig, an invention of Henry Foust, has been installed as a part of the equipment.

The peculiar feature of the Foust jig

is divided longitudinally into three compartments, the outer compartments being plunger compartments and the central division carrying the sieve and the ore. The stroke of the two plungers is simultaneous, the two line shafts being kept in the proper relation by means of crank disks and a connecting-rod at one end of the jig.

The mechanism by means of which the concentrates are automatically discharged from the center of the bed consists of a hollow cylinder surrounding the open end of the discharge pipe and sufficiently large in diameter to provide a passage for the concentrates between its inner walls and the discharge pipe. This cylinder is supported upon legs above the sieve permitting the concentrates to enter from below;

*Joplin, Mo.

its upper end is closed by a cap through the center of which passes a thumb-screw for the adjustment of the cone valve of aluminum which regulates the discharge into the open end of the pipe.

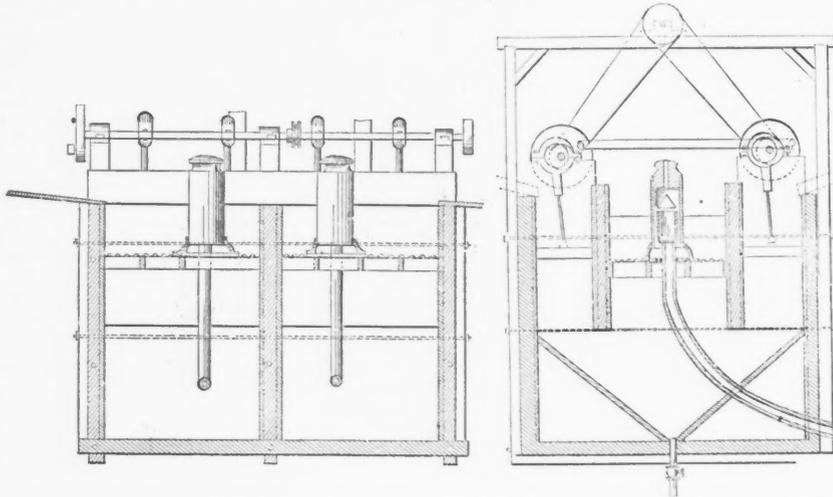
THE VIRGINIA MILL

The ore at the Virginia mill contains from 3.5 to 5 per cent. recoverable zinc and lead mineral, thus giving the jig a trial on ore which is very similar to that

sand jig is drawn off as concentrates, while a part is returned for a second treatment on the same jig.

The hutch which passes through the sieve of the rougher passes to the cleaner, from which the bedding and hutch from the first five cells consist of hutch. The hutch of the last two is returned over the cleaner while the bedding from the last two cells goes to the chat rolls and the sand jig.

Automatic discharge of concentrates, thus materially simplifying the duties of the jig man; saving of the fines which ordinarily pass over into the sludge and are either wasted or saved at extra trouble and expense on tables; reduction of the expense of mill construction, the cost of a 500-ton plant with the Foust jig being estimated to be no greater than that of an ordinary 300-ton plant; material increase in the size of the cell, and the comparative impossibility of crowding the jig.



FOUST JIG, LONGITUDINAL AND CROSS SECTIONS

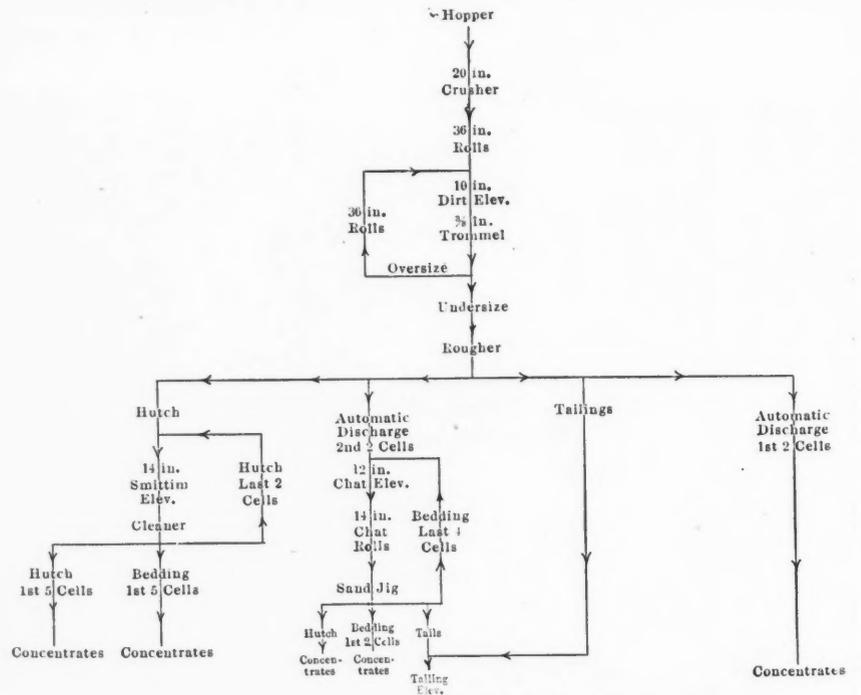
of the recognized sheet ground north of Webb City and west of Joplin. The equipment of the mill consists of a power plant of the usual type, the necessary crushing and sizing machinery, a rougher of the Foust type, a cleaner and a sand jig of the Cooley pattern.

The Foust rougher has four cells, the middle compartments of which are 4x5 ft. Water is supplied to each plunger compartment by a 2-in. pipe reduced two-thirds. The plungers work at the rate of 90 strokes per minute. A 6-in. bed of material is carried on the sieves. The sieves are of wire cloth, three and four wires to the inch. The Cooley jigs are of the usual type, the cleaner consisting of seven 30x42-in. cells, with sieves having five wires to the inch; the sand jig contains six 30x42-in. cells, with sieves of six wires to the inch.

The process of concentration does not differ materially from that in operation at other plants of the district, the ore passing from the hopper to a 20-in. crusher, thence to a set of 36-in. rolls, whence it is elevated and screened to 3/8 in., the oversize passing through another set of 36-in. rolls and returning to the screen. The 3/8-in. size passes to the Foust rougher. The product drawn off by the automatic discharge of the first two cells consists of very coarse concentrates, while that from the second two cells passes to a chat elevator, to 14-in. chat rolls, and to the sand jig. Here the hutch consists of concentrates, and the tailings are drawn into the tailing elevator and ejected from the mill. A part of the bedding ore of the

Thawing of dynamite in hot water is bad practice, not only because the paraffin coating is washed away so that the nitroglycerine is given a chance to wash away from the "dope," but the explosive power is also decreased owing to the effect of the soda ingredient in the dynamite being "killed." The water-soaked or steam-soaked sticks of dynamite are more sensitive to cold than those thawed in a dry atmosphere, for water is a better conductor of heat than dry paraffin-coated paper.

Calcium, either pure or combined, is certainly destined to a brilliant future. "More easily worked than sodium, and less violent in its reactions," says J.



FLOW SHEET, VIRGINIA MILL

The Virginia mill at present has a capacity of 450 tons per shift of 10 hours. The installation of Foust jigs throughout in the equipment is expected to increase the capacity greatly. It is claimed by the inventors of the Foust jig that a rougher and cleaner of that type concentrate the ore so thoroughly that tables are unnecessary for ordinary Joplin ores. The advantages claimed for the Foust jig as compared with the ordinary types are:

Escard in *Eclairage Electrique*, "it seems particularly suitable for metallurgic applications which necessitate employment of reducing agents to purify the molten metal when running."

In thawing dynamite a steady dry, moderate heat is best. Too high a heat is apt to produce chemical changes in the dynamite which make it extremely sensitive.

The Forest of Dean Iron Mine, New York

A Deposit of Magnetite within 50 Miles of New York City, Worked before the Revolutionary War, Still Yields Commercial Ore

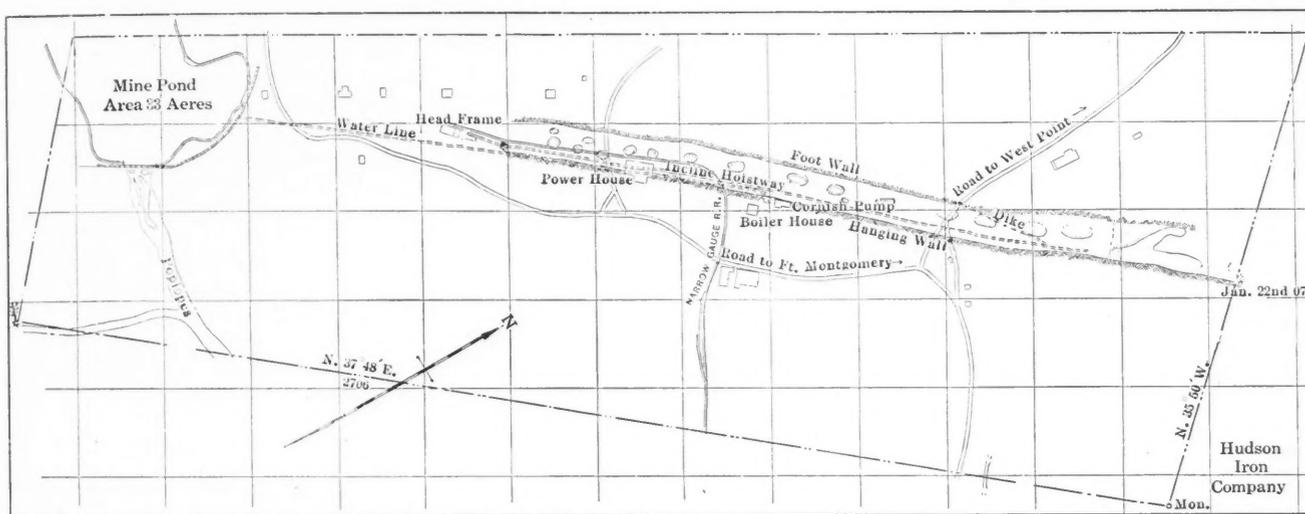
BY GUY C. STOLTZ*

The Forest of Dean mine is situated five miles west of Fort Montgomery, Orange county, N. Y., and 43 miles northwest of New York City. The strike of the deposit follows the general course of Great valley, bordered on the southeast by Long mountain and on the southwest by West hills. Of the mines in the

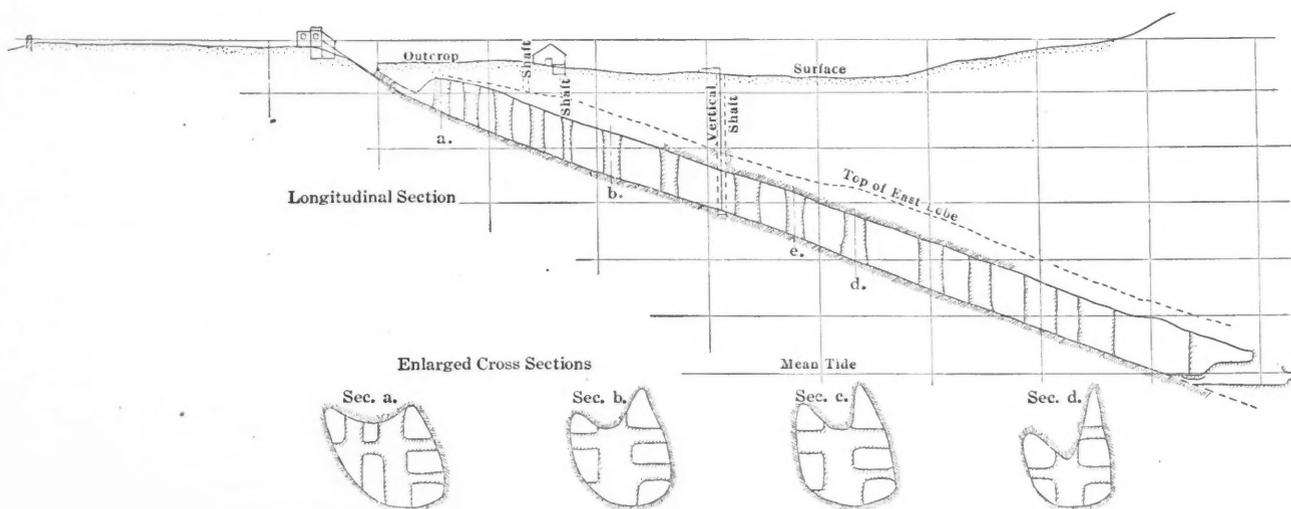
mine, the production amounted to 500,000 tons.¹

Since 1906 the Hudson Iron Company has been working the mine, paying a royalty; it purposes to advance the workings to its own property, where it is the intention to hoist as before through the Forest of Dean incline shaft.

incline shaft was sunk. The higher of the two lobes lies to the east. A wedge-shaped horse of gneiss lies between the lobes and penetrates farther into the orebody as the workings become deeper. It is quite probable that if the pitch of the deposit does not change radically, the horse will gradually approach the foot-



MAP OF THE FOREST OF DEAN IRON MINE, NEW YORK



SECTIONS, FOREST OF DEAN WORKINGS, NEW YORK

country that are now operating, this mine probably has the longest record as a producer. According to records preserved in the neighborhood the property was worked as early as 1756. In the period of 1865 to 1894 when the Forest of Dean Iron Ore Company operated the

OREBODY AND GEOLOGY

The orebody is a pod of magnetite, apparently folded upon itself into a synclinal, the cross-section being roughly the shape of a heart. The upper parts of the lobes outcrop at the surface, whereon the

wall and sooner or later cause the deposit to pinch out.

The orebody and high micaceous inclosing gneisses strike and pitch to the northeast and dip steeply to the southeast. They probably lay originally in a nearly horizontal plane, the syncline being developed during a period of folding and pressure. The anticlinal folds have been

*Mining engineer, Port Henry Iron Ore Company, Mineville, N. Y.

¹Bulletin 112. Economic Geology 16. "The Mining and Quarry Industry of New York State." By A. H. Newland, July, 1907.

eroded by glaciation and stream action.

Folding seems to be intimately associated with the more important magnetite deposits of the State. At Mineville the immense deposit in No. 21 and Joker Bonanza mines is similarly folded but anticlinally, the horse of gneiss wedging into the orebody from below. Other deposits in the vicinity also show folding of this type. At the Cheever mine near Port Henry a part of the deposit lies in a very moderate anticline and syncline.

As a rule the miner in the Forest of Dean mine is not hampered by running

that would contain 17,000 tons of ore.

The ore is a rich magnetite of non-bessemer character. An analysis quoted from Smock's report shows the following composition:

COMPOSITION OF FOREST OF DEAN IRON ORE.	
	Per Cent.
Iron oxide.....	83.56
Silica.....	5.00
Phosphorus pentoxide.....	2.30
Alumina.....	tr
Manganous oxide.....	0.53
Lime.....	5.51
Magnesia.....	1.19
Carbon dioxide.....	1.05
Water.....	0.20
	<hr/> 99.44

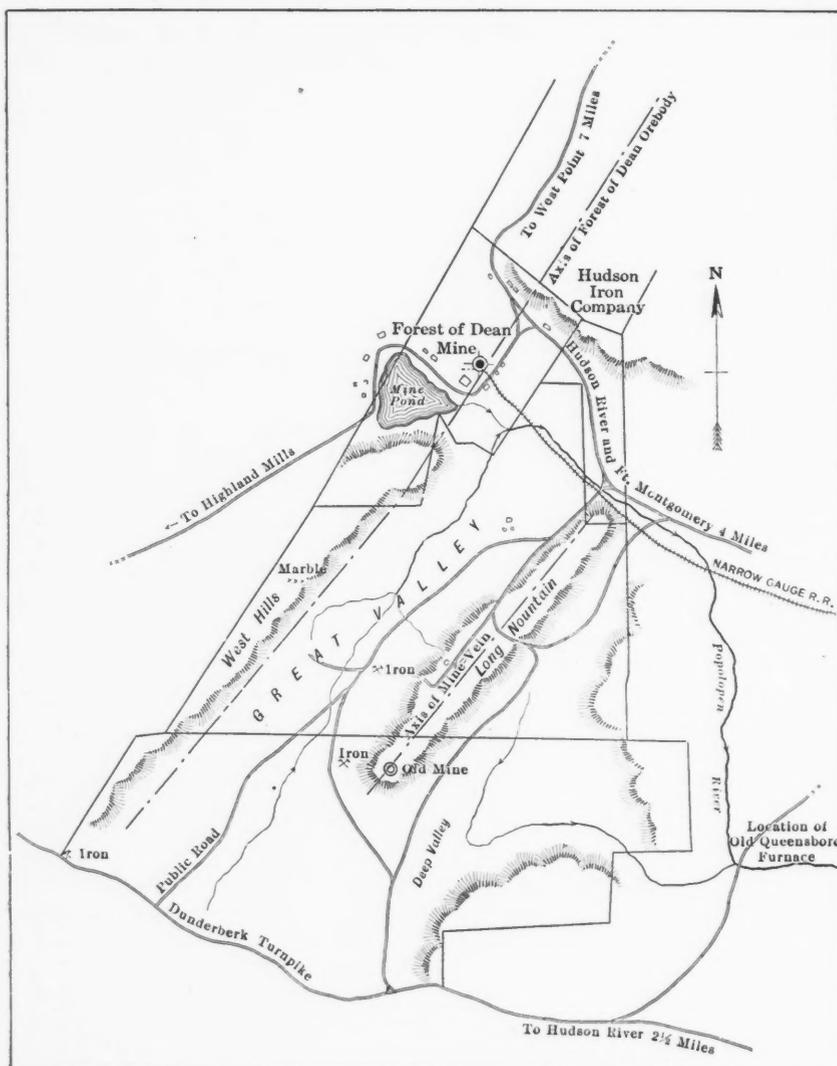
the ore. The ore is hoisted to the surface on an inclined track at an average angle of 23 deg.; the track follows the footwall along the strike. Timber is used only along portions of the hoistway to protect it from possible falls. The regular tram cars of 3-ft. gage and 2 tons capacity are hoisted. They are end dumping, and the door is tripped mechanically at the headframe, emptying the ore into a chute, which delivers it, lump and fine, directly to a jaw crusher, capable of receiving a lump 10x20 in. The crusher is driven by a belt-connected Bacon simple steam engine. After being crushed to about 4 in. the ore is discharged on a 30-in. belt conveyor. Three men pick out the rock and very lean ore, which is thrown into tram cars and taken over a trestle to the dump.

The conveyor empties into an 80-ton storage bin. From the bin the ore is drawn off through three chutes into 10- and 20-ton cars and hauled by a Davenport locomotive over a 3½-mile narrow-gauge tramroad and dumped into a storage bin at the terminal of the road. The ore is loaded into the ½-ton buckets of an aerial tramway 6300 ft. long, which carries it to a 1000-ton storage bin on the dock at Fort Montgomery. The ore may also be dumped directly into cars or into a boat to be hauled to the company's furnace at Secaucus, N. J.

POWER PLANT

Both steam and water power are used. The latter is furnished by Popolopen pond, covering an area of 160 acres, which, controlled by a gate dam, feeds into a creek flowing into the Mine pond covering about 33 acres. A dam provided with a gate valve feeds the water into a 3-ft. pipe line which carries it a distance of 800 ft. to the power plant. Here two 4½-ft. Pelton wheels, driven by about 50 ft. head of water discharged through duplex nozzles, operate a belt-connected Rand Imperial, type 10, compressor. An auxiliary Ingersoll-Sargeant compressor is run by steam.

A 10-in. pipe from the main water line discharges under a head of about 60 ft. upon a 6-ft. Pelton wheel geared to a Cornish pump having a 13-in. discharge. The rods of this pump operate through a vertical shaft sunk in the hanging wall, to a sump half-way up the incline and about 250 ft. vertically from the surface. Two Worthington pumps run by air, lift the water up the incline a vertical distance of 275 ft., into the sump at the vertical shaft. A Bacon double-drum steam hoist, winding a ¾-in. rope and equipped with drums 4 ft. in diameter takes the ore up the long incline, the rope winding on itself three times. I understand that the Hudson Iron Company intends to double track the incline and hoist in balance, to drive the hoisting engine by wire-rope transmission from the Pelton wheels, and to install a generator for lighting the



MAP OF REGION SURROUNDING THE FOREST OF DEAN MINE

into dikes and by having to deal with the rise or fall of the orebody. Once an unusually large dike of dark gray rock, called "Blue Jay" by the miners, was encountered on the footwall side about 1100 ft. from the outcrop. It measured 4 ft. thick and stood the full height of the slope, crossing the deposit at an angle of 13 deg. east of the strike. The course of the dike was so near the angle of the general strike of the orebody that it did not enter the hanging wall until it had followed the ore for 300 ft. It has been estimated that it occupied a space

The proportion of iron and phosphorus in the ore is fairly uniform; the general average of samples, I understand, assays 60 per cent. iron and 0.80 per cent. phosphorus. The lime in the ore is desirable in the metallurgical treatment of the ore, but it slacks in the mine and frequently necessitates re-roofing the workings, and gives trouble in mining.

METHOD OF MINING AND HANDLING THE ORE

The deposit is mined by the pillar method recovering about 60 per cent. of

mine and the surface plant by electric current.

Nos. 2 and 3 Rand drills are used and operated under a pressure of 80 lb. at the drill.

Under the Forest of Dean management, the plant was operated entirely by water power. Power was then taken from two overshot water wheels 40 ft. in diameter by 5 ft. face. The water was stored overhead in two tanks directly over the wheels, each tank having a capacity of about 24,000 gal. One water wheel connected by clutch and gearing drove a compressor, and, by means of a crank connection, the Cornish pump. The other wheel was direct-connected to the drum for hoisting, and was thrown in and out by a friction clutch.

The Nature of Bauxite

At a recent meeting of the Société de l'Industrie Minérale, Francis Laur reviewed the history of the discovery and development of bauxite, and outlined some of the various opinions as to its nature and composition.

In 1821 a sample of mineral was found by one Blavier, near the village of Baux, Bouches-de-Rhone, and was sent by him to Berthier, who analyzed it. Berthier published a note on the mineral, which was a new species to him, in Vol. VI of the *Annales des Mines*, of that year, in which he stated its composition to be: Al_2O_3 , 52; FeO_2 , 27.6; water, 20.4; chromium, traces. The deposit was originally opened in connection with iron-smelting works, which were, naturally, soon abandoned, and the occurrence of the mineral was practically forgotten until comparatively recent years.

In 1873, during the boring of a tunnel on the railroad line between Montpellier and Paulhan, a deposit of exceedingly pure and white bauxite was disclosed, which became an object of interest to geologists.

The well known diversity in the color and texture of bauxites can probably be referred to differences in the modes of origin. Some deposits have almost certainly been formed by the action of hot springs, while others have equally certainly been formed by the decomposition in place, of richly aluminous rocks, under atmospheric agencies. In either case bauxite is characteristically amorphous. Study into the nature of bauxite is confused by the double character of alumina, which acts as a base in reaction with silica, forming silicates, and as an acid in the presence of iron, forming ferro-aluminates.

H. Fischer does not admit that bauxite is a mineral species, but considers it a mixture of iron oxide and red clay. Zirkel considers it a mixture of alumina,

silica and sesquioxide of iron. Hofman looks upon it as a mixture, in widely varying proportions, of diaspor and limonite. Richards and Sainte-Claire-Deville consider it a combination between diaspor and brown hematite. Watson, Philips and Hancock agree in thinking of bauxite as a variable mixture, in which the tri-hydrate of alumina, $Al_2O_3 + 3H_2O$, is the principal constituent. Liebrich thinks that bauxites have the general composition, $Al_2O_3 + nH_2O$, in which variable proportions of the water are replaced by iron and silica. Bauxite would thus occupy a position between diaspor, with 15 per cent. water, and gibbsite, with 34.6 per cent. water.

M. Laur concludes, from his own large experience with French bauxites, that the percentage of alumina tends to hold closely between 68 and 69 per cent., that the total of the three variable elements, silica, iron and water, holds closely to 27 per cent., the remaining 4 per cent. consisting of accidental constituents such as titanium, vanadium, chromium, etc. Although the three variable elements may replace each other in great diversity, their total is never far from the percentage mentioned. Thus, in the case of the white bauxite at Villeveyrac, the iron is almost completely replaced by silica; in the red bauxite of Var, iron replaces almost all of the silica and part of the water; while in the Alabama bauxites, both silica and iron are in subordinate amounts, the ore from that district having almost the theoretical composition of the tri-hydrate. At Baux, the three types are found combined.

Titanium is the most common impurity of the accidental group. It has not yet been determined in what form the titanium appears, whether titanate of iron or of alumina, or simply as titanite oxide. Sainte-Claire-Deville is said to have found crystals of rutile in the residue from an analysis of bauxite. The proportion of titanium occasionally reaches 12 per cent., but in ordinary amounts it has no ill effect upon the utility of a bauxite, on account of its insolubility.

Hartley and Ramage have lately subjected bauxite from Antrim, Ireland, to spectroscopic analysis, by which the presence of impurities in minute amounts could be easily detected. In the so-called pure alumina made from this bauxite they found sodium, potassium, copper, iron, lead, gallium and traces of indium. In the crude bauxite they found, in addition to the above, silver, nickel and chromium. In the aluminum made at Foyers from the same material, they found all the previously mentioned elements, and in addition, calcium and manganese, the last two of which, however, were undoubtedly introduced during the electro-chemical process. In bauxite from New South Wales, other chemists are said to have recognized traces of neodymium and lanthanum.

Colorado, Columbus & Mexican Railway

By F. A. JONES*

The projected line of new railroad known as the Colorado, Columbus & Mexican Railway, is pushing its survey and reconnaissance at a rapid rate.

This projected line is from Columbus on the Mexican border northward to Durango, Colorado, and will be 400 miles long, including spurs. It passes through the copper camps of the Burro mountains, through the gold-silver camps of the Mogollon mountains, and through the coal-fields of McKinley and San Juan counties, New Mexico.

The proposed line can be constructed on a 1½-per cent. grade as a maximum. It is proposed to connect eventually with Salt Lake City and Seattle, and its southern extension will connect with the Kansas City & Orient line at Miñaca, Mexico.

This southern extension will traverse the eastern slopes of the Sierra Madres, and will open up one of the richest mining sections of the Mexican Republic. The prime object in building the first section of the road from Columbus to Durango, is to supply the mining centers of the Southwest and of Mexico with cheaper fuel. The corps of engineers expect to complete the location early in the fall, when construction will begin.

The general geological reconnaissance is being made by Prof. Fayette A. Jones, of Albuquerque, who expects to complete the first division of his work early in the summer.

Rise of Earth Temperature

M. Durnerin has recently communicated to the Société de l'Industrie Minérale the result of his observations on temperature taken during some deep boring operations in Meurthe-et-Moselle. The principal difficulties in the observation of the earth's temperature are currents of underground water, the admission of outside water into the bore-hole, and the heat produced by oxidation which goes on when the hole passes through carboniferous or pyritiferous strata.

He found that one degree of temperature was gained every 53 m. in Triassic sandstones and every 16.5 to 20m. in carboniferous conglomerates having a shaly matrix. These results confirm the previous knowledge that the rise in temperature is more rapid in the older strata. It is probable that in the future development of the deep coal measures of Lorraine, relatively high temperatures, necessitating, perhaps, the use of artificial cooling apparatus, will be encountered.

*Albuquerque, New Mexico.

Gold Mining and the History of Civilization

Production of Gold in All Ages and Its Effect on the History of Mankind. How the Search for Gold Has Extended Civilization

BY F. LYNWOOD GARRISON *

The history of gold and gold mining has a human interest possessed by none other of the mineral products of the earth. Man appears to have had scarcely emerged from the Neolithic, or Stone Age, before he discovered in the stream beds a heavy, ductile metal having a dull gloss and enduring color which attracted an awakening sense of beauty. Far back in these dim ages we can imagine him searching among the gravels resulting from the then not distant glacial epoch for these beautiful yellow grains and nuggets, with which to adorn his primitive nakedness. When it was that man first learned to melt or fuse together these rare and precious particles we have no means of knowing; at any rate he appears to have known from the first that this ductile metal could be easily hammered and wrought into trinkets.

FIRST MENTION OF GOLD IN HISTORY

Man jumps into history a comparatively civilized creature, as is attested by the Babylonian or Chaldean and Egyptian monuments, not to mention the Chinese. Of the gradual evolution of Neolithic man into a civilized being we know practically nothing. We can only guess something of his primitive condition by studying the habits and customs of the few remaining savage and semi-savage tribes now in existence. Probably the oldest historical reference to the use of gold by man is in the Vedic hymns ("Vedas") of India, of about 4000 to 5000 B. C. Here we are told the finding of gold created excitement, and the gods were asked for more of it. According to Herodotus, vessels of gold were in possession of the ancient Scythians and were said by tradition to have fallen from the skies, but were probably made of gold from the Ural mountains. Thus we see man really enters history a complex creature, adorned with gold, and with wants and desires greater and more complex than the demands of mere animal existence.

We are told in the book of Job, 28-1, that "gold is refined, and that man hath dust of gold." Gold and pure gold are mentioned in the same book, 28-19, and in Proverbs, 8-19, thus showing a distinction between gold as found in the earth and gold as refined, or purified. I take it from the context of this chapter of Job, the writer speaks of what he saw of mining in Egypt and perhaps in the land of Ophir. It is well known that the ancient Egyptians and Phœnicians delved into the

earth for mineral substances, and washed gold from the gravels. Modern search and prospecting for gold in Egypt have so far failed to realize satisfactory results, and the modern gold production of Rhodesia which was the Ophir of the Israelites, has not been remarkable. The goldfields of the ancient Egyptians were probably mostly in Nubia, where I fancy there never were any rich deposits, as we would now rate them.

OPHIR

The exact location of Ophir has given rise to much speculation; recent archaeological research has all but conclusively shown that southern Rhodesia (Matabeleland), if not the land of Ophir itself, was the place whence Ophir derived its treasures and the source of the gold of Tyre and Sidon, in fact the Eldorado of the ancient world. There is not a particle of doubt that the ancients obtained quantities of gold from this place. The wealth of the region appears to have been first developed by the Sabæans, a Semitic people occupying southern Arabia, then later by the Phœnicians who were not only the great traders but also the most skilful miners and metallurgists of these early times. The Phœnicians appear to have brought their gold from Ophir or Havilah by way of Madagascar. Tarshish was the outlet, or port, of the land of Ophir and is supposed to have stood on the site of modern Sofala in Portuguese East Africa.

The quantity of gold derived by the ancients from this source was undoubtedly great for the time, and must have taken the very cream of the region, for modern operations in Rhodesia have been disappointing, the placers and rich oxidized outcrops having been pretty well exhausted by the old workers. No other place in the ancient world appears to have been anything like as rich in gold as Ophir, and it is doubtful indeed, if Ophir, even in its pristine condition could be considered rich, according to modern ideas.

With an unlimited supply of slave labor under relentless taskmasters, much gold could be extracted from very poor alluvials or lean quartz veins. Such deposits today would be probably unprofitable, notwithstanding our advantages with modern labor-saving appliances. We are wont, now-a-days, to admire the engineering skill of the old Egyptians who built the pyramids and other structures of a gigantic character; while undoubtedly much cleverness was shown in the plan and execution of these works, they were made

possible and successful only by the vast supply of slaves at the disposal of the ancient engineer. The unit of such human life had less value to him than a mule or a ton of coal to us, and was expended for the same purpose, that is, the generation of power.

