

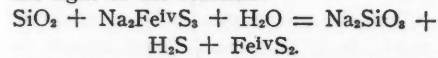
**THE ENGINEERING AND MINING JOURNAL**  
MINING AND METALLURGY ESTABLISHED 1866

**The Replacement of Quartz by Pyrite.**

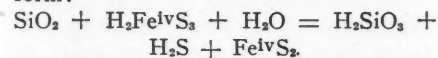
By CHARLES S. PALMER.

A case has recently come to my attention where quartz is manifestly primary to, and is replaced by pyrite. The occurrence is paralleled by many instances of ore deposition. It is possible to explain this common phenomenon from the very chemical reactions which are suggested by the relative positions of the pyrite and the quartz. The explanation also probably requires the supposition of a temperature somewhat elevated, say, 100° C. to 200° C., and also of some unknown compounds. Indeed, the case is peculiar in that the very juxtaposition, of the substances SiO<sub>2</sub> and FeS<sub>2</sub>, is itself incidental evidence for the existence and interaction of a compound which is not known. I refer to the substance Na<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>, sodium sulpho-ferrite. I will discuss first the probable function of this unknown compound in the replacement of quartz by pyrite; and will later discuss the general evidence for the chemistry of the pyrite molecule.

The facts are that silica seems to have been removed; pyrite seems to have taken its place. Let me picture the change in the light of the reaction:

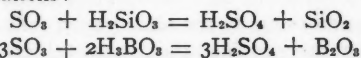


Now this speaks only of an ordinary exchange, resulting in an alkaline silicate and hydrogen sulphide, with the separation of pyrite. Given the sodium sulpho-ferrite, and the rest follows so obviously that explanation is superfluous. The sodium salts would probably be carried, in and out, in a current of hot and alkaline solution. Indeed it can be written in the form:



This equation gives essentially the same result, only both the silicon and the iron are represented in the form of acids rather than of salts. The difference is not momentous from the standpoint of theory, though it may be from that of fact—but not necessarily.

The point is that, considering silica as an acid anhydride, and pyrite as an acid anhydro-sulphide, the one is replaced by the other, as is illustrated in the following equations:



But now the question arises as to the chemistry of pyrite: does this substance ever act as the acid residue of a sulpho-acid with the correlative sulpho-salts? And here it should be noted that the substantiation of a fairly complete series of salts, implies naturally the real, though possibly unstable acid to correspond there-

to. Thus the carbonates are well known; but carbonic acid proper—in the form of H<sub>2</sub>CO<sub>3</sub>—has never been obtained except in very dilute water solution. The nearest approach to the real carbonic acid is in the alkyl salts (as ethyl carbonate, methyl carbonate, etc.), which are colorless, volatile liquids, amenable to vapor-density measurement, and thus also to molecular-weight determination. All this argues clearly in favor of the very unstable but not absolutely unknown carbonic acid proper. Now as regards the chemistry of Fe<sup>iv</sup>S<sub>3</sub>, it should be analogous to an Fe<sup>iv</sup>O<sub>3</sub>, which is not known—though manganese, its next lower neighbor, has MnO<sub>2</sub> (which acts like SO<sub>2</sub> in the sulphites in giving rise to the manganites). Thus, bixbyite, Fe<sup>ii</sup>Mn<sup>iv</sup>O<sub>3</sub>, clearly shows an acidiferous tendency. Now iron fails to carry out this rôle in its oxygen chemistry; but it seems to make up for it by its sulphur chemistry. Naturally pyrite, FeS<sub>2</sub>, would be referred to some such series of the sulpho-salts as the sulpho-stannates for a type. Thus we might have Na<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>, sodium normal-sulpho-ferrite, Na<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>, sodium meta-sulpho-ferrite and the like. These compounds are customarily ignored, but Dammer, the great German manual, is authority for the following: Na<sub>2</sub>Fe<sup>ii</sup>Fe<sup>iv</sup>S<sub>4</sub>, di-sodium ferrous normal-sulpho-ferrite; Ag<sub>2</sub>Fe<sup>iv</sup>S<sub>4</sub>, silver normal-sulpho-ferrite; Cd<sub>2</sub>Fe<sup>iv</sup>S<sub>4</sub>, cadmium normal-sulpho-ferrite. To be sure we are still lacking an illustration of the desired salt Na<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>; but this is only one step removed from the actual. The reason may be in the excessive ease of hydrolysis; but if the way is clear on both sides of the gap—as it seems to be—we need not worry particularly regarding the actual gap, though more information would be a comfortable possession. But it may be a case like that of silver hydroxide, for example. This substance, AgOH, is not known in the pure form, as it loses water, passing to the oxide Ag<sub>2</sub>O; yet the oxide itself is slightly soluble in water, as though it formed silver hydroxide, AgOH; and for many years moist silver oxide has been used in manipulating the hydroxyl group into organic radicals, just as though silver hydroxide actually existed. The illustration is well in point. In the case of pyrite, Fe<sup>iv</sup>S<sub>3</sub>, as the reaction seems to lead up to the probable alkaline salt Na<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>, or the acid itself H<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>, instability may not trouble us—we have the plausible results at hand and abundantly.

But, again, the waters of mineral sulphide deposits are usually regarded as being alkaline and hot. Now, whether there is a temperature region of temporary stability of the unknown acid H<sub>2</sub>Fe<sup>iv</sup>S<sub>3</sub>, somewhere between 100° and 200° C., we know not. It may be a temperature region of reaction tendency between the silica and the pyrite. That would be rational, for the whole trend of modern explanation is toward kinetic rather than static equilibri-

um; which, in English and in this case, means that we may explain the actual chemical exchanges as though they involved certain molecules and compounds which, in fact, may exist only momentarily, being unstable when removed from the fulcrum of molecular exchange.

The case is not unique in the history of good theory and conservative explanation. Moreover, it suggests considerable laboratory work which can but lead to clearer views and safer ground. Certainly it is desirable that there be more research on pyrite and silica in hot alkaline water under some pressure—on the supposition that both are acidiferous substances. Meanwhile, the facts of ore deposition accumulate, and wait for an explanation.

**The British Mint.**

The total number of coins made by the British Mint during the year 1904 was as follows, according to the preliminary report just issued:

	Imperial.	Colonial.
Gold.....	11,753,809	.....
Silver.....	13,681,476	42,210,000
Nickel.....	.....	264,000
Bronze.....	24,673,152	2,550,000
Total.....	50,113,437	45,024,000

The total number of pieces struck was 95,137,437, which compares with 114,697,720 in 1903, showing a decrease of 19,560,283 coins. There were received at the Mint, as light weight or worn coins, 954,000 sovereigns and 1,146,000 half-sovereigns in gold, and 638,839 silver coins; these were melted down and used in new coinage.

It is not to be supposed that the new coins issued represent an addition to the circulation equal to their value. A large amount of coin disappears each year, from various causes—such as use in jewelry, export, actual destruction by fire, or shipwreck, and by hoarding. It is impossible to determine the amount of these losses; but it is certain that a large part of the new coinage is required to replace that which has disappeared.

**THE BIGGEST LOCOMOTIVE.**—The record for size and weight in locomotives has been broken again. The Baltimore & Ohio railway has placed in service a freight engine of the Mallet compound type, that weighs 334,500 lb. This monster has twelve drivers of 56-in. diam. arranged in two groups. The forward group is operated by the low-pressure cylinders and the rear group by the high-pressure cylinders. This grouping enables the locomotive to take a curve of shorter radius, and the large wheel-base (30 ft. 6 in.) favors the rails. There are nearly two miles of boiler tubes in this remarkable locomotive, and the boiler pressure may be carried as high as 235 lb. The design is well adapted for slow work where the grades and curves are numerous.

### The Mesabi Iron Ore Range.—III.

BY DWIGHT E. WOODBRIDGE.

Roughly speaking, nine-tenths of the ore-bearing formation of the Mesabi district passed first out of government ownership into the possession of lumbermen and timber speculators. The entire region, except where too swampy, was covered with a magnificent growth of virgin white pine trees, tall, straight as arrows, and with comparatively little underbrush. It was, in fact, a vast pinery, and nothing else, to these lumbermen, who went through the woods looking upward, and stumbling unwittingly over one of the greatest treasures a kindly nature had left open for man. They had no thought of the vast wealth that lay beneath their feet. One or two concerns, taking up lands for timber, were sure enough of iron ore to instruct their cruisers carefully to examine and note the occasional outcroppings; a few suspected ore as a possibility but most of those leading in the original development of the region, do not claim to have had any early suspicion of what was to come in a few years.

The remaining tenth of the land was owned by the State of Minnesota. Under the laws organizing territories of the United States, sections 16 and 36 in each township, or one-eighteenth of the area, were reserved for public schools. In addition to this, all land designated by the government surveyors as swamp became a part of the State's possession. When the government surveyor ran his lines about a section, he marked on his notes wherever swamps occurred and by connecting these points on his plat, certain districts were included within the boundaries of swamp; these were thereafter known as 'swamp lands.' As such, they went to the State, to be used for such public purposes as seemed best. These purposes were to aid State schools and public institutions, for grants for internal improvements, etc. Under these grants come all swamp lands that belong to railways subsidized by the State, such as the Duluth & Iron Range, and others.

Mr. Jas. B. Geggie, of Duluth, was exploring for hard ore on the Vermillion range in the year 1887. Passing up and down that line he frequently noticed what was called the "red cut" in section 28 T 59 R 14, where the roadway passer through a shallow bank of reddish gravelly material. Mr. Geggie thought this was ore, and investigation confirmed his suspicion. He began exploration that year and sank a number of test pits, working northward off the land he had under option and to property owned by the State of Minnesota. He found indications of iron in every pit, and in some there was clean, soft ore as fine as flour. No one suspected the possible presence of soft ore in the State, and Mr. Geggie was looking for a vertical vein of hard ore, such as

was being mined on the Vermillion range. This fact, and the information gained from a survey, that he was off his land, so discouraged him that he ceased work for the time being. But he took steps to secure an act under which lands could be leased, and then, in association with the late Geo. C. Stone and with Joseph Sellwood, recommenced explorations. But work did not then meet the expectations of the little syndicate and the camps were abandoned. All this occurred prior to the discovery of merchantable ore at Mountain Iron.

When Mr. James B. Geggie, in 1887, found his pits on section 20, T 59 R 14, following the formation away from his land to that of the State, he looked up the law and found there was no way of gaining title to State lands. A consultation with his attorney, John M. Miller, then of Minneapolis, brought the conviction that the only way to secure the land he had been exploring, was through the passage of an act authorizing the State to lease its mineral tracts.

At the following session of the legislature, in 1889, Mr. Geggie had a bill presented, which was afterwards passed with little modification, permitting the issue of leases for exploring, and of 50-year contracts for mining State lands, on the payment of 25c. per ton royalty as the major consideration. During the discussion that followed its presentation, the rate of royalty permitted by the bill was frequently amended, and at times it looked as though it might be put at \$1 per ton, which would have effectually barred exploration on the lands of the commonwealth. The Geggie bill was, of course, personal, and to save its promoter from loss through an error in surveys; but it was thought best to make the act general, in order that lands owned by the State and underlain with mineral, might be made available for commercial enterprise and become a source of revenue to the commonwealth. It is probable that not far from 100,000,000 tons of iron ore have been exposed through the provisions of this act.

In the vicinity of Hibbing, large tracts of land that were later found to be mineral-bearing, were taken up in the '80's by Messrs. Hull & Boeing, of Detroit, Mich. These lands were 'looked,' as the term for examination of timber reads, by M. H. Alworth, a land cruiser; and as a result, he was given an interest therein; so the firm became Alworth, Hull & Boeing. To this firm belongs the distinction of owning as large a tonnage of Mesabi ores in the ground as probably belongs to any single interest. They have leased to many mining companies. Half a dozen mines near Hibbing—among them the Hull, Sellers, Agnew and Susquehanna—are on

their lands. These, as well as other tracts, were bought for pine, at prices ranging from \$1.50 to \$2 per thousand feet, or, say, about \$2,000 per 160-acre piece. This timber was sold, doubtless at large profits, and the iron ore beneath came as a pleasing and unexpected increment.

In 1882 a public land sale was held at Duluth. Wealthy lumbermen and pine speculators were present from all parts of the United States; probably 100 of the heaviest timbermen of the country were assembled, and the sale itself was the most important that the government had ever held. The lands to be sold were among the most magnificently wooded of any in the Northwest, and included large areas along what was afterwards called the Mesabi range, especially near Hibbing. So urgent were the buyers of this pine that much bad blood was engendered and tracts were frequently pushed to prices far above their supposed value. One evening a member of one of the buying syndicates called a young 'land looker' of Duluth into a corner of the hotel where all met after the day's sessions, and asked him to bid for them the following day; as, if they showed their own hand, the price would be advanced on them, or they would be unable to buy their entire list at any price. He agreed, and their list of 26 forties among the lands to be sold were turned over to him. The next morning, as the first of these listed tracts was called, the young man bid the minimum price, \$1.25 an acre. From across the room at once rose Alonzo J. Whiteman, then a prominent pine operator and a very rich man, now claimed to be one of the notorious criminals of the United States, and called out, "George, are you making this bid for yourself?" The only answer that could be made was "Yes" and though it was an unpleasant thing to say, the cruiser did so.

Turning to the room full of bidders, Mr. Whiteman said, "Gentlemen, here is a young land looker who is trying to get some of this timber for himself, and I, for one, will not bid against h'm." Governor Pillsbury, of Minnesota, who sat near, then said, "Young man, how many forties do you propose to bid for?" and when told the number was 26, opined that was a rather big deal for a woodsman to have the money to take; but that he, too, would refrain from bidding against a young man they knew and liked. The result was that every one of the 26 forties was bid in at the minimum price during that morning by the same young fellow.

In the evening, the successful cruiser, disgusted with his part in these proceedings, met his principals and reported his results. They were astonished and were reimbursing him in some economical manner. One proposed that he should have a twelfth of the mineral right; the other thought that excessive; and they finally compromised on a \$20 bill, which was at

once utilized as an irrigation fund for the three. The principal who had objected to giving a twelfth of the mineral right had no idea that he was retaining value, but did not care to have another man interested in the land, in any way. At that time, all the experts denied the

Holland had been accompanied through this timber by an old Indian cook who came from the Marquette range, and was fairly crazy, as it seemed, on the subject of ore under this pine. A few forties were bought from Eaton & Merritt, of Duluth, for enough to make the price of them all

the Burt, is producing 1,000,000 tons and paying its lucky owner \$250,000 per annum.

Wright & Davis, another firm from the same district, owned at one time nearly all the ore-bearing formation across T 57 R 21, including what are now the Mahoning and Stevenson mines, as well as many other valuable tracts. Among outside properties, they owned the Duluth, Mississippi River & Northern railway, built for logging purposes. All these were sold to James J. Hill, for the Great Northern road, and formed the nucleus of the enormous business controlled by the Great Northern upon the Mesabi range. Messrs. Wright & Davis almost gave away their lands, receiving for them about \$4,000,000. The annual net profits from royalties and traffic based on this sale, cannot be much less than \$2,000,000. In the Eveleth district, much of the ore-bearing land was owned by Eldridge M. Fowler, of Pasadena, also a lumberman, who died in November, 1904. Murphy & Dorr and Robinson & Flynn, Michigan firms, held and still hold large and valuable tracts in that vicinity, some of them in common with the Fowler estate.

Mr. Fowler bought his lands for less than the pine was worth from one Morris Thomas, a Duluthian who is still working around in the woods taking small logging contracts winter after winter. Interested with Mr. Fowler were Peyton, Kimball & Barber, Duluth lumbermen, and Simcoe Chapman, a Saginaw man, who negotiated the trades. These lands included a large part of the ground on



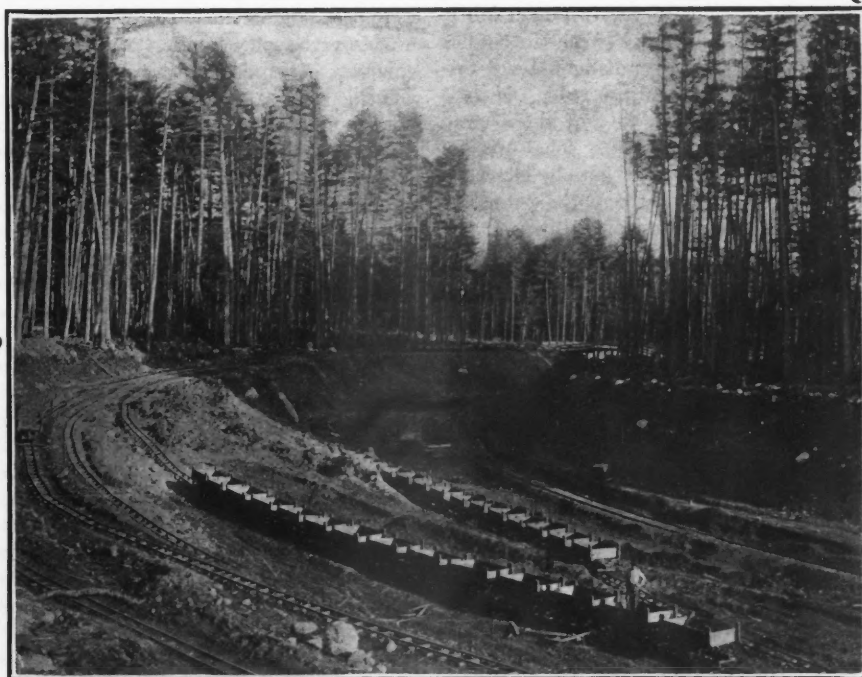
MAHONING MINE IN 1893.

possibility of iron or other mineral in that part of Minnesota, but a few old-time explorers, Indians, and cruisers had been struck by the appearance of the country, and were quietly talking among themselves of the resemblance of its few rock outcrops to what they had seen in mining regions.

On these 26 forties bought that day at \$1.25 an acre and a \$20 bill to the young and popular bidder, have since been found mines aggregating a tonnage of more than 75,000,000 tons, a princely fortune. And it was primarily A. J. Whiteman, now a fugitive, whose every move is watched by detectives, who made it possible for this fortune to be secured within one control.

This was the case, of course, with all these timber holdings. In the vicinity of Hibbing were many tracts taken by Wellington R. Burt, of Saginaw, another Michigan lumberman. These lands are now under lease to the Oliver Iron Mining Company, and include the great Burt open-pit. In 1888 Mr. Burt made arrangements with Geo. N. Holland, a well known cruiser and estimator of Duluth, to 'look' certain lands and draw on him for their purchase. There were some forty 40-acre tracts in T 58-20, that then belonged to the C. N. Nelson Lumber Company, of Cloquet, and it was in financial straits. Mr. Holland knew this, and got a low price for the bulk of these lands. Mr. Nelson was at first unwilling to part with the mineral rights, but finally did so.

\$17,000. Holland had always been paid by an interest in the land he 'looked' and took; but this time Mr. Burt, thinking the



MAHONING MINE IN 1894.

deal a small one, preferred to pay a straight cash commission, and did so. On these 1,600 acres are now known to exist four or five important mines, one of which,

which the Fayal mine has been developed, and all of the Spruce, Adams and Cloquet. From these lands Mr. Fowler's income in royalties last year was more than \$500,000.

an amount that can be duplicated annually for many years. Chapman early sold out his minority interest, and some years afterwards received a check from Fowler for \$20,000. Peyton, Kimball & Barber did not care for mineral rights on such unpromising lands, and sold their share long before ore was found.

In the early days of the Mesabi, R. M. Bennett, of Minneapolis, appreciated what was coming, and secured an agreement with J. S. Pillsbury, of the same city, under which he was to have a half interest in the Pillsbury lands when he had uncovered 100,000 tons of ore.

Mr. Bennett interested John M. Longyear, of Marquette, a leading owner of iron lands on the Gogebic range, and it was the matter of a brief period and a few dollars to prove up their end of the deal. What are known as the Pillsbury, Bennett & Longyear lands, were developed under this agreement. In this land are the Glen and Monroe mines. A somewhat similar agreement with Wright & Davis gave rise to the Hill, Bennett & Longyear lands, all of which are in the western part of the range.

Biwabik mine was an old timber tract, and was the most important of a number of holdings of John Williams, of Chicago, now dead. Of the large mining groups operating in the district, the Merritt family secured much State land and some very valuable private tracts, including the famous Mountain Iron mine. Concerning the way in which this, originally a State selection, came into private hands, there has always been considerable discussion, and the State at one time made an unsuccessful attempt to regain possession.

The Merritt holdings formed the nucleus of John D. Rockefeller's Lake Superior Consolidated Mines, which in 1901 became a component part of the United States Steel Corporation. The original Merritt properties were largely increased from time to time through the persistent and far-sighted efforts of William J. Olcott, manager for Mr. Rockefeller, and to such an extent that the Rockefeller mines went into the Steel Corporation at a far higher valuation than those of companies that had been as long in the field with as good opportunities.

The Minnesota Iron Company confined itself to that portion of the Mesabi, east of the line between ranges 17 and 18. In townships 57 and 58, range 17, it secured immensely important tracts, largely by purchase from lumber companies operating at Cloquet, Minn., and by lease from Fowler and associates. There were times when this company might have bottled up the Mesabi at a nominal price; but, happily, fate did not so decree. Speculation as to what might have resulted in such event leads into an interesting field of thought. In 1900, the Minnesota Iron, the Duluth & Iron Range Railway, the Illinois Steel, and some subordinate companies were combined as the Federal Steel

Company, and the following year went into the great Steel Corporation.

It was in 1896 that Henry W. Oliver, of Pittsburg, after long and laborious argument, succeeded in interesting Andrew Carnegie in the business of iron mining upon the Mesabi. Mr. Carnegie had previously held aloof from mining enterprises, deeming them unnecessary for the steel-maker. They formed the Oliver Mining Company, and their first joint accession to the mines Mr. Oliver had previously held was the great Mountain Iron, which they leased from Mr. Rockefeller's Lake Superior Consolidated. The latter's idea at that time was that there was more profit in hauling ore than in mining it; and his whole policy tended toward securing tonnage for his Duluth, Missabe & Northern road and his Bessemer Steamship Company, whose splendid fleet he was then engaged in constructing. The Oliver Company secured the Mountain Iron practically without bonus, and at a reasonable royalty.

Under Mr. Oliver's oversight, and by the direct management of his associates in the northwest, the company's policy was commendably broad and liberal, in sharp contrast to that of some others; and was directed to gaining possession of the best mines, not alone of the Mesabi, but of any Lake Superior district. It was also directed, like that of the Rockefeller company's local representatives, toward placating public sentiment and making friends, rather than enemies, about the scenes of its operations. In pursuing its plans to secure mines, it entered all other ranges along the lake, and put Thos. F. Cole, now its president, in charge as general superintendent. Early in 1897, the company secured the very cream of the Gogebic range. Later, it took very important mines on the Marquette and Menominee ranges, and Dr. Nelson P. Hulst was made general manager of these operations. At the formation of the United States Steel Corporation, this company was a most important factor, and it was the work of Messrs. Hulst and Cole, as heads of the Oliver Iron Mining Company, with \$1,250,000 capital, that made that capital worth to the Steel Corporation the sum of \$68,000,000 in money. It may well be said that the entry of Messrs. Oliver and Carnegie into ore mining on Lake Superior was, in its bearing on the steel trade of the country, second in importance only to the discovery of the Mesabi.

Other steel-making companies, of more or less note, secured themselves, at least in part, as to ore reserves. The American Steel & Wire Company led among these; under the efficient direction of Joseph Selwood, an old and most experienced miner of the Lake Superior region, it took a number of mines. These became a part of the Oliver Iron Mining Company's property after the amalgamation of American Steel & Wire with United States Steel, and still further added to the tre-

mendous lead the company was getting. Outside steel-makers have since then gone into ore, chiefly to protect themselves for the future.

During the early '90's, when both mining companies and individuals were most active in their search for Mesabi ore lands and mines, large sums were paid for properties. In the years 1892 and 1903, these aggregated four or five million dollars, mostly as bonuses for leases. At that time, too, higher royalties were paid than later experience proved advisable. The Mesabi Iron Mountain Company closed a contract, for a royalty of 65c. a ton; and the Biwabik was operated for a time under a 50c. royalty. These were extreme cases, but they show to what lengths the boom of that day carried ideas of values. Of course, these contracts have long since been modified. Neither the enthusiasm of tyros, nor the experience of miners, astonished at the enormous reserves of high-grade ore they were able to discover at comparatively slight costs, was proof against the intoxication of big figures. Not only were royalties put high, but the minimum agreements made in the first year or two of the range would, if carried out, have flooded the market and given sufficient Mesabi ore to have supplied all the furnaces of the North.

The range was, at that time, severely handicapped by the prejudice against its fine ores, on the part of practically all furnacemen. While a few were even then able to use up to 60, and even to 75, per cent Mesabi in their furnaces; the average was not more than 25 per cent; and this was generally believed to be extreme. In such a condition, with an immense tonnage of this undesirable ore pressing on the market, on account of excessive minimum agreements at mines, and the necessity that new and weak concerns should begin to receive return for their labor and investment, Mesabi ores were at a decided discount in price. The furnaces were not slow to see their advantage and act upon it. The burden that had been on furnace managers to take what specifications ore men could force upon them, had been changed to the other foot, and ore miners had to submit to specifications demanded by furnaces. This pressed doubly hard on the Mesabi.

There was, too, an important differential on lake freights in favor of the old ranges. This has been eliminated, until now ore from the most distant ports goes to Lake Erie receiving docks, at a far less rate per ton than that of those nearer the east. Rail freights from the Vermilion and Mesabi to Lake Superior, have always been higher than from old ranges to their ports, but the distance is much longer, and the rate paid is greater, in most cases not so much, as to ports lying nearer the lake. But with all these cumulative prejudices and differentials against them, the life of early Mesabi operators was not spent on flowery beds of ease.

### The Hoisting Problem.\*

By JAMES R. THOMPSON.

The conditions of the problem vary with different districts, and, indeed, each individual mine seems to receive, even if it does not require, an independent treatment. It is not strange, then, that the practice of the Lake Superior mining region should have produced an immense variety of hoisting machinery. It is a difficult matter for any one to select those plants which are best fitted for the work they have to perform, and the general conditions they have to meet. Opinions will necessarily differ as to which are best, and yet it seems that the experience of more than fifty years in one of the greatest mining regions of the world should have developed some ideas. In view of the great diversity of hoisting machinery, it is pertinent to ask whether there are any well-settled fundamental principles, and what are the requirements to which a modern hoisting plant should conform?

The solution of the hoisting problem presents several phases, of which the three most important are mutually dependent, namely, the relation to underground requirements, the mechanical features, and the financial aspect—which usually dictates the final decision.

The direct productive work of a mine is that done underground, and every other activity must be so arranged that the underground operations may proceed efficiently. It is fundamental, then, that the workmen should not be obliged to wait upon the hoist, but rather the hoist must be a servant, always ready for service when called upon. From the underground standpoint, the speed of hoisting is of the first importance.

Hoisting practice on Lake Superior largely, but perhaps unconsciously, conforms to a certain standard of speed. This standard may be stated as follows: No matter what the depth, the load must be hoisted from the bottom of the mine within one minute, and the round trip must take not more than two and one-half to three minutes. This seems arbitrary enough, but the fact is, that the second-motion hoists installed at the iron mines of from 300 to 800 ft. depth have roughly conformed to it no less than the big Nordberg quadruple engine at the Tamarack, with its 25½-ft. drum, hoisting from approximately 5,000 ft., and making from 18 to 20 trips per hour. A duplicate of this hoist is now being installed, a fact which speaks for itself. It is on record that a hoist at the De Beers mine, at Kimberley, has made 46 round trips in one hour per single skip, and has maintained an average of 32 round trips per hour for 24 hours from a depth of 1,260 ft. A first-motion hoist, with 12-ft. drums, installed some fifteen years ago at an iron mine about 500 ft. deep, could undoubtedly,

if it actually did not, exceed that record. That such a speed of hoisting is unnecessary and excessive is indicated by the fact that a plant recently installed at the same iron mine, to meet the same conditions, has drums but six feet in diameter instead of twelve. Coal mines, which usually screen their product at the top of the shaft, are apt to serve a large territory by one shaft, and with lighter loads hoist more rapidly, often reaching the rate of a round trip per minute from a depth of 500 or 600 ft. It might be expected that the large iron mines, especially as they gain depth, would reduce the number of operating shafts and require a more rapid rate of hoisting; however, observation of the shafts projected, and the hoisting facilities planned, leads to the conclusion that the rate of hoisting quoted will suffice to dispose of the required production.

The load has varied from one ton, in the early days of shallow mines, to a maximum of 5 tons in the iron mines, and 7½ tons in the copper district. Evidently it has been found wise to increase the product by increasing the load, rather than to increase the rate of hoisting. It may be stated, then, as a result of Lake Superior experience, that the requirements of a hoist are that it must hoist the load in one minute and make a round trip in three minutes, no matter what the load or depth.

In considering the mechanical phase of the problem, many questions arise which must be decided in conformity with the two fundamental principles of engineering design; the plant designed must be capable of doing the required work without breaking down; it must be built and operated at the lowest possible cost; that is, the plant must be designed both for economy in first cost and for economy in operation. When these conditions conflict financial considerations will dictate the proper compromise.

The first element to be considered is that of power. Late practice uses about 150 lb. steam pressure. This is somewhere near the limit at which ordinary standard pipe and fittings and ordinary workmanship are satisfactory. This pressure, moreover, as compared with 100 lb., until recently the maximum carried, gives a 50 per cent increase of power, with less than 5 per cent increase of coal consumption. Such increased power means smaller engines, and hence a lighter construction throughout, a distinct advantage in first cost of plant. To derive such a large increase of power with so small an added expenditure for fuel means an economy of operation such as can be duplicated in no other manner. In a recent case, the saving in first cost by erecting the plant for 150 lb. steam instead of for 100 lb. was sufficient to pay for a new boiler plant complete, designed for the higher pressure, to say nothing of the

further economy of operation after the high-pressure equipment was installed.

In ordinary power-plants, the means of arriving at ultimate economy are well understood and commonly practiced. Where steady power is required, the advisability of installing compound-condensing or triple-expansion-condensing engines is unquestioned. The duty required of a hoisting plant, however, is peculiar, and the ordinary treatment does not necessarily fit the case. The load upon a hoisting engine consists of the weight of the ore, which is the total live load, the weight of the cage, car or skip, which is a constant dead load, and the weight of the rope, an important percentage of the whole, which is a dead load continually varying in amount, being greatest at the beginning of the trip and nothing at the end. Added to this variable and largely unprofitable loading of the engines is the extremely intermittent character of the service required. The engines must start the maximum load, attain full speed in six or seven revolutions, hoist a continually decreasing load to the surface and stop short—all within one minute, and after a longer or shorter period of idleness, they must repeat the operation. Under such conditions the ordinary methods of obtaining economy of operation in steam-engine practice are insufficient, if not positively worthless. Lake Superior experience has fully demonstrated that a simple Corliss or other automatic variable cut-off gives more economical results than a slide valve or fixed cut-off, and engines of such design have been adopted at deep mines. The results of the attempt to gain a still greater economy of operation by the use of compound or triple-expansion engines are indefinite, if not negative. The subject is one of practical difficulty, for the reason that no one knows definitely what steam is required by the various types of engines in actual hoisting service. Even the compound and triple engines must use steam non-expensively to start and rapidly accelerate the load, and as different plants, and, indeed, the same plant at different times, are handling loads which vary greatly in the proportion between the live and dead loads, it is impossible to estimate the steam consumption in the ordinary method. The boilers supplying steam for hoisting usually also supply steam for pumping, air-compressing and other purposes, which renders it impossible to determine directly just the amount of coal to be charged to the hoisting. Even if this could be done, two plants are rarely to be found working under conditions sufficiently alike to render an accurate and reliable comparison possible. The mining fraternity would certainly welcome a definite demonstration that under actual working conditions in our mines, the use of compound or triple-expansion engines would give a real economy. Failing such an accurate basis of knowledge,

\*Abstract of paper read at the meeting of the Lake Superior Mining Institute. Milwaukee, August, 1904.

we can only say that the impression seems to prevail that it is useless to endeavor to reach a greater economy of steam consumption in hoisting plants than is reached by the simple Corliss engine. A cross-compound-condensing hoist was installed at the Lake shaft of the Cleveland Cliffs Company. A recent installation at the same mine is of the simple Corliss type. The Calumet & Hecla mine has apparently aimed at the extreme limit of steam economy in its hoisting practice, while the Quincy and Tamarack are installing hoists with simple Corliss engines. The beautiful Calumet & Hecla hoists, elegant in workmanship and finish as they are, have no general reputation for economy in steam consumption. If they really have proved unusually economical, it would seem that some, at least, of their neighbors, operating under similar conditions, would have abandoned the simple Corliss engines for a more efficient type.

It is generally recognized that increased speed of an engine means increased power. Lake Superior hoisting practice, however, has proceeded on the idea that increased capacity was to be gained only by an increase in the size of the drums, ignoring the advantage that might be obtained by increasing engine-speeds. The increase of engine-speed tends to lessen the size of the whole plant, and I think it safe to predict that in the future engines of higher rotative speeds will be used, and this important method of gaining increased capacity, moderate weight and low first-cost, will not be overlooked.

Owing to the nature of the load, many plans have been used both for equalizing the variable weight of the rope, and for so combining two single hoists that the dead weight of one load would counter-balance the dead weight of the other. The advantages of these various plans have recently been presented by an eminent engineer, in an article appearing in *Mines and Minerals*. A typical hoisting problem will aid in presenting the idea and the conditions assumed in the article referred to; this was stated to represent a large mine in the West; it also represents the problem as frequently met in the Lake Superior country, and will serve my purpose very well. Given a vertical shaft 2,000 ft. deep from which to hoist two cars, each holding 2,000 lb. on a double-deck cage, the load will be:

	Weight. lb.	Per cent of total at bottom.	Per cent of total at top.	Average per cent of total.
Ore.....	4,000	32	47	39.5
Cars, cage, and sheave to bale.....	4,500	36	53	44.5
2,000 feet 1½-inch round rope.....	4,000	32	00	16
Total load at bottom.....	12,500	100	..	100
Total load at top.....	8,500	..	100	..