GOLD AND LABOR SUPPLY

Similar conditions appear to have obtained in ancient Babylonia or Assyria. The supply of gold to this ancient civilization was directly dependent upon the cheapness of human life, which in turn affected its cost of production just as fuel does in modern times; with this difference, that in addition we have now to pay for the labor a price which no mechanical device or chemical process will offset, and had we no richer sources of supply than these ancients, gold would cost us as much as diamonds and rubies. This view seems to explain the apparent abundance of gold in the ancient world, and the repeated failures in modern times to find the source of these riches. What Solomon's temple cost in human life we can but faintly imagine! Some idea of the value and quantity of gold at the command of this celebrated potentate may be had from the Book of Kings I, 9-28 where it is said Hiram (about 1100 B. C.) brought from Ophir 420 talents of gold, or about \$840,000 of our money. In the same book 10-14, we are told the weight of gold that came to Solomon in one year was 666 talents, which figures out about \$1,332,000 in our money. This probably represented the bulk of his revenue¹ for a record year, and its insignificance as compared with our present conditions can be understood when it is stated that this sum would be equal to about 1 per cent. of the annual production of the South African mines which in 1907 was \$136,750,000. The quantity of gold in possession of the ancients was undoubtedly insignificant as compared with modern times, but its value was cor-

¹The Babylonian and Phœnician gold talent was probably the same as that mentioned in the Old Testament, and has been variously reckoned at from \$1700 to \$2000 in our money. Taking into account the decreased purchasing power of gold in modern times, it would seem advisable to adopt the larger equivalent as a corresponding unit of value, that is \$2000. Some authorities have placed the value of this gold talent at \$30,750, which would make the annual revenue of Solomon \$20,497,500 (See Kings I, 10-14, also Chronicles II, 9-13) and the total of David's temple fund at over \$3,000,000,000 (Chronicles I, 22-14) stupendous sums out of proportion with which we know to have been the limited gold resources of the ancients. The estimate of \$1700 to \$2000 as the value of the gold total is that given by the "Century Dictionary," seems reasonable, and about right (see also Scribner's "Dictionary of the Bible," Vol. 111, p. 420).

*Mining engineer, Philadelphia.

respondingly greater; the ratio of quantity to value appears to have remained nearly the same down to about the beginning of the sixteenth century.

GOLD AND SLAVERY

It is curious and significant how gold mining and slavery march hand in hand down through the ages, from Rameses to Lincoln, for it was not until the outbreak of the American Civil War that the use of slaves for the production of gold in some of the Southern States entirely ceased. After the discovery of America the Spaniard mixed piety with the twain, and proceeded to conquer the two American continents with a barbarism and greed sanctioned by the State and blessed by the Church.

The average duration of life among the slave workers of the ancient world may be gaged by that said to have been the limit in the silver mines at Laurium, in Greece, which is stated not to have exceeded two years from the time of entrance into the workings. With all this barbarity, the production of gold in the ancient world was never large as we would now consider it. The Romans mined gold in Hungary and Spain; and it is claimed that even in the days of the Roman Republic as many as 40,000 slaves were kept confined in the mines of Spain.

THE MIDDLE AGES

During the Middle Ages, gold mining in Europe languished, for then mankind was chiefly occupied in despoiling itself by destructive warfare. The accumulation of gold in Europe when America was discovered is said not to have exceeded \$225,000,000; an amount, it seems to the writer, larger than the probable truth. With the discovery of America a new world, in fact as well as fancy, was opened to the people of Europe. A perusal of the Spanish writings of the time shows with great distinctness that the underlying motive of their American explorations was a quest for gold. The precious metals were so exclusively the object of the attention of Spain, that but little attention was paid to any of her possessions that did not produce them. Payments in specie were the great object of the Spanish merchant, and to this every other commercial advantage was sacrificed. Whatever may have been the faults of her colonial system in general, with regard to mining Spain always adopted a liberal policy.²

DISCOVERY OF AMERICA

Columbus found the natives of the first land he discovered in possession of some gold, and was told by them of a larger island to the south where it was abundant. In Cuba he failed to find much, and not until the north coast of Santo Domingo was reached did he meet with natives

possessing any considerable quantity. His expeditions into the interior of this beautiful island indicated that the source of the gold was in the gravels of the streams flowing down from the high mountains which form the central core of the island. The history of the early Spanish occupation of Santo Domingo is one of greed and barbarity. It caused the enslavement of the mild and gentle natives, and their subsequent extinction; for forced to the unaccustomed hard labor of washing gold from gravels with crude and primitive tools, these poor creatures died like flies; the gold production consequently rapidly decreased and was but partially revived by the introduction of African slaves.

Nowhere do we find purer gold than in the streams of Santo Domingo, and there are probably few rivers in South America surpassing in richness the Yaqui del Norte of this island. Some of the Spanish priests, like the honest Las Casas, strove to ameliorate the wretched condition of the natives and check the barbarity of their masters, but they did not prevail. This history is repeated in Mexico and Peru, as one can see who reads Prescott. The hardier Aztecs and Incas³ survived, and were the stock from which the present inhabitants of these countries came. In Santo Domingo, Jamaica, and to a large extent in Cuba, the negro replaced the Indian, and thus two (omitting Jamaica as a British colony) of the most beautiful and fruitful islands in the world would have come under his degrading dominion, creating discord and disorder that have been at times a menace to the political and physical well-being of the people of the United States.

MEXICO

Mexico has never, until recently, been noted as a gold-producing country. The Spanish *conquistadores* found the Aztecs possessed of gold, silver and copper ornaments and utensils. The exact date when the Spaniards realized that there were great silver deposits in Mexico is apparently not known. The gold and silver of the natives seem to have been derived from stream beds and the outcrops of veins. The Spanish pioneers sought for gold placers and extracted some of that metal by washing; the silver that they obtained from outcrop or shallow ores was smelted with the carbonate of soda found in neighboring lagoons. Their fuel was charcoal; possibly they used some lead ore in their rudimentary smelting operations to collect the silver. It was not until the Spanish miner, Bartholome de Medina, invented the *patio* process in 1557 that the relatively poor ores could be treated. Medina was the first to apply amalgamation to silver, al-

though it was much earlier used in gold milling. The *patio* process is essentially a treatment or chloridizing operation with common salt in the presence of copper sulphate, using mules and horses to mix the charge by trampling with their feet. It is called the *patio* process because it takes place in an inner court or yard (the *patio*) and has been a characteristic feature of Mexican metallurgy for 350 years.⁴ From the end of the conquest in 1521, to the introduction of this process in 1557, it is not probable the country produced any great amount of the precious metals. The Aztecs were known to have considerable gold which their native rulers received as tribute; hence it is probable the Spaniards obtained quite a large amount from the native stores, but as compared with the treasures taken from the Peruvians by Pizarro and his followers the spoil of Cortez is insignificant. The conquest of Mexico, although a brilliant exploit, failed to produce the golden results that had been the dream of Spain since the first voyage of Columbus. After the occupation of Mexico the Spaniards sent out expeditions in search of the golden temple of Doboyba and of the golden sepulchers of Zeno; for gold was ever floating before their distempered vision.⁵ Gold was the incentive and recompense, and in the pursuit of it the Spaniard rarely hesitated as to the means.

PERUVIAN TREASURES

The barbarities and the golden loot of the Peruvian conquest are probably unsurpassed in history. Prescott tells us that the troopers of Pizarro even shod their horses with silver, and that the amount of gold paid as a ransom for the liberation of the Inca Atahualpa amounted to 1,326,539 *pesos de oro*, which, allowing for the greater value of money in the sixteenth century, would be equivalent to about \$15,500,000. Of this the Spanish Crown received one-fifth, a tax subsequently reduced to a tenth of all the gold and silver obtained by barter, rapine or mining operations. Allowing for exaggeration, the quantities of gold and silver obtained by Pizarro and his contemporaries must have been very great. The avidity of the Spaniards for the precious metals enhanced their value in the eyes of the Peruvians, who had heretofore treasured them simply for purposes of State and religious decoration.

The Spaniards failed to find gold deposits equal to those from which the Incas had derived the treasure that paid Atahualpa's ransom, although about the end of the seventeenth century rich placers were discovered in the mountains east of Lake Titicaca. Shortly after this other rich deposits were found on the eastern slope of the inner Andes. The silver

²The word "Inca" should be, strictly speaking, applied only to the Peruvian rulers, but by common usage it is used for the whole people.

⁴Rickard, "Journeys of Observation," San Francisco, Cal., 1907, p. 112.

⁵Prescott, "Conquest of Peru," Vol. I, p. 194.

²Ward's "Mexico," Vol. 1, pp. 86 and 88.

treasures of Potosi eclipsed the golden fame of Peru. As soon as the unprecedented extent of the silver deposit at Potosi was recognized, Bolivia became the greatest source of that metal in the known world and the most important province of the transatlantic domains of the Castilian king. That one mountain has produced 2,000,000,000 oz. of silver, even by the use of the crude processes which the Spaniards found in use among the Indians. Seventy million ounces were taken out in the first 30 years.⁶ The total production of silver in Bolivia during the colonial period exceeded 3,000,000,000 ounces.

The toll which the Spaniard took of life was far worse than their greed for gold, one in fact being the consequence of the other. During the first two centuries of Spanish occupation the enslaved Peruvians appear to have decreased in numbers from about 40,000,000 to less than 4,000,000. Each village was required to furnish a certain number of laborers annually; lots were drawn as for prescription, and the unhappy creatures who drew the bad numbers went off to meet certain death in dark, wet pits and galleries. The destruction of life was frightful; the returns made by the officials charged with the impressment demonstrating that in the neighborhood of Potosi the Indian population fell within 100 years to a tenth of its original numbers.⁷

THE MINES OF COLOMBIA

A similar condition of affairs appears to have existed in Colombia under the early Spanish rule. The Chibchas, a people nearly as civilized as the Aztecs and Incas, were enslaved, and for two centuries obtained gold and silver in return for their lives. Whole districts were depopulated, and the industry was for a time destroyed by the very greed of their masters. Notwithstanding this, it is estimated that since the Spanish conquest more than \$750,000,000 of gold has been derived from Colombia. Granger believes the production to have been about \$1,000,000,000 during the Spanish occupation.⁸

It is said that after the followers of Heredia had conquered the Antioquia district of Colombia each man received a larger amount of gold than the conquerors of Mexico or Peru. The founding of Cartagena resulted in placing the Spaniards in possession of the valley of the Cauca, and the remarkably rich gold deposits of Antioquia as far north as the 5th degree. The Chibchas, who inhabited the southern plateaux of Colombia, possessed a relatively high degree of agricultural and industrial skill; they manufactured cotton cloths, mined gold and emeralds, worked artistic ornaments, and had a circulating medium and calendar.

Their lack of military skill and coherence made them an easy prey for the Spaniard, who had a much harder task in subduing the more savage tribes in the gold-bearing valleys of the upper Magdalena and Cauca rivers. In Antioquia the hard struggle to escape impressment into the mines nearly exterminated the natives. The same thing happened on the plains of the Caribbean coast. To work the mines or plantations negro slaves had to be imported, with the result that black blood predominates in the lower regions of Colombia, while the descendants of the Aborigines are in a majority on the eastern plateaux.⁹

Spain was not alone in this conscienceless quest for gold. The Dutch overran Guiana toward the close of the sixteenth century in hope of finding gold. The same incentive also drew Sir Walter Raleigh into these regions during the reign of James I, and cost him his head, because he failed in his efforts, though they led indirectly to Great Britain's acquiring her only foothold on the South American continent.

The defects of the Spanish colonist system are well known. The successors of the *conquistadores* possessed few of their virtues and all their vices. The redeeming merit of the *conquistadores* was their remarkable courage and perseverance. To realize this one must himself have traversed some of the terrible deserts, swamps, and mountain passes of South America, and felt their heat and cold; nothing daunted these old Spaniards, and had their humanity equaled their greed, the history of South America would have been far different.

NORTH AMERICA

The forces and motives back of the colonization of North America sharply contrast with those of the Spaniards, and are on a much higher plane. They were in the main a desire for religious and political liberty, a free soil and a free church, and while these English and Dutch settlers were perhaps no braver than the *conquistadores*, they certainly possessed higher ideals and better moral fiber. It was a most fortunate thing, however, that the streams and mountains of the North American Atlantic seaboard yielded little or no gold, for it would have attracted the least desirable elements of England's population, those who desired wealth without hard work, a class of people who would not remain to raise families and cultivate the soil, in other words, become actual colonists. The vast stores of coal and iron of this region appealed but little to the early settlers, and it was nearly 250 years later that the industries based upon such mineral resources can be said to have been thoroughly established.

It is true there crops up in early Colonial history evidences of some interest in mining and mineral wealth. Who may

say the stern Puritan, the rugged Dutchman, or gentle Quaker never had their dreams of golden riches dug from the earth? The unknown, the golden fantasy, has ever appealed to the credulity and romance of human nature, else hard-headed traders, business men, would not so readily part with their money at the call of blatant, patent humbuggery and folly.

Raleigh's later expeditions were made on money borrowed for the distinct purpose of searching for gold in Guiana. We are told that at Jamestown, Va., one of the settlers discovered some yellow dust shining in the bottom of a stream near the settlement. Immediately, the whole colony was afflicted with a veritable gold fever, and, neglecting all else, gave themselves up to the pursuit of this precious metal, which turned out to be mica.

Copper mining appears to have received considerable attention from the early settlers of New Jersey and eastern Pennsylvania, as is attested by a large number of very old workings to be found in the Triassic shales and sandstones of this area. In the Southern States gold was washed and mined in early Colonial days, and this industry has continued down to the present time. But except when operated by slave labor these deposits, as a rule, have never been notably profitable.

Gold mining, as an essential element in North American history, plays no part, for it was not until the discovery of gold in California that this infatuating, peace-disturbing source of wealth affected the general population in a sufficient degree to be of notable significance. These discoveries advanced the hands of the clock fully forty years for California;¹⁰ civilization sprang up like magic at isolated spots on the Pacific, and extending eastward across the Sierra Nevada soon joined hands with a greater but slower advance westward from the Mississippi valley, spreading over and filling every habitable nook and corner in a vast area previously a wilderness or inhabited by savages. Following close upon the heels of the California discoveries came the development of the Comstock lode and its immense yield of silver. With this, and scarcely before, the precious metal-mining industry of the United States can be said to have come into existence. Forty-five years later came the Alaskan gold discoveries which proved a golden magnet that drew the tide of civilization into a most inhospitable region which probably would not have been settled for centuries to come. It is certainly to the credit of our race that throughout the period from the discovery of gold in California in 1848 to the Klondike rush of 1897-98, no war that can be traced to greed mars our historical record. On the contrary, the inherent virtues of the Anglo-Saxon never

⁶Dawson, "South American Republics," Vol. 2, pp. 241-242.

⁷Ibid, Vol. II, p. 242.

⁸ENGINEERING AND MINING JOURNAL, August 4, 1906, p. 194.

⁹Dawson, Ibid, p. 416.

¹⁰The gold production of California from 1848 to the present time has been estimated at about 1½ billion dollars.

showed to better purpose than in the wild days of the "Vigilantes" and the Klondike rush. Much suffering, death, and private wrong certainly came as a consequence of these violent movements of population, and the unsettled or temporary conditions of civilization that resulted. But in a national sense these events carried no disgrace and little disorder.

AUSTRALIA AND SOUTH AFRICA

With the passing of Spain from America the gold-producing industry came almost entirely into Anglo-Saxon hands. The discoveries of gold in New South Wales, Australia, in 1851, followed closely on those of California, and from then on to the development of the Rand mines in the Transvaal, Australia appears to have been second only to the United States in the production of gold.¹¹ But the golden calf was destined once again to bring on discord and war, this time in South Africa. The Boer war of 1899-1900 tested the might of the British Empire and caused more treasure to be wasted than the Rand mines will ever put back into the pockets of England.¹² The production of the Rand has probably reached its maximum, or is likely from now on to decline slowly but steadily.

MODERN STOCKS OF GOLD

In drawing some practical deductions from the above sketch, we are forcibly struck with the immensely increased production of gold since the discovery of America, and the vast accumulated stores of this metal which must now be in existence. It is evident, were it not for the enormously greater commercial activities of modern times and the improved or higher scale of living among the working classes of the white races, the purchasing power of gold would be greatly lessened. Even as it is, some economists take this view, a wholly erroneous one to our notion, as will be seen upon analysis. It seems highly probable that the Oriental or Asiatic races are today enjoying no higher scale of living and comfort than did the European peasant of the Middle Ages; for the Asiatic, therefore, gold is no cheaper than of yore, and his purchasing and spending powers have not changed in centuries. To a Chinaman, supporting himself and family upon a wage of 10 or 15 cents a day, gold is now as much a rarity as it was to the poverty-stricken peasant of feudal Europe. The scale of human living has naturally improved in about the same ratio as the growth of commerce and the spread of individual liberty. The demand for gold as a standard of value and a medium of

exchange increases with trade, and a consequent growth of wealth and improved scale of living. The discovery of America gave a tremendous impetus to commerce, and at the same time provided great, virgin goldfields that poured into Europe an unprecedented stream of treasure. Had the Spaniards found no gold in Mexico and South America, it is more than probable they would have never been able to undertake the Conquest. Pizarro's first expeditions to Peru were equipped only with the greatest difficulty; the settlers and authorities at Panama, whence they sailed, had no faith in the scheme, and it was not until indubitable evidences of the finding of gold were exhibited both at Panama and in Spain that funds for subsequent expeditions could be obtained. In fact, without the element of gold the history of Central and South America would have been far different; gold has been the greatest factor in it and a tremendous force in moving mankind for both good and evil. Its practical absence in eastern North America forced the colonists to obtain a living from the soil, or by mineral products of less commercial value, a condition tending to a permanency of settlement that led to the creation of a great and new nation. The French colonization of Canada is due chiefly to the fur trade, a source of wealth more ephemeral than gold mining and quite as demoralizing. When the gold discoveries of California and Alaska did come, civilization and trade in North America were too firmly established to be seriously affected by them. On the contrary, the farmer from the more crowded sections of the East followed the miner; still California became a great and prosperous State many years sooner than it would otherwise have been but for the gold of its streams and mountains.

GOLD IN MODERN TIMES

It has been assumed, and with reason, by some economists, that the greatly enhanced production of gold in modern times has lessened its purchasing power, that is, made it cheap. The production of the world in 1905 was \$377,647,700, and in 1906, \$400,342,100, an increase of \$22,694,000, or 6 per cent.; in 1907 the yield was \$405,000,000, an increase of \$4,657,900 or 1 per cent. The annual consumption of gold in the industrial arts of the world is surprisingly large and cannot be accurately determined, but from the best available data it appears to be in the neighborhood of \$100,000,000. This would leave about \$300,000,000 to meet the increasing demands of commerce for currency. South Africa continues to show a steady increase, which, according to well informed persons, cannot be expected to continue much longer. In the United States, Alaska and Nevada are the only sections showing any great increase, while many of the older gold-producing

districts exhibit a decrease, which in the case of Colorado amounted to \$2,750,000 last year. In 1906, Mexico had a slight increase. In Australia there was a decrease of over 4 per cent. In Canada, a decrease of 18 per cent. and in Russia 12½ per cent. A contemplation of these figures is not reassuring to those who expect a steady and continued increase in the world's production of gold; moreover, it is evident that improved methods of treatment and extraction are not offsetting the exhaustion of older districts. New gold territory must be acquired if the ratio of increase is to be maintained, and unless this is found in South and Central America and Siberia we have at present no indication where it may be. It seems, therefore, safe to assume that the gold currency of the world is in little danger of being debased by over-production, especially in the face of the enormous and constantly increasing consumption of gold in the industrial arts.

GOLD AND WEALTH

In modern times the greed for gold has become a greed for wealth in all forms, and thus translated was the cause of the Russo-Japanese war that led to the everlasting humiliation of the Russian government and a heavy addition to the undeserved misery of the Russian peasantry. Similarly, Japan, inflated with this success, becomes aggressively important in the world, and assumes a position of eminence not justified by her material resources and commercial methods, a condition pregnant with danger to the peace of the world. Human greed is probably no less now than at the time of the *conquistadores*; in autocratically governed countries it often takes the form of outside aggression, as above cited, while in democracies it is manifested within the nation itself by the creation of crushing monopolies, corrupt municipal government, and other forms of imposition familiar to the thoughtful American. Greed and graft are harmonious terms, one to the other, much used of late, and dangerous alike to both the individual and nation. Barbarities may have ceased to be committed in the name of gold, but they are not uncommon when influenced by greed. Barbarism within the pale of the law exists today in all countries, and always has its motive in greed. Thus has our whole historical record been stained by a lust for gold, and this will probably so continue to the end.

In case that dynamite is thawed in a house heated by steam, the dynamite should be placed at such a distance from the pipes that an even moderate heating is obtained. The end of the steam pipe that passes through the thawing house should be open to the atmosphere so that over-heating of the powder house is difficult.

¹¹The yield of gold in Australia from 1851 to the present time is estimated at 1¼ billion dollars.

¹²The yield of the Rand and outlying districts up to 1906 was \$826,680,312. The entire production of Africa in 1906 was \$135,472,537 of which \$119,618,507 came from the Rand.

Reclaiming a Flooded Gypsum Mine

By E. H. FISHACK*

During the summer of 1907 the Consumers Gypsum Company, of Port Clinton, Ohio, employed a rather unusual method for recovering its mine with entire success. The company obtains its raw material from shallow workings on the shore of Sandusky bay below water level. A break-through of water from the lake flooded the quarry and drowned the pumps. The great volume of the water and the character of the ground through which the break occurred called for the heroic measures here described.

Gypsum is deposited in this field along the shores of the Sandusky bay, the beds

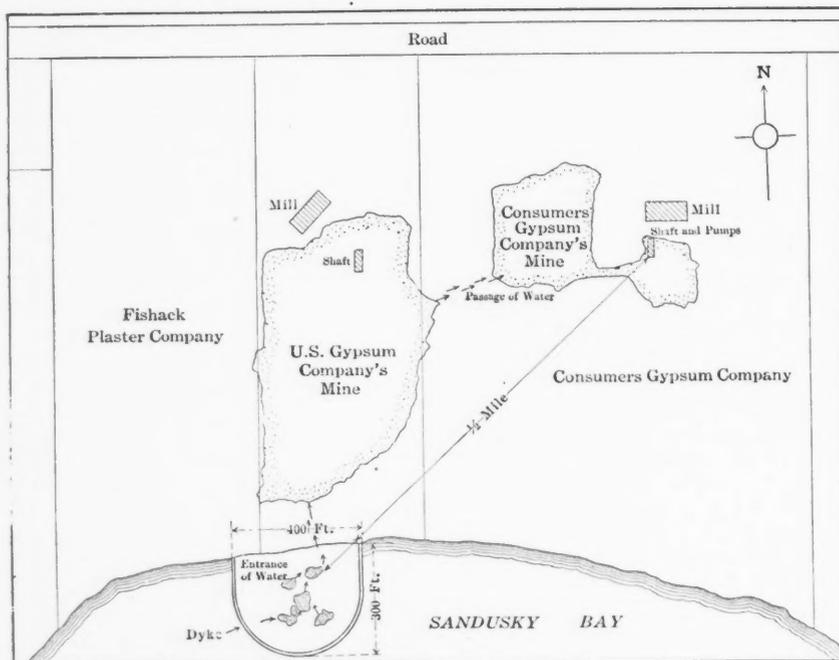
States. Five years ago two plants in operation in this field were absorbed by the United States Gypsum Company. This company in extending its mining operations, drove so near the shore of the bay that water came into the mine through a seam of carbonate of lime which frequently occurs between the strata of gypsum. Within a few hours the inflow was so great that the pumps could not handle the water and the workings were abandoned leaving all the tools and considerable rock ready for the mill in the excavation.

The Consumers Gypsum Company had opened a mine directly east of the abandoned property and constructed a plant at an approximate cost of \$100,000. As manager of the company I left a division wall 270 ft. thick between our mine and that of the United States Gypsum Com-

pany's mine at a point in the bay where the roof, a shaly carbonate of lime, outcrops, and we decided upon an attempt to reclaim the property by diking in that portion of the bay from which the water was supposed to have found its way into the workings. At this point the depth of the bay does not exceed 6 ft., and by scounding we discovered depressions or holes in the floor of the bay. We further determined by boring outside the area which we intended to inclose that the rock was covered by from 7 to 9 ft. of solid clay. Having decided upon the area and the nature of the bottom we drove a line of 2-in. sheet piling fastened at the top and at the water line to cheek pieces. Inside the sheet piling we drove a line of round piling 8 ft. from the sheet piling and 8 ft. from center to center. After anchoring the top of the sheet piling to the bottom of the round piling we placed railroad ties upon the two rows of piling; the addition of rails completed a track upon which to convey clay in cars from the shore. A clay filling 8 ft. wide across the top was built up along the piling to about 3 ft. above the water level.

Immediately upon completing the filling we started an 8-in. and a 10-in. centrifugal pump at our shaft which is approximately one-half mile from the inclosed area, and in 36 hours our theory that the water was supplied from Sandusky Bay was proved to be correct. The water was lowered sufficiently in both mines to permit the water from the inclosure to begin to drain into the workings. After seven days' continuous pumping with the centrifugal pumps, we were again taking rock from the mines and had resumed the operation of the plant.

The area of the bay inclosed was approximately three acres. The water in the inclosure was drained completely, leaving the floor of the bay perfectly dry in a few days. In order to ascertain the actual condition of the floor we excavated at five points down to the rock. At the point farthest from the shore line we found that the limestone was missing and we drilled into 6 ft. of excellent gypsum, while at points a couple hundred feet nearer the shore we found that the roof was a broken, shaly mass about 16 in. thick, while farther back the stone was solid and unbroken, proving that the water had entered where the roof was shattered or absent. The clay over the rock was exceedingly tough and the opening showed the effects of a downward flow of water, the bottom being in the form of a cone. Whatever may have caused the channel between the opening in the bottom of the bay and the workings, the operation was a success and we reclaimed the property. Since the United States Gypsum Company's mine was flooded the property has been abandoned and the mill has been torn down. Had our company been com-



MAP OF GYPSUM MINES SHOWING POSITION OF DIKE IN THE BAY

lying from 20 to 60 ft. below the surface. The surface is very level and is not more than 5 to 10 ft. above the level of the bay, so that all operations are conducted below the lake level. According to the Geological Survey of Ohio the bed dips to the southeast at approximately 25 ft. per mile, the portion farther east being thin and of no commercial value; but borings made during last year, indicate that the dip is to the northeast instead of the southeast. Gypsum has been mined in the field for about 50 years, in early years being made into plaster of paris in a small way. Within the last 15 years gypsum has become a substitute for ordinary lime in the manufacturing of mortar for plastering purposes, and the consumption of gypsum products has increased very rapidly throughout the United

pany. After the United States Gypsum Company's mine was flooded, considerable water entered our workings, but not in quantities to prevent our handling it. In time, however, it broke through in a small seam and from that time on the action of the water wore the soft rock away so rapidly that our pumps were soon overcome, although we had a pumping capacity of 5,000,000 gal. in 24 hours.

We tried to confine the flood to the chambers from which the stream came, but it would invariably work its way around the bulkheads and break out with full force. On July 14, 1907, the inflow became so great that we could no longer handle it, and our mine promptly filled up to the bay level; the water rose 26 ft. in the shaft.

METHOD OF OPERATION

My theory had been that the water en-

*Manager, The Consumers Gypsum Company, Port Clinton, Ohio.

pelled to do likewise it would have involved a loss including the value of gypsum left standing of more than \$250,000. As far as the undertaking is concerned, we do not consider it a great engineering feat so much as a display of nerve.

To protect the dike from the action of storms and ice, a rock filling was made outside the sheet piling. The holes in the floor of the bay were also cleaned out and tamped full of clay as a protection in case the dike should give way.

Some Important Paint Tests

BY G. B. HECKEL*

A series of paint tests have been undertaken in several parts of the country by the Paint Manufacturers' Association of the United States. The first of these tests was begun nearly two years ago by the North Dakota Agricultural College at Fargo, N. D. The 16 formulas, furnished by the paint manufacturers represented all the popular and successful types of prepared paints on the market, ranging from a base of straight lead and zinc, in varying proportions, to a combination of zinc and barium sulphate. In these formulas all the reinforcing or inert pigments were represented, including silica, calcium carbonate, calcium sulphate, magnesium silicate, etc., the object being to provide formulas which, without duplicating existing paints, would each stand as typical of its class.

The North Dakota test, being the first undertaken, was crude in details. In North Dakota the air is normally dry, the summers are not hot and the winters, although cold, are equable and not subject to hygroscopic extremes. It was therefore decided that a series of similar tests should be undertaken on an enlarged scale at other points in the country where climatic conditions are different. To initiate this new series Atlantic City, N. J., and Pittsburg, Penn., were selected as typical of severe painting conditions.

A board fence 178 ft. long and 5½ ft. high, running north and south was erected in each case and primed with Prince's mineral paint. Panels of Dutch weatherboarding, 3 ft. by 15½ in. were prepared from yellow pine, poplar, and cypress, each piece of lumber used in these panels being inspected by a professional lumber inspector. About 50 per cent. of the lumber received from the mills was rejected as unfit.

The paint formulas tested include those used in the original North Dakota tests, with the addition of a number of formulas representing the various pigments and combinations of pigments in common use for painting wood structures, including a dozen or more brands of white lead purchased in the open market, zinc oxides, sublimed white lead, zinc-lead white, litho-

pone, etc. A series of greens is also being tested at Atlantic City by request of the Philadelphia Master Painters' Association, which finds great difficulty in obtaining a green that will not mildew in this locality.

The painting of the panels was done under cover in each case, so as to obtain initial uniformity of conditions. This precaution was not observed in the Fargo tests, and it is obvious that comparison between two paints is impossible if one is applied in the open on a damp, foggy day and the other on a clear, dry day.

The formulas are prepared in three colors, white, light yellow and light gray. Each of these colors, in each formula, is applied in duplicate to each class of wood. There are thus, for example, two panels each of cypress, yellow pine and poplar painted in white with the formula composed of equal parts each of hydrocarbonate white lead, zinc oxide and barium sulphate and these are duplicated in yellow and gray prepared on the same white paint base.

The formulas were ground by various manufacturers, the preparation of each being intrusted to the manufacturer presumably most familiar with the technical procedure of that particular type of paint.

The paints as furnished are in consistency about suitable for a finishing coat. The required thinning in each case is done by the inspectors, accurate records of kind and quantity being kept. Weighing before and after application preserves a record of the paint consumed for each coat and also gives the necessary data for ascertaining the spreading rate. After the priming coat has been applied and allowed to dry a black cross is stenciled on the center of each panel. The degree to which this cross is obscured by the second and the third coat respectively indicates the relative opacity of the paint. About one week was allowed for drying between coats, the inspectors alternating between Atlantic City and Pittsburg and thus keeping the two tests in progress at the same time.

After complete drying of the third or finishing coats the panels were fastened to the fence by means of brass screws. This will permit their removal for laboratory inspection at any time. At one corner of each panel a small plate of clear glass and a duplicate plate of orange glass in a wood frame has been securely attached and sealed, so as to exclude atmospheric agencies while allowing the light to reach the painted surface below. By this means it is expected to ascertain what effect, if any, the actinic rays of the sun have upon the durability of a paint film. The duplicate panels bearing the same paint formulas are placed one on each side of the fence so that each undergoes an eastern and a western exposure.

Before the application of the paint each panel was carefully photographed on a fixed scale with the lens stopped to 164

so as to secure detail; these photographs have been filed for future reference.

It is not expected that the results of these tests will settle finally and conclusively the relative merits of competing pigments and types of paint, but it is expected that they will furnish much valuable information; and as they are extended to other sections of the country, such tests may furnish cumulative evidence that will be valuable and suggestive.

The Iron and Steel Institute

The annual meeting was held in London, England, May 14 and 15.