It appears, then, that the net load of ore is only 32 per cent of the total load at the bottom, and 47 per cent of the load at the top, an average of 39.5. This means that with an unbalanced hoist, about 60 per cent of the total work done is dead work. In other words, the engines must do two

and one-half times as much work as would be needed if no part of the load was dead weight, or if all the dead weight was counterbalanced. If an ordinary balanced hoist is used, in which the cages are balanced while the rope remains unbalanced, the net load will average 66.66 per cent of the entire load, as compared with 40 per cent average net load with an unbalanced hoist.<sup>1</sup>

Under these conditions, a proper design for hoisting in balance is very important; but the question arises whether the more important economy cannot be obtained by reducing the proportion between the dead load and the net load. If the dead load could be entirely eliminated, the problem of an economical hoist would be reduced to that of securing the best engines. The nearer that result can be reached the more important becomes the engine, and the less important the balancing features of the design. Moreover, conditions are not always such that a balanced hoist can be used. Let us assume the same depth of shaft, but change the load to one of five tons and hoist it in a skip. We can then make up the total load as follows:

	Weight. lb.	Per cent of total at bottom.	Per cent of total at top.	Average per cent of total.
Ore.....	10,000	57	74	65.5
Skip and rope from sheave to bale.....	3,500	20	26	23
2,000 feet 1½-inch plow steel rope.....	4,000	23.	00	11.5
Total load at bottom.....	17,500	100	..	100
Total load at top.....	13,500	..	100	100

The net load of ore is then 57 per cent of the maximum load, in place of 32, and 76 per cent of the minimum load, instead of 47, averaging 65.5 per cent. This means

	Weight. lb.	First Assumption.				
		Bottom load. per cent.	Top load. per cent.	Average load. per cent.	Ordinary balanced hoist. per cent.	Full balanced hoist with bal. rope. per cent.
Ore.....	4,000	100	100	100	100	100
Cage and car.....	4,500	112.5	112.5	112.5	..	..
Rope.....	4,000	100	..	50	50	..
Total on engine... ..	12,500	312.5	212.5	262.5	150	100
Second Assumption.						
Ore.....	10,000	100	100	100	100	100
Skip.....	3,500	35	35	35	..	..
Rope.....	4,000	40	..	20	20	..
Total on engines... ..	17,500	175	135	155	120	100

that with an unbalanced hoist only one-third of the total work done, instead of 60 per cent, is dead work. Stated differently, the engines do only one and one-half times, instead of two and one-half times, the work necessary if none of the load lifted was dead load. Furthermore,

	Weight. lb.	Per cent of total at bottom.	Per cent of total at top.	Average per cent of total.
Ore.....	4,000	32	47	39.5
Cars, cage, and sheave to bale.....	4,500	36	53	44.5
2,000 feet 1½-inch round rope.....	4,000	32	00	16
Total load at bottom.....	12,500	100	..	100
Total load at top.....	8,500	..	100	..

an unbalanced hoist under this assumption is practically as efficient as the balanced hoist under the conditions first assumed. If now we assume that this plant is made to work in balance in the ordinary way, we find that 83.33 per cent of the total work done is consumed by the net load,

and only one-sixth of the total work is used in lifting the dead load. In some cases it would be feasible fully to balance the dead load by attaching a balance rope to the bottoms of the skips, extending from one skip to the other around a pulley placed at the bottom of the shaft. With the addition of the balance rope, the design of the hoist becomes theoretically perfect, that is, by this arrangement the entire effort of the engines would be utilized in lifting the weight of the ore and of the ore alone, the variable load of the engines would be overcome, and the only difficulty in attaining economy of steam consumption would be the intermittent nature of the duty required. The balance rope has, I believe, been lately installed on the Whiting hoist, at the Red Jacket shaft of the Calumet & Hecla mine. So far as known, it is used nowhere else on Lake Superior. With the exception of the balance rope, the latest and best Lake Superior hoisting practice largely conforms to the typical conditions assumed above with the heavy load.

A table presented herewith, based on the net load as the unit for comparison, per-

haps shows the differences of the two assumptions in a more graphic manner.

If a reduction of dead load results in such economy as indicated by the figures

given, the inquiry immediately arises whether the process may not be success-

<sup>1</sup>In an ordinary balanced hoist the skips balance each other and the average weight of the ascending rope is equalled by the average weight of the descending rope, so that, theoretically, the load on the engines is due only to the net weight of the ore. In starting, however, the load on the engines is much greater, being the entire weight of one rope added to the net weight of the ore. Considerably larger engines, therefore, are required to start the load than would be required if a perfect balance of the rope weight existed at all times. At the end of the trip, the load is due to the net weight of ore diminished by the entire weight of one rope, a condition in which the large engines, necessarily used to start the load, are excessively underloaded. With this style of hoist the load always varies by an amount equal to the entire weight of both ropes, or twice the amount of variation which occurs in hoisting an unbalanced load.

It is, of course, impossible to determine how much the advantage of the theoretical balancing of the ropes is greater than the disadvantage due to the use of larger engines and to the very irregular distribution of the load. The tables given, referring to the balanced hoist, therefore, were based on the assumption (more or less inaccurate, according to circumstances) that the advantages and disadvantages exactly offset one another and that the work done by the engines of a balanced hoist is that due to hoisting the average weight of one rope added to the net weight of ore.

fully applied even to the plant itself. In Lake Superior practice, increased hoisting capacity, either for depth or product, has largely been obtained by increasing drum-diameters, which has resulted in the common use of large-diameter drums even for a moderate depth. It requires no inconsiderable power to start, accelerate, move rapidly and then stop suddenly a large and heavy mass of machinery. It certainly requires considerably less power to handle small machinery than it does to handle large. The question is, is it possible to serve our mines satisfactorily with smaller and lighter drums, thus decreasing the size of engines needed, and the size, weight and cost of the entire plant? If the facts are as stated above, it is evident that improvement in this direction should be possible. Consider again our assumed hoisting problem. The article already quoted specified as necessary a straight drum 9 ft. 10½ in. diam., driven by engines 22 in. by 60 in. a good-sized drum and a slow-speed engine. On the same basis, if the net load should be increased to 10,000 lb., as suggested, engines 32 in. by 60 in. would be required, and the plant would probably weigh more than 225,000 lb. Consider the results of using a drum of only 6 ft. diameter. With a steam-pressure of 150 lb., 20 in. by 42 in. engines are ample to handle the load, and the whole plant would weigh about 105,000 lb. First-class builders offer engines of that size, with a guarantee of satisfactory service and wear, with a speed of 125 rev. per min., which would give a rope-speed of 2,375 ft. per min. with a first-motion hoist. Such a plant would then answer the underground requirements, as it would hoist the load in less than one minute. The first cost would be low on account of its moderate weight, and the cost of operation would be low because of the economy of using a high steam-pressure, and because the net load hoisted would be a maximum, and the dead load, including the machinery losses, would be a minimum.

In hoisting in balance from a mine with many levels, or of constantly increasing depth, it is usual to use two drums which can be operated independently or in balance, as desired. The very considerable width obtained by the usual construction, placing two small drums carrying so large an amount of rope end to end on one shaft causes the ropes to lead from the head-sheaves onto the drums at an undesirable angle, unless the hoisting is situated far from the shaft. The question of rope-lead under some circumstances, such as obtain in mountainous regions, where level space is limited, has undoubtedly led to the general adoption of the flat-rope reel-hoist, because the rope always leads in one line from the reel to the head-sheave. Under ordinary circumstances, where room is not so important, the width of a single six-foot drum, carrying 2,000 ft. of rope, say,

11 ft., is not sufficient to cause an undesirable rope-lead, with the hoist placed reasonably near the shaft. Where two drums are necessary, the advantages of the small-drum design, on the score of greater structural strength and low first-cost of plant, are sufficient to warrant its adoption wherever possible. The difficulty of the rope-lead is easily overcome by placing the two drums side by side, on parallel shafts, instead of end to end on a single shaft, driving them by side-bars like the side-rods of a locomotive. Second-motion plants are often designed with two drums, mounted on separate parallel shafts, and the driving pulleys of Whiting hoists are operated with side-rods, as suggested. No first-motion plant hoisting with drums has ever been constructed in this manner. The benefits of securing a satisfactory hoisting plant which would weigh less and cost less for the plant itself, as well as requiring less expensive foundations and building, should abundantly justify an unusual construction, and especially a construction to which there can be no mechanical objection.

Furthermore, the small straight-drum design, driven by high-speed engines, has all the advantages sought by a conical-drum design; that is, ability to start the load with engines of reasonable size and a sufficient rope-speed for the hoisting capacity desired. The Whiting system has recently been advocated by several eminent engineers as desirable for deep hoisting, on the ground that the balance-rope or tail-rope hanging from the bottoms of the cages rendered the load on the hoist uniform and enabled more economical engines to be used. The balance-rope could be used on an ordinary balanced hoist as well as on a Whiting hoist. Equally efficient engines could be used on the one as on the other. Considering the many turning sheaves used by the Whiting system, the slippage of the rope on the driving pulleys and the cumbersome method of adjusting the hoist to varying conditions, it seems improbable that it has any advantages over the ordinary type of balanced hoist, with two drums that can be used independently or connected in balance, as desired.

Some of the financial aspects of the hoisting problem have been indirectly considered in the foregoing, as it is impossible to exclude the question of cost from comparative value. In any given case, in searching for the best hoist, all things considered, there is usually a choice of several, embodying apparently many desirable features. How shall our choice be guided in the best interest of the surplus from which dividends are paid; for, after all, this is the main question, and includes all the others. Three properties on the Mesabi with practically identical conditions recently purchased hoists. One paid \$1,400 for its hoist, the second paid \$2,600, and the third \$4,600. Under their conditions,

the amounts paid were not vitally important, perhaps, but in considering a larger plant, the question of spending \$14,000 or \$26,000 or \$46,000 for a hoist is of great importance, and the choice of the more expensive machinery should rest on stronger grounds than mere personal preference, such as controlled the purchase of the small hoists. When should a hoist costing \$26,000 be purchased instead of one costing \$14,000, assuming that both will raise the required amount of ore? The answer is evident: When the definite saving in the cost of operation of the expensive plant is sufficient during the time it is being used to pay the whole of its additional cost and a good rate of interest on the same. Otherwise the more costly plant is a source of unnecessary expense. Many plants on Lake Superior have been installed too large for present needs with the idea of making them large enough for many years of added development. It is doubtless true in many instances that the interest charge on the extra cost of such plants during the years they were being operated below their economical capacity would more than pay their entire cost when plants of such capacity became really needed. The attempt to discount the future and make a single installation cover both present needs and possible future requirements may easily be overdone. The desire to discount the future must not be allowed to unfit the plant to meet the present known conditions in the most efficient and economical way.

From the standpoint of the purchaser, then, whose point of view I have attempted to present, the following conclusions may be drawn as to the requirements to be met by an ideal modern hoisting plant. It should use at least 150 lb. of steam pressure, because of the smaller size and cost of engines then required, and the fuel economy resulting. It should hoist the load from the bottom in one minute, and make a round trip in less than three minutes, no matter what the load or depth of shaft. The net load should be as large as possible in proportion to the dead load, and the mass of moving machinery should be kept as small as possible. The most perfect plan of balancing feasible under the individual circumstances should be used. A plain Corliss or other automatic, variable cut-off engine is best, and it is desirable to use engines of as high rotative speed as is found practicable in other lines of engine practice. The drums should be as small as possible for the required hoisting speed and capacity, when driven by high-speed engines. Straight drums should be used, as there is no advantage to be gained by special designs of cone-drums, rope-reels or other hoisting systems, sometimes advocated, over straight-drum designs, with the drums made as small as they may be made by using engines of high rotative speed to drive them.

### Copper Mines near Havana, Cuba.

By WALTER HARVEY WEED.

The old copper mines near Havana are perhaps the least known of the many copper deposits of an interesting island. The Santiago copper mines have been great producers and have been repeatedly described. The other deposits in Cuba are numerous, occurring in almost every province, and from published descriptions it is evident that they possess common characteristics of mineral character, rock association, and structural features, which ally them to certain Italian deposits, but have a marked individuality of their own. The only one of these deposits which I have studied in detail is that near Minas railway station, 14 kilometers east of Havana.

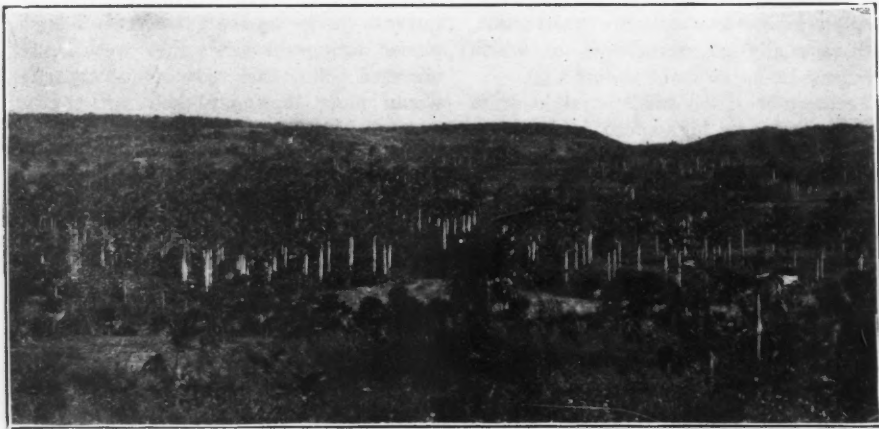
The geology of Cuba is, in its broader features, relatively simple. The central core of the island is formed of a complex

palmetto-like leaves, and the weird screw pine, are the characteristic features. These are the hills of Minas, the Minas de Cobre of olden days. Vast heaps of gray waste and green-stained ore, old shafts overgrown and insect-infested, bits of slag rich in copper pellets, all prove a former activity, that naturally led to the re-opening of the old deposits.

The Minas area of serpentine is not large. So far as determined, by its peculiar vegetation, it is about two miles in diameter. It forms a group of hills whose crests constitute a horseshoe ridge, with the gullies and ravines of the center opening northward toward the sea. The summits are grassy, the slopes covered by a diaphanous drapery of shrub, dotted by a few palms, with palmetto-like leaves, and in hollows with the *mahatma*, or screw palm, peculiar to these hills. There it little or no soil, bare rock shows everywhere, and the place is strangely unlike

opened by the present owners to determine the size and value of the orebodies. Large dumps and long cross-cuts driven for drainage, show that the mining operations, carried on at a time when the ore was carted three miles and loaded aboard vessels at Punta del Cobre, was not in vain. These old workings are like the *antiguas* of all Spanish-American countries in their rambling course and general character. The present shaft is 280 ft. deep, and both shaft and drift are timbered in modern American style. There is considerable water, at a depth of 20 to 30 ft. below the surface, and this despite the fact that the rock appears relatively impervious and free from fissures, and that the openings are upon dry and well-drained hillsides, at more than 30 ft. above the main drainage channels. The ore occurs in well-defined lenticular bodies, the largest having a thickness of about 20 ft. in the middle, and tapering at each end; the lenses are 20 to 200 ft. long, and extend downward with a northeast pitch. They all occur along a well-marked, persistent fracture-plane, with a smooth and striated wall, polished balls of serpentine, shaley, loose, more or less mushy material, all showing pressure and movement (friction breccia). The freshest rock is well serpentinized, dark, and almost black in color, with waxy porphyritic crystals of bastite in a dully resinous ground mass. It is not schistose. The orebody is solid, shows no crushing, and where small ore-masses are found in the fissure-filling, they show no mark of movement. In one instance a fault crosses and displaces the orebody, but the fault-plane shows scarcely any breccia. It is either a clean fracture or carries a mere film of clay. The orebodies are all of pyrrhotite, with or without chalcopyrite. The ore has a fibrous grain, but is not schistose, and no other minerals are recognizable, except where, at the borders, it passes gradually into country rock.

The change of olivine and olivine-bearing rocks into serpentine is well known. It is, according to Merrill, a deep-seated phenomenon and not due to weathering. The change can take place in various ways, all involving hydration, with an increase of volume of 20 to 33 per cent.<sup>1</sup> In large masses of intrusive basic rocks this great increase of volume is accompanied by the formation of expansion and dilatation fissures. Such fissures check up the rock, in an interlacing network, without order or arrangement. But if the mass is confined by rigid rocks on the sides this increase of bulk must find relief by the formation of extensive cracks and the vertical shifting and adjustment of masses, with the formation of friction-breccias and gliding planes. Such boulders and zones of pressed matter are well known in almost all serpentine masses, and



THE MINAS DISTRICT, CUBA.

of schist, serpentine, and crystalline rock, in places cut by igneous intrusions, and mantled by the Cretaceous limestone which covers the greater part of the island, and is only obscured by residual or alluvial clays. At numerous places, patches and broad areas of serpentine are found, generally forming hills, some times rising to form mountain ranges. In many places this serpentine has been found to contain deposits of copper, more rarely of chromium, of iron, and of manganese.

Fifteen miles east of Havana harbor the coast line is broken by a small bar-enclosed bay, whose western arm bears the name of Punta del Cobre, or Copper point. Back from the high, wind-swept platform, whose cliffs face the ocean, a steep slope, covered with tropical verdure and a few cultivated clearings, descends to the valley of the small stream, whose lagoons and marshes form the head of this little bay. Beyond this stream rise low, rounded slopes of the Copper hills, the vegetation of which is in curious contrast to that of the surrounding country. Bare gray rocks show here and there, while the diminutive tree palm, with its quaint and scanty top of two or three

the fertile fields, dotted with royal palms, of the surrounding landscape.

The slopes about the hills show coral-reef limestone and red clay. The hills are formed of serpentine, in various tones of brown, green and gray, but of uniform character, and devoid of prominent outcrops. This rock is netted with a multitude of minute interlacing veinlets of fibrous (or asbestiform) serpentine, none of it valuable for fiber, however; but no persistent direction of jointing was observed, though carefully hunted for, nor any long fracture or fissure line. The surface shows many large boulder-like masses of limonite, and several places where deposits of limonite are certainly in place. This material has every character of a gossan, and at several points, on stripping, it has been found to cover copper ore, which consists of chalcopyrite in grains, patches and stringers, scattered through a somewhat fibrous crystalline pyrrhotite.

The known deposits occur in three separate masses a mile apart, all three formerly mined, presumably by slave labor, early in the century. Several of these old workings have been cleared and re-

<sup>1</sup> Lindgren, 'Metasomatic Processes,' p. 13.



## The Pratt Coal Mines in Alabama.

BY W. R. CRANE.

have been described by Geikie<sup>2</sup> and other text-book writers. The formation of nickel and of chromite deposits is currently believed to be due to this serpentinization. The ultra-basic igneous rocks are known to be persistent carriers of copper, and in Italy the famous Monte Catini deposit consists of several large, irregularly lenticular orebodies in a mass of crushed serpentine, surrounded by normal serpentine and little-altered basic rocks, all parts of an intrusive body in Tertiary limestone. The Cuban orebodies appear to be of similar origin, and to be due to the segregation of copper primarily disseminated through the original peridotite rock, concentrated during serpentinization and gathered along the greater fractures which served as trunk-channels and deposited there, partly as the filling of fissures and partly as replacements of the serpentine.

The future of these Cuban ore deposits, like those of the similar deposits in Italy, can not be foretold, except that the larger lenses may prove to occur along the fissure-lines, and hence prospecting should be limited to such places. While it is true that the size and richness of the orebody cannot be prognosticated, there is good reason to believe that the use of the dipping needle can be as successfully applied here as in the pyrrhotite of Sweden. There orebodies show no secondary black sulphides, and insignificant amounts of oxide and carbonate of copper.

The outcrops of limonite are the most prominent features in the local geology. It was at first believed that these masses were either the gossan above masses of ore, or broken off and rolled masses detached during the gradual degradation of the region, and left by reason of their insoluble character and porous texture. By putting gangs of men at work on these supposed outcrops at various places, it was found that they were a mantle of limonite due to surface, or more properly subsoil, waters, and hence not true gossan, but a concretionary ironstone of lateritic origin, like those described by Harrison in British Guiana.

The three chief natural hydrates of alumina are gibbsite  $Al(OH)_3$  or  $Al_2O_3 \cdot (H_2O)_3$ ; bauxite  $Al_2O_3(OH)_4$  or  $Al_2O_3 \cdot (H_2O)_2$ ; and diaspore,  $AlO, OH$  or  $Al_2O_3 \cdot H_2O$ . Sometimes bauxite seems to vary toward diaspore in composition. The series is completed by alumina,  $Al_2O_3$ .

The oxide ores of iron, aside from hematite,  $Fe_2O_3$ , and magnetite,  $Fe_3O_4$ , fall into an interesting series. There are turgite  $(Fe_2O_3)_2 \cdot H_2O$ ; goethite,  $Fe_2O_3 \cdot H_2O$ ; limonite  $(Fe_2O_3)_2 \cdot (H_2O)_3$ ; and xanthosiderite  $Fe_2O_3 \cdot (H_2O)_2$ . They carry chemical water respectively as follows: Turgite, 5.3; goethite, 10.1; limonite, 14.5; and xanthosiderite, 18.4 per cent.

<sup>2</sup> Manual of Geology, p. 231.

Alabama produces over 12,000,000 tons of coal yearly, and is the most important mining State in the South. The coal is largely used in the State in the production of iron. There are fully 50 coal seams; the coal is bituminous, and generally of excellent quality. As a coking coal it varies, and the best Alabama coke is made of a mixture of coals from different seams. An important feature of the coalfields of Alabama is that they are, for the most part, in close proximity to deposits of iron ore.

There are three distinct coalfields: the Warrior, Cahaba and Coosa, which are given in the order of their importance. The Warrior is the most westerly field, and has, at least, nine separate coal strata, of which the Pratt seam is most extensive. It averages 4 ft. 6 in. and the coal has the following composition: Water, 1.50%; volatile carbon, 31.18%; fixed carbon, 61.00%; ash, 5.40%; and sulphur, 0.92 per cent.

The coal of this district belongs to the Appalachian area of the Carboniferous. It lies in synclinal valleys, the intervening anticlines having been eroded. Furthermore, the whole district has been disturbed by faults.

The strike of the Pratt seam is NE-SW. The dip is NW, but varies considerably. The usual dip at the outcrop is 12° to 15°, the range being 8° to 30°; the steepest inclination is in the southern part. Decrease in dip appears with distance from outcrop, until a 5° inclination is common, and in cases the bed becomes almost horizontal. There is variation in the inclination of the coal stratum even in the same field, which, however, is gradual. This, together with other local disturbances, contributes to make working irregular; but if it were not for the faults, the irregularity produced by folding would not seriously interfere with development.

The faults in this part of the basin are not only frequent but also are of considerable magnitude, from a few feet to 100 ft. or more. The strike of the faults is NW-SE, and makes an angle of 85° to 90° with the strike of the coal outcrop. The pitch of the fault planes is variable and is often reversed. The angle of the pitch ranges from 45° to 90°. Large wedge-shaped areas may be formed by two faults pitching in opposite directions, the displacements taking place on the foot-wall sides, and producing an elevated area of coal made up of hanging-wall, which may even overhang the adjacent depressed stratum. The faults with their direction, angle and displacement, are shown in Fig. 1.

A noticeable peculiarity of the faults of this district is that, as a rule, the maximum displacement is at the outcrop, and varies with distance from the out-

crop in a manner similar to that of the dip. Faults, with displacements of 100 ft. or more, may, in a few thousand feet, tail-out, the coal stratum continuing undisturbed as though no faulting had occurred. Again, the reverse may be the case; and a mere fissure with no displacement may develop into a considerable fault. If the existing faults were produced at the same time as the folding that formed the basin, excessive faulting must have occurred, with a wide range in displacement—that portion with the maximum displacement having been eroded with the crests of the anticlines.

As a rule, the coal is not seriously disturbed along the faulting planes. Occasionally, however, the coal is broken up for several feet along the fault.

The direction of 'drag' is not easily determined, although a careful examination of the faulted surfaces is usually rewarded by some slight indication of the direction of movement. When no definite conclusion can be inferred, other indications must be sought after. Conditions at the outcrop may be determinative, and, with other indications, usually give the information necessary for determining whether the movement was an upthrow or a downthrow. The elevation of the particular part of the stratum in question is also of considerable value in determining which way to drive; but is often rendered valueless by the development of unknown pitching of the beds. Displacements ranging from 50 to 100 ft. may occur in each of a number of faults pitching in the same direction, thus producing a terraced effect in the workings. This is shown in Fig. 1.

Folds and counter-folds run through the field, constantly changing the inclination of the strata, and causing adjustment of the workings to suit the change of conditions. Fortunately the pitches are moderate and come within the range allowable for the system employed.

The Blue Creek portion of the Warrior field is more irregular in section than any other; the folds are more pronounced and the slopes steeper, thus affecting the method of working. Minor folds are occasionally encountered, but they do not seriously interfere.

The top and bottom strata are, as a rule, exceptionally good, where not disturbed; the former is mostly a hard, often calcareous, shale, while the latter is fire-clay and occasionally shows some shale. With depth, or distance from the outcrop, a sandstone top often comes in. In many cases, in rooms 40 to 60 ft. wide and 100 ft. long or more, coal from which was removed ten years before, the roof is still standing, being supported by 6 and 8-in. props, spaced 4 to 6 ft. apart.

The cleavage or 'cleat' of the coal is

pronounced, and is at right angles with the fault planes. The distance between the cleavage planes ranges from 1 to 4 in., thus rendering the coal easy to mine, but difficult to remove in large pieces. The tendency is to produce a high proportion of small coal. However, as much of the coal is coked, no special loss results.

The Pratt coal stratum varies in thickness from 48 to 54 in., and is uniform in character and texture. It is divided into three benches by shale partings, which are quite prominent; one occurs about 10 in. from the top of the stratum, and ranges from 1 to 2½ in. in thickness, while another is 6 to 8 in. from the bot-

The mines are opened by slopes run with the pitch. They are, therefore, practically normal to the outcrop and are usually double, being 13 ft. wide, and 5 ft. 3 in. high, measuring from the top of the rails; the roof is then brushed down about 12 in. to allow for the extra height above the thickness of the coal stratum. Air-ways are driven on both sides of the main slope; they are 6 to 12 ft. wide, and are not brushed down, their height being the thickness of the coal stratum. These three parallel passages have 25 to 30 ft. centers. Headings are driven from the sides of the slope, 250 to 300 ft. apart; are 16 ft. wide, and from 5 to 6 ft. high, be-

ings, when pack-walled, are but 8 or 10 ft. wide, which affords sufficient room for haulage.

Break-throughs are connecting passages between the parallel ways, such as air-ways and slopes, back-entries and headings. They are 6 to 8 ft. wide and spaced 25 to 35 ft. apart, the distance depending upon local conditions of haulage and ventilation.

The rooms are driven to the rise, and consequently from the upper side of the headings only. They are about 40 ft. wide and have approximately 50 to 55 ft. centers. The chain pillars are about 25 ft. wide. The rooms are 200 to 250 ft. long,

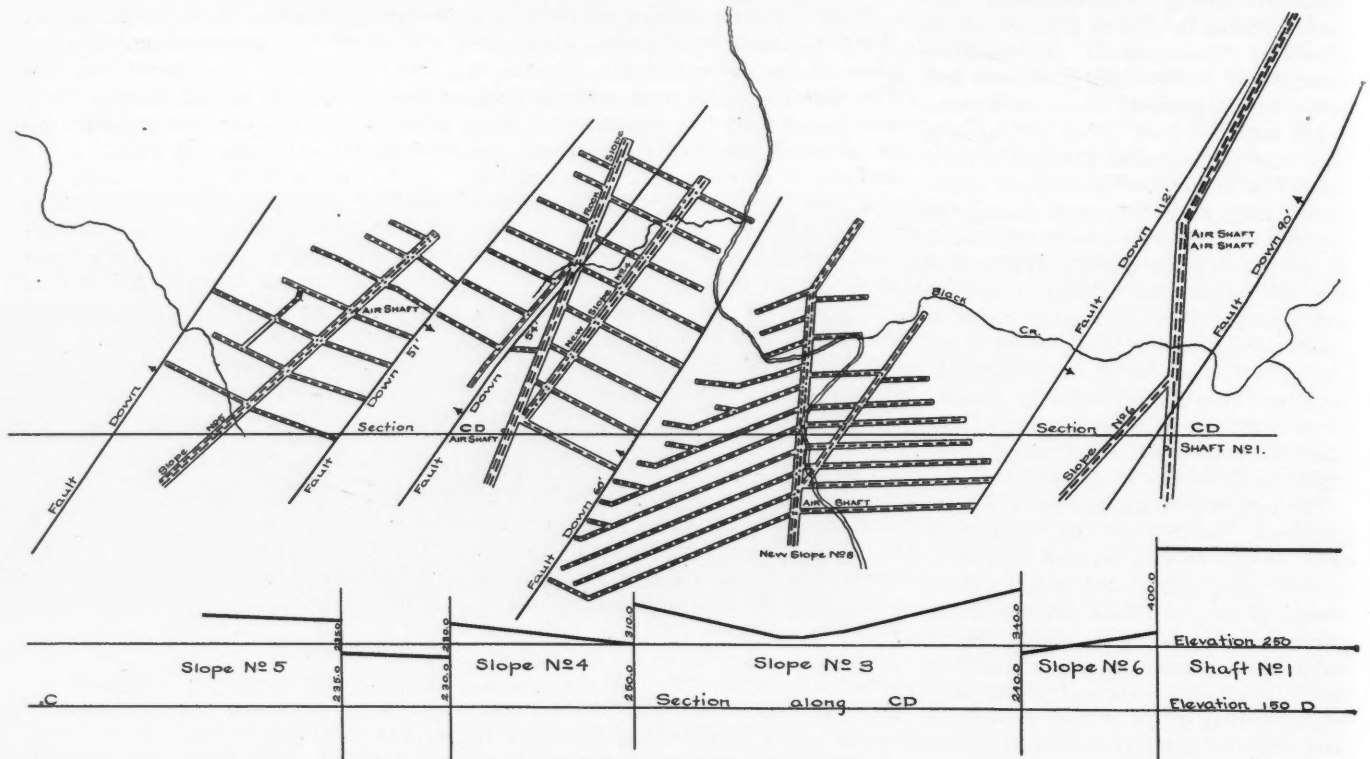


FIG. 1. WORKINGS OF PART OF THE PRATT MINES.

tom, and varies from ¼ in. to 1 in. in thickness. These partings necessitate hand picking, and even then considerable dirt gets into the fine coal; washing the coal before coking is thus rendered necessary. There is not much sulphur except in the top bench, or that portion of the stratum lying above the upper parting. The upper bench of a face of this coal, on being exposed to the mine atmosphere for some time, turns white, owing to the sulphur coming to the surface.

The room-and-pillar system of mining is commonly employed; and as the coal stratum is inclined, it is customary to run the rooms to the rise to facilitate handling the cars and to simplify drainage. Most of the mines of the district have passed the steeper pitches, adjacent to the outcrop, and are now being operated on more moderate inclinations. Where counter-folds occur, the workings may be horizontal or the pitch may be even reversed. Working under such conditions is not difficult.

ing brushed down to permit haulage by animals or electric locomotives.

The direction and grade of the headings is determined by the grade permissible for haulage. Under irregular conditions, a direction is chosen that will make a fairly uniform grade on both sides of a roll. The usual grade of headings is 2 and 3%, the range being from 1 to 4 per cent.

Below the headings, and at a distance of 25 to 30 ft., 'back-entries' or air-ways are driven. These are 10 to 12 ft. wide and are not brushed down. The waste material obtained from the brushing of the headings is used in building pack-walls, or gob-walls, from 6 to 8 ft. wide; these are placed on the sides of the headings opposite the rooms, or on the lower rib of a heading. This permits much coal to be removed from the pillars between headings and air-ways, without materially weakening the support of the roof. The necks of the headings are not pack-walled, as the solid coal is stronger. The head-

ings, unless shortened by a sudden change in pitch.

Where steep pitches are encountered, it is necessary to change the direction of both headings and rooms to permit the proper grade. Instead of driving the headings at right angles to the slopes they are run diagonally across the dip, and the rooms in turn run diagonally also, thus increasing the grade of the headings, and decreasing that of the rooms, so that cars can be run by hand, in and out of the rooms. The miners object to pushing cars up grades higher than 5%; and occasionally the grade of the heading exceeds that allowable for ordinary methods. In such a case, auxiliary slopes are employed, which are operated similarly to the mine slopes. Such slopes are preferred to the use of chutes. However, the pitches are, as a rule, so moderate that the proper grades can readily be maintained with the possible inconvenience of irregular mine workings.

Break-throughs are made in the pillars

between the room and chain pillars, to permit the air to pass from one lift or set of entries (heading and air-way) to the next above; also to permit the passage of men and animals. The air-ways parallel with the slopes are also used as man-ways; usually, only one is connected with the surface. Slopes are driven face-on, or as face openings; headings are end-on or butt entries; while rooms are driven face-on or are long-horn, half-on or short-horn, depending on the angle that they make with the cleat.

Owing to the coalfields being cut up by faults, it is necessary to work each area independently of those adjacent. It is evident, then, that each area is operated as a complete mine in itself. Occasionally, when the displacement of two faulted portions is 50 ft. or under, the practice is to connect them by one or more slopes (see slope No. 4, Fig. 1). The inclination of such slope with the horizontal, varies largely with circumstances—the common angles are 25°, 30° and 35°. When a gravity arrangement is not practicable, the coal is hauled up the slope in pit cars by an electric hoist.

Coal is won at the face by both hand and machine work; in the former case by pick and bar, the undercuts being 10 to 12 in. high and 48 to 54 in. deep. Vertical cuts are not usually employed except to align the rooms and passages. In a few mines, chain mining-machines of the Jeffrey make are in operation, being more satisfactory as the operators become skilled in handling them. When undercut, the coal is broken down by shots placed next to the roof. The average speed of making a cut 4 in. high and 6 ft. deep, is 5 minutes; much time is consumed by the men shifting and setting up the machine.

The coal broken down at the face is loaded directly into pit cars, which have a capacity of 2,800 to 3,000 lb. They operate on tracks of 36-in. gauge, the rails being 40-lb. steel. Temporary tracks are laid in the rooms. The loaded cars are pushed by hand from the rooms onto the heading tracks, from which point they are collected into trains, or trips, of 2 to 5 cars for mule haulage; and in trips of 18 to 20 for electric motor. At the make-up stations, or partings, in the main slopes, they are made up into the proper number for trip haulage up the main slope to the surface.