The following is a list of papers that were submitted:

1. "On Cast Iron in the Construction of Chemical Plant." By F. J. R. Carulla, Derby.
2. "On an Experimental Electric Furnace for the Smelting of Iron." By Prof. B. Igewsky, Kiev, Russia.
3. "On the Pyrometric Installation of the Ordnance Factories, Woolwich." By J. Wesley Lambert, Woolwich.
4. "On Improvements in Plate Rolling Mills." By A. Lamberton.
5. "On the Application of Colour Photography to Metallography." By E. F. Law.
6. "On the Department of Metallurgical Chemistry in the National Physical Laboratory." By W. Rosenhain, Teddington.
7. "On the Utilization of Blast-Furnace Slag for Portland Cement." By C. von Schwarz, Liège, Belgium.
8. "On a New Fatigue Test for Iron and Steel." By T. E. Stanton, Teddington.
9. "On the Physical Qualities of Steel in Relation to its Mechanical Treatment." By James E. York, New York.

Reports on research work carried out during the past year were submitted by C. A. Edwards, Manchester; J. A. N. Friend, Germany; D. M. Levy, Birmingham; A. M. Portevin, France; A. K. F. Hiorth, Norway; B. Saklatwalla, India; E. Hess, United States; C. Benedicks, Sweden; and H. C. Boynton, United States, Carnegie research scholars.

Although the extended experiments made, in 1906, under the supervision of Doctors Haanel and Héroult for the Canadian Government proved the feasibility of producing pig iron from Canadian ores in an electric furnace, at possibly as low a power consumption as 0.25-h.p. year of electrical energy per ton of pig iron, the 2000-h.p. three-phase furnace, erected by Doctor Héroult for Mr. Nobel in Shasta county, California, is, according to Joseph W. Richards (*Journ. Franklin Institute*, Jan., 1908), the pioneer electric pig-iron furnace of the commercial world.

*Secretary Paint Manufacturers' Association of the United States, Philadelphia, Penn.

CHART OF MINE GASES

BY CLYDE MYERS

COMMON NAME.	PROPER NAME.	CHEMICAL FORMULA.	COMPOSITION (molecular)	DENSITY.	SPECIFIC GRAVITY.	CHARACTER.	EFFECT.	COMBUSTIBILITY.	EXPLOSIVE.	CAUSED BY.	TEST FOR.	WHERE FOUND.
Firedamp. (1)	Light Carbureted Hydrogen.	CH ₄	12 parts C. 4 H.	8	0.55	Slight smell.	Suffocates. Will not support life.	Burns in air. Alone or pure extinguishes flame.	Very explosive at 1 Vol. CH ₄ , 9 Vol. Air.	Is natural product like oil of coal and is found in proximity to both.	Oil safety lamp. #2% cap. 6%, long flame.	Rises to roof and highest parts of mine.
Whitedamp. (2)	Carbon Monoxide or Carbonic Oxide.	CO	12 C 16 O	14	0.967	No color. No taste. No smell.	Poisonous as arsenic or prussic acid. 0.05% 30 min. giddy; 0.10% 30 min. cannot walk; 0.20% 30 min. unconscious; 1% 30 min. death.	Combustible alone.	Explosive at 2 Vol. CO, 5 Vol. Air. increases danger of dust explosion.	Explosion of CH ₄ . Some explosives. Coal burning with insufficient air.	Mouse or bird affected more quickly than man.	After Gas (CH ₄) or dust explosion. After blasting with certain explosives. Gob or coal fires in mine.
Blackdamp. (3) Chokedamp.	Carbon Dioxide. Carbonic Acid Gas.	CO ₂	12 C. 32 O.	22	1.527	Slightly acid taste and smell.	3.5% breathing deepens ink. 6% marked panting. 10% severe distress. 15% partly unconscious. 25% death.	Lights still burn. Lights still burn. Candle weakens. Lights go out.	Non-explosive at any mixture with air.	Explosion of gas. (CH ₄) Blasting of men and animals. Gob-fires.	Ordinary light goes out at 15% O ₂ . Hydrogen lamp still burns.	In afterdamp of explosions. Heavier than air. May sink to floor or low part of mine.
Stinkdamp. (4)	Sulphureted Hydrogen.	H ₂ S	2 H. 32 S.	17	1.183	Smell of rotten eggs.	Poisonous when pure. Diluted causes headache and giddiness.	Combustible.	Explosive.	Indicates heating of coal or gob. Before or by mine fires. Indicates spontaneous combustion about to occur.	Smell of rotten eggs. Blackens silver.	Vicinity of gob or mine fires. Heating coal or gob.
(5)	Nitrogen.	N		14	0.971	Neutral.	Suffocating when large quantity present. Will not support life. No oxygen.	Non-combustible.	Non-explosive.	Explosion of CH ₄ , or dust absorbs oxygen of air. Nitrogen remains.	No test.	After explosions in afterdamp. Being air—O absorbed by explosion.
Afterdamp	is a mixture of	CO CO ₂ N ₂ and H ₂ O	Carbonic Oxide Gas Carbonic Acid Gas Nitrogen (pure) and Watery Vapor			combines the characteristics above noted.						

The above chart of mine gases, beginning with the explosive and dangerous firedamp, which by its ignition, generates a mixture of (2), (3) and (5), and in event of firing the coal possibly generates (4), is intended as a quick reference for superintendents, mine foremen, fire bosses, miners, drivers, and in fact all who have occasion to enter, or work in coal mines. It can be cut out, and placed in a memorandum book in the pocket, where it will be easily and quickly accessible. A distribution of this or similar charts among mine workmen would surely have a beneficial effect and might be the means of saving life and property.

Coal Mining in Pictou County, Nova Scotia

The Seams, 1500 Feet below Sea Level, Are Gaseous and Dusty, but Strict Regulations Make Mining Unusually Safe

B Y H. E. C O L L *

The Pictou county coalfield occupies a valley lying between two prominent lines of hills, running east and west, and is drained principally by the East river, which cuts the field at its most productive point. The tide runs half across the field, and to the east and west the land rises to about 250 ft. above sea level, at the farther ends of the field. The land is rolling and is made up of heavy glacial deposits, the drift in places attaining a thickness of 75 feet.

GEOLOGY

In Part B of the 1902 Geological Report, Fletcher gives the following classification in descending order:

proof, and until the time when properly placed bore holes will be put down, it will remain undetermined. The total thickness of the productive measures amounts to about 12,000 ft. To the south they are succeeded by the older rocks, upon which they lie unconformably.

The most interesting feature of the Pictou district is the series of faults, which traverse the measures in two main directions. The larger series are those having a general direction north and south and running at right angles to the strike. On the sides of the basin these are in the nature of rolls or wrinkles, in which the coal in some cases has been squeezed completely out. The coal shows

The district has been a geological battle ground for almost 50 years, and has been the subject of numerous papers, and reports. Little has been added to the knowledge of the field and in several instances, relating to faults, actual development has proved that they are of little importance and do not attain any magnitude. Of these faults, the most interesting are, the McCulloch, given as over 2000 ft., the Potter Brook, the Mill Race and the Lawson. For years these faults dominated over any development of adjacent sections until the several coal companies were forced by actual need of coal, to push their sinkings further down, so that today all



FIG. 1. YALE MINE OF ACADIA COAL COMPANY, THORBURN, NOVA SCOTIA

- Pernian { Upper red sandstone and shale group with thin bands of limestone.
- { Middle gray sandstone and shale group with small coal seams.
- { New Glasgow conglomerate.
- Carboniferous { Coal measures.
- { Millstone grit.
- { Carboniferous limestone.
- { Carboniferous conglomerate.
- Devonian... { Upper red slate and shale group.
- { Middle gray slate and shale group.

Immediately north of the supposed limits of the field is a heavy conformation known as the New Glasgow conglomerate. This rock does not interfere with an extension of the field underneath the newer measures, but it has long been recognized by geologists that the field on the north is cut off by an extensive fault, which marks the division between the conglomerate and the coal measures. Whether this faulting has completely destroyed these measures is still open to

no disturbance approaching these faults until within a distance equal to the thickness of the seam, when the coal becomes broken, and where it comes against the roll is so polished as to reflect like a mirror. No dislocation of the shales takes place, and apparently the rolls are due to lateral pressure, traveling in lines parallel to the strike. Traveling down toward the basin, these rolls become heavier until reaching the bottom, the rock breaks and the basin is crossed by a "down-throw" fault. This is the only point where actual dislocation of the rocks occurs. The other series of faults are in the form of pinches and run parallel with the strike. These constitute much more serious drawbacks to the mining of the coal than do the north and south rolls. They are only found along the high dips and are heaviest on the north side of the field.

of these faults with the exception of the Mill Race, have been passed through by the mine workings and have lost their field importance.

The following is a condensed section showing the seams on the east side of the East river, in what is known as the Albion section:

Strata. Black shale and sandstone bands.....		1200 ft.
Ford seam.....	50 ft.	
Strata. Gray shale and sandstone.....		150 ft.
Cage seam.....	22 ft.	
Strata. Gray shale and sandstone.....		120 ft.
Third seam.....	6 ft.	
Strata. Gray shale and sandstone.....		125 ft.
Purvis seam.....	3 ft.	
Strata. Shales and sandstone.....		140 ft.
Fleming seam.....	4 ft.	
Strata.....		5 ft.
McGregor seam.....	12 ft.	
Strata.....		210 ft.
Stellar seam.....	5 ft.	
Total.....	102 ft.	1950 ft.

*Mining engineer, Stellarton, Nova Scotia.

In the Westville district the following section is taken commencing with the outcrop:

Acadia main seam	17 ft.	
Strata		200 ft.
Coal	12 ft.	
Strata		115 ft.
Coal	6 ft.	
Strata		90 ft.
Coal	8 ft.	
Total	43 ft.	405 ft.

The Vale district on the east has the following section on the crop:

McKay seam	3 ft.	
Strata		100 ft.
Oil shale	8 in.	
Strata		500 ft.
Valve seam	3 ft. 6 in.	
Strata		700 ft.
McBean	8 ft.	
Strata		37 ft.
Coal	2 ft.	
Total	17 ft. 2 in.	1337 ft.

There are three other seams occupying local basins above the McKay bed. This

served mines of Nova Scotia to the Duke of York for a period of 60 years. The Duke transferred the lease to a jeweller's firm in payment of his debts, and from them it was received by the General Mining Association who at once commenced operations to develop the Albion section. On Dec. 7, 1827, the first coal to be hoisted by steam power in the Province was taken from the "store pit," which was sunk 212 ft. to the Ford seam. In 1832 the first of a long series of fires and explosions occurred. In 1839 another fire got beyond control, and the workings were abandoned. Other pits were sunk successively to the dip, the deepest being about 450 ft., and the coal mined to the rise. Explosions and fires occurred in 1861, 1863 and 1867, and in February of the latter year the last of the "bye" pits was aban-

1868, and in 1873 an explosion took place killing 59 men, and causing the temporary closing of the mine. In 1872 the McBean seam on the eastern edge of the field was opened up and worked extensively until in 1885 an explosion took place killing 13 men. Two years after this disaster the mine was abandoned, being at present full of water. In 1886 the Vale seam was opened, but the crop coal being of such poor quality, development was not pushed for a number of years. At the present time the Vale mine enjoys the distinction of working the only seam of coal in the field which has not had an explosion or fire.

PRESENT CONDITIONS

At the present time the principal coal areas are held by the following coal companies:



FIG. 2. ALBION MINE OF ACADIA COAL COMPANY

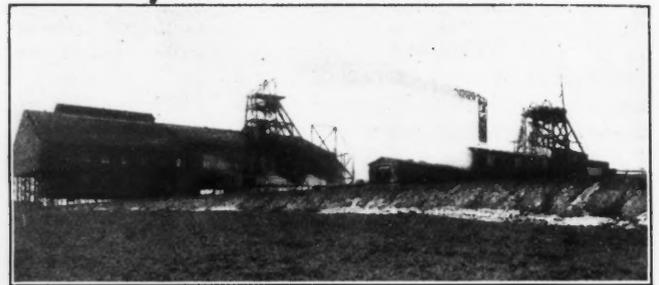


FIG. 3. ALLAN SHAFT MINE AT STELLARTON, NOVA SCOTIA



FIG. 4. DRUMMOND MINE OF INTERCOLONIAL COAL COMPANY, WESTVILLE, NOVA SCOTIA

Vale section is the largest of the three, if taken complete, but owing to the seams being smaller than the Albion section and the outcrop coal of poorer quality, little attention was paid to the development of this latter section until within the last three years. At this time it is realized that the Vale section will be the main producing one of the field in a few years' time.

HISTORICAL

Coal in Pictou county was first discovered in 1798 and the first mining was done in the MacGregor seam about 1801. Shortly after this, the Ford seam was discovered by John McKay, who shipped coal to the garrison and navy at Halifax during the war of 1812. Between 1812 and 1825 the production amounted to about 3500 tons a year. In the latter year, the British government leased all the re-

done. In 1850 the Dalhousie shaft was sunk to the Ford seam, and worked extensively until 1872, when the whole mine was severely squeezed and was later abandoned.

The Ford seam was first developed in 1866 and worked until 1880, when an eruption of water from the old workings killed six men; this accident was followed a month later by an explosion killing 44 men, and setting fire to the mine. Some of the bodies are still in the dip workings. It was found necessary to admit water from the East river and the plant was abandoned for several years. In 1890 the water was pumped out and an effort made to develop the lower section of the seam, but owing to trouble from the old fires, it was once more abandoned. In the meantime other mines were being opened up.

The Drummond slope was put down in

Intercolonial Coal Company, 9 sq. miles, operating at the Drummond mine, Westville.
 Nova Scotia Steel and Coal Company, 4 sq. mile, operating at the Marsh mine, Coalburn.
 The Acadia Coal Company, 16 sq. miles, operating at the Acadia colliery, Westville; the Albion colliery, Stellarton; the Allan shafts, Stellarton, and the Vale colliery, Thorburn.

The shipments for the county during 1907 are divided as follows:

Intercolonial Coal Co	274,388
Nova Scotia Steel & Coal Co	36,700
Acadia Coal Co., Ltd.	321,912
	<hr/> 633,000

The Marsh mine coal is used at the steel mills at Trenton, the other two companies have shipping piers at Pictou harbor, which will accommodate boats up to 5000 tons capacity. Both companies are in a better position this year than ever in their history, which speaks well for a field that has had 100 years of service and that coaled the first steam vessel that

crossed the Atlantic from Canadian shores.

The six mines now being operated within a total distance of nine miles, have dips ranging from flat to 80 deg., and consequently each mine has two or more different methods of taking out the coal. Bord-and-pillar work by means of self-acting planes with rooms driven to the rise off main levels, has been the standard for mining the coal in Pictou county. Longwall has been used successfully in the Drummond and Acadia mines for a number of years, and owing to the nature of roof and bottom, much better results can be obtained in working all the seams by longwall. The weight of the surface in the deep workings seriously interferes with mining the coal by bord-and-pillar.

With the exception of the new Allan shafts all the operating mines are slopes, which average between 20 and 30 deg. from the horizontal; in length the Drummond slope exceeds 7000 ft. Millions of tons of coal have been lost by fires, explosions, creeps and crushes, and many lives have been sacrificed, all brought about by carelessness on the part of men and management, and a general lack of proper methods for mining the great thickness of the Ford seam.

Today coal is being mined 1500 ft. below sea level from seams noted for the amount of gas they give off and the large quantity of dust that is made. The fact that these operations are being carried on successfully is due to the excellent mine laws and special rules of the companies, and the rigid discipline that is observed underground by the mine management. Safety lamps, mostly of the "Wolf Magnetic Lock Type," are used exclusively. All powder must be approved by the Government and known as a "safe powder." Holes can only be fired by shot-firers who pass an examination and receive a certificate before being appointed to service.

REGULATIONS FOR SHOOTING

No fast shots are permitted, and the number of holes, method of charging and shooting, and the timbering of working faces, are all rigidly controlled by the mine officials. Each face must be examined for gas before any shot can be fired. Heavy feeders are often struck which are strong enough to foul a whole air current. The writer has seen a feeder giving off sufficient gas to flame in a lamp, after mixing with a 25,000-cu.ft. split from the main air current. Since the workings are below sea level, the flow of gas in relation to the falling and rising of the barometer is extremely noticeable, and in fact the majority of the mines regulate the speed of the fan by the reading of the barometer.

Recent Government experiments indicate that calcium chloride is valuable as a dust preventive for roadways.

Making Coke from Indiana Coal

SPECIAL CORRESPONDENCE

Making coke in Indiana is no longer an experiment. Coke is now being made from Indiana coal within two miles of Linton in Greene county, in coke ovens of the latest and most approved bee-hive type constructed at a cost of \$30,000. It seems strange that this is true after it has been taken for granted for all these years that Indiana coal would not make coke.

The coke that is being made in these ovens is being shipped to Chicago, where it is being used in great iron foundries and subjected to the most severe tests that coke is compelled to undergo. These are the first coke ovens ever built in Indiana for the manufacture of coke in a commercial way and are now turning out coke of admittedly good quality.

AN ACCIDENTAL DISCOVERY

It is said this experiment with Indiana coal for coke making was brought about as the result of an accident a little over a year ago. The United Fourth Vein Coal Company, which owns several thousand acres of land in Greene county, has seven mines, one of which is called the Black Creek mine. About a year ago, a serious fire occurred in this particular property, burning for 48 hours. While the fire raged, the mine was closed up air-tight in order to smother the flames. When it was possible to enter the mine the owners found a peculiar situation; by sealing the mine they had converted it into a huge underground coke oven and the walls of coal had been burned into coke.

This condition attracted the attention of E. L. Wolford, vice-president and manager of the mining company and he brought to the surface numerous pieces of coke he had found in the mine. Mr. Wolford had always heard that coke could not be made from Indiana coal, but the coke that he brought out of the burned mine raised a doubt in his mind as to whether this was true or was merely a prejudice against Indiana coal. Thereupon he decided to find out for himself whether Indiana coal was good for coking.

After talking the matter over with the officials of the company, it was decided to have tests made and he took the samples to Chicago and solicited the services of C. A. Bickett, president of the Bickett Coal and Coke Company, and requested him to have the tests and experiments made. Mr. Bickett had always been less skeptical of the qualities of Indiana coal than had a good many others, and while he was not overly enthusiastic over the proposition at first, he called to his aid J. I. Jones, an expert coke man connected with the Bickett company. Mr. Jones

took the coal and coke samples to a testing plant in eastern Ohio and spent several months there in working out the tests and experiments that were to show what Indiana coal was good for.

The coke was subjected to tests of textile strength and carrying power, in fact everything possible was done to show up the quality of both coke and coal, and the results obtained were such as to cause Mr. Bickett to become interested in carrying on experiments on a much more extensive scale. Arrangements were made between the Bickett company and the Union Fourth Vein Company by which these experiments were to be made at the Indiana company's mine, where the supply of coal would be ample.

Mr. Jones built a battery of ten bee-hive coke ovens and gave the coal a thorough test. The ovens are located at the mouth of the Black Creek mine. Mr. Jones was assisted by P. J. Torney, an expert coke maker from the Pennsylvania coke regions. Mr. Torney now runs the ovens and looks after the actual work of coke making.

THE METHODS OF COKING

Coal intended for coking at these ovens is first crushed and then pulverized. At the end of the battery of ovens is a tower in which the crushing and pulverizing machinery is operated. From the pulverizer, the coal is reduced to dust, descends into a "larry" which runs on a track located on top of the ovens. A charge of five tons makes a layer of coal about 25 in. deep in a 12-ft. oven and is carbonized in 48 hours.

If it occurs that the coke made from Indiana coal is good foundry and metallurgical coke, it will give the coalfields of the State the greatest boom they have ever experienced. Already there is an excellent market for all the coke that can be manufactured. In addition to booming the mining industry, the success of the proposition will save Indiana consumers of coke many thousands of dollars annually, since the freight rate is one-half less than it is on Eastern coke. The people in the vicinity of Linton are greatly encouraged and there seems little doubt but that a great industrial center will be built up in the locality.

The quantity of sulphuric acid in mine water varies according to the locality and condition of the mine. Some mine water has been found to contain only a few grains while the water in other workings often contains over 100 grains per gallon. Water containing only two or three grains per gallon will ruin boilers in a short time. The use of condensed water from the exhaust is not advisable unless the lubricating oil used is absolutely free from animal fats, as fatty acids form an insoluble lime soap which coats the boiler at the water line causing it to weaken.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

A working load on a hoisting rope should be $1/20$ of its ultimate strength. The strength of a splice is about $2/3$ that of the rope.

The miners of the Pittsburg region object to the compulsory use of smokeless powder, claiming it reduces their earnings. The inspectors contend that it diminishes the dangers of explosions.

The constant arcing in oil switches has a tendency to blacken the oil somewhat by forming a carbon deposit; it is therefore absolutely necessary that the oil should be removed occasionally and filtered.

In European coal mines, the maximum percentage of gas allowable in the main return airways is definitely fixed by law for each class of mine; if at any time the stated percentage is exceeded, every workman must be withdrawn until the defect is remedied.

If a rope dressing is used, which hardens on exposure to the atmosphere, care must be taken to see that the groove in the sheave at the shaft head is kept cleaned out, for if this is not done, the winding rope is likely to be thrown off the sheave by the accumulation of hardened oil.

The higher the temperature of detonation, the less the time required to ignite firedamp; therefore, it is claimed by many, that the temperature of detonation of an explosive should be as low as possible and the gases evolved from the explosive should be such as to quench any flame that may result, and to lower their temperature quickly.

When sinking a comparatively deep shaft, a portion of the pit should be bratticed off for ventilation. The fan may be used either as a blower or as a suction ventilator. A suction fan will clear the smoke out more quickly and admit light sooner than a blower; however, by blowing, good air may be obtained at the bottom soon after firing.

It is stated on good authority that a mixture of three parts of good Colza oil with one part of the best paraffin with a flaming point above 80 deg. F., is the best oil for use in safety lamps. Each ingredient of the mixture should be purchased separately and mixed at the colliery. It is not desirable to buy the mixed oil sold by many dealers under various names.

The chain-cutter type of coal-mining machine gives good results in soft, regular, easily mined coal, provided the floor

and roof are of the requisite size for operating the machine. Where the roof is bad and the coal hard, and filled to some extent with sulphur balls, the pick-machine is preferable as it takes up less room during operation and is easier to move from place to place.

At some mines the care and maintenance of the underground tracks is totally neglected. Although it is seldom possible to construct and maintain a perfect haulage road, dirty road beds, defective rail joints, worn-out switches, and ungraded haulways are the enemies of true economy. A well maintained gangway or entry lessens the risk of accidents to men and mules and reduces the cost of transportation and the wear and tear on rolling stock.

The use of tools should never be permitted in a building where dynamite is being thawed, for it is next to impossible to prevent small particles of the explosive from being scattered about and a blow would explode them under certain conditions. Primers should never be prepared in a thaw house, for even though great care is exercised, someone might leave a cap where it would cause trouble. The floor of a thaw house should be kept clean and occasionally scrubbed with hot lye.

The speed with which a shaft may be sunk depends largely upon the character of the strata through which the pit is driven and the kind of machine used in hoisting. The use of steam drills is decidedly objectionable, especially where the shaft is timbered. As sinking progresses, the strata reached are often of such character that the heat of the steam causes the rock to soften or slip. Compressed-air machines give good results in hard rock, but experience shows that in slate, shale and sandstone better time is often made by hand drills.

In lift mining in gaseous workings, each lift should have two splits of air current, one on each side of the slope; for two lifts working, there should be four splits; with three lifts, six splits, etc. The counter-gangway workings should be ventilated by the split from the gangway below, or in case the counter-road covers a large area, an independent split from the main intake should be introduced. For shaft workings, the intake should be divided into two splits at the foot of the shaft running off along the gangway in the opposite direction from the shaft. Separate splits should be taken off each

gangway heading and for each panel of the workings operated by an inside slope or plane.

A practical method of lessening the strain of starting on a hoisting rope is to introduce between the cage and the cap, a sleeve link through which a pin passes; this latter is also passed through the top of the cage. Threaded upon the pin are alternate layers of india rubber and sheet iron held together by a double-lock nut. The top of the link is connected with the top center ring of the bridle chains by a chain which is shorter than the cage bridles. When the load is lifted, these disks of rubber are compressed and the strain is relieved. Another satisfactory method is to mount the pulley pedestals upon springs similar to those of railway cars; when both of these arrangements are used together, the results are most satisfactory.

When a shaft has reached a seam of coal to be developed, the practice at many anthracite collieries is to provide a small excavation directly under the hoisting compartments for a timber frame upon which the hoisting cage is to rest. On the dip side of the shaft a place should be driven in the coal for a sump, while gangways are being driven to the right and left along the strike to develop the bed. Gas-feeders in the floor of working places give much trouble by often being set on fire from the flame of a blast. When this occurs, they should be followed up and extinguished or a serious mine fire is likely to result. One method of extinguishing such feeders is to explode a little dynamite near them; the shock of the explosion will generally extinguish the burning gases.

A chain-grate stoker used in a Heine type of boiler produced no smoke when the rate of driving is 42 lb.; but if the same fuel were burned in a hand-fired boiler of the same make, smoke was obtained when the rate of driving was 26 lb. This difference between the two systems of firing may be attributed to the fact that with the chain-grate stoker, the supply of fuel is gradual and the coal gives off the volatile matter by degrees, so that as soon as the gases are given off, they are completely burned; with hand-firing, the fuel is piled on top of the incandescent coal and heated quickly; this sudden rise in temperature of the fresh coal causes the sudden giving off of combustible hydrocarbons distilled as volatile matter and results in the production of smoke.

Work of the Geological Survey of Canada

Explorations in the Newer Districts of Canada Geology. of the Yukon, of Cassiar and Other British Columbia Districts and Northern Quebec

SPECIAL CORRESPONDENCE

In pursuance of the policy adopted last year, which has met with general appreciation, of publishing the Geological Survey's summary reports¹ as early in the year as possible, it has been found necessary to dispense with the maps and plans which formerly accompanied these documents. Another change consequent upon the recent reorganization of the department, is that the particulars of the mineral production of Canada, formerly given in this report, are now furnished by the report of the Mines Branch, to which the mining statistical staff has been transferred. In his introduction, Prof. R. W. Brock, acting director, points out that the activity in the mineral districts, noticeably in Cobalt and northward to and along the line of the Grand Trunk Pacific railway, has resulted in a pressing demand for geological information which must be met by corresponding activity of the Survey, necessitating additions to the strength of its staff and an increased appropriation.

There were in the field last season 20 parties whose work, covering a wide range of territory in the newer and less accessible parts of the country has been of much practical value from an economic point of view. Space will not permit a reference to many of the reports.

COAL IN THE SOUTHERN YUKON

D. D. Cairnes continued his explorations in the southern portion of the Yukon chiefly between Whitehorse and Tantalus, where coal and copper were being largely developed. Discoveries of coal were reported at a number of points along Lake Labarge, the Lewis river and its tributaries the Teslin and Big Salmon rivers. These were examined, but except within a few miles of Tantalus, where the coal measures cross the river, the so-called coal proved to be dark or black shales; in other instances seams of coal where they existed were only a few inches thick. At Tantalus mine considerable progress had been made; the two main tunnels had been driven in over 1800 ft., and 31 rooms opened up. The shipments during last season were expected to amount to 9000 tons. The formations here dip to the east, and at Tantalus Butte, across the river to the west, showing the presence of a synclinal fold. These measures are known to extend in a northern direction for several

miles at least, and in a southerly direction over 50 miles, crossing the Whitehorse-Dawson wagon road 70 miles from Whitehorse, and in all probability extending considerably farther. They have been traced throughout a distance of 60 miles, and wherever a section has been made two or more workable seams of good bituminous coal have been found. In the places from which it has been obtained at a depth the coal cokes satisfactorily.

WINDY ARM

The only properties working to any extent on Windy Arm were the Vault, Venus and those of the Anglo-American Consolidated Mining Company. Development was retarded by internal dissensions and other causes. On the Venus approximately 1800 ft. of work was done during the season and 100 tons shipped to the Tacoma smelter, which netted \$60 per ton. At Livingstone creek the old creek channel has been discovered and is being worked above Discovery by tunneling from the present creek bed and drifting through. The pay on the old channel averages 30 ft. in width and 2 ft. in depth. The hillside claims on the old creek gravels have produced on an average about \$25,000 each. The estimated output of the creek for the season was about \$100,000. On Williams creek a number of claims had been staked, but the Bonanza King was the only one on which any work had been done. The ore is quartz, carrying chiefly bornite, chalcopryrite and malachite and was claimed to yield gold, silver and copper, but average samples obtained showed only traces of gold and silver and from 3.29 to 4.21 per cent. copper.

THE CASSIAR DISTRICT, BRITISH COLUMBIA

Investigations in the Bulkley valley, British Columbia, were continued by W. W. Leach, who gives an account of mining conditions on the upper part of the Telkwa river and the country between that and the Zymoetz, which has been but little prospected. The greater part of the region is underlaid by rocks of the porphyrite group and almost entirely of volcanic origin; the most important from a mining point of view, being the later eruptives as all noteworthy mineral discoveries are situated in the volcanics near their contact with these rocks, or in or alongside dikes from their main bodies. A large area of these eruptives was found on the western ridges of the Hudson Bay mountains, which has received

much attention of late. At Hankins' camp, situated at the head of Goat creek, a group of claims located by Messrs Loring, Forrest and the Hankin Brothers are among the oldest mineral locations in the district. The mineral deposits occur in nearly horizontal beds, following the bedding planes of the volcanics, and show decided enrichment in the immediate vicinity of the dikes. On the Eldorado, Naiad and Telkwa claims the best showings are to be met with, comprising at least two beds of ore, each about 5 ft. in thickness, consisting of iron pyrite, copper pyrite and a little pyrrhotite and magnetite in a gangue of altered country rock, epidote, quartz, etc. The copper percentage is small, but it is claimed that some gold is present. The orebodies are much thicker near the dikes. On Howson creek considerable development work has been done and many new claims located. Open cuttings on several locations showed good chalcopryrite and specular iron ore. At the Silver Heels, a claim belonging to the Telkwa Mining, Milling and Development Company, the vein was 15 ft. in width; and at the Anna Eva, owned by the same company, a new cut showed some higher-grade ore, chiefly chalcopryrite and specular iron, with a good deal of quartz, across a width of about 25 ft. Among the claims visited on the Hudson Bay mountains were the Copper Queen and Iron Mask at the head of Lyon creek, the ore consisting almost entirely of arsenical pyrites carrying about gold \$8, silver 0.52 oz. to the ton. During the year nothing was done on the coal properties of the Kitimat Development Syndicate, the Cassiar Coal Company, or the Transcontinental Exploration Syndicate, situated on the Telkwa river or on Goat creek; and it was not expected that much development would be undertaken before the route of the Grand Trunk Pacific was finally settled. On the property of the Telkwa Mining Company on Coal creek, at the head waters of the Morice river, exploration work had been carried on, and the limits defined. Though the area is small, the coal is of high grade. On Goldstream, a little below its junction with Coal creek, a new coal area was discovered about 2x2½ miles in extent, in the form of a basin, the coal outcropping on both sides of the valley. It has been opened up at one place and two seams uncovered, the upper one showing 5½ ft. and the lower seams 3½ ft. of clean bright coal. Another and a smaller area was seen about two miles

¹"Summary Report of the Geological Survey of Canada for 1907." Pp. 132. Ottawa, 1908: King's Printer.

farther down Goldstream. Other areas of coal-bearing rocks were noted at Driftwood creek, Moricetown, at the head of the Zymoetz river, and on Hudson Bay mountain, but at none of these localities has any workable seam been found, and it seems probable that the seams reach their maximum thickness in the Telkwa-Morice river district and thin out rapidly toward the north. It is fairly certain that no great coalfield exists in the Bulkley valley district from Hazelton to the headwaters of the Morice, but many comparatively small, isolated areas are known in which the coal varies from a lignite to a semi-anthracite.