To illustrate present practice in hauling, a description is given of the methods employed in Slope No. 3, Pratt mines, the property of the Tennessee Coal, Iron & Railroad Company, and one of the largest and best equipped mines in the district. (Fig. 2.) The slope is provided with two lines of track. A mile in from the mouth of the main slope a second slope branches off at an angle of about 50°. At the junction of the two slopes is the haulage terminus. Engine plane haulage is the system employed. The Webster, Camp &

Lane Corliss winding-engine has 22 by 60-in. cylinder, is provided with two drums, brakes and reversing gear. Each drum has a capacity of over 6,000 ft. of  $\frac{7}{8}$ -in. steel cable.

The regulation number of cars to a trip is 20, the one at the rear being provided with a 'growler' to prevent the cars running back into the mine. Special couplings are used as a precaution against breaks, yet they do occur. As an additional precaution against breaks, the winding-rope is provided with several feet of chain to which the cars are attached.

Each track is independent of the other. By gravity, the empty trips are transferred to the terminal parting in the main slope, whence they can be thrown by switches to either slope. By shifting the cable from the center of one track to the other, connection can be made with a waiting

vertical work is done. Ordinary steam and electrical pumps are, however, used as sinking pumps in the slopes, when much water is encountered. They are mounted on trucks and lowered to any desired point. Sumps are formed at the foot of air shafts where the pumps are installed.

Ventilation is important. There is considerable gas present, as is shown by small blowers. Safety lamps are not used, except by fire-bosses and shot-firers. Mine fires are occasional for which the gas is probably largely responsible. These fires have, in the majority of cases, been extinguished by water, lines of pipe often being laid for thousands of feet from the water supply to the locality of the fire. Fans of the Guibal type and from 14 to 16 ft. in diam. with blades 6 ft. wide are in use. Electrically driven fans 6 to 7 ft. in

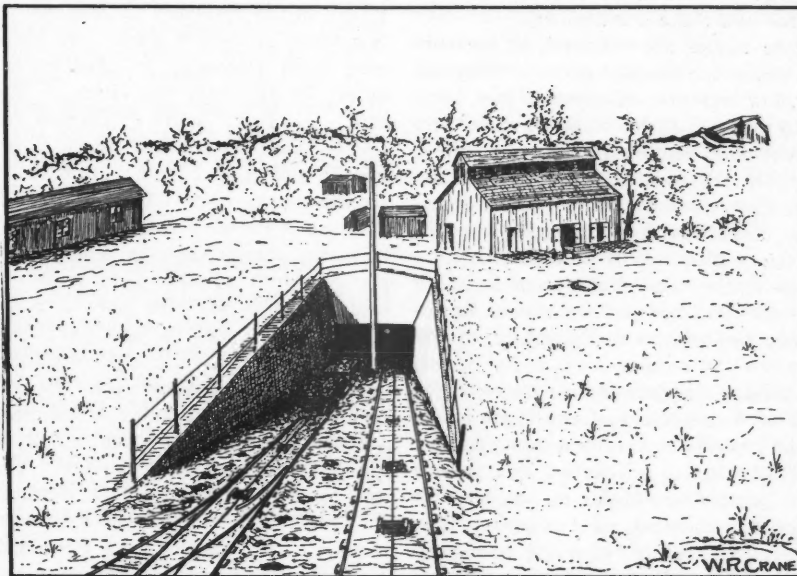


FIG. 2. SLOPE NO. 3, PRATT MINES.

trip of loaded cars. Trips are hauled up the slope at the rate of a mile in 8 or 9 minutes.

Six Jeffrey electric mine-locomotives are employed in the mine for distributing empties to the headings, collecting loaded cars and delivering the loaded trips to the parting at the end of the main slope haulage. Two of the locomotives are 10-ton and four 6-ton weight. Each locomotive has a capacity of 12 trips of loaded cars per day. Mule haulage has been dispensed with. The auxiliary mine slopes are often operated as gravity planes, but more often as engine planes, by small electric hoists.

The mines are neither dry nor wet. For ejecting the water a variety of pumps is employed, steam—simple and duplex—and electric—simple, duplex and triplex. The steam pumps are largely confined to the higher levels; while the electric pumps are installed in the deeper portions.

The pump-lifts range as high as 500 ft. Sinking pumps are not applicable, as little

diam. are also employed, being installed at the foot of air-shafts. The exhaust system of ventilation is the usual practice. The main slopes are intakes, the fans being installed at the mouths of the air-ways, which run parallel with the slopes. The electrically driven fans are auxiliary, and are placed where a positive movement of air currents is essential. The air currents entering the main slopes pass downward, split and return by way of the workings, entering by headings and passing upward through the rooms and breakthroughs, from one lift or level to another, until the outcrop is approached, when they are conducted to the air-ways and through them to the fans, thence escaping to the surface.

The mines of this field are not extensively timbered, owing to the naturally strong top and bottom. The slopes are provided with caps and posts and often a middle prop, which stands between the two lines of track. Headings are seldom provided with timber supports. Rooms

have two and three lines of props, spaced from 10 to 12 ft. apart. The props used are made of 6 or 8-in. round timbers split in two. Occasionally the full sized timber is used. Steps are occasionally provided in the man-ways, especially in the steeper portions. Pump stations and partings are well but not elaborately timbered.

Several of the large companies employ convicts. Formerly, the coal mining companies employing State convicts, paid the State a fixed sum per year or month for their services, assuming their maintenance. Recently, however, a new arrangement has been made by which the State maintains and guards the convicts, the companies paying the usual mining schedule rate on all coal won by convict labor. In mines employing convict labor, all exits from the mine must be provided with barred doors, which are closely guarded. A large proportion of the convicts are colored and make good miners.

Slope tipples are employed at the surface end of the haulage system. They are long, low trestle-work constructions, upon which the loaded trips from the mines run, are emptied, and returned to the mines. The cars are usually removed from the main slope track by switch-backs. Automatic cross-over dumps are employed in modern plants. As a rule the hoist is placed at the end of the tippie opposite the slope, the rope passing over a sheave at that end of the tippie, thence to the slope.

A brief description of the surface equipment of Slope No. 3 of the Pratt mines will be given. The Corliss winding engine, mentioned above, is installed in a powerhouse situated at one side of, and with its longer dimension at right angles to the tippie. The hauling ropes are conducted in rollerways and over deflecting sheaves. The handling and dumping of the cars upon the tippie is automatic.

The system of steam generation is unique, and is possible by close proximity to a large battery of coke ovens. Vertical water-tube boilers of the Cahall and Wickes types, are installed. To the boilers are run flues through which the heated gases escaping from the ovens pass, which, together with some coal, supplied in the usual manner, give an inexpensive and efficient steam generation. Many runs show that, with the coking ovens connected, the actual coal consumption is 1 lb. per horsepower hour.

Only two sizes of coal are produced: the undersize for coking, and the lump for steam production and shipping. The undersize passes directly from the screens to the washers, and thence to the ovens. At other mines in the district a number of sizes are produced, as lump (extra large); fancy lump; egg; and slack or small coal, usually coked.

The electrical equipment consists of three 150-kw. Jeffrey generators, driven by Skinner engines, one to each generator. These generators furnish current for all

the electrical equipment, as locomotives, mining machines, pumps and a larry on the surface, besides supplying light for the surface and underground works.

Much credit is due to Mr. J. M. Franklin, manager, and to Mr. Hamilton, engineer of the coal mines of the Tennessee Coal, Iron & Railroad Company, for the equipment and operation of one of the most modern mines in the South.

That the conditions warrant such extensive equipment speaks well for the future of coal-mining. Improvement is noticeable in the iron mines as well as in the coal mines, in fact, first-class equipment is the order of the day in connection with all mining operations in Alabama.

### Mining in Java.

Some prospecting has been done and about \$10,000 expended, in Poronogo division, in the residency of Madioen, near Soerabaia in eastern Java. By carriage road from Poronogo to Madioen is 19 miles; by rail from the latter to Soerabaia, is four hours. Tunnels have opened and cut several veins 6 ft. in width; and it is roughly estimated that 500,000 tons of ore are blocked out. More than 200 tons have been shipped to Europe, the results showing from 12 to 22 per cent iron (FeO); 4 to 22 per cent lead; 14 to 20 per cent zinc; 1 to 5 per cent copper; 1 to 2 oz. of silver; and 0.1 to 0.2 oz. of gold. The reports would indicate some uncertainty as to the particular method most suitable to handle this complex ore, which will require both sorting and concentration. Australia promises to be the most feasible destination for reduction at present, the total cost of mining, and of freight from Poronogo to Melbourne being figured at 27 guilders (about \$10) per ton. Labor is cheap, coolie workmen being available; transportation is good and can be improved.

**GEOLOGY AT SIMPLON.**—That geologic conclusions are largely a matter of theory has been demonstrated again, by the work in the Simplon tunnel. According to one of the engineers, Herr Sulzer, the geologists prophesied that the dips of strata in the mountain were mostly vertical, whereas they proved horizontal, which increased the labor of drilling and expense of roof supporting. The geologists were also entirely at fault as to water conditions; and the heat encountered at one point, near where the hot water appeared, was 25° higher than the engineers had been led to expect. The difficulties were so great and unusual that the tunnel contractors asked for extension of time and an increased appropriation. It is expected that the first tunnel will be open to traffic by May 1 next.

"No taskmaster but one's own enthusiasm" is a motto to win results.

### Anthracite Coal Production.

In our issue of Jan. 5, we gave the anthracite shipments for eleven months ending Nov. 30. The statement for the full year is now accessible, and is given below. This table includes the shipments by rail from the mines, irrespective of destination, and includes also such coal for railroad use, as is hauled away and not delivered at the mine.

The tonnage, as divided among the different companies, was as follows:

	—1903—		—1904—	
	Tons	Per ct.	Tons	Per ct.
Reading . . . . .	11,490,963	19.4	11,399,622	19.8
Lehigh Valley . . . . .	9,737,160	16.4	9,611,426	16.7
N. J. Central . . . . .	7,404,612	12.5	7,201,276	12.5
Lackawanna . . . . .	9,575,657	16.1	9,333,069	16.3
Del. & Hudson . . . . .	5,927,283	10.0	5,276,797	9.2
Pennsylvania . . . . .	4,555,459	7.7	4,765,953	8.3
Erie . . . . .	6,343,852	10.7	5,711,173	9.9
Ont. & Western . . . . .	2,693,462	4.5	2,646,460	4.6
Del. Sus. & Sch. . . . .	1,634,489	2.7	1,546,746	2.7
Total . . . . .	59,362,937	100.0	57,492,522	100.0

The changes in tonnage and proportion last year are given below:

	Tons.		Per ct.	
	D.	I.	D.	I.
Reading . . . . .	91,341	0.4		
Lehigh Valley . . . . .	125,734	0.3		
N. J. Central . . . . .	203,336			
Lackawanna . . . . .	242,588	0.2		
Del. & Hudson . . . . .	650,486	0.8		
Pennsylvania . . . . .	210,494	0.4		
Erie . . . . .	632,679	0.8		
Ontario & Western . . . . .	47,002	0.1		
Del., Sus. & Schuylkill . . . . .	87,743			
Total . . . . .	1,870,415			

The principal increases in proportion were on the Pennsylvania, which last year was the only company showing an actual gain in tonnage. The important decreases were on the Erie and the Delaware & Hudson. The decrease in the total shipments was 3.1 per cent.

The shipments from the three regions, into which the anthracite country is generally divided, were as follows:

	1903.		1904.		Changes.	
	D.	I.	D.	I.	D.	I.
Schuylkill . . . . .	16,474,790	16,612,055	1,137,265			
Lehigh . . . . .	7,164,783	6,988,182	D. 176,601			
Wyoming . . . . .	35,723,364	33,892,285	D. 1,831,079			
Total . . . . .	59,362,937	57,492,522	D. 1,870,415			

The greater part of last year's decrease was in the Wyoming region, the northern and northwestern section of the field. That region produces about 60 per cent of the coal, the Schuylkill supplying about 28, and the Lehigh 12 per cent.

Allowance for the coal sold at the mines to employees, and other local trade, and for the coal used in operating the mines, would bring the total tonnage of anthracite for the year up to about 63,816,000 tons. Not all of this was taken from the mines, however, a considerable quantity being furnished by the washeries which are operating on the old culm piles. In 1903 the total washery coal reported was 3,677,909 tons. There is no reason to believe that the quantity in 1904 varied much from the preceding year, and the total may be taken at about 3,700,000 tons. This would make the quantity mined 60,116,000 tons of prepared coal, as the approximate total for last year.

In the Leyner water-drill, used for boring rocks, a jet of water is forced through the center of the bit while it is working.

### High-Temperature Measurements.

The melting points of the metals, their alloys and their salts, have long supplied a familiar means of measuring temperature; but the difficulty of procuring a sufficient number of substances of ascertained melting-point has, until recently, prevented the general application of the method. This difficulty no longer exists, for 'Seeger cones,' having melting-points ranging from 590° to 1,850° C., with intervals of about 20° C., are now procurable from any dealer in chemical apparatus. In describing these cones, Thomas Gray, in a paper read before the Scottish section of the Society of Chemical Industry, October, 1904, says that they consist of triangular pyramids composed of kaolin, mixed with silica, boric acid, and various metallic oxides in the necessary proportions to form a graduated series. The melting-points of the various compositions have been determined by Hecht with the help of a standard thermo-couple. In applying the method, a number of cones, having a range of melting-points which include the temperature to be measured, are placed on a fireclay plate and introduced into the furnace. If the cones have been properly chosen, the first members of the series will be observed to melt, while the last will remain unaffected. The melting-point of the cone which just softens sufficiently to cause the apex of the pyramid to bend down to the base-plate, is taken to be the temperature of the furnace.

By the calorimetric method, a cylinder or ball of metal is heated in the furnace and dropped into a measured quantity of water; from the rise of temperature of the water, the temperature of the furnace is calculated. The metal used may be platinum, nickel, copper, or wrought iron. Platinum is to be preferred, as it does not oxidize when heated, and has no chemical action on water. The total heat of platinum up to 1,600° C., namely, the amount of heat which 1 grm. of the metal gives out when cooled from the various temperatures down to 0° C., has been carefully determined. From a chemical point of view, nickel is more suitable than iron; but the determinations of the total heat of nickel by different observers do not show a very satisfactory agreement. Iron is the least suitable metal chemically, as it oxidizes, scales, and decomposes water at high temperatures, but it possesses the advantage of being always available, and the cylinder is thus easily replaced.

In the thermo-electric method, the electro-motive force which is generated when the junction of two dissimilar metals is heated, is measured; and from the value of this, the temperature of the heated junction is deduced. The metals which are suitable for this purpose must have a high melting-point, and should not alter in structure and composition when heated; they must also be perfectly homogenous.

Platinum and the metals of the platinum group most nearly fulfil the conditions referred to above. The thermo-couples used practically are composed of wires of platinum opposed to an alloy of platinum either with 10 per cent of rhodium, or with 10 per cent of iridium. The wires of the couples are joined by fusion in the oxy-hydrogen flame, insulated by threading through perforations in a porcelain rod about one-quarter inch in diameter, and the free ends of the wires are connected to terminals in a wooden handle. As the composition of the wires is rapidly altered by exposure to heated furnace gases, the couple is enclosed in a porcelain tube, glazed within and without, which is sometimes encased in a wider iron tube to minimize the risk of fracture.

For occasional observations of temperatures up to 1,000° C., the calorimetric method, using an iron cylinder, will be found serviceable. The comparatively trifling cost of the apparatus is its chief recommendation. For higher temperatures, a platinum cylinder may be used; but care must be taken to avoid loss of heat in transferring the cylinder from the furnace to the calorimeter.

### Spanish Mineral Exports.

The exports of metals from Spain for the eleven months ending November 30 are reported as follows: Pig iron, 40,672 metric tons, against 46,050 tons in 1903; copper, 26,710 tons, against 28,312 tons; spelter, 1,872 tons, against 2,227 tons; lead, 163,331 tons, against 148,063 tons last year. Exports of minerals for the eleven months are reported by the *Revista Minera* as follows, in metric tons:

	1903	1904	Changes
Iron Ore. ....	7,021,562	6,637,962	D. 383,600
Copper ore. ....	965,621	949,700	D. 15,920
Zinc ore. ....	106,784	125,445	I. 18,661
Lead ore. ....	2,370	4,495	I. 2,125
Pyrites. ....	509,828	503,939	D. 5,889
Salt. ....	272,737	320,573	I. 47,836

Imports of fuel into Spain for the eleven months were 1,947,911 tons of coal, an increase of 76,961 tons; 160,561 tons of coke, a decrease of 6,902 tons. Most of this coal and coke was from Great Britain.

### Wood Distillation in Sweden.

A patent on a process for dry distillation of wood, by which the oils are extracted with superheated steam, has been granted to a Swedish engineer, Frans Elfström. The plant required is inexpensive, the process is a rapid one, the waste of charcoal is small, and the recovery of oils and acids is increased by about 25 per cent. The turpentine has none of the usual burnt smell, and is said to be superior even to the French oil.

Several lumber firms have installed the process and are utilizing the waste from their saw-mills and from their logging operations, the economy of this practice being very pronounced.

### Notes on the Assay of Tellurides.

"Comparison of a wet and crucible-fire method for the assay of gold telluride ores, with notes on the errors occurring in the operations of fire assay and parting," is the title of the United States Geological Survey's bulletin No. 253, by Hillebrand and Allen.

Their investigations dispel all doubts as to the accuracy of the crucible assay of tellurides, showing that the results obtained by this method, provided that the inevitable loss by absorption in the cupel is recovered, are equal to those of the wet analysis.

Loss of gold in the slag is small, but cupel losses are appreciable. The loss by volatilization during cupellation is generally slight as compared with that by absorption. At a temperature which allows the formation of abundant feather-litharge, volatilization is negligible, or may be compensated by retention of lead. At high temperatures, however, volatilization may equal one-half of the absorption, in the case of a quartation alloy. The loss of gold by absorption is influenced, more than is generally supposed, by slight changes in temperature. It is greatest with pure gold and alloys low in silver.

Experiments failed absolutely to show the need of a higher temperature, at the end of cupellation for gold beads than for silver. The most exact results were obtained when feather-litharge was still abundant at the moment of brightening. It is altogether unnecessary to leave gold beads in the muffle after brightening, to remove the last of the lead, for there is no reduction in weight by so doing.

Silver can be completely extracted from quartation alloys by nitric acid; but more than one repetition of the acid treatment and subsequent washing is called for, if complete extraction is to be expected. Tests, made with mixtures of pure nitrous and nitric acids, show that the solvent action of the nitric acid upon gold is so slight that it need not be considered as a possible disturbing factor in parting.

**COBALT IN THE BANKET.**—Mr. Andrew F. Crosse has detected the presence of nickel and cobalt in the concentrate obtained from the treatment of the banket, at Johannesburg. The analysis and physical properties indicated that the mineral was either cobalt glance or speiss cobalt. This discovery accounts for the arsenic which appears in the clean-up at the mills. It is described in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa.

Cyanide is being made indirectly from barium carbide, which comes from the electric furnace. Calcium cyanamide, also a product of the electric furnace, promises to be an important source of cyanide.

### A Geological Survey of Illinois.

The necessity for a geological survey of Illinois is urged by Governor Deneen in his first message to the legislature, and the appropriation of a sufficient sum is recommended. On this question we give some extracts from a paper prepared by A. Beament for the Western Society of Engineers:

It is desirable to mention briefly the work which has already been done, because many people no doubt believe that the natural resources of this State have been studied to an extent as not to warrant such work being taken up again. In February of the year 1851, the legislature of the State of Illinois passed a measure authorizing a geological survey, and made a meagre appropriation to carry on the work. Nothing of consequence, however, was accomplished till the late A. H. Worthen received his commission as director of the survey from the then governor W. H. Bissell on March 22, 1858. The reports made by Worthen fill eight large volumes, the first not appearing till 1866, because delayed appropriation did not permit of earlier publication; the final volume appearing in 1890, two years after Worthen's death. To the casual observer these eight volumes would suggest that the natural resources of Illinois had been well studied and a very full inventory of the valuable mineral deposits lying below the surface of the State had been presented to the people. This, however, is not true, because only one-seventh of these reports is devoted to economic geology, and there were three reasons for this. First, that the amount of money available was limited. Second, that natural outcroppings of the strata are comparatively limited, and that a large portion of the surface of the State is covered by drift, for this reason requiring a different method of investigation than that which would suffice in a State like Pennsylvania, for example, where outcroppings are so numerous. And the third reason is, that Worthen was much more interested in the animal and plant fossils than in geology proper; therefore, his best efforts were devoted to paleontology, and in this line his work is superb, being known and admired the world over. Owing to exhaustion of the original volumes of the report, and a demand for information by people who were anxious to develop the mineral resources of the State, three volumes were published in 1882, entitled 'Economic Geology of Illinois.' Some have supposed that these volumes contained information not in the original reports. They were, however, nothing more than simply reprints of that portion of the reports which treated geology proper. For our present knowledge of the extent of the mineral resources of the State, we are indebted to coal mining operations more than to any other source. But miners seek their own rather than the community's welfare, and

there is a much greater need for a geological survey at the present time, than could have been realized a few years ago, and it is about time the people made an inventory of the valuable minerals which Providence has placed at their disposal, and which may be obtained if location is known.

One of the pernicious habits of careless writers and speakers, is to repeat the old absurd assertion, that our coal deposits are "inexhaustible" and may be depended upon to supply fuel for "ages"; thus people who are not familiar with the matter, are led to believe that money expended in investigating fuel supply, and to encourage careful and economical mining, is wasted. The history of anthracite mining in Pennsylvania illustrates the rapidity of the exhaustion of important coal deposits; already the era of low cost mining has passed; prices are necessarily rising rapidly, and it is difficult to predict a longer life than 50 years for these fields, unless it be on the assumption of a still more prohibitive price, sufficient to curtail sales seriously. In Illinois, the low priced mining is in the thick seams, or in the thick portions of the seams. The maximum area of the territory underlain by thick seams, as far as present knowledge permits of an estimate, is only 12% of the total coal measure area, and 9% of the entire area of the State.

One of the sources of opposition to expenditure of money for geological work, is from agricultural communities in which no mining is carried on, but in a mining locality where the work is of really less importance, the people may be depended on to favor such project. The coal measure formation is practically present in the entire State except that portion north of La Salle, and if the agricultural portion of the community realized the large and important income to be derived from the sale of coal which may be found, geological investigation would be demanded.

The proper conduct of a geological investigation in Illinois will require some deep drill holes in the interior of the State. In this feature, the problem presents itself quite differently from that of many other localities. The author, being particularly interested in the coal business, would suggest a study of the value of Illinois coal, to be determined by proper sampling and analysis. Methods and devices have been recently perfected at the State University by Prof. S. W. Parr, which make it possible to undertake work of this character, which formerly could not have been attempted except at considerable expense.

The Western Society of Engineers being the representative industrial organization of Illinois, the author believes it should endorse any proper effort which is being made to bring about this much needed and valuable work.

The dissociation temperature of zinc sulphate is 739° C.

### Books Reviewed.

*Handbook on Sanitation. A Manual of Theoretical and Practical Sanitation. Second Edition.* By George M. Price. New York; John Wiley & Sons, London; Champan & Hall, Ltd. Pages, 316; illustrated. Price, \$1.50.

This book, while intended chiefly for city dwellers, builders, architects and inspectors—contains much that is useful to everyone who builds a house anywhere. Its contents are, in large part, applicable to conditions in a mining camp, as well as in a large city. The first part is on sanitary science; the second is on sanitary practice, which is treated under four heads: (1) Habitations; (2) Trades and Occupations; (3) Foods; (4) Disinfection and Disinfectants. It is a compact and clearly written handbook.

*Canada. Report of the Commission Appointed to Investigate the Different Electro-thermic Processes for the Smelting of Iron Ores and the Making of Steel in Operation in Europe.* Eugene Haanel, Commissioner, Ottawa, Canada; Department of the Interior. Pages, 224; illustrated.

We have heretofore referred to some of the conclusions reached by the Canadian Commission, and embodied in this report. It is a valuable document, giving a summary of the work so far accomplished in the electro-metallurgy of steel. This has been done chiefly in France and Sweden, because it has been in those countries that it was possible to generate electricity cheaply by water-power. The conditions are very nearly re-produced in parts of Canada, and this report, showing what has been done, may indicate what can be done in the future. The commission has collected the available information on electric smelting, in one volume, which will be of service to metallurgists.

*University of Texas Mineral Survey. Report of a Reconnaissance in Trans-Pecos Texas.* By George Burr Richardson. Austin, Texas: State Printers. Pages, 120; with maps and illustrations.

This is Bulletin No. 9, of the excellent series issued by the University Mineral Survey in Texas. The reconnaissance reported upon was undertaken primarily to determine the conditions of occurrence of underground water. The area studied is situated in western Texas between the Pecos River and the Rio Grande, and extends from the Texas & Pacific Railway northward to the New Mexico boundary. It includes about 9,000 square miles and is somewhat larger than the State of Massachusetts. Six months, from June to December, 1903, were spent in the field. The bulletin describes in order, the topography of the area studied, the stratigraphy, the geological structure, the mineral resources and the underground waters. The minerals of the region are coal, salt,

petroleum, and sulphur; all as yet undeveloped. The Trans-Pecos region is entirely different from the great plain which constitutes the larger part of Texas. It is a mountain region, lying within what is known geologically, as the Cordilleran province. It has been little studied until recently, and presents an interesting field for exploration. Only a part of it is included in the present reconnaissance, and that part is the least known, so that the notes here presented, are an addition to our knowledge of the State.

*The Electric Furnace.* By Henry Moissan. Translated from the French by A. T. de Moulipied. London: Edwin Arnold. New York: Longmans, Green & Company. Pages, 320; illustrated. Price, \$2.75.

The electric furnace, though suggested many years ago, has had its practical development almost entirely within the past twelve years. It has greatly extended opportunities for investigation, putting at the service of the chemist temperatures far higher than could be attained by the combustion of fuel; ranging, in fact, up to 4000°C. M. Moissan has been a steady worker and experimenter with this device, and no one is better qualified to write of the results so far obtained.

The book is divided into five chapters. In the first are described the different types of electric furnaces used in these researches, and their application to the study of the fusion and the volatilization of a number of refractory bodies. The second chapter contains a study of the three varieties of carbon—amorphous carbon, graphite, and the diamond. Chapter III deals with the preparation of some elements in the electric furnace. The elements investigated were chromium, manganese, molybdenum, tungsten, uranium, vanadium, zirconium, titanium, silicon, and aluminum. Chapter IV contains an account of the researches carried out on some new series of binary compounds—the carbides, the silicides, and the borides. The preparation, properties, and analyses of hitherto unknown compounds are given. More especially, the preparation of calcium carbide has been subjected to fresh investigation, and this is dealt with in some detail. The last chapter contains an account of recent work, bringing the book up to the latest possible date.

*Modern Industrial Progress.* By Charles H. Cochrane. Philadelphia and London; the J. B. Lippincott Company. Pages, 648; with 400 illustrations. Price, \$3, net.

The man who wants to know what is going on in industries other than his own will find this book of interest. It is an up-to-date résumé of the world's progress in forty leading trades, with no attempt to cover the whole ground, or to go very

deeply into statistics. The effect seems rather to have been to cull that which is most interesting and striking in each of the prominent fields of labor.

The reader is taken on an excursion, as it were, into the great workshops. He hears the hum of the whirling dynamos, sees the glare from the throats of blast furnaces, skims the atmosphere with the aeroplanists, and whispers across continents with Marconi; he races in the latest 90-h.p. automobile, and speeds with the electric train at 130 miles an hour! the leviathans of the nautical world are opened for inspection, and the great guns and death-dealing torpedoes are made to give up their secrets; he goes to the mountain top to look out with a mammoth searchlight, and into astronomical observatories to peep through both equatorials and refractors.

He sees the logs chopped in the forest, follows them down the flume to the river, and the ocean raft; thence to the paper mill, where the mighty rolls, often more than a mile in length, are produced for the use of the modern newspaper. In the newspaper office he hears the steady click of the linotypes, watches the marvelous autoplating machine, and finally the intricate web perfecting presses that have made possible daily circulations in six and seven figures.

He goes a mile below the surface to see the miners drilling in the flickering light, stopping awhile in the refinery, and chatting with the adventurous seeker after gold. Tunnels and canals are visited, and the bridge engineer is made to tell how he hangs the long steel spans over broad waterways. The progress of machine-building is followed from its beginnings to its latest developments, and the several forms of power development are examined and discussed.

The evolution in modern foods, and the methods followed to secure pure drinking water, are told, together with the progress of the agriculturist, the development of wheat growing, and roller milling. A look is taken into the new type of glass works, with the continuous tank furnaces, and also at the automatic bottle-machines; the textile factories are visited, so that one may see the cotton carded, the wool spun, and the silk woven. The leather, shoe and rubber trades, each receive attention; also liquor and tobacco, petroleum and oil refining, clay and aluminum, and more modest industries.

Not least in interest are the chapters on 'The Machinery of Amusement' and 'How Money is Manufactured.' Evidently few subjects have escaped Mr. Cochrane, whose name is not new in the field of writing of technical matters for non-technical readers. While the book should be appreciated by technical men in all lines, it is addressed to the great public, those who have never taken the time to acquire the language of the engineer or the scientist, but who want to know in

plain Anglo-Saxon, what is going on in the world.

So far as we know this is the first book issued since 1900 that undertakes to tell graphically in a popular manner what is doing in the world's workshops. No book is large enough to tell the story, but these 648 pages are well filled, and copiously illustrated.

### Books Received.

In sending books for notices, will publishers, for their own sake and that of book buyers, give the retail price? These notices do not supersede review in a subsequent issue of this JOURNAL.

*Suction Gas.* By Oswald H. Haenssgen. Cincinnati, Ohio; The Gas Engine Publishing Company. Pages, 88. Price \$1.

*Marl Deposits in Ontario, Quebec, New Brunswick and Nova Scotia.* By R. W. Ells. Ottawa, Canada; Published for the Author. Pamphlet, 12 pages.

*United States Department of Agriculture. Progress Report on the Strength of Structural Timber.* By W. Hendrick Hatt. Washington: Government Printing Office. Pages, 28.

*United States Geological Survey. Forest Conditions in the Absaroka Division of the Yellowstone Forest Reserve in Montana.* By John B. Leiber. Washington: Government Printing Office. Pages, 148; with maps.

*United States Geological Survey. Mineral Resources of the United States. 1903.* Compiled under direction of David T. Day, Chief of Division. Washington: Government Printing Office. Pages: 1,204.

*Geological Survey of India. Geology of Upper Assam and the Auriferous Occurrences of Assam.* By J. Malcolm Maclaren. Calcutta, India; Published by the Survey. Pages, 56, with maps and illustrations.

*Geological Survey of Canada. Report on the Origin, Geological Relations and Composition of the Nickel and Copper Deposits of the Sudbury Mining District in Ontario.* By Alfred Ernest Barlow. Ottawa, Canada: Public Printer. Pages, 236; with maps and illustrations. Price, 25 cents.

*Geological Survey of Canada. Bulletins of the Section of Mines. Platinum.* By Elfric Drew Ingall. Pages, 28. *Apatite.* By R. W. Ells. Pages, 32. *Graphite.* By R. W. Ells. Pages 32. *Manganese.* By Elfric Drew Ingall. Pages, 28. *Infusorial Earth.* By T. Denis. Pages, 16. *Asbestos.* By R. W. Ells. Pages, 28. *Mica.* By R. W. Ells. Pages, 32. *Salt.* By Elfric Drew Ingall. Pages, 36. *Zinc.* By Elfric Drew Ingall. Pages, 16. *Molybdenum and Tungsten.* By R. A. A. Johnston, and C. W. Willimott. Pages, 16. *Peat.* By R. Chalmers. Pages, 40. Ottawa, Canada: Public Printer.

## Correspondence.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested.  
Letters should be addressed to the Editor.  
We do not hold ourselves responsible for the opinions expressed by correspondents.

*Spodumene in South Dakota.*

Sir.—In your valuable statistical number of Jan. 5, under the head of spodumene production, you report only the quantity of the valuable crystalline variety, saying the spodumene is found "in small quantity" in South Dakota and elsewhere. It may be of interest to record that the receiver of the Harney Peak Tin Mining, Milling & Manufacturing Company, sold about 600 tons of spodumene in the year 1903 and about 250 tons in the year 1904; the principal buyers being near one of our Atlantic ports, where the ore was employed in the extraction of lithia.

ALBERT R. LEDOUX.

New York, Jan. 16, 1905.

*A New Iron Range in Minnesota.*

Sir—A new iron ore district lying west of Lake Superior about 90 miles and on the line of the Northern Pacific Railway, in Crow Wing county, Minn., has been discovered by Cuyler Adams, of Duluth. The deposits lie in a section of country not heretofore supposed to contain ore; in fact the region is heavily drift-covered and there are no known rock outcrops of any kind in it. The ore formation was discovered by long and patient exploration with a dip-needle, Mr. Adams having been engaged in the work for over 10 years.

While the ores as a rule are not at all magnetic, the enclosing rocks and the formation as a whole are more or less so, and he was able to plat the strata under the drift with sufficient accuracy to place drills at various points on the range and show up the ore.

The district has been named the "Cuyuna" by Prof. C. K. Leith, who visited the region for the United States Geological Survey last fall, and who will make a preliminary report upon its geology as soon as he shall be able to make microscopic examinations of the different rocks by means of slides now in preparation. Prof. Leith's idea of a possible correlation of the Mesabie and Penoque-Gogebie formations was published about two years ago in the 'Mesabie Monograph' of the United States Geological Survey, and before Mr. Adams' theories and discoveries were made public, so that the two had arrived independently at somewhat similar conclusions regarding such possible correlation.

Mr. Adams' magnetic data and mapping, so far verified in each instance by the drill-holes, show two parallel ranges, the general strike of which is northeast

and southwest. The lower one appears to have a length of about 15 miles; the upper one is much shorter. Judging from the drill cores the dip of the lower range would appear to be about 70°, but whether to the northwest or southeast cannot be definitely stated at the present time.

A considerable amount of drilling by churn and core drill has been done on this range at four different points on the strike from half a mile to a mile apart. The country rocks are greatly disintegrated and altered, and may all be different phases of some rock originally of the same general character. The ores are generally red and brown hematites; sometimes crumbly and too soft to core, and at others very hard, dense and fine grained. A large percentage of siderite or carbonate or iron occurs in some of the rocks.