THE OSOYOOS DIVISION, BRITISH COLUMBIA

A report by Charles Camsell deals with Camp Hedley, Osoyoos mining division, British Columbia, situated on the western side of the Okanogan mountain range. The district so far has been entirely a gold producer, though it gives promise of copper. The ore deposits belong to the class known as contact metamorphic. The principal ore mineral is arsenopyrite and the deposits are unique in the respect that arsenopyrite has never hitherto been found in such proportion to the other sulphides in contact deposits of this kind. Chalcopyrite is common, though scarcely in such quantities as to become important as an ore of copper; but on the Warhorse claim chalcopyrite occurs associated with pyrrhotite in sufficiently large bodies to make this claim a promising one, as the ore also carried some gold and silver. On the Red mountain pyrrhotite occurs in such quantities as to make the compass useless for surveying. The Yale Mining Company owns some 25 claims in the camp, of which only two, the Nickel Plate and the Sunnyside, are being worked at present; the ore from these is treated by the Daly Reduction Company in a 40-stamp mill and cyanide plant. The Nickel Plate is the largest producer of gold in the province. The Nickel Plate orebody lies in altered sedimentary rocks, interbedded with which are intrusive sheets of andesite. Both arsenopyrite and pyrrhotite occur, but the gold is always associated with the former, and the greater the mineralization by arsenopyrite the higher are the gold values. In both the Nickel Plate and the Sunnyside the andesite sheets play an important part, and with other cross-cutting dikes have been the cause of confining the high values to restricted areas. In the search for other orebodies in this camp the apparently accidental conjunction of dikes and dipping strata such as are here found should be borne in mind.

THE TRANSCONTINENTAL RAILWAY LINE

In his report of explorations along the National Transcontinental Railway location from Sturgeon river westward, W.

H. Collins describes the iron formation existing on both sides of Kashaweogama lake, on the portage between Island and Cliff lakes, which outcrops over a width of 1000 ft. At a mile north of the east end of Kashaweogama lake magnetic bands were detected by the dip needle. The formation appears again near the north end of Iron lake, on the portage to Savanne lake and at numerous points above Savanne narrows; but at all these points the seams are narrow and silicious and of no economic value. The south side of lake Kashaweogama is better mineralized, the belt being at least a quarter of a mile wide, containing bands of ore from 7 to 16 ft. wide. An analysis showed 30.74 per cent. metallic iron. The analysis of another specimen obtained from the laboratory of the Atikokan Iron Company yielded 53½ per cent. metallic iron. The geological surroundings are quite comparable with those of the Vermilion range of Minnesota. The existence of hematite in association with the magnetite is favorable, but unlike the jaspilite of the Temagami and Vermilion ranges, the Kashaweogama quartzites are in dull gray and black tones, red bands being infrequent.

THE TEMISKAMING AREA IN QUEBEC

In view of the Cobalt discoveries, considerable attention has lately been devoted to the area from Lake Temiskaming eastward in Quebec, in the hope that the Cobalt formation would be found to extend in that direction. An examination of that region by Morley E. Wilson following up previous investigations, does not tend to confirm such expectations. Mr. Wilson's report states that no discoveries of economic importance have as yet been made, though a considerable amount of prospecting has been done. Since the silver ores of Ontario are associated with the post-Huronian diabase, the limited extent of this rock in the area examined greatly reduces the probability of similar discoveries being made.

Two iron-range areas are known in the Keewatin of the region, one in the neighborhood of Clear lake and the second crossing the portage from Kakake lake to the Quinze river. In the Clear lake area two parallel ranges appear on the surface at varying intervals, consisting of bands of quartz and silicious magnetite, carrying a large amount of iron pyrites. The maximum width of the outcrops is 30 ft. The Kakake iron range consists largely of jaspilite, but like the Clear lake occurrences is not of sufficient extent to be of value. The diorite of Fabre township appears to be well mineralized, containing chalcopyrite, galena, calcite and other minerals. No large quantities, however, have been located.

OTHER EXPLORATIONS

Among other contents of the report of sufficient economic interest to deserve a

more extended reference are the reports by J. Austen Bancroft on the portion of the British Columbia coast inlet; G. S. Malloch, on the Cascades, Pallisa and Costigan coal basins; D. B. Dowling, on Explorations in the Rocky mountains; R. W. Brock, on the Lardeau district, British Columbia; and E. Rodolphe Fari-bault, on Lunenburg county, Nova Scotia.

The Diamond Industry in South Africa

SPECIAL CORRESPONDENCE

The recent financial depression has had a far-reaching effect upon the diamond industry. Up to the latter part of October, 1907, the De Beers company was producing at the rate of 30,000 tons of blue rock per day of 24 hours, or \$30,000,000 worth of diamonds per year. The company was then operating five mines 24 hours each day, and six days out of each week. About Nov. 1, when the effect of the financial depression began to be felt, the working hours in the mines were cut to 16 instead of 24, and the hoisting time was cut to 12 hours; the effect of this was the reduction of the output by almost 50 per cent. Two months later the hoisting time was cut to eight hours per day, which further reduced the output. The next cut was the reduction of the number of working days per week to five, the working hours remaining the same; this arrangement continued well into 1908.

In April, 1908, the Dutoitspan mine, at Kimberly, producing about 12,000 tons of blue rock per day, was closed down. This mine furnished more than one-third of the total output of the De Beers company. It will probably not be reopened for a year or more.

Conditions in May, 1908, were about as follows: The De Beers company had reduced its output from 30,000 tons of blue rock per day to about 11,000 tons, and the salaries of all of its employees had been cut one-sixth. All other companies had curtailed their output and some had shut down completely, the only companies of importance still operating being the Premier Company, of the Transvaal, the Jagersfontein Mining Company, of the Orange river colony, about 60 miles from Kimberly, the Roberts-Victor Mining Company, of the Orange river colony, about 35 miles from Kimberly, and a number of minor operations.

Although there are many rumors afloat, it cannot be said that there is much encouragement in the situation, for it is not known to a certainty when operations will be resumed on a large scale. A slight decrease in the cost of living, about corresponding to the cut in salaries and wages, is noticeable.

THE ENGINEERING AND MINING JOURNAL

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.
505 Pearl Street, New York.

London Office: 6 Bouverie Street, London E. C., Eng.
CABLE ADDRESS "ENGINJOUR, N. Y."

Subscription, payable in advance, \$5.00 a year of 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines, \$6.50 in Canada.

To Foreign Countries, including postage, \$8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1907 we printed and circulated 507,500 copies of THE ENGINEERING AND MINING JOURNAL.

Our circulation for April, 1908, was 41,500 copies.

May 2.....	12,500
May 9.....	9,500
May 16.....	9,500
May 23.....	9,500
May 30.....	9,500

None sent free regularly, no back numbers. Figures are live, net circulation.

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The Zinc Ore Question

One of our readers in Utah has written us as follows:

"May I be permitted to say that I was disappointed in the editorial on 'The Zinc Ore Question' in the JOURNAL of May 9, 1908. I had hoped for editorial comment on the reasoning which lead the courts to decide that zinc ores do not come under the head of 'metallic mineral substances in the crude state.' On the same page with the text of the decision, you published some statistics on the mineral production of Germany, and listed zinc ore under a special headline, 'Metallic Ores.' Can it be that there is really a difference between 'metallic ores' and 'metallic mineral substances in the crude state?'"

The recent decision of Judge Burns was substantially a repetition of the previous decision of the Board of General Appraisers, Feb. 5, 1907, which was fully discussed in the JOURNAL of Feb. 16, 1907, wherefore it did not appear necessary to reiterate the opinions therein expressed. We quote from that editorial as follows:

"It is to be admitted that when the Dingley law was enacted no one thought that in a few years the United States would be importing zinc blende, and when such importations were begun there was ground for the belief that blende fell under the 'catch-all' paragraph, providing that 'metallic mineral substances' in a crude state, not elsewhere specified, should be dutiable at 20 per cent. *ad valorem*, as the Secretary of the Treasury ordered. Now the Board of General Appraisers, guided by a decision of the circuit court of appeals in what is considered to be a parallel case, holds that the phrase 'metallic mineral substances' applies only to that class of mineral substances in which metal appears in a free state, such as the ores of gold, silver and copper. Inasmuch as the only ores of the above character which are of commercial importance are those of gold, silver and copper, and they are specifically on the free list, this clause in the Dingley act under the recent decision becomes meaningless. Literally this interpretation of the adjective 'metallic' is doubtless correct, but if that adjective be limited in this way we shall need something to take its place in everyday usage. The chemical compounds which occur ready formed in nature are called minerals; and the minerals from which the metals are extracted for prac-

tical purposes are called ores. Ore is commonly defined as a metallic mineral substance. Now, we are told that this is incorrect. But if not metallic, what? Certainly not metalliferous—metal bearing—which is far broader than metallic, including every mineral which contains a metallic element, whether, commercially extractable or not."

It seems to us that there is but little that can be added to the above expression of views. The classification of zinc ores under the heading of 'metallic ores' to which our correspondent refers was simply an example of common usage, which the court has declared to be vague and careless. There are, of course, many examples of careless classification that do not stand the tests when the precise meaning of each word is weighed by the courts. The fact is that while the phrase "metallic mineral substance" expresses our general understanding of the ore of a metal, it seems not to withstand a refined verbal analysis. Thus, although most of us would say offhand that zinc ore is a metallic mineral substance, we should be equally ready to say that limestone and magnesite are not metallic mineral substances. Yet, calcium which is a metal and according to the periodic law is a first cousin of zinc, can be obtained from limestone, which is one of its ores; and magnesium, which is even a nearer relative of zinc, can be obtained from magnesite. Both calcium and magnesium are commercial metals. If zinc ore is a metallic substance so is limestone and magnesite; if limestone and magnesite are non-metallic, so also is zinc ore non-metallic. Confusing analogies of this kind can be multiplied to such an extent that the Board of General Appraisers, and later Judge Burns, were obliged to interpret literally the doubtful clause of the Dingley law and say that "metallic mineral substances" comprises only those in which metals as such at present, even if that clause of the Dingley law be rendered meaningless.

However, as a matter of fact the decisions in this respect have been comparatively of little consequence, inasmuch as the chief importations of zinc ore into the United States are the carbonates and silicates, and their classification has hung upon the definition of the word "calamine." As to this matter, we have never been in doubt from the beginning, because as we have said repeatedly any definition

of calamine which would restrict it from covering all of the carbonates and all of the silicates of zinc would violate the commercial and metallurgical usage of a century, or in fact since the zinc industry became an industry. The fact that certain mineralogists, among whom there is confusion as was carefully pointed out long before the zinc-ore question became controversial, applied the word calamine to a certain mineral species could not be allowed by the courts to nullify previous and subsequent commercial and technical usage. In this particular the complainants against the free admission of zinc ore never had a sound leg to stand upon. Calamine is by no means the only example of a commercially used class-name covering several different species of mineral. Among other examples may be cited mica, including the mineral species muscovite, biotite, etc.; pyrites, including the mineral species pyrite, marcasite, chalcopyrite, arsenopyrite, and others; asbestos, including chrysotile and amphibole. Even the term blende is gradually becoming a class-name, since ferruginous and non-ferruginous forms of zinc sulphide have been found to have important commercial and technical differences.

But why all these quibbles and hair-splittings over definitions? Simply because the case rests upon the precise construction of language. There is little or nothing of guidance as to the intent of the Dingley law. When it was before Congress no one dreamed that zinc ore would ever be imported into the United States. More than 100 years ago, in the first tariff of the United States, calamine (then used for the manufacture of brass by the cementation process—before the art of making spelter had been discovered in Silesia and Belgium) was put on the free list, and there it remained except from 1846 to 1861. When it was mentioned in the first tariff it included all the silicates and carbonates of zinc, inasmuch as scientists had not yet distinguished among them. Probably the framers of the Dingley law did not know what calamine was; it had been on the free list in previous tariffs; nobody had objected; so they simply let it stay. If Congress had any intention it is peculiar that it should specifically have put one ore of zinc on the free list and nowhere made any mention of the other, blende. When it was sought to exclude these ores it was necessary to show

that blende came under the "catch-all clause," wherefore the importance of the precise meaning of the word "metallic" in this case.

We have been of the opinion that the litigation over this zinc-ore question, which is greatly disturbing the zinc industry, should now cease, but it appears that the case must be passed upon by the Court of Appeals. Probably the Government which is the appellant, has felt that inasmuch as it represents complainants it must take the case to the court of last resort in order to insure satisfaction. However, it will be no more than fair to the other side, which has now obtained two favorable decisions, if the Government becomes more equitable in its practice respecting the importations which are all the time being made under protest. It has been formally called to the attention of the Treasury Department that its collectors have insisted upon an arbitrary valuation of zinc ore, upon which a duty of 20 per cent. is collected, which works a great hardship upon the shippers. The collectors refuse to notice the fluctuations in the price for spelter and appraise the value of zinc ore at the same figures when spelter is worth 45c. per lb. as when it was worth 6c. per lb. Thus, the duty instead of being 20 per cent. *ad valorem* often amounts to 100 per cent. *ad valorem*. Obviously, such a procedure is preposterously unjust and savors of opera bouffe rather than equity and intelligence.

The Scope of the American Institute of Mining Engineers

In recent discussions respecting technical societies it has been manifest that there is a good deal of misconception respecting the American Institute of Mining Engineers, including its constitution, its scope, and the work that it is doing in behalf of the professions which it represents and the mining industry in general. It is not fitting that erroneous statements, conveying wrong impressions, should go uncorrected.

Among other things, it has been recently declared that the subjects of "a proposed mining bureau, the work of the Geological Survey, the conservation of natural resources, and the many matters that affect the civic side of engineering life," are "tabooed" by the Institute, which does not afford an opportunity for

the discussion of ethical problems, or enable the profession to give expression to its opinion on national questions, such as the mining law, legislation against fraud, prevention of accidents, etc.

As a matter of fact, not one of these questions is "tabooed" by the rules or practice of the Institute. On the contrary, practically all of them have been treated in papers and discussions, which can be found in the volumes of its *Transactions*, as, of course, is known to everyone who is familiar with that valuable publication.

In the rules of the Institute, as they stood before its incorporation in January, 1905, there occurred the statement: "It is understood that papers and discussions should not include matters relating to politics or purely to trade." This provision was understood to refer to pending questions of party politics, or the tariff, or debatable criticisms of the governments of foreign countries. But we believe it has never been invoked as a reason for rejecting any paper offered to the Institute. Certainly it was not so invoked against the papers of Doctor Raymond and others on the United States mining law, or sundry papers and addresses on professional ethics, or statements and discussions of the work of the U. S. Geological Survey, or the prevention of accidents in mines—on all of which subjects the *Transactions* of the Institute give emphatic contradiction to this notion.

Moreover, whatever may have been the force of the above-quoted provision, it is worthy of notice that, in the constitution and by-laws of the Institute, adopted in February, 1905, immediately after its incorporation, *this provision was omitted*, so that there is at this time no limitation whatever upon the discretion of the council in the acceptance of papers. If anything was ever "taboo," it is so no longer.

It is true that the present, like the former, rules of the Institute forbid it to declare by vote its corporate and collective approval or disapproval of any outside "technical or scientific opinion, or proposed enterprise." This position does not necessarily prevent, and it has not, in the history of the American Institute of Mining Engineers, actually prevented, the free and fruitful discussion of such propositions. With regard to the international nomenclature of iron and steel, the gen-

eral use of the metric system, the best methods of laboratory analysis, the best sections and specifications for steel rails—not to mention many other important subjects—the Institute has offered a free forum of debate and has drawn out valuable and influential expressions of opinion. It is true, however, that these expressions have been individual and there has been no formal expression of the Institute as a body, or even any effort to elicit the consensus of opinion among its members. Such, of course, could have been done at any time by amending the constitution, if the membership had desired, but we are informed that no such amendment has ever been proposed.

Another erroneous statement recently made is that the Institute has become merely a "publishing agency." It is not to be denied, we think, that the publication of the enormous volume of contributions to the *Transactions*, coming from all parts of this and other countries, is the work which puts the Institute most in evidence, but the publication of technical papers by no means measures the scope and activity of the Institute, either at present or at any time in its history. The Institute holds two or three meetings each year, for which its council earnestly desires, and unceasingly strives, to secure a large attendance, lively oral discussions, and professional and social intercourse which will be profitable and agreeable. Anyone who attended the Toronto meeting of the Institute last summer, or the New York meeting last February, would not say that the Institute has ceased to have good oral discussions or valuable intercourse among its members.

Among the other activities of the Institute are the maintenance of a grand headquarters in New York (for which it has assumed heavy pecuniary liabilities), and whatever may be the present opinion of the members of the Institute respecting the removal to the new building (for which they decided by practically unanimous vote) no engineer can fail to acknowledge the honor to the engineering profession in its possession of a monumental building devoted solely to professional uses. The commodious headquarters of the Institute in the Engineering building offer to its members advantages which are material. Any member of the Institute is free to make its rooms his temporary headquarters during a visit to New York, where he may have his mail addressed and may be accommodated with

the use of desk, telephone and the usual office conveniences.

Finally the Institute is, in conjunction with two other great technical societies, developing what will be the most important technical library in America (possibly it has already attained that position). This library is to the advantage of every member of the Institute who may need to do research work, and is extensively employed. It is as much to the benefit of members non-resident in New York as to those who reside here, inasmuch as the non-residents can and do secure assistance by correspondence.

It is evident, therefore, that the American Institute of Mining Engineers is much more than a mere publishing society. It is an international organization of mining engineers and those who are interested in the mining industry, and as we remarked in an editorial about two months ago it offers various material advantages that are well worth the initiation fee and annual dues.

Rand Working Costs and Profits

The improved returns of many of the South African mines have produced more activity recently in the London share market. June is the month when most of the companies declare their half-yearly dividends, and it is anticipated, owing to the general average increase in the monthly profits, that increased dividends over last year will in many cases be made. It is customary for Rand mining companies to publish at the end of each month the number of tons crushed, the ounces of gold won and its value and the estimated working profit. Those who calculate the probable dividend from the declared profits are likely to be disappointed, as the apparent working profit does not, as a rule, coincide with the distributed profits, because out of the surplus on working account deductions are made for Transvaal taxes, interest on debentures or loans, capital expenditure and other outgoings of a like nature. For example, the mine companies belonging to the Rand Mines, Ltd., for the year ending Dec. 31, 1907, produced gold to the value of £4,616,285 and declared dividends to the amount of £1,174,014. The value of the yield per ton was 33.7s. Deducting the dividends from the yield, the balance is 25.2s. per ton, as against a declared working cost of 21.1s. per ton. The profit on one basis is

12.6s. per ton and on the other 8.5s. per ton, or a difference of 4.1s. per ton.

There is at the present time a vigorous attempt being made to reduce working costs, and in this praiseworthy endeavor, the question of profit is likely to be lost sight of. The reduction in working costs that has been made during the last year is largely due to the inclusion of poorer ore. Wider stopes mean cheaper mining, but also lower grade ore, and while the policy will have the effect of extracting more gold from the mine than would otherwise be the case, it may at the same time reduce the profit of the stockholder. The mines of the Rand have an abundance of low-grade ores and by mining down to the level of the working costs, the profits might be made to disappear altogether, although the industry would be conducted on a large scale. It is well to point out that the struggle for low working costs is leading the mines into danger. It is to the interest of the shareholders to have the largest profit in the shortest time. A mine is a wasting asset and its value may be calculated actuarially from the present value of a dividend spread over a certain number of years. It can easily be shown that it pays to sacrifice a few years of life and low-grade tonnage and to increase the grade over a shorter period.

In relation to the subject of working costs, it must be noticed that the practice of charging to capital account part of the surplus from the ordinary revenue and expenditure account requires to be closely watched. The temptation exists for managers, in order to get credit for low costs, to charge to capital account expenditure which ought properly to be included in working. What shareholders would like to see, of course, would be a statement showing declared profits agreeing more or less with the dividends, and it ought not to be difficult to give the information. As they are at present, the "profits" are misleading.

As regards the question of keeping a reserve gold account to equalize the monthly returns, there are differences of opinion. Some companies have dropped it, while others keep it on showing month by month how the reserve gold account stands. As the variation in the monthly return can be seen from the amount taken from or added to the reserve gold account, it is difficult to see what good the reserve gold account does when we give figures showing how this equalization has been effected.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Ore Contracts from a Producer's Point of View

The article by Henry M. Adkinson, contained in the JOURNAL of May 16, is a valuable contribution to the producers of ores who must necessarily sell their product to the smelters. Many unfavorable contracts to sell products to the smelters are made without a proper understanding of the resulting settlements, and it is only human nature for smelter officials to take advantage of such conditions. The producer who understands the business and who is favored with competition for his product, seldom fails to get all that he is entitled to receive from the smelters, but for reasons too well known to the profession he refrains from advertising it.

As a typical illustration of the wisdom of analyzing smelter returns, the following results taken from the books of a mining company doing business in this State, are given under the identical forms used by Mr. Adkinson:

TABLE NO. 1. OLD CONTRACT.

Net weight.....	1660.461 tons		
New York Values.		Per cent.	
Gold at \$20.67.....	\$34,318.72		
Silver at market.....	44,782.68		
Lead at market.....	32,677.87		
Total value of product..	\$111,779.22		
Total marketing expense, including freight at \$8.74 per ton.....	\$14,528.42	12.9974	
Net proceeds.....	56,981.27	50.9766	
Producer's portion..	\$71,509.69	63.9740	
Treatment.....	5,841.85	5.2263	
	34,427.68	30.7997	
Smelter's portion.....	40,269.53	36.0260	
Total.....	\$111,779.22	100.0000	

An average of the ore shipped during this time shows: Au, 1.324 oz.; Ag, 27.82 oz.; Pb, 24.61 per cent.; Cu, not allowed, hence not assayed; Fe, 6.75; SiO₂, 38.64; Zn, 9.60 per cent.

TABLE NO. 2. NEW CONTRACT.

Net weight.....	78.851 tons		
New York Values.		Per cent.	
Gold at \$20.67.....	\$1,128.78		
Silver at market.....	2,076.85		
Lead at market.....	2,921.64		
Copper at market.....	219.84		
Total value of product..	\$6,347.11		
Total marketing expense, including freight at \$9 per ton.....	783.20	12.3394	
Net proceeds.....	4,035.56	63.5810	
Producers' portion.....	\$4,818.76	75.9204	
Treatment.....	347.77	5.4793	
	1,180.58	18.6003	
Smelter's portion.....	\$1,528.35	24.0796	
Total.....	\$6,347.11	100.0000	

A typical assay of the ore shipped during this time shows: Au, 0.77 oz.; Ag, 41.44 oz.; Pb, 15.20 per cent.; Cu, 0.77; Fe, 6.00; SiO₂, 46.40; Zn, 11.40 per cent.

In connection with the above it should be stated that the results shown in Table No. 1, prevailed before smelting competition entered the field, while the results shown in Table No. 2 were secured through competition brought about by a generous advertising of the product for sale. Why not?

used up in the cables, and nothing else. That is to say, with a length of, say, a mile of cable, two cables each of a half mile long, the maximum heating effect depends upon the square of the pressure used in the cable, divided by a constant, which does not change, whether the cable is large or small. The reason for the law that the heating effect is independent of the size of the cable where it is measured by the pressure used in the cable, is the fact that the product of the weight and

TABLE NO. 3. GENERAL SUMMARY.

	Pro-ducer's Portion. Per Cent.	Smelter's Portion. Per Cent.	Treat-ment. Per Cent.	Freight Per Cent.	Unknown. Per Cent.	Average Gross Value. Per Ton.	Average Total Deduction Per Ton by Smelter.	Average Deduction Per Ton for Treatment.	Average Deduction Per Ton for "??"
Table No. 1...	63.9740	36.0260	5.2263	12.9974	30.7997	\$67.31	\$24.25	\$3.52	\$20.73
Table No. 2...	75.9204	24.0796	5.4793	12.3394	18.6003	80.49	19.38	4.41	14.97

The desirability of securing the flat smelting rates, as advocated in the concluding paragraph of Mr. Adkinson's paper is quite apparent. Then the layman might understand. It takes a lawyer to understand the provisions of many of the smelting contracts now in force and many good miners are, unfortunately, poor lawyers.

A. G. BROWNLEE.

Denver, Colo., May 20, 1908.

Explosive Effects of Electric Currents on Coal Dust

I note the remarks of Timothy W. Sprague, of Boston, in the JOURNAL of April 25, on the recent paper by Professor Bedson and Mr. Widdas. I think Mr. Sprague has mistaken the object of the experimenters, in giving the explosive effect, with the currents named. As I understand the matter, the idea was merely to show how high temperatures could be obtained, sufficient to explode the different forms of coal dust, by the currents named.

The currents passing in ordinary lighting or power cables, come under quite a different category. It may be interesting, however, to Mr. Sprague and others, to know that the maximum heat that can be produced by an electric current, passing in any conductor, say the conductors employed for lighting and power in a coal mine, for any given length of conductor, depends upon the square of the pressure

resistance of a conductor of any given length is constant. If the weight of the conductor is halved, its resistance is doubled, and *vice versa*.

By the pressure used up in the cable is meant that which is employed in driving the current that is passing through the cable; and the importance lies in the fact, that under ordinary working conditions, about 10 per cent. of the total pressure employed would be used up in the cable, the remainder being employed in driving the current through the lamps or motors. When a short-circuit occurs, however, the whole of the pressure is employed in driving current through the cable, up to the short-circuit. The effect will be better understood when it is stated that for a pair of cables, each a half mile in length, and with a pressure of 50 volts used in the cables themselves, 10 per cent. of a 500-volt service, the maximum temperature the conductors can reach, will be 1.7 deg. F.; while if a short-circuit occurs at the end of the half mile, causing the whole of the 500 volts to be employed in driving a current through the mile of cable, the maximum temperature obtainable will be 170 deg. F. If the length of cable exposed to the full pressure of 500 volts is only a half mile, for example, a short circuit occurs a quarter mile from the generator, the maximum temperature obtained is 680 deg. F.; and if the short circuit occurs at one-eighth mile from the generator, so that the circuit comprises only quarter of a mile cable, the maximum temperature obtainable is 2720 deg. F.

It will be noted that these figures are given as the maxima obtainable. The temperature that any body to which heat is being delivered assumes depends upon the rate at which heat is being delivered, and the rate at which it is being abstracted. The above figures are on the assumption that none of the heat delivered to the cable is abstracted.

The importance of the figures lies in showing how very quickly the heating effect increases when short-circuits occur, and that with any given length of cable the sizes of the cable are immaterial.

SYDNEY F. WALKER.

Bath, England, May 6, 1908.

Recent Mine Explosions

Much has been said concerning the perils of coal mining, and especially so since the great disaster at the Monongah mines in West Virginia on Dec. 6, 1907. This frightful explosion was closely followed by another, the Darr mine, in Pennsylvania, and these great losses of life and property have been a principal topic of discussion among mineowners and mine experts.

Many have arrived at the conclusion that dust has been the destructive agent in recent disasters. Dust explosions are possible, but in early coal mining, such explosions were unknown. Before the discovery of the safety lamp, the presence of firedamp was ascertained by the miner creeping constantly forward along the entry holding a candle or lamp in one hand and screening the flame with two fingers of the other hand, in the meantime keeping his eye closely fixed on the top of the light; as he reached the explosive atmosphere, the top of the flame began to assume various colors and to elongate in sharp spires giving off minute luminous sparks. This condition indicates the extreme danger point and a sudden movement of the body or a quick lowering of the lamp would cause an explosion. Light carburetted hydrogen gas, usually called firedamp, is emitted from the minute pores of the coal and its associate strata, and is generally found in greater abundance near dikes and faults in coal of a free and open burning kind.

Machine mining should be dispensed with and safety lamps used in all gaseous mines. If the intake is large enough in one opening to install two fans, they must be driven by two separate engines; however, a better plan is to have a second opening separate and apart from the first one. An excellent plan is to have four or five openings to one large tract of coal, the entire production going over one tiple. Each opening should be worked separately with no connection to any other opening; a small high-speed fan installed at each drift or slope will insure safety to life and property. In large mines we often find that it would take a man two or

more days of 10 hours each to visit every chamber in the mine.

In shaft or other mines where the conditions are such that only one opening can be made, drill holes not less than 4 in. in diameter and three to the acre, properly cased up would allow the greater portion of the dangerous gases to escape before the coal is removed. This arrangement would certainly lessen the number of fatal accidents.

The dust in coal mines is heavier than air and makes ventilation sluggish in dusty places. In such localities it should be frequently sprinkled down, which operation renders the fine coal harmless so far as the dust itself is concerned.

U. R. SMITH.

Morgantown, W. Va., May 2, 1908.

Exports of Copper from the United States

It has been argued that our extremely large exports of copper could not be continued for any length of time, and it may be worth while to look back at the development of the export movement from this country for a period of 26 years. For the purpose of comparison, the time is divided into four periods which show the development as follows:

PERIOD NO. 1.	
	Tons.
1891	43,500
1892	40,195
Average	41,848
PERIOD NO. 2.	
	Tons.
1893	80,387
1894	77,130
1895	63,935
Average	73,817
PERIOD NO. 3.	
	Tons.
1896	125,605
1897	125,685
1898	131,237
1899	119,810
1900	151,988
1901	92,208
1902	164,451
1903	138,435
Average	131,178
PERIOD NO. 4.	
	Tons.
1904	247,421
1905	230,863
1906	205,460
1907	228,836
Average	230,395

The year 1901 is an exceptional year on account of the peculiar situation of Amalgamated, but on the average of the three years—1900-02—there is not much difference as against the whole period.

It is noteworthy that the increase in exports between periods one and two is about 75 per cent.; between periods two and three about 80 per cent., and between periods three and four about 75 per cent. It is further noteworthy that the larger exports have always commenced in a year of extremely low prices and more or less disturbed conditions in this country, namely, in 1893, 1896 and 1904. It seems, therefore, reasonable to assume that a

similar period of increased exports is now at hand. Our total exports for the seven months beginning Oct. 1, 1907, and ending April 30, 1908, have been 210,000 tons—or at the rate of 360,000 tons for the year. Our total exports for the first four months of this year have been 111,000 tons—or at the rate of 333,000 tons for the whole year. According to the precedent as cited before, a continuance of such large exports seems feasible.

The question of accumulation of large stocks in Europe during periods of large exports has been raised of late also, but the actual figures of controlled stocks in English and French warehouses do not seem to justify the assumption that extremely large exports were always coupled with unreasonably large stocks in European warehouses. For the purpose of comparison, the stocks of copper in English and French warehouses at the end of each year beginning with 1892 are given below and also the stocks on April 30, 1908:

	Tons.
1892	50,745
1893	42,745
1894	50,764
1895	42,917
1896	31,277
1897	27,455
1898	22,346
1899	17,517
1900	24,435
1901	15,701
1902	11,215
1903	5,601
1904	10,009
1905	5,683
1906	9,324
1907	13,060
1908, April 30	18,050

These figures show that stocks of copper in years gone by were much larger in Europe than they are at present, and that the present accumulations are certainly not alarming.

CUPRUM.

Boston, May 21, 1908.

Quantitative Blow-pipe Assay

The letter of S. H. Brockunier in the JOURNAL of May 23, speaking up for the practical value of the quantitative blow-pipe assay, strikes a very true note. Every year about a half dozen students at Lehigh University receive instruction in blowpipe work, and their experience in the field corroborates the statement as to the value of this method in obtaining first approximations to the value of an ore.

It should not be forgotten that the suitability of a method of analysis is very largely determined by the nature of the sample to be tested. In many branches of quantitative chemical analysis, the analytical methods are far more accurate than the average accuracy of the sample to be analyzed. In other words, the difference between two analyses of one sample will be much less, on an average, than the difference between the true value of two samples purporting to represent the same lot of material; or, to be brief, accuracy in sampling lags behind accuracy in analyses. We should always bolster

up the weak spots, and considerably more attention should be given to accuracy in sampling.

This leads us, by parity of reasoning, to claim that the quantitative blowpipe assay has really a much larger field than is usually claimed for it. If a single piece of ore is brought to the laboratory or picked up by a prospector, of what greater use is an analysis of this single piece made in a half day and accurate to 0.2 per cent. of the metal contents, over and above an analysis made in a half hour and accurate to 2 per cent. of the metal contents? The next piece of ore from the same locality may contain 10 or 100 per cent. more metal, or 10 to 100 per cent. less, and it is absolutely a waste of time and effort to make a highly accurate analysis of a piece which does not represent, with somewhat corresponding accuracy, something tangible back of it. On such *occasional* pieces or samples, the blowpipe analysis gives results which are as accurate as it is worth having them; in fact, an analysis of greater accuracy is only likely to lead to fictitious ideas of the value of the material at hand.

Therefore, for occasional pieces of ore, in order to obtain a first approximation to the value of the material at hand, in nine cases out of ten the blowpipe assay is as accurate as can or should be desired. The time consumed in such assays is only a fraction of that ordinarily required; the laboratory can be carried in a cigar box, the consumption of reagents is extremely small, and the engineer is enabled to "travel light and strike quick."

JOSEPH W. RICHARDS.

Metallurgical Department, Lehigh University, May 23, 1908.

Assay of Tin Ore

In the JOURNAL of Feb. 22, 1908, there is a description of a method for the assay of tin ores by George Hohagen. I have been experimenting with tin ores lately, and, therefore, read the article with interest; but I regret to find nothing new in it.

Mr. Hohagen evidently deals with very rich ores; but even with such ores the cyanide fusion pot assay is unreliable; results will vary as much as 2 and 3 per cent. Mr. Hohagen includes under Class 1 ores from mines, and concentrates known as *barrilla*, containing from 50 to 70 per cent. tin. Then in referring to Class 1 for treatment he takes 2 grams, of *barrilla* 5 grams. Should this not be reversed? Otherwise it would appear that the mine ores are 5/2 times as rich as the *barrilla*, which would be impossible.

I should like to ask if Mr. Hohagen knows of a quick, reliable method for treating ores containing under 3 per cent. tin, 60 per cent. silica, 10 per cent. mica and 12 per cent. magnetite, with small quantities of arsenic and antimony. I

have studied the latest methods of L. Parry, C. A. Meiklejohn in the JOURNAL and others. The most satisfactory is that of reducing the tin oxide to metallic tin by means of hydrogen or coal gas. This is, however, tedious and inconvenient for anyone situated in the country.

HERBERT L. JENE.

Sydney, N. S. W., March 23, 1908.

Mining in Australia in 1907

F. S. Mance's statement in the JOURNAL of January 4 under "Mining in Australia in 1907" that: "Two mines which have been important producers are the Mount Mollo and O. K., but the fall in the price of copper compelled the suspension of smelting operations," is only partially true. What he states about the former company is correct; but his remark does not apply to the latter company.

For the six months ending Sept. 30, 1907, the O. K. company smelted 10,661 long tons of ore producing 866.4 long tons of blister copper, the cost being £40 12s. 6d. per long ton at the mine. The output of copper for the six months ending March 31, 1908, should be nearly 700 long tons. The cost of landing blister copper at the nearest seaport (Cairns) is about £5 10s. per ton.

A. P. SELLEY-DAVIDSON.

O. K. Mines, North Queensland, April 6, 1908.

Milling at the Tiro General

In connection with my article on the Charcas plant described in the JOURNAL of April 4, I feel that I should explain further my statement that dry crushing is cheaper than wet crushing, which is contrary to the opinion generally held. However, I think that the common impression that dry crushing is the more expensive comes from the former usual practice of crushing in stamp batteries. Naturally, dry crushing in a stamp battery, with its reduced capacity, is more expensive than wet crushing.

R. C. CANBY.

El Paso, Texas, April 21, 1908.

When treating cyanide solutions, containing copper, antimony, arsenic, mercury, cobalt, nickel, tellurium and selenium, by means of zinc shavings, it is impossible to prevent those metals from precipitating. Apparently the amount of tellurium precipitated on the zinc depends upon whether the telluride ore is roasted or not, and also possibly upon the accelerators added to the cyanide solution. At Kalgoorlie when the ore is roasted and treated with simple cyanide solution, little tellurium is precipitated in the zinc boxes, but when bromo-cyanide is used on raw ores a large quantity of tellurium is precipitated with the gold.

American Museum of Safety Devices

Two gold medals and the diplomas of the American Museum of Safety Devices were awarded at a luncheon meeting at the Engineers' Club, May 25. Charles Kirchhoff, chairman of the committee of direction, presided. Dr. W. H. Tolman, director of the museum, stated that the exposition was a working model for a permanent museum, and that some of the more important exhibits had been donated to it. There are 10 such museums in Europe. To push this work, an educational committee, under the chairmanship of Bishop Potter, has been organized; another valued member is His Eminence, Cardinal Gibbons.

Dr. Tolman announced that the gold medal offered by the *Scientific American* for the most meritorious invention in transportation at the exposition was awarded to the Rich Marine Fire Detecting and Extinguishing System, with an honorable mention to the Welin Quadrant Davit Company, and to the Simmen Automatic Railway Signal Company. The jurors were Prof. F. R. Hutton, chairman, H. H. Westinghouse, Cornelius Vanderbilt, Samuel Sheldon, George Gilmour, John Hays Hammond, and Stuyvesant Fish.

For motor vehicles, either on land or on water, Francis H. Richards, the inventor, offered a gold medal, which was given to the Non-Explosive Safety Naptha Container Company (McNutt patents), with honorable mention to the Rutherford Wheel Company. The jury were Dr. S. S. Wheeler, Casper Whitney and A. G. Batchelder.

The exposition at the rooms of the museum, 231 West Thirty-ninth street, was closed on May 27. It has attracted technical men, railway officials, architects, and industrialists, all of whom have expressed their satisfaction at its high character and the hope that the movement for a permanent museum may be successful.

Leadville, Colo., as a mining district has been remarkable for the variety of its ores, which contributed to the development of a great smelting industry. The ores produced may be roughly classified as lead carbonate, lead sulphide, lead-iron sulphide, pyrites (cupriferous and non-cupriferous), manganiferous limonite, and silicious. All of these are treated by the lead smelters. In general, the ores are more valuable for their silver content than for their gold content but there have been some very rich gold mines, for example the Little Johnny. Manganiferous iron ore, too low in silver to be profitable as flux to the lead smelters, has been shipped in large quantities to iron and steel works. Zinc blende is sold in large amount to zinc smelters. In one or two mines ore has been obtained sufficiently rich in bismuth to make it valuable for that metal.

The Waihi Gold Mine

SPECIAL CORRESPONDENCE

The great New Zealand mine, the Waihi, has issued its report for the year ending Dec. 31, 1907. The gross returns and the dividends paid to shareholders constitute a record for this undertaking. During the year 356,974 short tons were treated, from which gold and silver to the value of £878,485 were recovered. The dividends and bonuses amounted to £396,725, equivalent to 80 per cent. of the par value of the stock. The report of the superintendent closes with the statement that very large bodies of payable ore have been opened up during the year in No. 8 level, which may reasonably be expected to continue in depth and thus enable the present satisfactory position regarding the ore reserves to be maintained. The total amount of ore of average milling value in sight is 1,299,979 short tons. The progress made by this great mine is remarkable. The first dividend was declared in the year 1893, the rate for that year being 15 per cent. In 1895 the rate rose to 40 per cent., in 1903 to 60, while for the year 1907 it is no less than 80 per cent. The average assay value of the ore for the year 1907 was \$13.18 per ton, being \$0.42 less than in 1906. The actual yield in 1907 was \$11.80, or \$0.42 less than in 1906. From these figures it will be seen that the extraction was 89.5 per cent. Working expenses have been reduced. A gas-power plant has been erected and the coal consumption per horse-power has been lowered by about one-half. The cost of working per ton is not shown in the report, but can be calculated from the statement of accounts as follows, on mining; it is given here in American money:

	Amount.	Per Ton.
Stopping and general mining expenses.....	£128,462	\$1.728
Mining development.....	24,581	0.336
Transport of ore 15 miles.....	5,459	0.072
Crushing through rock breakers.....	9,228	0.120
Milling.....	45,861	0.624
Extraction of bullion by cyanide, including acid treatment, assaying and melting.....	86,794	1.152
General expenses, repairs, salaries, office expenses in New Zealand and London.....	57,287	0.768
Total.....	£357,674	\$4.800

There was also expended on capital account £53,299, or \$0.70 per ton, and on depreciation of plant and machinery £35,012, or \$0.45 per ton, both of which amounts were provided for out of revenue.

From an engineering point of view, it is to be regretted that no figures are given as regards the cost of pumping. The quantity of water raised during the year amounted to 507,428,359 gal. in all.

The company has three mills, the Waihi mill of 90 stamps and four tube-mills, the Victoria mill of 200 stamps and five tube-mills, and the Union mill of 40 stamps, or a total of 330 stamps and nine tube-mills.

The average duty per stamp per day during the year was 3,794 tons. The full number of tube-mills was not working throughout the year.

The report gives full particulars of the developments underground. The detail, if anything, is too full, and the information as to the value of the lode in the different levels might well be condensed and printing and paper saved.

The bullion contains a considerable amount of silver, the average gold and silver contents and value per ton of ore being, gold, 11 dwt. 1 grain; silver, 4 oz. 5 dwt. 10 grains. A feature of the accounts is the large amount placed to reserve. The market value of the investments, all in gilt-edged securities, was at the close of the year about £180,000. Altogether the report of the company discloses a very prosperous condition of affairs, and the shareholders are to be congratulated on having a mine which has had such a successful career and which promises so well for the future.

Association of State Geologists

Representatives of 20 of the state geological surveys, meeting in Washington May 13, organized an Association of American State Geologists. Provision was made for an annual meeting and the appointment of various committees for the transaction of the business of the association. H. B. Kümmel of New Jersey was made president, H. F. Bain, of Illinois, secretary, and J. H. Pratt, of North Carolina was appointed to act with them, forming an executive committee. W. B. Clark, of Maryland, I. C. White, of West Virginia and J. H. Pratt were appointed a committee to investigate the distribution of documents by the various surveys. J. M. Clarke, of New York was appointed to represent the State geologists on the general committee on nomenclature now being organized, with Samuel Calvin, of Iowa, and E. A. Smith, of Alabama, as associates. The following resolution was unanimously adopted:

Whereas, our country and the sovereign States composing it now face serious problems relating to the preservation of our national resources, and,

Whereas, these problems—of wisely administering our forests, our minerals, our soils, our water resources—are tomorrow to be the subject of a conference between the governors of the various States and the President of the United States, and,

Whereas, we deem a contour-topographic map of our country so necessary to the intelligent solution of these and equally important problems,

Be It Resolved, that we more earnestly ask of the State and Federal authorities in conference assembled, their support in securing such a map, and, since the State and national interests are here so closely

one, we most respectfully suggest: That State and Federal appropriations for topographic surveys be increased, and that more immediately the Federal appropriation be increased for this work to meet the State appropriations now available.

Be it Resolved Also, that a copy of these resolutions be presented to said conference of the governors with President Roosevelt with our greetings and respect.

International Congress for the Prevention of Accidents

Among the most important congresses to be held this year in Europe is the eighth International Congress for the Prevention of Accidents. Its sessions are held every three years, and are attended by the influential government officials, publicists and social economists, men of affairs and professors. The reports of the Congress are made by eminent specialists, so that the volume of these proceedings is the record of the world's latest and best advance in accident prevention.

Of especial value will be the report of an international committee on the standardization, so to speak, of accidents, their causes, duration, and results, so that a world standard may be agreed upon as the basis for a comparative study.

Membership in this Congress is only \$2, which entitles the subscriber to all the reports and the complete proceedings. The membership fee may be sent to Dr. W. H. Tolman, 231 West Thirty-ninth street, New York, by whom it will be acknowledged and forwarded to Rome.

Amatrice

Amatrice is a precious stone, which is being produced and cut and polished by the Occidental Gem Corporation, of Salt Lake City, Utah. The mine which is the source of the stones is situated in Tooele county, Utah. The commercial name of the stone, amatrice, which is euphonious and prepossessing, is derived from the word American to denote that it is strictly an American stone, and from the word "matrix."

Minerally, the stone is a variety of variscite, which is a hydrous phosphate of aluminum. According to Dana, this mineral species has a hardness of 4, vitreous luster, deep emerald green to bluish green color. The specimens of the stone from Utah, which we have seen have been decidedly harder than stated by Dana, being able to scratch window glass rather easily. In appearance the stone resembles Chinese jade, but it is of a lighter green and is mottled with brown, having a very pleasing appearance. The stone is being cut for use in pins, brooches, and necklaces.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

REDUCTION PROCESS—Art of Reducing Aluminum and Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed Aug. 22, 1904. Serial No. 221,748. (U. S. No. 886,757; May 5, 1908.)

COAL AND COKE

COAL STAMPING—Improvements in Coal-Stamping Machines. Heinrich Berve, Sehnappach, Germany. (Brit. No. 27,305 of 1907.)

COKE—Process of Desulphurizing Coke. Erastus L. Stoner, Scottsdale, Penn. (U. S. No. 887,145; May 12, 1908.)

COKE-OVEN CONSTRUCTION. John W. Cocher, Johnstown, Penn. (U. S. No. 885,468; April 21, 1908.)

COPPER

PURE COPPER—Process for Obtaining Pure Copper. Lucien Jumau, Paris, France. (U. S. No. 885,622; April 21, 1908.)

SMELTING-FURNACE SPOUT. David H. David H. assignor to The Canadian Copper Company, New York, N. Y., a Corporation of Ohio. (U. S. No. 886,286; April 28, 1908.)

GOLD AND SILVER

AMALGAMATING APPARATUS. Fred D. Fenn, Boise, Idaho. (U. S. No. 887,319; May 12, 1908.)

AMALGAMATOR. Frederick B. Sanford, North Yakima, Wash. (U. S. No. 887,699; May 12, 1908.)

FILTER—Automatically-Operated Filter. Oscar H. Fairchild, Denver, Colo., assignor of two-thirds to William Areher Diboll, Denver, Colo. (U. S. No. 884,914; April 14, 1908.)

FILTER. Ernest J. Sweetland, Goldfield, Nev. (U. S. No. 885,398; April 21, 1908.)

ORE TREATMENT—Means for Treating Crushed Ore Previous to Cyaniding or the Like. Henry L. Templer, Cleveland, Transvaal. (U. S. No. 886,892; May 5, 1908.)

SLIMES TREATMENT. Charles E. D. Usher, Johannesburg, Transvaal. (U. S. No. 886,900; May 5, 1908.)

TUBE-MILL LINING—Honeycomb Lining for Tube-Mills and Similar Grinding and Crushing Machines. Hubert P. Barry, Waihi, New Zealand. (U. S. No. 887,575; May 12, 1908.)

IRON AND STEEL

FERRO-ALLOYS—Process of Alloying Tungsten, Molybdenum, etc., with Iron and Steel. Philo Kemery, Pittsburg, Penn. (U. S. No. 887,648; May 12, 1908.)

FERRO-ALLOYS—Process of Producing Low-Carbon Ferro-Alloys. Edgar F. Price, Niagara Falls, N. Y., assignor to Electro Metallurgical Company, Chicago, Ill., a Corporation of West Virginia. (U. S. No. 886,658; May 5, 1908.)

LEAD

SULPHIDE ORE TREATMENT—Process of Recovering Metals from Their Sulphide Ores. Edward F. Kern, Knoxville, Tenn. (U. S. No. 885,761; April 28, 1908.)

MICA

MICA-TRIMMER. Edmund G. Shepherd, Ottawa, Ontario, Canada. (U. S. No. 888,197; May 19, 1908.)

NICKEL

ORE TREATMENT—Process of Recover-

ing Nickel from Silicious Ores. Adolphe Chalais, Philadelphia, Penn. (U. S. No. 887,735; May 12, 1908.)

MINING—GENERAL

HOISTING SYSTEM—Controlling System for Hoists. Barton R. Shower, Chicago, Ill., and Arthur C. Eastwood, Cleveland, Ohio. (U. S. No. 885,961; April 28, 1908.)

TUBBING—Improvements in the Form of Metallic Lining or Tubbing for Mine Shafts. Cuthbert Burnett, Durham, England. (Brit. No. 14,476 of 1907.)

METALLURGY—GENERAL

VENTILATION—System for Ventilation of Mines. William E. Elliott and John G. Wilson, Sharon, Penn. (U. S. No. 888,073; May 19, 1908.)

ELECTROLYTIC PROCESS of Producing Metals. Edgar F. Price and William S. Horry, Niagara Falls, N. Y., assignors, by mesne assignments, to Central Trust Company of New York, trustee, a Corporation of New York. (U. S. No. 886,857; May 5, 1908.)

EXTRACTION—Process for Extracting Metals. Dennis R. Robertson, Denver, Colo. (U. S. No. 886,866; May 5, 1908.)

FURNACE LININGS—Manufacture of Refractory Materials for Furnace Lining, etc., from Natural or Artificial Spinels. Alexandre Alexandrowitsch, Paris. (Brit. No. 2294 of 1907.)

REFRACTORY MATERIAL—Method of Making Refractory Articles. Charles F. Burgess, Madison, Wis. (U. S. No. 884,463; April 14, 1908.)

SMELTER FUMES—Apparatus for Condensing Fumes and Gases. George C. Richards, Berkeley, Cal., assignor to Richards Gas and Fume Condenser Company, Oakland, Cal., a Corporation of California. (U. S. No. 888,119; May 19, 1908.)

SMELTING—Art of Smelting Ore. Alfred Steinbart, Pittsburg, Penn., assignor of one-half to George L. Collard, Clairton, Penn. (U. S. No. 887,974; May 19, 1908.)

SMELTING CONVERTER and Forehearth. Ralph Baggeley, Pittsburg, Penn., Charles M. Allen, Lo Lo, Mont., and Edward W. Lindquist, Chicago, Ill.; said Allen and Lindquist assignors to said Baggeley. (U. S. No. 886,030; April 28, 1908.)

MINING AND METALLURGICAL MACHINERY

BLASTING-TOOL. Lewis K. Kramer, Monte Vista, Colo. (U. S. No. 888,240; May 19, 1908.)

BUCKET DUMPING—Mine-Bucket-Dumping Attachment. Michael M. Callaghan, Columbia, Nev. (U. S. No. 884,363; April 14, 1908.)

BUCKET-LOADER for Wire-Rope Tramways. Frederik B. Whitmore, Alta, Utah. (U. S. No. 885,117; April 21, 1908.)

DREDGE—Mining-Dredge. Thomas P. Rochford, Valdez, Alaska. (U. S. No. 886,728; May 5, 1908.)

DRILL—Hydrocarbon Rock-Drill. John V. Rice, Jr., Bordentown, N. J., assignor of one-eighth to Albert Edward Tower, Poughkeepsie, N. Y., and seven-eighths to Fred E. Tasker, New York, N. Y. (U. S. No. 886,407; May 5, 1908.)

DRILL-STEEL SHARPENER. Joseph Sopp, Georgetown, Colo., assignor of one-fourth to Roy Russell Wheeler, Silver Plume, Colo. (U. S. No. 888,361; May 19, 1908.)

MINER'S CAGE. Heinrich Heiling, Daldorf, near Dillmen, Germany. (U. S. No. 887,193; May 12, 1908.)

MINER'S CANDESTICK. James R. Blake, Bisbee, Ariz. (U. S. No. 884,632; April 14, 1908.)

MINER'S LAMP. Ralph L. Graves, Sumpter, Ore. (U. S. No. 886,204; April 28, 1908.)

MINER'S LAMP. Samuel J. Thompson, Bluefield, W. Va. (U. S. No. 886,441; May 5, 1908.)

ROCK-DRILL. Governor D. Warren, Cripple Creek. (U. S. No. 887,363; May 12, 1908.)

ROCK-DRILLING MACHINE. Henry Hellman and Lewis C. Bayles, Johannesburg, Transvaal. (U. S. No. 887,801; May 19, 1908.)

SAMPLING—Sample-Taking Machine. Abraham Fenstermaker, Colton, Cal. (U. S. No. 887,615; May 12, 1908.)

TUNNELING-MACHINE. William J. Hammond, Jr., Pittsburg, Penn. (U. S. No. 885,044; April 21, 1908.)

ORE DRESSING

CENTRIFUGAL ORE SEPARATOR. Philip F. Peck, Chicago, Ill. (U. S. No. 887,841; May 19, 1908.)

CONCENTRATING APPARATUS. James P. Evans and Randall P. Akins, Denver, Colo., assignors of one-fifth to Isabel Nesmith Evans, Denver, Colo. (U. S. No. 885,692; April 21, 1908.)

CONCENTRATING-TABLE. John D. Kohlmann, Milwaukee, Wis. (U. S. No. 885,349; April 21, 1908.)

CONCENTRATOR—Dry Concentrator. Burroughs C. Gillette, New York, N. Y. (U. S. No. 888,156; May 19, 1908.)

CONCENTRATOR—Submerged Ore-Concentrator. Charles L. Buckingham, Denver, Colo., assignors of one-fifth to Isabel Nesmith Couney, Denver, Colo. (U. S. No. 884,636; April 14, 1908.)

CRUSHING—Improvements in Grinding and Crushing Apparatus, a Number of Small Rollers Being Adopted Instead of Two Large Ones, to Increase the Working Capacity. Anders Johan Ericsson, Stocksund, Sweden. (Brit. No. 28,512 of 1907.)

ORE-CONCENTRATOR. George T. Cooley, Joplin, Mo. (U. S. No. 887,922; May 19, 1908.)

ORE SEPARATOR—Dielectric Separator. Henry M. Sutton, Walter L. Steele, and Edwin G. Steele, Dallas, Tex. (U. S. No. 888,432; May 19, 1908.)

ORE-STAMP. William B. Easton, Chicago, Ill. (U. S. No. 886,686; May 5, 1908.)

ORE-WASHING MACHINE. Hugo H. Meyer, Raelne, Wis. (U. S. No. 887,490; May 12, 1908.)

OXIDIZING—Process of Oxidizing Sulphide Ores. Byron E. Eldred, Bronxville, N. Y., assignor to Combustion Utilities Company, New York, N. Y. (U. S. No. 885,328; April 21, 1908.)

PULVERULENT ORE TREATMENT—Process for the Baling Together of Pulverulent or Dusty Ores. Hugo Dicke, Frankfurt-on-the-Main, Germany, assignor to Jacob Edward Goldschmid, Frankfurt-on-the-Main, Germany. (U. S. No. 886,683; May 5, 1908.)

SEPARATION—Process for Separating the Liquid from the Solid Portions of Treated Ores. Edward P. Lynch, Mill Valley, Cal. (U. S. No. 885,004; April 14, 1908.)

SLIME SEPARATOR—Centrifugal Slime-Separator. John T. Lindahl, Stockholm, Sweden, assignor of one-half to Carl Axel Halling, Stockholm, Sweden. (U. S. No. 884,830; April 14, 1908.)

STAMP-MILL SHAFTING. Frank S. Kirkland, Milwaukee, Wis. (U. S. No. 885,259; April 21, 1908.)

METALLURGICAL MACHINERY AND APPARATUS

ELECTRIC FURNACE. Edgar F. Price, Niagara Falls, N. Y., assignor, by mesne assignments, to Central Trust Company of New York, trustee, a Corporation of New York. (U. S. No. 886,856; May 5, 1908.)

ELECTRIC FURNACE. Edwin Appleby, Chicago, Ill. (U. S. No. 882,733; March 24, 1908.)

ELECTRIC FURNACE. Herman L. Hartenstein, Constantine, Mich., assignor, by mesne assignments to Continental Investment Company, Duluth, Minn., a Corporation of Minnesota. (U. S. No. 883,110; March 24, 1908.)

OIL-BURNING Reverberatory Furnace. George Fraser, Topeka, Kan. (U. S. No. 886,050; April 28, 1908.)

REGENERATIVE FURNACE. Nicholas L. Heinz, La Salle, Ill. (U. S. No. 887,194; May 12, 1908.)

Personal

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

F. R. Weekes has left New York for Florida on professional business.

Arthur W. Jenks is in southern California examining mining properties.

Victor G. Hills, of Cripple Creek, Colo., is in Wickenburg, Arizona, on professional business.

Robert Schorr, of San Francisco, arrived in New York May 21, on his return from an extended trip to Europe.

George Weddell, of Newcastle-on-Tyne, England, is at Pioche, Nev., making an inspection of his extensive mining interests there.

Frank H. Probert, consulting engineer and mining geologist, has removed his offices to 820 Central building, Los Angeles, California.

H. E. Taylor, of Crooksville, O., has been appointed manager of the National and Carbondale mines of the Sunday Creek Coal Company.

James Hoatson, president of the North Butte Copper Company, has returned to his home at Calumet, Mich., after spending the winter in Europe.

C. M. Barnett has been appointed president and general manager of the Chesapeake & Ohio Coal and Coke Company, with office in New York.

General Sir Henry Wilkinson, trustee for the owners of the Black Eagle gold mine, Lake of the Woods district, Ont., has arrived at the property from England.

President Agassiz and Vice-President Livermore of the Calumet & Hecla mine have returned to Boston after a visit of 10 days at the property in Michigan.

Gustavus R. Waeber, chief chemist of the St. Lawrence Pyrites Company, DeKalb Junction, N. Y., has resigned his position and is contemplating a trip to the Cobalt district in Ontario.

John Torrey Fuller, for five years connected with the De Beers Consolidated Mines, Ltd., of Kimberly, in South Africa, is visiting the United States, having been granted a leave of absence.

Major J. D. D. Graham and J. D. Henry, an oil expert, are looking over the Canadian oilfields to ascertain the feasibility of securing from that source a supply of fuel oil for the British Navy.

A. Hamilton, of Hammel & Hamilton, Los Angeles, Cal., sailed for Europe May 23, and will visit London, Berlin and Paris in behalf of the Harris Copper Company, Mexico, for which he is consulting engineer.

H. Lipson Hancock, general superintendent of the Wallaroo & Moonta copper mines in South Australia, and inventor of the Hancock jig, has been visiting the

copper mines of the Lake Superior country.

Floyd Harmon, of Cobalt, Ont., has returned to Toronto, from Rawhide, Nev., where he is connected with the Rawhide Northern Consolidated Mining Company as vice-president. Toronto capital is largely invested in the enterprise.

H. W. DuBois, consulting mining engineer, of Philadelphia, is planning to go upon an extended trip into the interior of British Columbia and the Dawson district of the Yukon territory, where he will be occupied for a number of months.

E. J. Franz, formerly superintendent of the Indian Valley Mining Company, has accepted the appointment of manager of the Indian Valley Consolidated Mines Company to take charge of all the mines controlled by the latter company, with headquarters at Greenville, Plumas county, California.

H. L. Morehouse, formerly a constructing engineer for the American Smelting and Refining Company, has gone to Ponderay, Idaho, where he is preparing plans for the enlargement of the Panhandle smelter. He will have direct charge of the remodeling and enlargement, while C. C. Titus, chosen manager of the plant by the Montana Mineowners' Association, will have charge of the operation of the plant.

Arthur L. Walker, who retired on Jan. 1, 1908, from his connection with the American Smelting and Refining Company as consulting engineer and member of the board of directors, and has since been engaged as general consulting engineer, in New York, has been appointed professor of metallurgy and administrative head of the department of metallurgy at Columbia University. His duties will begin on July 1 and he will take personal direction of the instruction in non-ferrous and electro-metallurgy and metallurgical design. Professor Howe will continue to deliver his lectures on iron and steel as heretofore. Mr. Walker has had an exceptionally valuable practical experience in all branches of metallurgical work and is one of the most distinguished metallurgical engineers of America. Columbia is to be congratulated upon securing his services.

Obituary

Benjamin C. Kingsbury, who died in Spokane, Wash., May 8, aged 73 years, was a pioneer of the Northwest, having gone to Montana in 1860. He was connected with the Anaconda in the early days of the Butte district, and had owned and operated mines in Idaho and Washington also.

Captain William Jones, one of the pioneers of the Lake Superior iron country, died at Iron Mountain, Mich., May 17, aged 75 years. He was employed at

the old Huron copper mine in Houghton county, Mich., more than 40 years ago. Later he was mining captain at the West Vulcan mine of the Penn Iron Mining Company, and more recently was at the Chapin mine.

There died last week in Grass Valley, Cal., a noted character who was widely known in that State for his long and persistent work as a miner under adverse circumstances. He was a pioneer and lost his sight by a blast some 56 years ago. Despite his affliction, Hyman Clendenning continued work as a miner until quite lately, when old age and ill health stopped him. He had a theory about the existence of a rich gravel channel underlying a certain tract of land, and for many years carried on work alone in a tunnel to develop this channel. Quite recently the Jenny Lind Mining Company struck this channel and is finding it extremely rich. While his theory was proven, it was of no benefit to the blind miner, who had been unable to get assistance to carry his tunnel to completion. So persistent was he, however, that he worked alone, as stated, for many years, and did his mining work with skill, notwithstanding his blindness.

Societies and Technical Schools

Lake Superior Mining Institute—The following circular from secretary A. J. Yungbluth is dated Ishpeming, Mich., May 18:

The thirteenth annual meeting, which was postponed last year, will be held on the Minnesota ranges, beginning Wednesday, June 24, and continue to Saturday, June 27. Local committees are now preparing the program and the members are assured an interesting trip over the ranges. The last meeting there was held in August, 1902, and many changes have been made since that time. Members preparing papers to be presented at the meeting are requested to notify the secretary, so that the announcement, by proper title, can be made.

The paper by Dr. B. W. Jones on "Mine Sanitation," read at the Houghton meeting in 1906, proved very interesting, and it is suggested that the matter be further discussed at this meeting. The subject of sampling ore at mines, and upper and lower lake docks is receiving much attention at present, and papers on this subject would be of great interest to the members.

The following is a list of papers already prepared for this meeting:

1. Sampling of Iron Ores, by Prof. L. S. Austin, Houghton, Mich.
2. Biographical Sketches, by J. H. Hearing, Eveleth, Minn.
3. The Standard Boiler House of the Oliver Iron Mining Company, by A. M. Gow, Duluth, Minn.
4. Automatic Throttle Closing Device for Hoisting Machinery, by Spencer S. Rumsey, Duluth, Minn.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Goldfield, Butte, Salt Lake City, San Francisco and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 20—Wm. Nichols, owner of the Polar Star hydraulic mine, Dutch Flat, Placer county, has been sent to jail for five days and fined \$500 for violating an injunction of the Superior Court of Sutter county, restraining him from further operation of his mine. The injunction against running the mine by hydraulic process was obtained through the efforts of the Anti-Débris Association, which also prosecuted him for contempt of court. It was charged that the tailings from the mine were allowed to pass from the dam into the Bear river and thence to the Feather river. Since Mr. Nichols' conviction three miners who assisted in working the Polar Star after it was enjoined, have also had injunctions issued against them. The Polar Star was being worked by Mr. Nichols under a permit and license issued by the California Débris Commission, and behind a dam constructed under their supervision, and it has always been his contention that this license was unassailable. However, the recent Supreme Court decision was to the contrary effect, and this is the first conviction obtained by the Anti Débris Association since that ruling was made.

The mining engineers from Los Angeles who have been testing the sands in the old buried channel in the tule lands southwest of Yuba City, Sutter county, claim to have found gold in parts of it to the amount of 15 to 70c. per cu.yd. This old channel is about 500 ft. wide and underlies the farms near the tule or marsh lands. Several ineffectual attempts have been made to work these sands profitably, and it is now proposed to handle them with a gold dredge.