Roughly in detail the drilling at the present time shows the following results:

On Sec. 10, T 46 R 28, a gray loose-grained rock, supposed to be taconite, but rather soft, and carrying a large percentage of siderite crystals and more or less brown hematite. There has been but one hole sunk here up to date, which is now about 400 ft. deep.

On Sec. 16, about 1¼ miles to the southwest, 11 holes have been put down, averaging some 300 ft. in depth. The rock further to the southeast is a highly ferruginous, soft, schistose rock, possibly an altered greenstone. This is succeeded to the northwest by red slates, paint rock, and these again by black slates and black ore containing some magnetite, and running from 32 to 52 per cent in iron. Last is a gray-green silicious rock, too soft to core and of undetermined character.

On Sec. 21, about a half mile further southwest, a soft gray micaceous, ferruginous rock too soft to core—and like that found to the southeast on Sec. 16—is the first rock coming from the southeast; next that for 100 ft. or more wide, and in one hole for 40 ft. at least, is a rarely black, jaspery, cherty, heavy, brown rock.

On Sec. 20, another half mile to the southwest, ore was found on 135 ft. of drift, for about 40 ft. assaying as high as 62.5 per cent and averaging for that distance about 57 per cent; then country rock, eruptive. After awhile, ore again in streaks, stopping about 400 ft. in ore. About 300 ft. west of this hole the drill cut through 40 ft. of soapstone (so called by the drillers) and ore; the bottom of the hole is now in ore. Some of the ore from this hole when assayed showed 6 per cent of manganese.

The assays for phosphorus on the range generally showed from 0.02 to 0.244 per cent.

Cole & McDonald are now drilling several miles further to the southwest on an option for a lease given by the Adams interests.

All the work done so far on the North

range has been on Sec. 30, T 47 R 28. Here a series of holes put in transverse to the strike, showed about 70 ft. of overburden, underneath which, to the northwest, was an unmistakable greenstone, hard and unaltered. Resting on this, to the southeast, were found large bodies of fine red paint rock and ore at least 100 ft. deep—the bottom has not yet been reached—and more than 200 ft. wide; the hanging-wall has not yet been located.

Beside the drills owned and operated by the Adams interests there are two outside parties drilling under options for lease from them. The different drills will be operated all winter, and from time to time others will be placed upon the new range by parties taking options for lease, negotiations for which are now under way.

The Northern Pacific Railway parallels the lower range for its entire length at a distance of about 1½ miles, so that the cheap transportation is ready.

EXPLORER.

Chicago, Jan. 2, 1905.

*Tube-Mills.*

Sir—I notice in the article on Colorado, page 19, of your excellent issue of January 5, that mention is made of tube-mills, and the article reads as if the initial installation for this section were made at the Liberty Bell mill at Telluride; whereas we installed the first tube-mill plant (in Colorado), at the Gold King mill near Silverton, Colorado, consisting of four tube-mills, 5 ft. diam., by 14 ft. long. These mills re-crush the tailing from an 80-stamp mill to pass 60-mesh screen, which is then classified and re-concentrated on Wilfley slimers. This tailing plant has been in successful operation for two months, and there is great promise of this type of mill proving a great advance in the fine crushing methods for this section. We are aware that the Liberty Bell is to install tube-mills, but the Gold King mill was planned over a year ago, and decision was reached to use these mills long before the Liberty Bell contemplated the use of this system of fine crushing. As we gave a great deal of care to the design of this Gold King mill, we feel somewhat jealous of the record, and would be glad to have you give us credit for this part of the development of this system. We (The Denver Engineering Works), are now designing another large 500-ton plant using tube-mills for re-crushing, which will probably be installed in the San Juan district during the coming summer.

FRANK E. SHEPARD.

Denver, Colo., Jan 14, 1905.

An ingenious patent for electrolytic decomposition of a fused bath, is described as a combination of two currents; an alternating current keeps the bath well fused, while a direct current effects the separation of the desired metal.



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EDITORIAL.

THE EXPORTS of gold from the United States in 1904 were the largest on record, except in one or two years of business disturbance. The total amount was \$121,138,415, of which about \$106,000,000 went to Europe; while part of the balance was sent to Southern America on European account. To offset this, the imports were \$84,803,234, so that the net balance exported was \$36,335,181. To this should be added a certain amount which is carried abroad without being reported at the custom house. This is usually in small amounts, by individuals, but reaches a considerable aggregate in a year. The demand for gold in Europe has been very strong, owing partly to the war loans. It must be remembered also that the United States Government paid \$50,000,000 abroad on Panama Canal account, a considerable part being remitted in gold.

THE APPROPRIATION of a sufficient sum for the beginning of a geological survey is advocated by Governor Deneen, in his first message to the Illinois legislature. The suggestion is an excellent one. The State had a survey for a few years only, though its great interests in coal, clay and other mineral products are quite large enough to warrant a systematic examination of its mineral resources; to say nothing of other benefits which might result. We hope that the governor's suggestion will meet with favor.

ON ANOTHER page we publish a practical discussion of that important problem, the cheap and rapid hoisting of material in deep mines. Is it possible satisfactorily to serve our mines with smaller and lighter drums, thereby decreasing not only the size of the engines required, but the size and weight—consequently, the cost—of the entire plant? This is a very live and important question in the Lake Superior region and wherever mining is done on a large scale at great depth.

IN THE JOURNAL for January 5, the average price obtained for zinc ore, or rather zinc concentrate, in the Joplin region, was given at \$45.50 per ton, through an error in transcribing the figures. The correct average, including the last two

weeks in the year, which were not available when the article was written, was \$35.92 per ton. The standard in the district for concentrate is 60 per cent zinc; the actual average of the ore sold is about 58 per cent. The average price would, therefore, work out about 3.1 cents per pound of zinc in the ore, or nearly 60 per cent of the average price of the metal at St. Louis.

A TAX UPON all coal mined in Pennsylvania is proposed by Governor Pennypacker, in his message to the legislature. The plan has not been much discussed as yet, though some coal operators have said that they would not object, provided it was imposed as a substitute for all other forms of taxation. Apparently the governor does not advocate this; but considers that it should not relieve owners of coal lands from the property taxes now levied on them. The plan he has in mind is rather a royalty, to reimburse the State for the depletion of its natural resources. Thus considered, it is not likely to meet with favor. A tax on production is not usually good economic policy, and the present proposal is no exception to this rule.

THE CONVENTION of the United Mine Workers at Indianapolis is of importance chiefly as indicating the feeling of the organization and its intentions for the future. The Inter-State agreement, which covers mining in a large part of western Pennsylvania and in Ohio, Indiana and Illinois, runs until April, 1906. Though some modifications are desirable, neither operators nor miners were disposed to attempt any changes this year. So far as reports of the convention have been received, they indicate confidence in President Mitchell and his policy, and a disposition to accumulate a reserve against emergencies. Both the Inter-State agreement and the contract with the anthracite miners will expire next year, and differences are postponed until that time. It is too far ahead to predict the outcome in 1906; many things may happen in a year.

THE STRIKE of the German coal miners grows in importance, over 200,000 men being out. Already there is a scarcity of fuel and some important iron works and factories, which derive their supply of fuel from the Rhenish-Westphalian district,

have been obliged to close. The Emperor has appointed a commission to examine into the causes of the strike, but even his powerful influence has been insufficient to induce the contending parties to open negotiations.

Without entering into a careful examination of local conditions, it seems probable that the miners had substantial grievances as to wages, hours of work and precautions against accident and disease. To these were added the arbitrary action of the syndicate, in which most of the collieries are united; the managers not only declined to consider any measures of relief, but even refused to listen to any complaints. Such action has undoubtedly helped largely to support the stubborn disposition manifested by the men.

THE ESTIMATE of gold production in Russia in 1904, which was given in the JOURNAL of January 5, was \$22,500,000. We have now received the statement of the Imperial Mint at St. Petersburg, which reports the receipts for the year at 34,300 kilograms, or \$22,795,780. This, of course, does not correspond exactly to the amount mined during the year, as some time is taken in transit from the branches of the Mint in Siberia; but in a series of years the apparent error will necessarily be compensated. It is usual, however, to add at least 10 per cent to the Mint statement for gold which is not reported and is not delivered to the authorities as the law requires in Russia. Such an addition would bring the total up to \$25,075,358, or about \$2,575,000 above our estimate. The decrease in gold mining activity, upon which our estimate was based, was not felt, apparently, until late in the year.

The silver receipts reported were 4,473 kilograms fine metal, and 3,620 kilograms crude, or unrefined, bars; a total of 8,093 kilograms, or 260,190 ounces of metal.

THE PRELIMINARY estimate of the Director of the United States Mint, published in our issue of January 5, credits California with a gold output of \$19,000,000 for 1904 and a silver yield of 1,380,000 fine ounces. This is the largest precious metal production the State has made in many years. Not since 1883 has the gold yield reached nineteen millions. In fact, in 1889, it had run down to \$11,212,000, but has been gradually increasing since that year. In 1903 the gold yield, according to the Mint,

was \$16,104,500, so that the increase for 1904 is practically three millions of dollars. Undoubtedly, this marged increase of gold product in one year is almost entirely due to the operations of gold dredging machines, which are rapidly increasing in number and capacity. In fact, it may possibly be seen, when the complete figures of the year 1904 have been compiled, that the output will exceed this preliminary estimate of the director. The receipts of California gold at the United States Mint in San Francisco, and the Selby smelting works, were in 1904 nearly 20 per cent above those of the previous year. These are the principal depositories for the gold from California mines, and their combined receipts are the best indications of the total gold yield. California is still six millions behind Colorado in gold production, but the State is nine millions ahead of the next in rank. With the big dredges which will come into operation early this year, the yield of gold in California in 1905 will probably show a still larger total.

#### Apprenticeship.

Among the recent developments growing out of the desire to further the best interests of the mining profession, none is more promising than that initiated by Bewick, Moreing & Company. This firm has arranged with the Council of the Royal School of Mines to take three picked students each year, and give them occupation at the mines in Western Australia. For a period of two years, such graduates will receive an amount—\$17.50 per week—sufficient to pay for all their needs, while bridging over the interval between leaving college and receiving appointment on the staff of a mining company. This is practically equivalent to an apprenticeship, without payment of a premium. It means that a young man of ability will have the chance of getting a start without the adventitious aid of family connection or financial influence. It is not possible to exaggerate the importance of this new departure, nor to express, in behalf of the young fellows about to begin their career, too strong an appreciation of the practical kindness of this action on the part of the firm engaged in the management of so many of the rich mines of Western Australia.

We hope the example will be followed by other established engineering and finan-

cial houses controlling groups of mines; and that the action of Mr. A. C. Moreing, an Australian, and Mr. H. C. Hoover, an American, will receive the flattery of imitation, not in London alone but also on our side of the Atlantic. Familiarity with the difficulties encountered by young graduates, who know not where to turn for the opportunity to show that they can work, prompts us to emphasize the usefulness of this modern form of apprenticeship. Professional life, like doors that we know, is entered by portals, on one side of which is marked 'Push', and on the other, 'Pull'. Many a young man of special aptitude is wanting in both, and in everything but capacity to work; for such, only opportunity is lacking. The big mining and smelting companies in this country—such as the Guggenheim Exploration Company, Phelps, Dodge & Company, the Lewishon, and several other interests identified with men of public spirit—could confer a lasting benefit on the country and the profession by following this example.

#### The Disposition of Gold.

As shown in this JOURNAL for January 5, the total production of gold in the world in 1904 was approximately \$350,000,000, the largest output ever recorded in a single year. The mining of this great output is the culmination of an increase which has been going on for the past ten years, with only a temporary check resulting from the war which closed the Transvaal mines for over two years. The addition of such large amounts to the world's stock of precious metal has been, undoubtedly, one of the prominent causes of the great commercial and industrial activity of the past ten years, and of the gradual increase in prices, which has been especially manifest in the last three years, notwithstanding the decrease in cost of production due to improved methods of manufacture and to better and cheaper transportation.

A question which has been much discussed is the disposition made of the new gold. Ten years ago, eminent authorities—like Soetbeer and other economists—estimated that not more than one-quarter of the gold mined in any one year could be reckoned as an addition to the world's monetary stock. Since then, there has been a disposition to accept a higher proportion, say, one-third; but beyond this, we think very few authorities are inclined

to go. This does not imply that one-quarter, or one-third, of the gold mined becomes actually coin in circulation; the modern commercial nations use paper so largely that gold stored in bank, or government vaults, as a basis and security for paper issues, largely exceeds the amount which actually passes from hand to hand in ordinary trade.

The estimate of the amount of gold monetized, either as actual coin or as bank accumulations, is not an easy matter. The coinage of the mints affords some basis; but every national mint uses quantities of gold which are not new. Light weight coin re-melted, foreign coins and other supplies enter into the totals to an extent not always to be ascertained. Moreover, not all the bank and government reserves are coin; bullion enters into them to some extent, and the proportion is not usually given in public reports. The quantity of gold used in the arts is a matter which has caused much discussion, with very little definite result. It is certain, however, that in years of business activity and prosperity the quantity used for decoration and personal ornament increases; and in America and Europe this reaches a large amount. It cannot be determined by the examination of assay-office and bullion sales, since manufacturers and jewelers are accustomed to use a good deal of coin. This is convenient, since its fineness required is definitely known, and it is readily obtained through banks and other commercial channels.

A considerable quantity of gold actually disappears. Fire and shipwreck each contributes its quota; while the actual abrasion of coins in circulation, though apparently trifling, reached a total far from negligible. The hoarding of gold in places from which it may or may not be recovered after a time is to be considered. Then there are shipments to countries like India and China, from which most of the metal absorbed does not return; it is practically lost and disappears so far as commerce is concerned.

The subject is an interesting one, but it is useless to carry speculation too far. Our modern economists claim that the collection and presentation of statistics have made great advances toward completeness in recent years; but in a matter of such importance as the disposition of the gold won from nature, they are still able to present only inferences and estimates.

#### Doctors and Professors.

That excellent periodical, *Science*, is the official organ of the American Association for the Advancement of Science, and the editor, Mr. McKeen Cattell, is a scholar and a professor. Therefore in matters of style, as accepted by the leading scientific men, that weekly journal ought to set a good example. We regret to say that it does not—in one particular. The table of contents in the issue of January 6 gives Dr. Robt. T. Hill as one of the contributors and, immediately underneath, Mr. Theo. B. Comstock. In the issue of January 20, Dr. Eastman refers to his distinguished friend Dr. Emmons. In this same number every contributor appears to be either a doctor or a professor, judging by the prefix which appears before each name. Now, we happen to know that one of the three gentlemen above mentioned claims no academic title, while the one who passes untitled is a Doctor of Philosophy, and the third is a Master of Arts of Harvard, and quite content with that. Shall we be forgiven for calling this bespattering of titles a vulgar habit? We laugh at the Colonels in the South who never went to war, and we smile at the civilian who by reason of a term as surveyor-general retires with the title usually won only by those who have seen long military service; we deride the pianotuners who call themselves 'professors', and the mining men who are self-appointed 'experts'. But if these are lapses from good taste, what is this new habit which obtains among scientific men? Not long ago we saw an official statement of the work under preparation by various members of the Geological Survey; every man appeared to have a handle according to his rank; the chiefs were styled 'Doctor', and the assistants 'Professor'; the chairmen were plain 'Misters'. In England they have a parallel weakness for adornment, but there it takes the form of a luminous tail, the alphabet being beggared by an array of letters indicative of fellowship and membership in various societies, not to mention the usual university degrees. Some of this is well enough, as indicating that the writer has received the benefit of an education fitting him to speak on recondite matters and it serves this purpose when used in books which are meant for a public unacquainted with an author's standing, but, as between companions of the craft, such as those to whom *Science*,

*Nature*, and other scientific papers minister intermittent literature, it should be unnecessary to use handles which give no weight of authority. A university degree is a mark of culture and an honorary degree is honorable; but if a Doctor of Philosophy is to receive the style of a physician, why not address an M.A. as Master Smith and a B.A. as Bachelor Brown? It has become a courtesy among scientists to address each other as 'Doctor', much as two convivial souls in Kentucky address one another as 'Colonel', or school superintendents in the West give each other the accolade of the 'Professor'. At one time when the doctorate of philosophy was given only by a few great universities and the honorary degree was a mark of real distinction, there was some excuse—but no reason—for the use of the prefix. But now that every little State institution and numberless second-rate universities in Europe sprinkle mankind with this honor, it has ceased to signify anything in particular, and men who are known as gentlemen make themselves ridiculous by a custom which has grown beyond the bounds of decorum.