The only producing chrome mine in California is that owned by Brown & Dougherty, near Castella, Shasta county. It is now shipping chrome ore for furnace linings to copper companies at Campo Seco, Calaveras county and Winthrop, Shasta county.

In the convention of the miner's union at Grass Valley this week the delegates unanimously approved the formation of a State miners union. Delegates from most mining districts in the State were present. All miners unions in the State will now vote on the question. Each member of every local is entitled to a vote; hence the final outcome will be a complete expression of the miners and top hands.

San Diego county mining men are waking up to the idea of advertising the mineral resources of the county. Already

the Escondido Mining Bureau has been organized to exploit the advantages of that particular district. In the same county a mining district has been organized at Ramona with Arthur Stockton as recorder. In the city of San Diego a meeting has been held by about 100 local mining men at which steps were taken to organize a San Diego miner's association for the advancement of the general mining affairs of the county.

A number of capitalists of Santa Cruz are promoting a power scheme which involves the cutting of a nine-mile tunnel in the big bend of the Pit river, where it is expected that 250,000 h.p. may be developed. The Pit is a large mountain stream extending from the upper portion of Modoc county in the Goose Lake region through the corner of Lassen into Shasta county. By many it is considered actually the main Sacramento river, for it is much larger than that stream where the two join and carries a much heavier volume of water at all seasons at the junction of the streams. It is, however, classed as a tributary of the Sacramento river.

M. R. Bacon, of Wyandotte, Michigan, is here to make final payment on the Lappin mine, Deadwood, Trinity county. The Lappin Mining Company has held it under bond for two years and has been meantime developing it.

Eastern men have purchased through Mr. McFarland the Big Four claims in the Hoag district, Modoc county, and extensive work will now begin. W. C. Stanley has also bought or bonded the Sunset claims in the same district.

The American Petroleum Company of Los Angeles has bought 1200 acres of oil land in Coalinga district, Fresno county, for \$2,000,000. This is undeveloped ground in the best portion of the proved Coalinga field. The same company has recently obtained an output of 2000 bbl. daily in the Sherman field near Los Angeles, and has about 5000 acres in Monterey county near King City and San Ardo.

Hart, California

May 18—Hart, the new California mining camp, is situated in the southeastern part of San Bernardino county, about seven miles from the Nevada State line. The camp is but four months old and has a population of 700 or 800, a two-story hotel, good business houses and many other necessities that would do credit to a much older camp.

Few camps equal Hart in surface showings; all along the mineral-bearing dikes one sees prospect holes from 10 to 50 ft. in depth, showing free-milling ore. Bodies of good ore have been found on the following mines and leases: Andrews & Marsh lease on the Piute Belle No. 1; Jumbo; Big Chief; Sloan lease; Pfunder lease; Woodward lease; Providence & Fairview group; Twin Peaks and many others. The Quartette Mining Company, of Searchlight, operating on the Jumbo claim was the first to erect a gasolene hoist and subsequent development has proved so satisfactory that it has purchased the adjoining claim, the Red Boy, for a consideration of \$60,000.

Foster Brothers, Hart & Hitt have installed a little giant mill having a capacity of 10 tons per day and are making tests on ores from the different properties, preparatory to erecting a large reduction plant. The Garavanza Mining and Milling Company is contemplating the erection of a large custom mill. The Sloan lease on the Jumbo claim will soon erect a gasolene hoist.

One of the most noticeable matters at Hart is the total absence of the rougher and gambling element and the fake or wildcat promoter. They are not tolerated and when one arrives in camp he is advised by the business league to take the next stage, in language that he does not hesitate to heed.

Goldfield, Nevada

May 19—The suit filed against the Mohawk Combination Leasing Company by the Goldfield Consolidated has been argued before the arbitrators this week and a decision and finding by them is eagerly awaited. The leasing company owned the leases known as the Kalfus and the Sheets-Ish which were on the Mohawk and Combination claims, and having broken through into each other's ground were consolidated after considerable managing in order to prevent further litigation. Four days before the lease expired the Consolidated claimed a breach of contract and refused to allow the leasers to enter the premises. The company then brought suit for \$50,000, on the ground that the leasers had blasted out the supporting pillars in the stope without putting in cribs called for by the contract, thus causing a big cave-in of the workings.

The leasers claim that the accident was caused by the working being undermined by the Begole lease and by the seepage of water from the Combination mill which

is near-by. In the north drift of the Kal-fus lease fully 250 ft. from the caved stope 50 men were at work at the time the lease was declared forfeited on ore which the arbitrators have had sampled and assayed with returns of 157 oz. gold per ton. The width of the orebody is not made public but is known to be in the neighborhood of 2 ft. The leasers claim that in the four remaining days of their lease they could have extracted more than enough money to pay the claims against them.

Judge Langan has appointed a receiver for the State Bank and Trust Company stating that he did not believe the bank to be insolvent, despite the fact that it has been closed since October 23 last, but that it does not appear to him safe to continue its business. During the brief proceedings of the day it developed that the bank had \$71,307 on hand in cash on March 21 and on April 24 only 30 days later it had only \$59,399. The bank's suspension involved liabilities of about a half million and is bringing at least a half dozen prominent men uncomfortably close to the penitentiary. It is not likely that more than 50 per cent will be recovered by the depositors.

Three of Goldfield's best prospects are likely to be consolidated under the new name of the C. O. D. Consolidated Mines Company with a capital of \$3,000,000. The properties involved are the C. O. D., Gold Bar, Victor and Victor Fraction. The purpose of the consolidation is to avoid impending apex suits. The new company will own 90 acres of undeveloped ground in the camp.

Salt Lake City

May 22—Articles of incorporation of the Independent Smelting Company have been filed. The organization has secured a lease, with option to purchase, of the plant of the Utah Smelting Company, near Ogden, and will operate it as an independent custom plant. The present furnace capacity is 250 tons of ore and fluxes per day, but the new management proposes to increase it. The ore treated is reduced to a matte, but plans are being made to add converter equipment. The president of the new organization is M. S. Browning, of Ogden, Utah; the manager, J. B. Jenson, of Salt Lake. The smelter was operated last year several months by the owners; the venture proved a failure from a financial standpoint, but a success metallurgically.

Owing to inclement weather, work of construction on the converter department of the Yampa smelter, in Bingham cañon, has progressed slowly and it will probably be July before the plant is ready for operation. The smelter is now treating 900 tons of ore per day, 300 tons of which comes from mines not owned by the company. The principal custom shipper is the United States Smelting, Refining and Mining Company, which supplies the

product from the Centennial Eureka mine, in Tintic.

The lead smelter of the United States Smelting, Refining and Mining Company, at Bingham Junction, will be ready to resume operation in about 30 days. Under the provisions of the modified decree granted by the Federal court, treatment will be limited to 700 tons per day.

Samuel Newhouse has recently become extensively interested in the Ohio-Kentucky and Prince Consolidated mines, at Pioche, Nev., and has made the announcement that steps will be taken toward the erection of a smelter at Bullionville, near Pioche. The initial unit, it is said, will have capacity for the treatment of at least 500 tons of lead-silver ores daily. While the plant is intended principally to supply treatment facilities for the mines stated, it will be open to custom work. There is a great deal of activity in Pioche at this time, and recent strikes there have demonstrated that the mineralized area of the district is much larger than many have heretofore regarded it.

Butte

May 24—During the past week work was resumed on the Neversweat and the West Grayrock mines. This leaves the Cora, of the Red Metal Mining Company, the only big copper mine in the camp which is still closed. The ore of the Cora, while running higher in silver than the majority of the hill mines, carries barely 3 per cent. copper, and it is not expected that the mine will be reopened until the price of the metal increases materially. General confidence is being restored among mining men in the district, and the amount of exploration work done in the outlying territory has shown marked increase in the past month. It is generally conceded that the Amalgamated properties are producing copper at a lower cost than for many years past, and according to those well versed in the costs of copper production it is not believed to exceed 10c. per lb. throughout the Butte district.

London

May 15—The Ore Concentration Company, which owns the Elmore vacuum process, held its general meeting the other day and it was reported that good business was being done. Orders have been received for 99 units. Some of these are in course of construction, some in course of erection and others are in regular work on a variety of ores in widely separated parts of the world. It was stated that two plants in different parts of the United States were about to come into operation, but the exact situations were not given.

The largest plant appears to have been erected at the Zinc Corporation's property at Broken Hill, Australia. At the present time about 3000 tons of ore, producing 1000 tons of concentrates, are being put through per week with successful results.

Many processes have been tried at Broken Hill to treat the large accumulation of zinc tailings, but so far without satisfactory results, and the success of the Elmore vacuum plant is on this account the more praiseworthy. Other installations referred to in the report are at the Cape Copper Works and at the Sulitelma mine in Norway. The work done so far with this process has been largely of an experimental character, but the results obtained indicate that it has a wide field for application.

The gloomy view that some South Africans take as regards the prospects of doing profitable business in the Transvaal is reflected in the decision of the directors of the Transvaal Goldfields, Limited, to go into liquidation. The company is one of the smaller groups or financial houses, owning claims, shares, options and mining property, for which at the present time there is no demand. Speculation is for the moment dead, and consequently a company such as this finds it hard to make profits for its shareholders, when the public will not come forward to buy its wares. An expensive staff has to be retained to investigate and select promising properties and with no business doing, the working capital disappears very rapidly. The policy pursued by the directors is certainly not a courageous one, although events may prove that it is a wise one. The acquisition of new properties might well be postponed for the time and during the interval establishment charges might no doubt be reduced to a small figure. The business is a legitimate one, and in good times the shareholders should do well, if their properties have been wisely selected. The mines of the Rand are at the present time doing as well as they have ever done and are making, in many cases, profits suitable for this class of business. With a return of public confidence there must be opportunities for profitable business in organizing new mines or in reconstructing old companies whose working capital is exhausted, and it seems, therefore, that the directors are acting too precipitately in liquidating at the present time, when values are low and when they must be throwing away to some extent the assets that the company possesses. It is a common thing to read in a report of a Rand mining company that the working capital is exhausted and that the mine is to be shut down until the financial situation improves. Surely if this is the case a company like the Transvaal Goldfields ought to be able to do business on favorable terms and must have plenty of opportunities of employing profitably the funds that it now proposes to distribute to its shareholders. If the finance companies, which have knowledge of what is good and what is bad on the Rand, will not employ their capital in bringing new mines to the producing stage, it is unreasonable to expect the public to open its purse.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY—BISBEE

Copper Queen—The Uncle Sam shaft is over 500 ft. deep. The Lowell shaft is down about 1400 ft. The last haulage drift to the Sacramento, on the 1200 level, is within 100 ft. of being connected. A new pump station on the 500 Holbrook is completed and also a new pump station on the 400 Czar. The grade of ore is at present well above what it was when copper was high. The grade of ore mined and shipped is governed on a minimum percentage basis. The lowest grade ore that will pay to mine under the governing conditions for each stope is carefully figured in the office, and the mine foreman runs in only ore of that percentage or above. Dr. James Douglas has been here during the week, going underground and looking over the surface work.

Calumet & Arizona—The copper output at the smelter in Douglas will run about 4,000,000 lb., a little under last month's production.

Superior & Pittsburg—A discovery of importance has been made during the week on the 1300 Hoatson. A body of sulphide ore, averaging about 7 per cent. copper, was encountered in a drift, which parallels the north end of the Del Norte claim. The drift has passed through 35 ft. of solid ore, and the face is still in ore. Several other drifts on the 1300 level, both of the Hoatson and Junction mines have cut stringers of sulphide. Most attention is being paid to straight ore production, keeping the grade of the ore as high as possible while maintaining the required tonnage.

Wolverine & Arizona—This company is working only five men, drifting on the Warren claim which adjoins the Queen and Shattuck properties.

SANTA CRUZ COUNTY

Leek-McDonald—At this mine, in the Tyndall district, drifts have been driven east and west along the vein for a distance of about 200 ft., and crosscutting will now be commenced to ascertain the width of the vein at that depth. The ore is a high-grade sulphide copper ore. California people are negotiating for the purchase of the mine.

Gringo—The mill at this gold mine in the Tyndall district has been started to work and ore is being stoped out of a high-grade shoot recently opened.

National Consolidated Mining Company—A hoist is being put in place at the shaft

in the Patagonia mountains. The shaft is down 175 ft., and will be sunk to 200-ft. level when the hoist is in place. Shipping ore is being taken out from the 100-ft. level.

Morning Glory—The shaft at this mine, in the Harshaw district, is down 100 ft. It shows a vein of copper ore 6 ft. wide. The ore is clean from wall to wall. A deal is pending for the sale of the property to Boston people.

Bland—A 400-ft. adit at this mine, in the Tyndall district, shows a vein of copper-sulphide ore $4\frac{1}{2}$ ft. wide.

Four Metals—A 650-ft. adit is being driven into the hill to cut the vein at this mine, in the Patagonia mountains. The tunnel is in 400 ft., and when completed, will cut the vein at a depth of 600 ft. A number of new buildings are being erected at the mine.

California

AMADOR COUNTY

Amoskeag—A new mill is being built on this mine near the Banner, five miles from Oroville.

Hidden Treasure—A half interest in this quartz mine near Forbestown has been purchased by J. F. Crabtree, of Nevada.

CALAVERAS COUNTY

Crown Point—At this mine, near Railroad Flat, James Ham owner, good rock is being mined, and is being crushed in the four-stamp mill.

EL DORADO COUNTY

Gilbert—At this mine, Greenwood, Perin Lee, manager, a 10-stamp mill is being erected.

FRESNO COUNTY

Gypsum—A. P. Shepherd has sold his gypsum mine near Mendota to San Francisco men, and has been engaged to install machinery for developing it.

INYO COUNTY

A very rich strike has been made in the claim of N. J. Robinson and A. W. Wells four miles from Beveridge, near the summit of the Inyo mountains, between Owens and Saline valley and numbers of prospectors have gone to the locality.

Four Metals Mining Company—The San José Company has installed new boilers and air compressors at its mines at

Cerro Cordo, and has surveyed the route for a new tramway.

KERN COUNTY

Comet—This property on Greenhorn mountain, Frank Robinson, superintendent, is about to recommence operations after a shutdown of a few months.

MOJAVE COUNTY

Sunset—This mine, in Hoag district, has been bonded to W. C. Stanley for a stated price of \$30,000. Some other deals of a similar character are pending.

NEVADA COUNTY

Arctic Group—These mines on Cañon creek, seven miles northeast of Washington, have been sold to R. B. Day and associates. New machinery is to be purchased to develop the properties.

Champion Mines Company—The Delhi mine of this company has declared a dividend of 5 per cent., after assessments have been levied for six years. A new orebody has been found below the drain tunnel.

Red Ledge—At this mine, near Washington, owned by the Williamson Brothers and H. Cole, high-grade free-gold ore is being extracted, the find being in virgin ground close to the surface.

PLACER COUNTY

Southern Cross—This mine, six miles from Colfax, is to resume operations under supervision of Wm. Abbott, of Nevada City.

PLUMAS COUNTY

Plumas-Mohawk—Work has commenced for the season at this property at Johnsville, where, last year four 10-ft. Huntington mills were installed.

Long Valley Mines Company—This company has been organized to take over the Hope or Haffner mines, and preparations are being made to put up a mill.

SHASTA COUNTY

French Gulch—In this district, at the Gladstone mine owned by the Hazel Creek Mining Company, J. O. Jillson, superintendent, 100 miners are now at work. The Brunswick is employing 20 men and the 10-stamp mill is busy. Mr. Leland having given up the bond on the Washington, the owners will now push development work themselves.

SAN BERNARDINO COUNTY

Oro No. 1—In the Pfunder lease of Block No. 2 in this mine at Hart, a strike has been made which is considered the

most important in the brief history of the camp. The orebody is wide and of high grade. Leasers and owners are prosecuting work at Hart with vigor.

Cat's Claw—In this mine in the Whipple mountains, owned by A. J. Richardson, of Los Angeles, there is a wide vein, and a large amount of ore in sight.

SIERRA COUNTY

Colorado and Yellow Jacket—These claims at Alleghany have been bonded by F. J. Hauber and C. C. Creary, of Deadwood, S. D. The ledges are strong ones, and have yielded excellent ore in the past.

SISKIYOU COUNTY

Welsh & Sons, at Grouse Creek, have started their hydraulic elevator and three giants, warmer weather having given them a better water supply.

Oregon Gold Mining and Water Power Company—Owing to the death of Chas. Coster, of New York, principal owner in this enterprise at Happy Camp, the hydraulic mines have been closed down for the present.

TRINITY COUNTY

Nash—This gravel mine at Coffee, has been leased to Furnace & Quinn, of San Francisco.

Golden Jubilee—Thirty men are at work in this mine at Coffee, and the new mill will shortly be completed.

Laws and Murphy—This hydraulic property at Junction City, under bond to J. McGillivray, has been fitted up and a short run will be made this season.

Fairview—Superintendent C. Dobler will at once put the mill of this mine, at Minersville, in shape as plenty of ore is now in sight.

Colorado

LAKE COUNTY—LEADVILLE

Dinero Tunnel—The breast of this adit, Sugar Loaf, is now in 2300 ft., and will require another 750 ft. before it cuts the Dinero veins. During the driving 12 veins have been encountered, but no work has been done on any of them.

Sunday Tunnel—M. A. Nicholson and associates, who have a lease on the Sunday mine, Bald Mountain, have secured the right of way to drive an adit from the head of California gulch into the Sunday vein, a distance of 2000 ft. The old Garibaldi tunnel will be used. At present a force of men is engaged in cleaning it out. When the tunnel cuts the Sunday vein it will be at a depth of about 800 ft. from the surface.

Arkansas Valley Smelter—During the week, Franklin Guiterman, general manager, and Edgar L. Newhouse, vice-president, of the American Smelting and Refining Company, visited this plant. At the

beginning of the week another furnace was blown in, making six now running.

Triumph—This property, Breece hill, was started at the beginning of the week by Lou. R. Johnston. It will be worked from the Yak tunnel, a drift having been run on the vein, which is close to Little Jonny No. 4 shaft. At present the vein is about 2 in. wide at the breast, carrying gold.

Fairview—Work was resumed on this property, Poverty Flat, recently, the lessees carrying on operations from the old shaft. A large body of iron has been opened and the ore will be shipped to the Salida smelter.

Placer Mining—With the opening of the season a number of placer mines in the vicinity have resumed operations, among them being the Twin Lakes and several claims in California gulch. Thomas Starr has started work in lower California gulch, opposite the old Union smelter, and the dirt gives good returns.

International—This property, Robinson, is now shipping 100 tons daily of a good grade of lead-sulphide ore to the Arkansas Valley plant and the smelter at Salida.

Belvidere—At this mine in Horseshoe district, a contract has been let to drive a tunnel 500 ft., the work to be started at once. The tunnel will cut a number of claims that have produced an excellent tonnage from the surface workings.

Louise—At this mine, South Evans gulch, the lessees have decided to sink the shaft another 100 ft., which will make it 400 ft. deep. When this point is reached drifting will be started in different directions to catch the orebody west of the Bald Mountain fault.

Berdella-St. Kevin Tunnel—The preliminary surface work has been completed and the work of driving the tunnel has begun; the tunnel is now in 100 ft.; the solid formation has been caught and the work of driving will proceed more rapidly from now on.

Yak Tunnel—The breast of this tunnel is now well into the workings of the Ollie Reed, South Evans, and is being driven ahead at the rate of 300 ft. per month.

LAS ANIMAS COUNTY

It is stated that an option on a tract of 12,000 acres of coal land near Stone-wall has been taken by William A. Clark, of Montana. Work will be begun at once opening a mine, and a railroad will be built to connect with the Colorado & Wyoming road. The coal is said to be a good coking coal, and Senator Clark's object in the purchase is to supply coal and coke for the United Verde Copper Company's mines and smelter.

SAN JUAN COUNTY

Henrietta—Operations are to be resumed in this mine at Silverton, under charge of E. C. Drew, who represents the

stockholders and creditors. A 100-ton mill is to be put up by the Colorado Iron Works Company. The mine and tramway have been inspected and found to be in good condition.

SAN MIGUEL COUNTY

The Tomboy, of the Exploration Company, the Smuggler-Union and the Liberty Bell, the three leading producers of the district, are running full capacity, and producing the usual amount of gold bullion and smelting product.

TELLER COUNTY—CRIPPLE CREEK

The activity and tonnage of the Cripple Creek camp continues to increase. The drainage tunnel is now in about 2350 ft., and the intermediate shaft down about 250 ft. On May 13, at a point 2435 ft. from the portal, the tunnel encountered a flow of water estimated at 1000 gal. per minute. It is not thought likely, however, that this is from the main water course, as the breast is still 12,000 ft. from the known contact between the granite and breccia area.

Elkton Consolidated—This company's latest dividend of \$37,500 brings the total to \$2,079,640 paid to date.

Idaho

BLAINE COUNTY

Idaho Consolidated—The hydroelectric power plant of 800 h.p. will go into commission about June 1. This company is also erecting a 225-ton concentrating plant which will start soon after the power plant is in operation. The mill consists of two units, a dry and a wet. The dry contains the Sutton, Steele & Steele dry tables, while the wet is the Wilfley tables with Callow screens and tanks. The company's headquarters are at New Castle, Penn. J. P. H. Cunningham, of Pittsburgh, is president, and Irvin E. Rockwell, manager.

Croesus—Electric equipment has been installed throughout, power being furnished by the Hailey plant. A 200-ton concentrator, now under construction, will go into operation shortly.

Independence—The 400-h.p. hydroelectric plant is nearing completion, and ground has been broken for the new concentrator of 120-ton capacity, which it is expected will be in operation by fall.

Indiana

MORGAN COUNTY

W. S. Blatchley, State geologist, has been called to investigate newly discovered coal beds in this county. It is reported that capitalists have already made plans to invest heavily. Mr. Blatchley is of the opinion that there are no coal deposits in the county, and until he can make the proper investigations, advises investors to be certain before going too far in their preparation for opening mines. "Black

or Devonian shale," said Mr. Blatchley, "is what I expect to find. It bears a strong resemblance to coal and contains sufficient gas to burn a short time. But it is not coal, and this is what capitalists will find out. However, if it turns out to be coal, as many believe, I shall rejoice."

Illinois

PEORIA COUNTY

Paradise Coal Mine—Sholl Brothers, who have owned and worked this mine at Bartonville for some time, have sold it to the Clark Coal and Coke Company, of Peoria. The price is said to have been \$150,000. The new owner will introduce electrical haulage and other improvements.

Kentucky

HOPKINS COUNTY

Kingston & Wolf Coal Company—This company has begun shipments from its new coal mine at Morton's Gap.

Michigan

BARAGA COUNTY

Detroit Graphite Company—The graphite mine controlled by this company, situated a few miles south of L'Anse, Mich., is to be opened as soon as weather conditions will permit. It is planned to take out about 1000 tons of ore during the season.

COPPER

Superior—Crosscutting is under way at the ninth level to intersect the lode. Drifts extended from the sixth, seventh and eighth levels continue in good copper-bearing rock and fine stoping ground is being blocked out. Development throughout has been entirely satisfactory, and the property will soon be on a producing basis. A survey has been completed from the shaft site to the Atlantic railroad. In all probability one or two heads of the Atlantic mill will be secured to stamp the rock, and shipments to the mill should begin soon.

Mass—Diamond drilling is still being carried on at this property, and a cross-section has been completed showing several promising formations. The more favorable are to receive special attention in the hopes of encountering the same formation that is disclosed at the Lake property.

Ojibway—The crosscut from the 350-ft. level of No. 2 shaft has not yet encountered the working lode; the character of the formation has changed and streaks of copper are appearing, indicative of the close proximity of the lode. The calculated distance from the shaft to the lode was at first given as approximately 70 ft., but it is now figured that it will be necessary to drive the crosscut about 100 ft. At No. 1 shaft the concrete collar is being

put in and a sump is being sunk at a depth of 135 ft. from surface. This will facilitate handling the water, which caused some delay in sinking during the spring break-up. Considerable grading, road building and laying of water mains has been done on the surface.

Arcadian—Work has been temporarily suspended at this property and the exploratory shaft has been allowed to fill with water. A reorganization of the company will probably be effected soon, and ways and means will be provided to carry on further development. The Arcadian tract comprises 3200 acres of land well situated in the mineral zone, and developments at the adjacent properties tend to strengthen the prospective possibilities of this property.

Quincy—Work has begun on the foundation for the new structural-steel shaft house, which is to be erected on the site of No. 2 shaft. During the course of construction, rock coming from this territory will be hoisted through No. 4 shaft, and little decrease in production should ensue.

Cliff—Exploratory work is being carried on at this property under the Tamarack management. Small shipments are being made to the mill, and the copper content of the rock is encouraging. The openings are being extended on an amygdaloid formation.

Atlantic—Development at section 16 is encouraging. At the 12th level the crosscut south encountered the lode at a distance of 200 ft. from the shaft. The lode at this point was 32 ft. wide. Drifting is being carried on at that point, and a good grade of copper rock is found. Crosscutting from the north drift at this level, 400 ft. from the shaft, is being carried on. The shaft is bottomed below the 16th level, with vein rock showing at that level.

Keweenaw—A plat has been cut at the 13th level preparatory to drifting. Two drills are sinking and 10 are extending openings. A temporary shaft house is being erected and will be ready to handle rock for the mill test which is to be run early in July. The mill is practically ready to run, the only drawback being the water supply. This difficulty will be easily solved by building the third dam across Eagle river.

Lake—The Copper Range railroad is building a spur into the shaft-site of the Lake property. This will facilitate handling supplies and will give the property an opportunity to make a mill test at an early date. The formation continues unchanged, and it is estimated that enough copper is being taken out to pay the cost of sinking the shaft.

Ojibway—The crosscut from the 350-ft. level of No. 2 shaft has passed through the Kearsarge lode; at the point of intersection it is 14 ft. wide and is well mineralized throughout, making good the

showing of the diamond-drill cores. Drifting has started east and west on the vein.

IRON

Oliver Iron Mining Company—This company has begun shipments of iron ore from its mines on the Gogebic range. On the Vermillion and Mesabi ranges curtailment of working forces has been general.

Saginaw—This mine, at Norway, on the Menominee range, has been partially shut down to repair the shaft.

Cleveland-Cliffs Iron Company—Work has been started on one of the two mines operated by this company in the Swanzy district. The first shaft will be sunk on land leased from the Chicago & Northwestern railroad, and the mine will be known as the "Northwestern." It is believed that the ledge is about 150 ft. from the surface. Both shafts will be concrete, and will be sunk by the Foundation Company, of New York, which company recently completed the Smith shaft of the Cleveland-Cliffs company.

Montana

BUTTE DISTRICT

Anaconda—The Neversweat mine resumed operations on May 18, after a period of idleness lasting seven months. Between 300 and 400 men will be employed. This was the last of the Amalgamated mines to open, the others having been in operation some three months. The Neversweat was closed down last fall on account of an accident to the hoisting engine, which is of the marine type and one of the largest in the camp.

Butte & Boston—The West Gray Rock, one of the smaller mines, is expected to start up this week, having been shut down for several months while new ore bins were being put in and an electric hoist installed. The property adjoins the East Gray Rock mine of the same company. The action of the new hoist will be watched with interest by mining men in Butte.

East Butte—This company expects to resume operations shortly. In a statement given out by the management it is said that the company has been newly financed and has now a large amount of capital at its command. The first work to be done will be to sink the shaft, now down 900 ft., to the 2000, cutting stations every 200 ft. The property is in good condition for the resumption of work, there being a well equipped surface plant on the property.

Tuolumne—Exploration work is being carried on steadily on the 1000 level. The vein has been drifted upon to the east a distance of 500 ft. from the crosscut; this will be continued until the east end line of the property has been reached, which will mean about 200 ft. further. With the exception of the remaining 200 ft., the 1000 level has been thoroughly explored,

and the entire vein shown to carry low-grade copper ore. The lead is 27 ft. in width at the point where it is intersected by the crosscut. The management states that sinking will be resumed about July 1, and the shaft will be sunk to the 1600. It is now down 1050 feet.

Butte & Buxton—This copper development company, organized last week, owns 13 full claims, situated about 10 miles southwest of Butte on the Oregon Short-line Railway. The claims are located in a district as yet comparatively undeveloped and almost wholly unexplored for copper, but known to contain gold and silver ores at shallow depth.

JEFFERSON COUNTY

Ruby Mine—This gold and silver property is owned by Patrick Dowling who obtained possession of it a little over a year ago. Mr. Dowling took a lease and bond on the claim, and within a short time after taking possession struck an ore shoot, which proved to be about 160 ft. long and from 10 in. to 3 ft. in width. Within eight months enough ore has been taken from the mine to pay the \$75,000 necessary to take up the option. The old mill which has been on the ground for a number of years is being remodeled and a new cyanide plant is being erected for the treatment of the low-grade ores, the high-grade being shipped direct to the smelters.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—The output for the week ending May 19 was as follows: To the Nevada Goldfield Reduction Works: Jumbo, 30 tons; Mushett, lease, 44 tons; Combination Fraction, 40 tons; Daisy, 20 tons. To the Western Ore Purchasing Company: Florence Gem, 39 tons; Rogers Syndicate, 441 tons; Mushett Lease, 46 tons; Ish-Hayes lease, 30 tons; Waterman's Sandstorm lease, 17 tons; Van Riper, Mohawk lease, 51 tons; Wingfield dump on the Florence, 379 tons; a total of 2072 tons, gross value of \$143,280.

California Nevada Power—This company will soon have an additional 8000 h.p. ready for distribution from the generating plant at Bishop, California. The plant represents an investment of about \$3,000,000.

Kendall—The Garrett lease has been sold to Vahrenkamp & Dorsey, and the shipments to the Bonnie Claire mill are expected to amount to 50 tons per day by the end of the week. A rate of \$1 per ton for the 35-mile railroad haul, and 75c. for the wagon haul has been secured, and it is estimated that the ore can be milled for \$4.

Mohawk—The crosscut east on the 600-ft. level is being vigorously pushed. A vein 19 ft. wide, averaging \$60, has been cut by this crosscut, which is now beyond the vein running for others known to lie farther east.

Rogers Syndicate—The lease on the Florence property has declared a dividend of \$35,000, making a total of \$125,000 paid in three months. On the 500-ft. level the ore did not keep up to the grade shipped from the levels above, but a raise from the 500 to the 400 encountered the high-grade shoot and if present averages are maintained another half million dollars will be taken out before the lease expires, July 11. The production for three days, May 10, 11 and 12, is given out as 149 tons, of a gross value of \$43,182. Half of this lease is owned by the Goldfield Syndicate Mining Company, Milwaukee and Chicago interests, who furnished funds to continue work after L. H. Rogers and associates, who own the other half of the lease, had exhausted their resources; \$55,000 was expended on this lease before pay ore was found.

Pittsburg Silver Peak—The company will add another 50 stamps to its present 100-stamp mill. The ore reserves in the mine and its prospects and the excellent work of the new mill seem to justify this addition.

NYE COUNTY—TONOPAH

Shipments—The ore shipments over the Tonopah & Goldfield Railroad for the week ending May 16 to the Western Ore Purchasing Company, consisted of 120 tons from the Tonopah Extension. The Tonopah company sent 3300 tons, the Belmont company 650 tons, the Montana-Tonopah 1100 tons, the Jim Butler, 200 tons, the Midway 100 tons, and the Mac-Namara 100 tons to the mills, making the total shipments for the week 5570 tons, valued at \$116,200.

Montana-Tonopah—The mill treated 1100 tons of ore during the week ending May 19, the extraction being 92.76 per cent. In the mine the new oxidized orebody has been followed in a winze for about 25 ft., the ledge showing as strong and as rich as when first encountered.

Midway—The raise started on the big ledge on the 835-ft. level last week struck quartz assaying \$30 per ton. Work has been suspended in the north crosscut from the bottom of the 200-ft. winze, pending more important work elsewhere.

NYE COUNTY—PHONOLITE

Mohawk Duluth—This company has sunk to a depth of 320 ft. on a contact. The ledge which shows an average width of over 2 ft., is a telluride ore. About 500 ft. of drifting has been done.

Pay Master—This mine is on the same ledge and contact as the Mohawk-Duluth. An adit has been driven for 600 ft. on the course of the ledge, and winzes have uncovered a shoot of good ore. The average distance between walls is a little more than 4 ft. The 6 in. of ore next the foot-wall is very rich, while the remainder of the ledge is also of sufficient value to sack and ship. Eight other ledges have been uncovered.

WHITE PINE COUNTY

Giroux—The Alpha shaft is now entirely cleared out and everything is being put in readiness to sink and crosscut the orebodies from the 1100-ft. level. An air compressor, capable of operating 24 drills, has been installed, and the pumps are again at work. The company anticipates a large flow of water as the shaft increases in depth, and hopes to be able shortly to run the concentrating mill at full capacity. Large tanks have been installed at the mill to conserve the water, and everything is being put in readiness to permit of early operation. It is expected that a direct smelting product will be obtained from the Alpha shaft with another 100 ft. in depth.

New Mexico

SOCCORO COUNTY

Enterprise Mining Company—This company, in the Mogollon district has completed the enlargement of its mill and is now running a full force of men.

Cooney—The last work at this mine owned by the Mogollon Gold and Copper Company has proved very satisfactory. Drifting on the seventh level has opened up ore both ways.

Top Mining Company—This company is pushing development work in both directions from the shaft. The ore is about 15 ft. wide between walls and of a mill grade.

North Carolina

BUNCOMBE COUNTY

Hafford & Co. are operating a gold mine at Rough Ridge, near Asheville, and a good orebody is said to have been opened. John Hensley is in charge as superintendent.

DAVIE COUNTY

Gray Gold Mine—This mine, near Statesville, has been leased to parties from the North. It is said that they are preparing to develop the mine and put in machinery.

MCDOWELL COUNTY

Southern Graphite Company—This company's property has been put in charge of F. W. Thomas, of Asheville, as referee in bankruptcy.

Oklahoma

OTTAWA COUNTY

New State—This mine made a strike of ore while driving an air-drift at a higher level than that on which the ore was supposed to be. This company is one of the new producers at Miami.

Oregon

DOUGLAS COUNTY

Mayflower—Development work has been pushed at this mine. A. W. Ziniker is in charge of the work. It is owned by residents of Kelso, Washington.

Oregon-Colorado—Ore is to be shipped from this mine as soon as the snow will permit teams to pass over the Calapooja range. F. J. Hard is manager. The ore carries copper and some gold.

Pittsburg—Development work has been started, and a road is being built to the mine. W. H. Shane is manager.

LANE COUNTY

Black Butte—Sufficient ore has been opened in this quicksilver property to warrant the starting of a furnace, which is now running. The capacity is 50 tons per day.

Combination—Sufficient ore has been developed to warrant the erection of a mill, at this mine near Mineral. R. H. Clark, one of the owners, is in charge.

Crystal—Vanadium ore has been found in one of the tunnels of this mine at Bohemia.

Grizzly—Galena has been found in the tunnel now being run on this property.

Lucky Boy—A receiver has been appointed for this company, which has been embarrassed by a number of small suits. The total debt is about \$250,000, most of which is secured by a mortgage on the property, which covers about 300 acres of minerals, near Blue River. The stockholders are chiefly residents of Portland, Oregon, the principal owners being J. H. Courtney, P. Grant, C. Longsteke, F. Sharkey, L. Sullivan and L. Zimmerman. Grant Phegley, of Portland, is receiver, and has taken steps to care for the mine.

Twin Rocks—The adit on this property is now 300 ft. in.

Utopian—A quantity of ore is ready to be shipped, as soon as a wagon road is finished to the Vesuvius mill, four miles.

Vesuvius—The mill is to be started soon. Concentrates will be shipped to the Tacoma smelter. F. J. Hard is manager.

Pennsylvania

BITUMINOUS COAL

Berwind-White Coal Mining Company—Wide interest is being manifested locally in the activity of a number of farmers, who appear to believe that this company, after buying the B seam of coal, has, as a matter of fact, in many instances actually operated the C or cement seam. John Fulton, the mining geologist, of Johnstown, Penn., and C. P. Collins, a well-known Johnstown engineer, have been doing some field work, and future action of the interested farmers will depend upon the nature of their report. The properties mentioned in connection with the damage suits comprise 656 acres, and the C seam in that locality yields about 4000 tons per acre. At this rate the farms would yield about 2,624,000 tons, giving an idea of the magnitude of the proposed damage suits. The company has let a con-

tract to the Westinghouse Electric and Manufacturing Company and the Westinghouse Machine Company for the following: Two 1500-h.p. Westinghouse steam turbines, two 1500-h.p. turbo-electric generators, six 500-h.p. rotary generators, 18 transformers, two 500-h.p. motors, two 225-h.p. motors, the switchboard and station appliances. This equipment is to be used in a central power plant, and will supply power for all of the company's mines in the Windber district. There is only one plant like this in the country at the present time, the other being in West Virginia.

Maryland Coal Company—President Knapp and other officials of the company visited St. Michael recently making an inspection of the shaft work and other improvements. One of the large shafts will be completed about June 1, and arrangements are being made to put it into service at once, in order to lose no time in getting the underground workings in shape. Work on the tippie, the boiler and engine houses, the stables, shops and offices will be pushed forward the coming summer. The main and air shafts go to 670 ft. depth.

South Carolina

AIKEN COUNTY

Peerless Kaolin Company—This company's property, including 160 acres, near Langley, has been sold to parties representing the American China Company, of Toronto, Ont. A good deposit of kaolin has been proved.

SPARTANBURG COUNTY

Keystone Granite Company—This company's quarry and other property, at Pacolet, have been sold at auction, and bought in by the trustee for the creditors.

South Dakota

CUSTER COUNTY

The first shipment of amblygonite to go to a foreign market left Custer recently for France, being shipped by W. R. and Spencer Bond and Frank Sutherland. The shipment contained 30 tons.

LAWRENCE COUNTY

Golden Crest—It is believed that the property will be able to resume within a few weeks, when the mill will treat at enlarged capacity.

Hidden Fortune—Henry J. Mayham has been granted an extension of two weeks in which to raise funds to redeem the property from the Continental Trust Company, of Denver.

Oro Hondo—J. W. Sparks & Co., of Philadelphia, has offered for sale the property here, for \$75,000. There is 300 acres and a good equipment. The prop-

erty has considerable development work done.

Flickinger—The property in Bald mountain district will be operated thoroughly this summer, and a large vertical ledge will be opened up. It contains milling ore running over \$7 per ton in gold.

Tinton—The 100-ton mill is now running steadily and later in the summer will be enlarged to handle double the present capacity. The mine is showing up well. About 30 men are now employed on the property.

Golden Reward—The Chamberlain filter-press has been finally adopted after successful tests. It now handles from 80 to 100 tons of slimes per day and more presses of a similar class will be installed.

Bock—The tunnel is in over 250 ft. and is being driven to catch the ledge found on the surface where gold ore was encountered in the vein.

Rochford-Wyoming Oil Company—The third well has entered the oil sands at a depth of about 300 ft. Two other wells are in oil and this oilfield promises much development here this summer.

Bosco Belle and Double Standard—Work has been resumed on both mines in Nevada gulch, and each will ship to the Golden Reward mill in Deadwood. The ore is of good grade.

Reliance—At a meeting of the officers and directors of this company, Frederick R. Baldwin, until recently with the North Homestake, was chosen general manager and will assume his new duties early next month.

PENNINGTON COUNTY

Eagle Mountain—Col. Clark will resume work about June 1 on his properties here and near Keystone, and will operate throughout the summer.

Lane—A rich strike in the placer beds was made by Bert Lane near Camp Harney. Machinery will probably be installed.

Custer Peak—A 10-stamp mill will be erected at once to handle the low-grade free-milling gold ore that has been opened up.

Continental Copper Company—The 500-ft. shaft will be sunk to 1500 ft., and the lower levels prospected. A new hoist will be installed and the property steadily worked.

Utah

JUAB COUNTY

Black Jack Consolidated—This company will shortly exercise the option on a one-half interest in the Silver Spar group, the consideration being \$10,000.

Colorado—This company has an indebted-

edness of nearly \$20,000, which, the management explains, is due to the heavy expense incurred in the installation of new electrical power and other mine equipment. Ore shipments will begin at once, however, and as the mine has much high-grade ore available, the obligation will soon be wiped out.

Crown Point—This Tintic company is developing, and has \$14,000 in its treasury to be applied to that purpose.

Iron Blossom—The shaft has reached a depth of 600 ft., and work is progressing on a limited scale.

Lower Mammoth—The directors of this company have ordered a resumption of development as well as ore production. The ore will be sent to the Tintic smelter for treatment.

Utah Mine—This property, at Fish Springs, has been a steady dividend-payer for many months. The ore is hauled by teams 60 miles to Oasis, the nearest railroad station, thence shipped to the Salt Lake valley smelters. Some good bodies of high-grade ore have been developed, and a carload marketed recently averaged 205 oz. in silver and 47 per cent. lead; the smelting company remitting \$3166 therefor. Dividends are disbursed at the rate of \$3000 monthly.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending May 16 were as follows: Cobalt Lake, 65,845 lb.; Cobalt Central, 49,200; Kerr Lake, 61,960; La Rose, 80,000; McKinley-Darragh, 60,000; Nipissing, 133,020; Nova Scotia, 106,765; O'Brien 63,800; Right of Way, 60,500; Temiskaming & Hudson Bay 60,000; Temiskaming 88,140; Watts, 66,000; Total, 895,230 pounds.

Peterson Lake—Cyril T. Young, of Haileybury has secured control of a lease on the Peterson Lake property known as Lucky No. 7 lease adjoining R. L. 404 on the Nipissing property. A force of men has been put to work with the object of tapping some of the Nipissing veins.

Rochester—The main shaft is down 90 ft. with about 100 ft. of drifting at the 75-ft. level. The main vein which has been stripped upward of 200 ft. on the surface shows a width of from 5 to 15 in. of calcite, carrying nicolite, smaltite and native silver.

Temiskaming—The main shaft is down more than 250 ft. and will be continued to the 300-ft. level. A shipment of 40 tons, sent to Copper Cliff, will run more than 4000 oz. silver per ton. On the first and second levels about 1000 ft. of drifting and crosscutting have been done and ore is being stoped from four veins.

Mexico

CHIHUAHUA

Shipments—The Banco Minero reports

the following shipments of bullion and ore for the week ending May 18: Batopilas Mining Company, 54 bars silver, value \$62,000; Waterson Gold Mining Company at Ocampo, 11 bars gold-silver bullion, value \$29,000; Rio Plata Mining Company, 400 sacks of concentrates, value, \$52,000.

Esmeralda-Parral—Plans are being drawn for a 200-ton concentrating plant to be erected this year on the property in the Parral district.

Garibaldi—This property, consisting of 24 pertenencias adjoining the Bien Venido mine in the Roncevalles district has been sold to Washington capitalists. Development is to begin at once. The same interests have also acquired 24 pertenencias in the Almoleya district near the Cigarrera mine.

San Mateo—This property in the Uhuachic district, owned by a Los Angeles company, has developed rich gold-silver ore at the end of a 690-ft. adit. A small water-jacket smelting furnace is planned.

La Prieta—One of the new electric pumps has been installed in this Parral mine. One night's run lowered the water in the shaft 8 ft. The second pump will be placed in a few days.

GUANAJUATO

The larger mining companies are employing every means to reduce the cost of production so as to avoid the necessity of closing down should the price of silver drop to 50 cents.

San Luis Flores—This new mine, owned by Spokane men, is developing good ore. The force of miners will be increased.

Frontera—The Dwight Furness Company is reported to have given an option on this group to Thomas Lawson of Boston.

MEXICO

La Cuchara—A body of lead-zinc ore has been struck in this mine in the Zacualpam district, and a concentrating plant will be erected. Two claims are being developed, Las Animas and the Cuchara. An adit is being driven to undercut some old workings.

Juarez—The adit in this property in the Zacualpam district has been driven 186 meters, and rich silver ore has been developed.

OAXACA

San Juan—Work has begun preparatory to drifting on the 525-ft. level of this mine in the Taviche district.

SONORA

Cananca Consolidated—The Mexican government has agreed to permit the entry of fuel oil duty free in the Arispe district for use as fuel in the mining camps of the company.

Tyopa—This ancient silver-gold mine

near the Guaynopa forts was recently re-discovered by a Mexican, and the property is claimed by Col. W. C. Greene, who is said to have a party of men on the ground to gain possession. The discovery and contest has aroused considerable excitement at Temosachic.

Africa

WEST AFRICA

Gold production in April is reported at 25,108 oz. fine, a decrease of 1608 oz. from March. For the four months ended April 30, the total was 97,032 oz. in 1906 and 102,032 oz.—or \$2,109,001—in 1907; an increase of 5000 oz. this year.

TRANSVAAL

The labor report for April shows that 10,290 Kafirs were received during the month and 9159 left. The total number of Kafirs at work April 30 was 130,991, an increase of 1131 over March. The number of Chinese on April 30 was 24,059, a decrease of 2445 from March 31; and a decrease of 28,990 from April 30 last year.

Australia

NEW SOUTH WALES

Gold production in March was 23,029 oz. fine. For the three months ended March 31 it was 72,481 oz. in 1907, and 62,562 oz. in 1908; a decrease of 9919 oz. this year.

Broken Hill District—Shipments from the Broken Hill mines for the three months ended March 31 are reported as follows:

	1907.	1908.	Changes.
Gold, oz.	626	870	I. 244
Silver in ore, oz.	1,324,013	1,396,256	I. 72,243
Lead in ore, tons.	28,708	32,116	I. 3,408
Silver-lead bullion, tons.	9,879	8,760	D. 1,119
Zinc concentrates, tons.	33,938	47,889	I. 13,951
Copper ore, tons.	211	15	D. 196
Zinc ore, tons.	215	.....	D. 215

The number of men employed in the district March 31 was 7901 against 8937 at the beginning of the year.

QUEENSLAND

Mount Morgan—During March this company's mills treated 21,220 tons of gold ore, saving 5141 oz. fine gold; an average of 0.24 oz. per ton. The copper-smelting plant turned out 597 tons of blister copper, containing 6567 oz. gold. The total gold production was 11,708 oz. fine.

TASMANIA

Gold production for the three months ended March 31 was 5092 oz. fine.

Mount Lyell—For the three months ended March 25, this company's smelter treated 94,549 tons ore and 3324 tons metal-bearing flux. The converters produced 1957 tons blister copper, containing 1933 tons fine copper, 155,010 oz. silver and 5113 oz. gold. The average return was 2.04 per cent. copper, 1.64 oz. silver and 0.054 oz. gold per ton of ore.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, May 27—The bituminous coal trade in the East is still dull, the demand for steam coal being very light. Anthracite trade continues fair, though not so active as it has been. The coal loaded at Buffalo for shipment up the Lakes is reported at 250,000 tons on May 25, against 550,000 tons at the corresponding date last year.

In the West trade continues quiet at most leading points. The Lake trade is opening up slowly. There is still some trouble over local agreements, and threats are heard of a strike in the Indiana bituminous district, where operators and miners have failed to agree on some points in the contract.

The strike declared by the Miners' Union on Jan. 1 last in the counties of Christian, Hopkins, Union and Webster in Kentucky has been formally called off. The mines in those counties have always been non-union, and the strike was never really effective. The present action is merely a confession that the attempt to unionize the district has failed.

The operators and miners of the Southwestern Interstate district—Missouri, Kansas, Arkansas and Oklahoma—have finally agreed upon wage scales, after two months of discussion. The old scale is substantially reaffirmed.

The government lawyers are making up their case in the suits to be brought against the anthracite-carrying railroads under the commodity clause of the Interstate Commerce law.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 16, in short tons:

	1907.	1908.	Changes.
Anthracite.....	2,116,163	2,058,900	D. 57,263
Bituminous.....	14,226,969	12,016,199	D. 2,210,770
Coke.....	5,339,392	2,569,441	D. 2,769,951
Total.....	21,682,524	16,644,540	D. 5,037,984

The total decrease this year to date is 23.2 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, three months ended March 31, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	5,463,092	639,249	6,102,341
Buff., Roch. & Pitts.	1,518,358	112,802	1,631,160
Penn. lines, N. Y. C.	1,759,751	17,656	1,817,407
Pitts. & L. Erie.....	1,826,609	637,414	2,464,023
Norfolk & Western.	2,308,048	444,977	2,753,025
Total.....	12,915,858	1,852,098	14,767,956
Total, 1907.....	14,875,562	3,619,825	18,495,387

In addition, the Baltimore & Ohio car-

ried 273,605 tons anthracite in 1907, and 212,109 in 1908; decrease, 61,496 tons.

Coal tonnage, Ohio Coal Traffic Association, three months ended March 31, short tons:

	1907.	1908.	Changes.
Hocking Valley.....	801,037	718,188	D. 82,849
Toledo & Ohio Cent..	412,019	291,426	D. 120,593
Baltimore & Ohio....	505,760	518,439	I. 12,679
Wheeling & L. Erie..	821,284	738,313	D. 82,971
Cleve., Lorain & Wh.	595,005	700,582	I. 105,577
Zanesville & Western	358,072	363,072	I. 5,000
Toledo Div., Pen. Co.	647,563	525,367	D. 122,196
L. Erie, Alliance & Wh.	292,636	312,338	I. 19,702
Marietta, Col. & Clev.	3,982	21,887	I. 17,905
Total.....	4,437,358	4,189,612	D. 247,746

The total decrease this year was 5.5 per cent.

Coal shipments reported by Southwestern Interstate Coal Operators' Association, two months ended Feb. 29, short tons:

	1907.	1908.	Changes.
Missouri.....	517,226	559,635	I. 42,409
Kansas.....	1,114,487	1,184,580	I. 70,093
Arkansas.....	418,125	440,431	I. 22,306
Oklahoma.....	525,757	567,231	I. 41,474
Total.....	2,575,595	2,751,877	I. 176,282

The total increase this year was 6.8 per cent.

New York

ANTHRACITE

May 27—The market is quiet and little new business is being done. Considerable coal is going to New England points and the Sound to close contracts. Both prepared and small steam sizes are in good supply; the movement which was expected did not materialize. It is reported upon good authority that anthracite mines will either close down entirely one week in June or else curtail production to a considerable extent. Prices are as follows: Broken, \$4.35; egg, stove and chestnut, \$4.60; pea, \$3.25@3.50; buckwheat No. 1, \$2.35@2.50; buckwheat No. 2 or rice, \$1.65@2; barley, \$1.35@1.50; all f.o.b. New York harbor.

BITUMINOUS

The soft-coal market is so dull that any slight improvement seems big. However, a disposition on the part of consumers to call for a little more coal is apparent in the far East, Boston and Sound points and where shipments are made by small barges. In New York harbor business is at a standstill and good grades of steam coal are offered at \$2.45@2.55 per ton.

Transportation from mines to tide is not good, considering the light volume of business. In the Coastwise vessel trade a little more coal is being carried on account of the attractive freight rates to New England points. Freight rates are as follows: From Philadelphia to Boston

and Salem, 55@60c.; to Portland, 60c.; to Lynn and Portsmouth, 70c.; Newburyport, 75c.; Saco \$1; Bath, 65@75c.; Gardiner, 80c.; Bangor, 70@75c.; to the Sound, 50@55c.; towages where usual.

Birmingham

May 25—Some improvement is to be noted in coal production, the Tennessee company having started up two of its mines recently. The market is dull yet, shipments to the outside of the State being at a low ebb. The smaller commercial coal operators are considering abstaining from making efforts to get business with the prices as low as they are at present. Coal-mining prices have been adjusted about as much as the men will stand. There is no demand worth mentioning for coke and the production is about the same as it has been for several weeks. The Sloss-Sheffield company started up its batteries of ovens in the city when the first of the city furnaces was put in blast.

Chicago

May 25—Quiet has settled upon the local coal market with the plentiful supply of new coal from Illinois mines visibly assured and the needs of large users not increasing. Fine coals are strengthening again and lump is weakening. Eastern coals are somewhat stronger, through restricted shipments.

Illinois and Indiana coal brings \$1.75@2 for lump, \$1.65@1.80 for run-of-mine, and \$1.30@1.60 for screenings. Brazil block is steady at \$2.80@2.90.

Smokeless is not stable except for the best New River and Pocahontas, which brings \$2.85@3.30 for run-of-mine. Youghiogheny is restricted to a light demand at \$3.20 for 3/4-in. gas. Hocking is in better demand and strong at \$3.15.

Domestic coals are quiet but selling steadily. Anthracite is unusually dull.

Indianapolis

May 25—There has been a decided and unexpected revival of business in the block-coal district. Mines formerly working only two and three days are now running full time, and some of them are crowded with orders. The change is due to the suspension of work in the bituminous district, and the fear that a strike will be forced.

Despite the boast during the several conventions last winter that the Indiana miners and operators were harmonious and ready to sign up the last year's scale, it has been impossible for them to agree

upon minor provisions relating to local conditions. The miners insisted on the elimination of several items, and by reason of the operators' refusal a suspension of work was ordered by the president of the Bituminous District organization. President Lewis has granted certain mines in southern Indiana permission to operate until the strike is finally settled. This act has created a charge of unwarranted interference with local affairs. The miners are very anxious to get work, however, and many side with Lewis that the items in dispute are too trifling to cause a strike. A conference has been called at Indianapolis this week.

Pittsburg

May 26—Operations at railroad coal mines have increased, and today they are being operated to fully 90 per cent. of capacity. Most of the coal is going to Lake ports for the Northwestern markets. The river mines continue to run full. Prices remain firm on previous quotations of \$1.15 at mine for mine-run coal. Slack has declined to 75c. and the demand is light.

Connellsville Coke—There is an improved demand and more idle ovens have been put on the active list. The minimum price for furnace coke is \$1.60 for spot, and on contract \$2 per ton at oven. Foundry coke also is higher, the minimum quotation today being \$2.10, and on contracts \$2.25. The *Courier* in its weekly report gives the production in both regions at 173,082 tons. The shipments aggregated 5424 cars, distributed as follows: To Pittsburg, 2332; to points west of Connellsville, 2775; to points east of Connellsville, 317 cars.

Foreign Coal Trade

Fuel exports of Great Britain, with coal sent abroad for use of steamships in foreign trade, four months ended April 30, long tons:

	1907.	1908.	Changes.
Coal.....	18,859,218	19,181,860	I. 322,642
Coke.....	289,545	362,223	I. 72,678
Briquets.....	447,823	490,552	I. 42,729
Total exports.....	19,596,586	20,034,635	I. 438,049
Steamer coal.....	5,947,394	6,244,036	I. 296,642
Total.....	25,543,980	26,278,671	I. 734,691

This shows an increase of 2.8 per cent. in coal sold for consumption beyond the limits of the United Kingdom.

Shipments of coal from Nova Scotia mines, four months ended April 30, long tons:

Company:	1907.	1908.	Changes.
Dominion.....	720,362	778,291	I. 57,929
N. S. Steel.....	120,279	155,737	I. 35,458
Cumberland.....	105,680	144,528	I. 38,848
Acadia.....	88,208	106,415	I. 18,207
Intercolonial.....	84,710	90,055	I. 5,345
Inverness.....	53,930	68,691	I. 14,761
Total.....	1,173,169	1,343,717	I. 170,548

All the companies showed increases. The total gain this year was 14.5 per cent.

Iron Trade Review

New York, May 27—The most important occurrence of the past week was the meeting of the steel producers and advisory committees in New York on May 21. Contrary to expectation, there was no decided movement to lower prices; at least, if any expression in favor of such action was made, it was done quietly. The official statement given out is as follows: "At the meeting today of representatives of the principal manufacturers of steel in this country the opinion was expressed by each one present that the prices of steel are reasonable and should not be reduced; that reduced prices would not increase purchases, and that most of their customers do not expect or desire any change. The opinion was unanimous that the meetings should be discontinued for the summer months unless the chairman should deem it advisable to meet at any time for reasons which do not now appear."

New business in finished material has been light, except that some contracts for structural work have been closed, mainly municipal work.

The pig-iron market has been quite active, a number of sales having been made during the week. Southern iron has again taken the lead, and most of the sales have been on the basis of \$11 up to \$11.50, Birmingham, for No. 2 foundry, with an inclination to the higher figure. Nearly all the sales were of foundry iron, basic being in less demand.

It is reported that some of these purchases have been of a speculative character, but the report cannot be confirmed.

Birmingham

May 25—Iron quotations are down as low as they have been in several years, No. 2 foundry having sold recently under \$11.50 per ton. The Sloss-Sheffield Steel and Iron Company has blown in No. 2 city furnace in Birmingham, and put out the Lady Ensley furnace at Sheffield. The Birmingham furnace is able to produce more iron than did the Sheffield furnace, so that the change increases the production in the district.

The recent sale of a large quantity of iron to a brokerage firm, mentioned heretofore, is reiterated, with the statement that there is to be no wholesale unloading for several months at least. Interviews secured indicate that there will not only be an improvement in prices, but also in the demand before long. President Joseph Hoadley, of the Alabama Consolidated company, announces that an offer to take a large quantity of iron at \$11.20 for No. 2 foundry, f.o.b. furnaces, was declined, and that considerable business is being received at the \$11.50 rate.

Chicago

May 25—Under the stimulus of a few large sales, the pig-iron market is strong.

There is apparently a feeling that the tide of business has turned. Ordinary lots are still small, however. Perhaps 20,000 tons have been sold in the last week against 5000 to 6000 tons in previous weeks. On contracts for the last half at \$10.75, Birmingham (\$15.10 Chicago) for No. 2 has been made, but the market holds firmly to \$11.50 Birmingham for ordinary sales for delivery in the second half, with 25@50c. more for delivery in the next 90 days. Northern iron sells at \$17.25@17.75 for small lots. Northern charcoal is in good demand but small supply at \$20@20.50.

Inquiries continue to increase in number. The market for iron and steel products improves slowly, except in structural steel, which is notably better. Coke is in better demand and well-adjusted supply at \$4.90 for first-class Connellsville.

Philadelphia

May 27—The sudden activity in pig iron has not as yet been reflected in this territory. A large amount of business has been done in other markets at the lowest rates, but the business here has been rather trifling. The determination to maintain prices in finished products has had a favorable influence.

Steel Billets—There is no present demand, though material is offered at very attractive prices.

Bars—The mills in this territory are hobbling along with irregular work.

Sheets—The smaller buyers are buying more promptly and more material at a time.

Merchant Steel—An inquiry or two from dealers for prices on large assorted lots for summer delivery brought out some very low quotations.

Plates—Local business is unimportant. Mills are willing to accept business at low prices.

Structural Material—No favorable conditions have developed as yet. Manufacturers have declined to express opinions on the maintenance of prices. Small orders are more frequent than a month ago.

Scrap—Some wholesale dealers have been endeavoring to unload large lots of steel scrap, but could not get offers that would cover cost. Business is very dull.

Pittsburg

May 26—The market appears much stronger, particularly as to pig iron. The inquiries for iron mentioned last week later developed into contracts. Sales both in the north and south amounted to more than 200,000 tons. When this active buying began it was generally believed that the whole situation would improve. Some disappointment was expressed when the announcement was made the day after the New York meetings that it had been decided to make no changes in prices.

There are still some who believe that prices will be reduced later by the large interests present at the meetings. Representatives of the large concerns, however, are positive today that present prices will be strictly maintained. Despite these statements, it is known that one large concern is cutting prices on steel bars. Owing to the low prices for light rails offered by the re-rolling mills they are getting all the business. As some of the large mills are taking orders this week, it is intimated that they are meeting the re-rolling rates. Plates are not strong and there are reports that if a buyer came into the market for a large tonnage he would have no difficulty in obtaining a satisfactory rate which, of course, would mean considerably less than 1.70c., the present quotation. No signs of weakness, so far as known, are noted in prices of structural material, some fairly good contracts having been placed within the week. The American Bridge Company, the Ritter-Conley Manufacturing Company and the McClintic-Marshall Company all have taken on new business, but in small tonnages.

The Amalgamated Association of Iron, Steel and Tin Workers closed its convention last week and has appointed its different wage committees. While the workers did not make any changes in the existing wage scales, the manufacturers do seriously object, and it is certain they will not consent to a renewal.

Pig Iron—The demand was principally for basic iron. During the past week the largest independent producer sold 25,000 tons to the American Steel Foundries, which also bought 10,000 tons from the St. Louis Blast Furnace Company for its Western plants. The single lot went at a trifle less than the regular price of \$15, Valley. Several good sales of bessemer iron were made and in some lots where chill-cast bessemer was desired the minimum was \$17. Sales of standard bessemer remained at \$16. On No. 2 foundry iron the price was firm at \$14.50, but the price has now advanced to \$14.75@15 at furnace. Gray forge is \$14@14.25. There are inquiries in this market for fully 10,000 tons of various grades of pig iron.

Steel—While no change in prices of bessemer and open-hearth billets has been made, it is confidently believed that a reduction is about to be ordered. Present prices are on a basis of \$28, Pittsburg, and the freight is divided. Tank plate is still quoted at 1.70c. and merchant-steel bars at 1.60c., but both are weak and these prices have been shaded.

Sheets—The market continues about the same. There is no falling off in demand and prices are firm. Black sheets are quoted at 2.50c. and galvanized at 3.55c. for No. 2 gage.

Ferro-Manganese—There has been another advance in ferro, the lowest price quoted today being \$47, Pittsburg.

Metal Market

Gold and Silver Exports and Imports
NEW YORK, May 27.
At all U. S. Ports in April and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Apr. 1908..	\$14,476,341	\$ 2,417,170	Exp. \$12,059,171
" 1907..	2,219,844	4,974,527	Imp. 2,754,683
Year 1908..	18,335,344	19,846,243	" 1,510,899
" 1907..	7,923,148	16,621,142	" 8,697,994
Silver:			
Apr. 1908..	4,452,564	3,308,106	Exp. 1,144,458
" 1907..	4,862,998	3,970,443	" 892,455
Year 1908..	17,038,851	14,138,762	" 2,900,089
" 1907..	19,532,394	15,355,969	" 4,176,425

Exports from the port of New York, week ended May 23: Gold, \$10,833,290, chiefly to France and Germany; silver, \$641,745, chiefly to London. Imports: Gold, \$116,019 and silver, \$20,839, both from the West Indies and South America.

Specie holdings of the leading banks of the world May 23 are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	\$312,055,400
England	\$187,856,395	.....	187,856,395
France	595,233,550	\$182,763,660	777,997,210
Germany	177,990,000	73,760,000	251,750,000
Spain	77,840,000	132,050,000	209,890,000
Netherlands	38,453,500	21,298,500	59,752,000
Belgium	20,493,335	10,246,665	30,740,000
Italy	181,895,000	22,075,000	203,970,000
Russia	562,700,000	35,920,000	598,620,000
Aust.-Hungary	233,365,000	66,525,000	299,890,000
Sweden	19,465,000	.....	19,465,000
Norway	7,325,000	.....	7,325,000
Switzerland	17,060,000	.....	17,060,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Gold and silver movement in Great Britain, four months ended March 31:

	Imports.	Exports.	Excess.
Gold	£16,824,776	£11,455,953	Imp. £5,368,823
1907	16,353,862	10,842,463	Imp. 5,511,399
Silver	3,408,028	4,579,820	Exp. 1,171,792
1907	6,342,720	6,606,243	Exp. 263,523

Of the silver imported this year the United States furnished £2,853,060, or 80 per cent. of the total.

Silver Market

SILVER AND STERLING EXCHANGE.

May.	Sterling Exchange.	Silver.		May.	Sterling Exchange.	Silver?	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
21	4.8725	53 3/4	24 1/8	25	4.8710	53 3/4	24 1/8
22	4.8720	53 3/4	24 1/8	26	4.8710	53 3/4	24 1/8
23	4.8715	53	24 7/8	27	4.8725	53	24 7/8

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to May 14:

	1907.	1908.	Changes.
India	£5,006,084	£2,889,358	D. £2,116,726
China	.....	516,400	I. 516,400
Straits	426,062	90,200	D. 335,862
Total	£5,432,096	£3,495,958	D. £1,936,138

Imports for the week were £227,000 from New York. Exports were £23,800 to India and £5000 to Hongkong; £28,800 in all.

Copper, Tin, Lead and Zinc

May.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
21	12 3/4 @12 1/2	12 3/4 @12 3/4	57 3/4	29 1/4	4.25 @4.30	4.55 @4.60	4.40 @4.45
22	12 3/4 @12 3/4	12 3/4 @12 3/4	57 3/4	29 1/4	4.32 @4.37	4.55 @4.60	4.40 @4.45
23	12 3/4 @12 3/4	12 3/4 @12 3/4	.....	29	4.32 @4.37	4.55 @4.60	4.40 @4.45
25	12 3/4 @12 3/4	12 3/4 @12 3/4	57	28 3/4	4.32 @4.37	4.55 @4.60	4.40 @4.45
26	12 3/4 @12 3/4	12 3/4 @12 3/4	56 3/4	28 3/4	4.32 @4.37	4.55 @4.60	4.40 @4.45
27	12 3/4 @12 3/4	12 3/4 @12 3/4	56 3/4	28 3/4	4.32 @4.37	4.55 @4.60	4.40 @4.45

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b.'s. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 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—As forecasted in our last report the increased demand for copper, which raised prices a little, culminated previous to the middle of last week. From May 21 to 27 the market has been extremely dull and weaker. A few producers continue to hold aloof, hoping to get the former prices, but others have been anxious to sell their whole output as made, and this has led to concessions in price, many being willing to sell electrolytic for 12 3/4, delivered 30 days, or a little less than 12 5/8, cash, New York. There seems to be a pessimistic feeling inspired by the increasing production and the failure of the consumptive demand to increase correspondingly.

In consequence of the reaction in the stock market, the active speculation in the London standard market, referred to in our last issue, subsided. As a result, European consumers have kept out of the market, and as domestic consumers also held aloof, few transactions have taken place, and these have been at somewhat lower figures, as noted above. Business in Lake copper has been particularly dull and quotations are but little more than nominal. Quotations at the close are 12 3/4@12 7/8c. for Lake copper; 12 1/2@12 5/8c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12 3/4@12 1/2 cents.

The London standard market, which closed last week at £57 15s. for spot, £58 10s. for three months, has gradually declined to £56 17s. 6d. for spot, £57 10s. for three months. The volume of transactions has been smaller, but it is noteworthy that at the present level of prices there is a general disposition among speculative circles in Europe to buy copper.

Refined and manufactured sorts we quote: English tough, £60@61; best selected, £60@61; strong sheets, £72@73.

Manufactured Copper—Sheets, cold-rolled, 18c.; hot-rolled, 17c. Wire, 14¾c. base.

Tin—The London market has shown a declining tendency throughout the week, and while it was expected that the Banka sale, which took place on May 25, would strengthen the market, this did not turn out to be the case. The closing is cabled at £128 2s. 6d. for spot, £127 2s. 6d. for three months.

The domestic market has been a very dull affair, transactions covering only small quantities which were required for prompt delivery. At the close the quotation is about 28.25c.

Lead—On May 21 a rather large business was done at advancing prices, which led to a sharp rise on the following day, that has since been maintained, a good business being done. The consumption of this metal appears to have maintained itself better than any of the other metals. As the production has been curtailed in consequence of the low price of lead as well as silver, no stocks have accumulated, and the article is in a strong statistical position. Prices have advanced and at the close we quote 4.32½@4.37½c., New York.

The London market has been dull, and prices have declined, Spanish lead being quoted £12 15s., English lead £12 17s. 5d.

Spelter—The demand for this metal continues sluggish, and while most of the producers are not disposed to press sales, as they cannot make a profit at present prices for ore and spelter, the few orders that presented themselves have been taken at a shade under last figures. At the close we quote 4.55@4.60c. New York, 4.40@4.45c. St. Louis.

The London market is quiet, good ordinaries closing at £19 15s., specials at £20.

Zinc Sheets—Base price is 7c. f.o.b. Lasalle-Peru, less 8 per cent.

Other Metals

Antimony—The market is inactive, but prices firm. Quotations are 8¾@9c. for Cookson's, 8½@8¾c. for Hallett's, and 8¼@8¾c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base.

Cadmium—In 100-lb. lots, \$1.25 per lb., Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York, \$45 per flask. San Francisco, large lots nominal at \$44.50, domestic, and \$43, export; small orders, \$45@46. London, £8 5s.

Platinum—The market has been unchanged. Prices are: \$25 per oz. for hard platinum, \$22.50 for ordinary, and \$17 for scrap.

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:

	Copper:	Imports.	Exports.	Excess.
Copper ore.....	38,099	.....	.....	.....
Matte, etc.....	26,643	.....	.....	.....
Fine copper.....	33,581	.....	.....	.....
Total copper....	50,713	18,005	Imp. 32,708	
Total, 1907.....	38,284	17,720	Imp. 20,564	
Tin:				
Straits.....	13,813	.....	.....	.....
Other.....	2,387	.....	.....	.....
Total.....	16,200	10,696	Imp. 5,504	
Total, 1907.....	14,860	9,546	Imp. 5,314	
Lead:				
United States.....	13,359	.....	.....	.....
Spain.....	36,134	.....	.....	.....
Other.....	31,748	.....	.....	.....
Total.....	81,241	18,322	Imp. 62,919	
Total, 1907.....	64,685	17,596	Imp. 47,089	
Spelter:				
Spelter.....	29,323	.....	.....	.....
Zinc sheets, etc.....	5,814	.....	.....	.....
Total.....	35,137	2,438	Imp. 32,699	
Total, 1907.....	38,182	1,777	Imp. 36,405	
Quicksilver, lb., 1,691,733	633,255	Imp. 1,058,478		
Quicksilver, 1907 1,612,956	910,131	Imp. 702,825		

Copper totals give estimated contents of all materials in fine copper. Tin-ore imports, not given above, were 6357 tons in 1907, and 9421 tons in 1908. Imports of iron and copper pyrites were 269,160 tons in 1907, and 301,777 in 1908; increase, 32,617 tons.

Wisconsin Ore Market

Platteville, Wis., May 23—The highest price paid this week for zinc ore was \$37.50, the base price declining from \$36 to \$35 at the end of the week. Lead ore brought as high as \$55 per ton, but was not bought according to a strict base price; local buyers make their bids high enough to assure getting a car or two when they receive orders to buy.

Ore shipments: week ended May 23 were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green.....	290,300	.....	.....
Benton.....	244,550	63,650	.....
Cuba City.....	208,550	.....	.....
Galena.....	156,800	.....	.....
Platteville.....	151,600	82,000	.....
Livingston.....	140,000	.....	.....
Strawbridge.....	129,600	.....	.....
Linden.....	109,950	.....	.....
Potosi.....	75,000	.....	.....
Elmo.....	66,720	65,540	.....
Highland.....	59,300	.....	.....
Mineral Point.....	54,000	.....	.....
Rewey.....	49,660	120,000	.....
Total.....	1,736,080	331,190	.....
Year to May 23.....	29,310,525	2,959,215	79,800

In addition to the above there was shipped to the Joplin Separator works at Galena, from Strawbridge, 80,000 lb., and to the electrostatic separator at Platteville, from Strawbridge, 56,400 lb., and from Linden, 71,400 lb. zinc concentrates.

Missouri Ore Market

Joplin, Mo., May 23—The highest price paid for zinc was \$38. on an assay base

price of \$35 per ton of 60 per cent. zinc, ranging down to a base price of \$32 and averaging, all grades of blende and silicate, \$32.84 per ton. The highest price paid for lead was \$59, an advance of \$1, while medium and lower grades advanced \$2 to \$4, so sharp was the competition. All grades averaged \$57.74, very little low-grade ore being marketed.

Following are the shipments from the district for the week ending May 23:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	2,437,020	749,920	\$63,176
Joplin.....	1,897,920	214,500	37,465
Galena.....	645,270	68,440	12,631
Alba-Neck.....	721,320	.....	12,623
Miami.....	428,980	171,320	11,243
Duenweg.....	345,540	167,080	10,619
Prosperity.....	332,910	55,200	7,259
Badger.....	341,600	.....	5,633
Granby.....	315,940	46,460	5,475
Aurora.....	323,390	5,410	4,443
Zincite-Sherwood.....	201,110	13,890	3,607
Sarcoxi.....	142,420	.....	2,349
Carthage.....	123,930	.....	2,256
Cave Springs.....	132,560	.....	2,187
Spurgeon.....	155,910	12,630	2,155
Quapaw-Baxter.....	64,720	8,180	1,208
Carl Junction.....	46,730	5,030	912
Totals.....	8,607,270	1,518,060	\$185,241

21 weeks.....191,540,520 28,092,350 \$4,021,048
Zinc value, the week, \$141,407; 21 weeks, \$3,304,704
Lead value, the week, 43,834; 21 weeks, 716,344

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January ...	45.84	35.56	January ...	83.58	46.88
February ..	47.11	34.92	February ..	84.58	49.72
March	48.66	34.19	March	82.75	49.90
April.....	48.24	34.08	April.....	79.76	52.47
May.....	45.98	.....	May.....	79.56	.....
June.....	44.82	.....	June.....	73.66	.....
July.....	45.79	.....	July.....	58.18	.....
August.....	43.22	.....	August.....	59.54	.....
September..	40.11	.....	September..	53.52	.....
October.....	39.83	.....	October.....	51.40	.....
November... 35.19	.....	November... 43.40	.....	.....
December... 30.87	.....	December... 37.71	.....	.....
Year.....	43.68	.....	Year.....	68.90	.....

Chemicals

New York, May 27—The general market is without interest and business is confined to contracts almost entirely. As a rule prices are firm and dealers are not anxious to shade quotations.

Copper Sulphate—Trading is quiet and the market is featureless. A few small lots are offered by outside dealers at \$4.50 per 100 lb., but standard goods remain at \$4.65 for carloads and \$4.90 for smaller lots.

Nitrate of Soda—The market is firm and the demand is fairly good in some quarters. The Permanent Nitrate Committee has placed the production "quota" at 39,500,000 metric quintals from March 31, 1908, to March 31, 1909. This compares with 45,000,000 quintals last year. The assignments in the past have always been somewhat flexible and consumers' requirements will undoubtedly be taken care of, if the demand warrants an increased production.

Mining Stocks

New York, May 27—The stock markets have been irregular and rather confusing, without any settled tendency. Advances and reactions have followed each other quickly, and for the most part without apparent reason. Gold exports for the week have been large, but have not affected the strong position of the banks and the ease of the money market.

The curb market has alternated between activity and dullness. The copper stocks have been fairly strong, with a variable demand, small gains and losses, about equally divided. There was some dealing in the Cobalts, but little in the Nevada stocks.

Boston

May 26—Earlier in the week the market was strong, but the excitement gradually subsided and at the close it was quiet. In fact, there was rather a narrow and uninteresting market today, except in a few stocks.

Amalgamated was an exception, showing many sales, and closing around \$64. Atlantic was also rather active, selling up to \$17.50, with close 50c. to \$1 less. Victoria, generally rather inactive, was a strong feature today, selling largely between \$5.75 and \$6. Copper Range sold today at \$70@70.50. North Butte closed at \$63. Boston Consolidated sold off to \$11, a reduction.

The curb market was rather quiet, as a rule; especially so today.

STOCK QUOTATIONS

NEW YORK May 26		BOSTON May 26	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine.....	3/4	Adventure.....	12
Amalgamated.....	63 3/4	Allouez.....	27
Anaconda.....	40	Am. Zinc.....	127 3/4
Balclutha.....	1	Arcadian.....	3 1/2
British Col. Cop.....	4 3/4	Arizona Com.....	18
Butte & London.....	16 1/2	Atlantic.....	16 1/2
Butte Coalition.....	22 1/2	Bingham.....	75
Colonia Silver.....	1/2	Boston Con.....	11 1/4
Cum. Ely Mining.....	8	Calumet & Ariz.....	108
Davis Daly.....	3	Calumet & Hecla.....	670
Dominion Cop.....	1 3/4	Centennial.....	22 1/2
Douglas Copper.....	4 1/2	Con. Mercur.....	1.40
El Rayo.....	1 1/2	Copper Range.....	70
Florence.....	3 3/4	Daly-West.....	10 1/2
Foster Cobalt.....	1/2	Franklin.....	8 1/2
Furnace Creek.....	15	Greene-Can.....	9 1/2
Giroux.....	3 1/2	Isle Royal.....	19 1/4
Gold Hill.....	1/2	La Salle.....	114 1/2
Goldfield Con.....	5 1/4	Mass.....	3
Granby.....	90	Michigan.....	9
Greene Gold.....	7 1/2	Mohawk.....	53 1/2
Greene G. & S.....	1/2	Nevada.....	12
Greenw'r & D. Val.....	.75	North Butte.....	63
Guanajuato.....	2 1/2	Old Colony.....	.50
Gnggen. Exp.....	150	Old Dominion.....	34 3/4
Hanapah.....	1.20	Osceola.....	88
McKinley Dar.....	1/2	Parrot.....	21
Micmac.....	3 1/2	Quincy.....	82 1/2
Mines Co. of Am.....	1 1/2	Rhode Island.....	13 3/4
Mitchell Mining.....	1/2	Santa Fe.....	2
Mont. Sho. C.....	1/2	Shannon.....	13 1/2
Nev. Utah M. & S.....	3 1/2	Superior.....	17
Newhouse M. & S.....	7 1/2	Tamarack.....	58
Nipissing Mines.....	6 1/2	Trinity.....	13 3/4
Old Hundred.....	1/2	United Cop., com.....	17 3/4
Silver Queen.....	1	U. S. Oil.....	123 3/4
Stewart.....	7 1/2	U. S. Smg. & Ref.....	37 1/2
Tennessee Cop'r.....	37 1/2	U. S. Sm. & Re. pd.....	41 3/4
Tir-Bullion.....	11 1/2	Utah Con.....	40 3/4
Union Copper.....	3 1/4	Victoria.....	5 1/2
Utah Apex.....	4 1/4	Winona.....	5 1/2
Utah Copper.....	31	Wolverine.....	133
Yukon Gold.....	3 3/4	Wyandotte.....	.50

*Ex. Div. †Ex. Rights.

‡ Last quotation.

N. Y. INDUSTRIAL

Am. Agri. Chem.....	19 1/2
Am. Smelt. & Ref.....	72 3/4
Am. Sm. & Ref., pf.....	97 1/4
Bethlehem Steel.....	14
Colo. Fuel & Iron.....	27
Federal M. & S., pf.....	72
Inter. Salt.....	18 1/2
National Lead.....	65 1/2
National Lead, pf.....	99 1/2
Pittsburg Coal.....	12
Republic I. & S.....	17 1/2
Republic I. & S., pf.....	67 1/2
Sloss-Sheffield.....	49 1/2
Standard Oil.....	60 1/2
U. S. Red. & Ref.....	113 3/4
U. S. Steel.....	36 1/2
U. S. Steel, pf.....	100 3/4
Va. Car. Chem.....	23

BOSTON CURB

Ahmeek.....	173
Black Mt.....	14 3/4
East Butte.....	6 1/2
Hancock Con.....	4 3/4
Keweenaw.....	6
Majestic.....	.62
Raven.....	1 1/2
Shawmut.....	.38
Superior & Pitts.....	12
Troy Man.....	1.50

NEVADA STOCKS. May 27.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.....	.13
Belcher.....	.24	St. Ives.....	.30
Best & Belcher.....	.46	Triangle.....	.04
Caledonia.....	.68	BULLFROG STOCKS	
Chollar.....	.07	Bullfrog Mining.....	.04
Comstock.....	.36	Bullfrog Nat. B.....	.05
Con. Cal. & Va.....	.28	Gibraltar.....	.05
Crown Point.....	.25	Gold Bar.....	.06
Exchequer.....	.20	Homestake King.....	.29
Gould & Curry.....	.05	Montgomery Mt.....	.05 1/2
Hale & Norcross.....	.30	Mont. Shoshone C.....	.87 1/2
Mexican.....	1.10	Original Bullfrog.....	.01 1/2
Ophir.....	2.55	Tramp Cons.....	.16 1/2
Overman.....	.08	MANHATN STOCKS	
Potosi.....	.03	Manhattan Cons.....	.09
Savage.....	.36	Manhat'n Dexter.....	.05
Sierra Nevada.....	.23	Jumping Jack.....	.04
Union.....	.19	Stray Dog.....	.04
Utah.....	.03	MISCELLANEOUS	
Yellow Jacket.....	.70	Golden Boulder.....	.07
TONOPAH STOCKS		Bonnie Clare.....	.08
Belmont.....	.93 1/2	Lee Gold Grotto.....	...
Extension.....	.87 1/2	Nevada Hills.....	2.06 1/2
Golden Anchor.....	.01 1/2	Nevada Smelting.....	1.25
Jim Butler.....	.25	Pittsburgh S. Pk.....	1.20
MacNamara.....	.25	Round Mt. Sphinx.....	.26
Midway.....	.38		
Montana.....	1.50		
North Star.....	.08		
Tono'h Mine of N.....	7.50		
West End Con.....	.37		

GOLDFIELD STOCKS

Adams.....	.03
Atlanta.....	.18
Booth.....	.16
Columbia Mt.....	.14
Comb. Frac.....	.46
Cracker Jack.....	.06
Dia'dfield B. B. C.....	.16
Goldfield Belmont.....	.15
Goldfield Daisy.....	.97
Great Bend.....	.25
Jumbo Extension.....	.27
Katherine.....	...
Kendall.....	.16
Lone Star.....	.07
May Queen.....	.06
Oro.....	.09
Red Hill.....	.19
Roanoke.....	...
Sandstorm.....	.27

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev.....	Apr. 23	May 15	\$0.10
Belcher, Nev.....	Apr. 29	May 20	0.10
Big Creek, Ida.....	Apr. 17	May 16	0.01
Brunswick Con., Cal.....	May 27	June 26	0.03
Butler-Liberal, Utah.....	Apr. 25	May 13	0.02
Century, Utah.....	Apr. 14	May 14	0.02
Charm, Utah.....	Apr. 31	May 13	0.01
Federal.....	Apr. 25	May 18	0.05
Jenny Lind, Cal.....	May 11	May 28	0.05
New Red Wing, Utah.....	May 2	May 19	0.01
Old Evergreen.....	Apr. 14	May 14	0.01
Oro Cobre, Cal.....	Apr. 17	May 16	0.02
Posey Canyon, Cal.....	Apr. 28	May 16	0.02
Potosi, Nev.....	Apr. 20	May 3	0.10
Silver Bell, Utah.....	Apr. 10	Apr. 27	0.01
Wabash, Utah.....	May 9	June 1	0.10
Washakie-Nev., Nev.....	Apr. 20	May 7	0.15
Western Mines, Nev.....	Apr. 16	Apr. 23	0.01 1/2
Zeibright, Cal.....	May 12	June 1	0.05

ST. LOUIS May 23

N. of Com.	High.	Low.
Adams.....	.30	.20
Am. Nettie.....	.03	.02
Center Cr'k.....	2.00	1.60
Cent. C. & C.....	68.00	66.00
C. C. & C. pd.....	76.00	75.00
Cent. Oil.....	125.00	100.00
Columbia.....	4.00	3.00
Con. Coal.....	19.00	16.00
Doe Run.....	125.00	110.00
Gra. Bimet.....	.25	.20
St. Joe.....	15.00	13.00

LONDON May 27

Name of Com.	Clg.
Dolores.....	£1 5s 0d
Stratton's Ind.....	0 1 6
Camp Bird.....	0 13 0
Esperanza.....	1 6 3
Tomboy.....	1 12 6
El Oro.....	1 4 6
Oroville.....	0 11 6

Cabled through Wm. P. Bonbright & Co., N. Y.

Monthly Average Prices of Metals
AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	68.673	55.678	31.769	25.738
February.....	68.835	56.000	31.852	25.856
March.....	67.519	55.368	31.325	25.570
April.....	65.462	54.508	30.253	25.133
May.....	65.981	...	30.471	...
June.....	67.090	...	30.893	...
July.....	68.144	...	31.366	...
August.....	68.745	...	31.637	...
September.....	67.732	...	31.313	...
October.....	62.435	...	28.863	...
November.....	58.677	...	27.154	...
December.....	54.565	...	25.362	...
Year.....	65.327	...	30.188	...

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

Month.	NEW YORK.		LONDON.	
	Electrolytic	Lake.	1907.	1908.
January.....	24.404	13.726	24.825	13.901
February.....	24.869	12.905	25.236	13.098
March.....	25.065	12.704	25.660	12.875
April.....	24.224	12.743	25.260	12.928
May.....	24.048	...	25.072	...
June.....	22.665	...	24.140	...
July.....	21.130	...	21.923	...
August.....	18.356	...	19.255	...
September.....	15.565	...	16.047	...
October.....	13.169	...	13.551	...
November.....	13.391	...	13.870	...
December.....	13.163	...	13.393	...
Year.....	20.004	...	20.661	...

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January.....	41.548	27.380	July.....	41.091	...
February.....	42.102	28.978	August.....	37.667	...
March.....	41.313	30.577	September.....	36.689	...
April.....	40.938	31.702	October.....	32.620	...
May.....	43.149	...	November.....	30.833	...
June.....	42.120	...	December.....	27.925	...
Av. year.....	...	...	...	38.166	...

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	6.000	3.691	19.828	14.469
February.....	6.000	3.725	19.531	14.250
March.....	6.000	3.838	19.703	13.975
April.....	6.000	3.993	19.975	13.469
May.....	6.000	...	19.688	...
June.....	5.760	...	20.188	...
July.....	5.288	...	20.350	...
August.....	5.250	...	19.063	...
September.....	4.813	...	19.775	...
October.....	4.750	...	18.531	...
November.....	4.376	...	17.281	...
December.....	3.658	...	14.500	...
Year.....	5.325	...	19.034	...

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January.....	6.732	4.513	6.582	4.363	27.125	20.563
February.....	6.814	4.788	6.664	4.638	25.938	20.875
March.....	6.837	4.665	6.687	4.527	26.094	21.075
April.....	6.685	4.645	6.535	4.495	25.900	21.344
May.....	6.441	...	6.291	...	25.563	...
June.....	6.419	...	6.269	...	25.469	...
July.....	6.072	...	5.922	...	23.850	...
August.....	5.701	...	5.551	...	21.969	...
September.....	5.236	...	5.086	...	21.050	...
October.....	5.430	...	5.280	...	21.781	...
November.....	4.925	...	4.775	...	21.438	...
December.....	4.254	...	4.104	...	20.075	...
Year.....	5.962	...	5.812	...	23.771	...

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

Metal and Mining Companies—U. S.

Table listing Metal and Mining Companies in the U.S. with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val), Total to Date, Latest Date, and Amt.

Coal, Iron and Other Industrials—United States.

Table listing Coal, Iron and Other Industrials in the United States with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val), Total to Date, Latest Date, and Amt.

Canada, Mexico, Central and South America.

Table listing companies in Canada, Mexico, Central and South America with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val), Total to Date, Latest Date, and Amt.

*Previous to consolidation \$1,436,250 were divided. †Amalgamated.

*Mexican Currency. †Since reorganization.

Water-softening Plant of the Pennsylvania Railroad

Experiments are being made with a new 30,000-gal. per hour water softener, designed by A. E. Holmon, and built by the Pennsylvania railroad at the shops in Indianapolis, Ind. The softener consists of the following parts: One settling tank or clear well, one mixing drum, one solution tank with lime-slaking tank above, one adjustable solution pump, one water motor and the necessary piping. To the water-motor shaft is attached, by chains and sprockets, stirring apparatuses mounted in the mixing drum and solution tank, also by adjustable crank arm, the solution pump.

The operation of the softener is as follows: When the valve at the raw-water inlet is opened, the water passes through and sets in motion the motor which drives the stirring apparatus and solution pump. For each revolution of the motor, the solution pump makes one stroke. The length of the stroke and the strength of the solution, which at Indianapolis contains lime and soda ash, are so adjusted that the necessary amount of chemicals, required for the proper softening, are pumped into the raw water. The chemicals meet the raw water in the pipe and flow together into the mixing drum, where the water is agitated for about one minute before flowing through the pipe to a settling tank, where it rises to the top and flows to the storage tanks through an overflow pipe.

The thorough mixing of the water and chemicals, under pressure, hastens the chemical action, so that it is completed before leaving the bell at the entrance of the settling tank; it also crowds together the precipitate in a more compact form, resulting in a quick and more complete clarification.

For removing the sludge, a system of pipes is provided in the bottom of the settling tank and connected with the waste discharge. The raw-water inlet and the sludge pipe are connected with a by-pass pipe, supplied with the necessary valves, by which water can be let directly into the settling tank, for stirring up the sludge, or, when necessary, to make repairs to the machinery.

The softener is not supplied with filters, the settling of the precipitate being expected to be complete, but pipes and floor space in the building are provided, so that sand filters can be put in if so desired.

Construction News

Hollsopple, Pennsylvania—Fred Zipf & Co., of Johnstown, Penn., have been awarded the contract for the construction of a fan-house and boiler-house for the Haws Coal Company. That company has

just finished the sinking of two shafts on the property to tap the B vein of coal, and work will be started in a day or two on the headframe and tippel. The company expects to ship coal about July 1. The output of No. 2 mine on the C vein, which was opened about five months ago, has been gradually increasing, and is now 300 tons per day. H. Y. Haws is president, W. D. MacCausland general superintendent and C. P. Collins, engineer.

Industrial

The Chicago office of Arthur Koppel Company has been removed to 334-338 Monadnock block.

American Process Company has removed its New York offices one door north to 68 William street.

Vanderbilt furnace, of the Birmingham Coal and Iron Company, at Vanderbilt, Ala., was started up May 5. It has a capacity of 250 tons of iron daily.

Jenkins Brothers announce that they have removed their Chicago offices from 31-33 North Canal street to more commodious quarters at 226-228 Lake street, corner of Franklin street.

Chalmers & Williams, Inc., Chicago, Ill., advise us that they have recently closed a contract with the Croesus Gold and Copper Mining Company for a complete Huntington mill plant.

Power and Mining Machinery Company has removed its New York office from 52 William street to 115 Broadway, and its San Francisco office from 148 First street to 217 Sheldon building.

Buff & Buff Manufacturing Company, Boston; Mass., advise that its shops are very busy again and working practically full time. According to present indications it expects to be working overtime in the very near future.

Chas. F. Iszard and J. Henry Warren announce the formation of the Iszard-Warren Co., Inc., makers of sterling transits and levels, engineers' field equipments, drafting-room outfits and supplies. Offices, salesroom and factory are located at 1122 Vine street, Philadelphia, Penn.

Wood Drill Works, Paterson, N. J., is distributing a neat 4-page circular setting forth a few of the points of merit in the manufacture of the "Wood" rock drill and the material that enters into its construction. Copies of same can be obtained from any of their representatives.

Herman Nieter, 2 Rector street, New York, has been appointed Eastern representative of the Canton Drop Forging and Manufacturing Company, of Canton, Ohio. Mr. Nieter is also Eastern agent of the Canton Boiler and Engineering Company and the Braddock Manufacturing and Machine Company.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., had on exhibition in booth No. 37 in the Auditorium Annex at the National Electric Light Association Convention, Chicago, a 5-horse-power single-phase motor of the latest design, a 10-horse-power polyphase motor and a set of standard Wagner instruments.

The Dayton Globe Iron Works Company recently shipped for installation at the power plant of the Juarez Light and Telephone Company, Colonia, Dublan, Chihuahua, Mex., a 10-in. New American turbine. The turbine is inclosed in a cast-iron flume with an opening on top through which the water is supplied to the wheel.

The Union Gas Engine Company announces the engagement of John F. Willard as manager. Mr. Willard has had many years' experience in the manufacture and sale of gas engines.

The company has leased the large stores, 503 and 505 Mission street, San Francisco, Cal., and will carry a sample line of engines for convenience of customers.

The Reese-Hammond Fire Brick Company, Bolivar, Penn., was sold a few days ago to M. R. Murphy, representing the First National Bank of Pittsburg, to satisfy a mortgage. The sale was conducted by the Union Trust Company of Pittsburg, which held the first mortgage and includes plants Nos. 1, 2 and 4, together with all the land and houses.

Herbert C. Petty was elected, May 13, a director of the Crocker-Wheeler Company. Mr. Petty accepted a position in the sales division of the company January, 1903, and advanced rapidly to the position of contract manager. The present honor conferred upon him is a recognition of the esteem and confidence which he commands among the stockholders of the company.

The National Ore Concentration Company has moved its general office from Milwaukee to Chicago where it will hereafter be found at room 1730 First National Bank building, corner of Dearborn and Monroe streets. This firm consists exclusively of ore milling engineers, making a specialty of the concentration of milling ores by the "Woodbury" system. Mr. E. T. Wright will continue to represent its interests in the capacity of president and manager.

The Southern Cambria Street Railway Company, which is constructing a line between Johnstown, Penn., and Ebsenburg, has awarded the Cambria Steel Company the contract for the viaduct between the tenth and eleventh wards in the city of Johnstown and also for the protection bridge that is to be erected near Conemaugh. The contract price for the viaduct was in the neighborhood of \$35,000 and the bridge about \$6,800. The viaduct will cross several avenues, the Conemaugh river and the tracks of the Pennsylvania Railroad and will be 1100 ft. long. The foundations for this work are already in place and the contract calls for the erection of the steel work.

The Dayton Globe Iron Works, Dayton, Ohio, has just received a contract from the Winchester and Washington City Railway Company, of Winchester, Va., to double its plant by the installation of two more hydro-electric units. The initial equipment consisted of two units of 45-in. Sampson wheels complete with rope drive to Westinghouse generators located on the floor above the wheel pits. The two new units for which contracts have just been placed will consist of improved "New American" turbines built by the Dayton Globe Iron Works Company. Each unit will consist of a pair of 49-in. turbines. Each pair of wheels will develop 1000 h.p. and 150 h.p.m. under 22 ft. 6 in. working head, and the power will be transmitted to the generators above through a rope drive. The power is used for manufacturing purposes as well as lighting within a radius of 20 or 30 miles.

Trade Catalogs

Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1429. Jaw Crushers. Illustrated.

Vulcan Iron Works, Wilkes-Barre, Pa. Circulars. Self-contained Steam and Electric Hoists. Illustrated.

Jas. J. Brossoit, Salt Lake City, Utah. Catalog. "Numa" Rock Drill Sharpener. Pp. 10, illustrated, 6½x9½ in.

Life Saving Devices Company, 50 Church street, New York. Catalog. Davidson Automatic respirating appliance for mines. Pp. 16, illustrated, paper, 5x7 in.

Sullivan Machinery Company, Chicago, Ill. Catalog No. 61. Stone Channelling Machines. Pp. 68, illustrated, paper, 6x9 in. Bulletin No. 58-D. Corliss Straight-line Air Compressor. Pp. 8, illustrated, 6x9 in.