#### Words and Their Ways.—VI.

Technology suffers from the supposition that grace and precision in the use of words belong rather to the humanities than to science. As a consequence, technical literature is burdened with vulgarisms and weakened by frequent lapses, which hinder the forceful expression of ideas. Those who deal with science and technology should avoid vague statements and mere adumbrations. Therefore the terms 'probably,' 'more or less,' 'about,' 'somewhat' and 'considerable,' should not be interlarded with a careless hand. All statements, like the accounts of a book-keeper, are subject to the proviso, "errors and omissions excepted." Therefore qualifications should be used only when required; they do not absolve from responsibility. There is no need to say that a mine is "about five miles" from a certain locality; it is most unlikely to be exactly 26,400 ft. from it. A shaft is said to be "250 ft. deep, *more or less*"; well, of course it is. There is "considerable copper" in the upper levels; does the 'considerable' add precision to the statement? 'Quite' and 'very' are similar literary camp-followers, useless hangers-on of speech. On rare occasions they serve their purpose; but that is weakened by

the frequent scattering of them where they are not wanted. Take any technical article and you will see that, nine times out of ten, 'very' is meaningless, because it conveys a standard of comparison, the unit of which cannot be stated. 'Quite' is usually mere frill. There is too much qualification in both printed and verbal utterance. People acquire the adjectival habit all too easily, and feel that every noun must be accompanied by some adjective. Thus we read that "new flumes are being built"; that something is an "assured fact"; and that the report is "certainly true." With some writers, all accidents are terrible, all fires are fierce, all losses are enormous, all rivers are flowing, and all moisture is wet. Sometimes it is well to pause in the onrush of words, and recollect that some things are self-apparent to the reader, without the hammering of a verbiage that is but the dust of ideas. We venture to point out other aberrations of language: The unnecessary use of the plural is becoming common. The geologist writes of the "gneisses and schists" of a region when he means the prevailing formation of gneiss and schist. If there be varieties of a rock, the plural serves its purpose; but to use it in a generic sense is spendthrift writing. One man speaks of the "slates" of a certain district when he means the series of slatebeds; now, if he wishes to convey the idea of different kinds of slate, the plural is well enough; but usually he refers to a number of beds of like character, and then the singular fulfils the purpose and conveys the collective sense. The growth of the plural habit is marked in the terms employed in milling, so that 'tailings,' 'middlings,' 'concentrates,' 'ores,' 'sands' and 'slimes' have won their sibilant way into technical writing. By using the singular in this JOURNAL, as explained on a former occasion, we hope to correct this evil.

#### Market Conditions.

Jan. 25.

The metal markets have been somewhat disturbed by the political news from Europe, but to a less extent than might have been expected. The demand for copper continues steady, both for home use and for export. Tin is quieter, with some disposition to buy at a lower range of prices. The business in lead continues steady, but the principal producer rather unexpectedly reduced the price \$3 a ton, for reason not

altogether clear. Spelter continues strong. The Joplin ore market shows very high prices; in fact the range is greater than is at all warranted by the price of the metal.

Silver has been dull and very quiet, with only moderate demand from the East.

In the iron and steel markets there is little or nothing new to report, and business is in much the same condition as last week.

The Western coal markets continue to suffer from over-supply, and the outlook is not altogether encouraging to operators. Demand for steam coal is very fair, but prices remain low. The seaboard bituminous trade is somewhat easier. Transportation conditions still continue troublesome to operators.

The anthracite trade is very quiet, without any noticeable change. It depends mainly upon weather conditions.

#### Metallics.

Culled from all sources. Our readers are invited to assist this department by sending similar material.

The Cooper Hewitt mercury-vapor lamp is the standard illuminant for photographic purposes.

It is stated that from basic sulphate solution, aluminum can be deposited electrolytically (by the McDermott process), and can be afterward burnished.

Mountain reservoirs will prevent destructive floods, save energy for useful work, and aid irrigation.

Continuous internal combustion of gaseous or liquid fuel promises, a partial solution of the problem of wasted energy in our prime movers.

A cheap and effective electric furnace can be made by building up a small box, (6 in. by 6 in. by 6 in.), with common fire-brick. The end bricks should be perforated for the insertion of the conducting carbons. 100 amperes at 150 volts, will do fair work; but the more, the better.

According to Henri Moissan, the production of diamond in meteorites (where it is found in both the white and the black variety) is associated with the genesis of iron sulphide (troilite) and phosphide (schreibersite).

Wire cables will often rust and break down in the interior, when there is no manifestation of this on the exterior. Sometimes it can be detected by a certain slackness, and yielding to pressure, at the point infected. Corrosive water and fume may be responsible for this hidden decay.

## DISCUSSION.

Readers are invited to use this department for the discussion of questions arising in technical practice or suggested by articles appearing in the columns of THE ENGINEERING AND MINING JOURNAL.

### CHEMISTRY OF COPPER DEPOSITS.

#### The Editor:

Sir—With much appreciation I read, in your issue of December 29, the courteous criticism of "Alchemist," whom, by the way, it would be pleasant to know by his right name. If you will permit me, I would like to try to persuade "Alchemist" that the chemistry of copper and sulphur has not suffered quite such hardships in my paper on the copper deposits at Clifton-Morenci as he appears to imagine. Let me say, first, that the title of the review of my paper in a recent number of the JOURNAL was somewhat misleading. The paper did not attempt to discuss 'The Genesis of Copper Deposits'; it was strictly confined to a description of conditions at the Clifton mines. Further, the solutions referred to were not ordinary surface waters, but belonged to the deeper circulation of the chalcocite zone. That  $SO_2$  is formed in small quantities during oxidation of pyrite in open air is true. Ferric sulphate is also formed, and as the two are incompatible, the result will be sulphuric acid and ferrous sulphate. During this stage of open air oxidation sulphites may possibly form, but it is very difficult to imagine that they could remain stable, and I am not aware that "the sulphite phase is a recognized one in the cycle of volcanic decay." As the waters from the surface percolate downward through the mass of unoxidized pyrite present at Clifton a short distance below the surface, that mineral will soon reduce the ferric to ferrous sulphate, and thus the principal active reagents will be limited to ferrous sulphate, cupric sulphate and free sulphuric acid. That  $SO_2$  is formed by the action of ferrous or cupric sulphate on pyrite or chalcopyrite has not been proved. And even if small quantities of sulphur dioxide did form, they would probably soon be oxidized by an excess of cupric sulphate.

The very fact that during the experiments of Mr. H. V. Winchell (*Bulletin Geological Society of America*, Vol. XIV, p. 269), cupric sulphate was for a long time in contact with pyrite without causing a precipitate, would seem to show that the evolution of  $SO_2$  must at best be excessively slight. The synthesis of chalcocite effected by Mr. Winchell by the action of  $SO_2$  and  $CuSO_4$  on pyrite is a highly important experiment, the merits of which I fully appreciate, but it does not seem to apply to conditions at Clifton-Morenci, partly for reasons already given, partly because the reaction is a *metasomatic interchange* between pyrite and the solu-

tions, not a simple product of precipitation. The formula given by Dr. Stokes for this replacement action may involve "some startling facts," but I think Dr. Stokes will be able to prove its correctness in his forthcoming bulletin on the subject, in which the actual experiments will be fully recorded.

WALDEMAR LINDGREN.

Washington, Jan. 16, 1905.

### GEOLOGY OF THE SUDBURY DISTRICT.

#### The Editor:

Sir—In your last issue for 1904, there is an interesting letter from Mr. Hiram W. Hixon on the geology of the Sudbury district, which requires a word of reply from the geologists who have worked in the region. Mr. Hixon is such an excellent chemist and metallurgist that no geologist would dispute his conclusions on those subjects, but one cannot expect his knowledge of geology to be equally profound, so that he will not be surprised if geologists do not accept his views. The geological section which he presents may be correct as to the structure of the rocks, but his idea that the eruptions between the sedimentary rocks are "simply the underlying and unaltered magma of the earth, brought to the surface by pressure-folds and erosion," shows how widely a good metallurgist may go astray when he ventures into geology. However, that point need not be discussed, since it has no real bearing on the question of the origin of the nickel ores. The rocks represented in his section are simply the country rocks on which the nickel-bearing eruptive rests, and into which it has sometimes penetrated. On his own showing the source of the ore was not in the rocks covered by the section, for, as he correctly says, the sulphides in them are scarcely at all nickelferous. The ores must have come from somewhere else, and Mr. Hixon believes they came by ascending thermal solutions. Where did they come from? He gives no answer beyond sneering at geologists for supposing that sulphide ores could "have existed through the planetary history of the earth." He is evidently not aware that geologists do not worry about the planetary history of the earth, being willing to accept a meteoritic or planetesimal theory of the earth's origin, which does not imply that the earth was necessarily a molten ball. In any case we are quite sure that easily oxidizable materials, such as native iron, do exist in eruptive rocks.

Will Mr. Hixon tell us where sulphide ores come from, if not from eruptive rocks in the beginning. Are they manufactured in some mysterious laboratory out of native metals and native sulphur and then dissolved in water to be sent on their travels toward the place of ore deposition? The advocates of an aqueous

origin of ores should clear up this question of the real source of the ores deposited by circulating waters. In most cases they are closely connected with igneous masses, and in all probability they were derived as sulphides from these massive rocks before they passed into solution by the aid of water and so-called mineralizers. If the ores deposited from solution originated in eruptive rocks, why should not some eruptives still retain such ores?

As regards the Sudbury nickel-copper deposits, after tramping with my assistants for three summers round the edge of the great basin-shaped eruptive sheet with which they are all connected, finding it continuous and almost everywhere accompanied by, at least, traces of ore on the outer or basic edge, I have no hesitation in saying that the prospectors were right in looking on the "diorite" as the source of the ore. The "diorite," or norite, as it has proved to be when fresh, passes by every gradation from pure rock to pure ore, fresh rock minerals, such as hypersthene, so easily modified into urallite by the action of water, enclosing first small and then larger particles of the sulphides, until pyrrhotite-norite is formed and finally nearly pure ore with a few rock-forming minerals embedded in its substance.

If Mr. Hixon will examine the North Star rock dump, to choose one of his own mines, with Captain Corliss as guide, he will find all these gradations, and will find also that the ore is never mixed in this intimate way with the greenstone or granite forming the country rock to the south, though it may penetrate these rocks as stringers or enclose blocks of them. The ore is never found separate from the basic phase of the eruptive sheet or projections from it.

A feature of great importance is better illustrated at the Creighton mine, a mile or two southwest of the North Star, namely, that the orebodies occur especially where the edge of the norite pushes outward as a bay into the underlying rocks; the larger the bay, the larger is the orebody, as recognized years ago by prospectors. If the bay has a dike-like outlet leading into the adjacent rocks, much of the ore will be found distributed along the offset, as at Copper Cliff, where there are four or five large orebodies in succession.

If Mr. Hixon will look down over the country from his rock-house at Victoria mine, he will see the rusty edges of the norite converging from northeast and northwest, forming the funnel which directed the norite and ore to his own mine. If the funnel had ended there, he would have had a larger orebody, since none of it could have escaped along a fissure to the Worthington mine, three or four miles to the southwest. The ore at the Victoria mine, therefore, did not

come from the enclosing rocks nor from below, but can be traced to the broad eruptive sheet which stretches for four miles to the north.

It may be well to sum up the arguments in favor of an eruptive origin of the Sudbury nickel deposits as follows:

1. The ore is always found at the basic or lower edge of a basin-shaped sheet of eruptive rock or on narrow projections from it.

2. The more important orebodies are in bay-like depressions of the country rock or along offsets from such bays.

3. The ore and norite are intimately mixed in all proportions, and ore is never found apart from norite. It may penetrate adjoining rocks as stringers or enclose blocks of them, but is never intimately mixed with them.

4. The great marginal ore deposits, like the Creighton mine where millions of tons are known to exist, show no hint of vein-structure or of replacement of rock by ore, and very little suggestion of deposit from solution, such as quartz or calcite or other minerals that might result from pneumatolytic action.

5. The offset orebodies, like those in the Victoria mine and Copper Cliff, always show the usual mixture of ore and norite, but have undergone some re-arrangement by solution and re-deposit, and in some cases, as at the Vermilion mine, almost the whole deposit may be due to water circulating from the adjoining mass of eruptive rock before it had lost its heat.

Every geologist who studies the region carefully will, I am sure, agree in the main, with the facts just briefly stated, but, if anyone wishes detailed proof of these points, he will find it in Dr. Barlow's admirable report on the Sudbury district, and in the last two reports of the Bureau of Mines of Ontario. The facts are easily explained by the magmatic differentiation theory, and, so far as I can see, in no other way. Exactly why the magmatic separation theory is ridiculous and "supernatural" to Mr. Hixon, who has such a childlike belief in the molten earth of the nebular theory, is not at all clear; and I would suggest that it might have been well for him to find out how far he could explain the undoubted facts mentioned in the reports by "ascending thermal solutions" or else to have "waited for further light" till he had a workable theory to propose.

A. P. COLEMAN.

Toronto University, Jan. 11, 1905.

Almost inexhaustible deposits of iron ore are said to be found in the northern part of Chile. The well wooded south part of this State can furnish abundant charcoal, which produces a higher grade of iron than does coke. Moreover, the electric process, presumably from the abundant water power, may also be employed.

### Mining in Siam.

According to H. G. Scott, Director of the Siamese Department of Mines, as quoted in the *Far Eastern Review*, mining in Siam is confined to tin, gems (sapphires and rubies), and gold; their relative importance being in the order given. The mining industry is under the control of the Royal Department of Mines and Geology, which was created in 1890. The Siamese mining act of 1901 is now in force for most parts of the country, and prospecting licenses and mining leases may be obtained without difficulty.

Gold is widely distributed in Siam, and is washed out of the alluvium by the natives in several districts. The chief of these are Pu Kirin, Bangtaphan, Kow Suplu, and Tomoh. In the latter district Chinese workers carry on lode mining as well as alluvial. The native gold mining industry is, however, unimportant, the total number of persons regularly employed probably not exceeding one thousand.

Gold mining according to modern methods has not been successful in Siam. Many concessions have been granted by the government, and much capital has been expended; but in no single instance have mining operations met with any success. This may be accounted for, partly by the difficult nature of the country for carrying on mining by Europeans, and partly by bad management; but it remains to be seen whether the future will bring forth better results.

Sapphires and rubies are the only gems the working of which is of any importance, though spinels, zircons, garnets and topaz are also produced to a small extent. Of the two forms of corundum, sapphires are very much more abundant and more largely worked than rubies. Siamese sapphires form a considerable proportion of the world's supply of this gem. Statistics, however, are not available, as there is no duty on the stones, and the work is carried on by numerous small parties of men, and even by individuals, who dispose of their findings to a number of traveling traders. Siamese rubies do not command a good price, as those of good color are mostly very small, whilst those of good size are of poor color. It is believed that any really good stones which are found are sent overland to Burma and sold as Burmese rubies. As regards statistics, the same remarks apply as have already been made about sapphires.

Practically all Siamese sapphires come from the district of Phailin in Battambang. Rubies are worked in a small way in the same district; but the chief ruby workings are in Chantaboon and Kratt.

The gem mining districts are, for the most part, exceedingly unhealthy; this fact being a great bar to European enterprise in this line.

Tin is the only metal the working of which is of any importance in Siam. Tin

is found in small quantities in the valley of the Nam Sak river and in various places in northern Siam; but all the deposits of importance are derived from, and lie adjacent to, the great line of granitic upheaval which forms the boundary-range between central Siam and Tenasserim, in the backbone of the Malay Peninsula, and may be traced down to the Dutch islands of Billiton, Banka and Singkep. This great line of granite is the source of practically all the vast alluvial deposits of tin which are found in Siam and the British and Dutch East Indian possessions. The Siamese territory is probably as well off in this respect as either the British or Dutch, and the deposits are very widely distributed. Of the Siamese possessions in the Malay Peninsula, tin is at the present time being worked in the following provinces: East Coast—Ratburi, Bangtaphan, Langsuan, Chaiya, Bandon, Lakon, Jalor, Rangeh, Rahman, Kelantan and Tringganu. West Coast—Kra, Renong, Takuapar, Panga, Takuatung, Puket, Trang, Stul, Pertis and Kedah.

In some of the provinces the works are small and unimportant; but the total annual production is little short of 5,000 long tons.

Generally speaking, all the mining is in the hands of Chinese, the labor is Chinese, and the smelting is done locally by Chinese methods. The only exceptions to these generalizations are that one British and one Dutch company are working in Kedah; an American company is making a small commencement in Bangtaphan, and a British smelting company is establishing an ore-buying agency at Puket. The number of Siamese and Malays engaged in tin-mining is very small.

There is an enormous field for the expansion of the tin-mining industry in the Siamese possessions in the Malay Peninsula; and considerable activity in prospecting on the part of European capitalists has lately been shown.

At present, Puket island (on the West Coast) is the most important tin-mining center in all the Siamese states; but Kedah, Takuapar and Renong (also on the West Coast) have a considerable mining industry. On the East Coast, Lakon, Sri Tammarat and Jalar (port Patani) are the chief centers. The most promising districts for future developments are in Kedah, Rahman, Jalar, Takuatung and Renong.

**LIGHT PRESSURE VS. GRAVITATION.**—It has been demonstrated that light exerts an actual pressure or repelling force, and that, if the earth were reduced to a cloud of dust particles of one hundred-thousandth of an inch diameter, the repellant force of the sun's light would equal the pull of gravitation on this cosmic dust. This strongly suggests that light pressure dominates the action of the tails of comets.

### Exhaustion of Outcrop Mines in the Transvaal.\*

By J. H. CURLE.

Within the next five or six years a number of the best-known mines on the Rand will have exhausted their good ore. Some of these mines, when this happens, will no doubt close down at once, and go into liquidation, while others are likely to try the experiment of working the large Main Reef, which—at least, on the central Rand—has so far only been worked at a profit in small patches here and there. The well-known mines that have now the shortest lives are Bonanza, Champ D'Or, Jubilee, Jumpers, Salisbury, Durban Roodepoort, Wemmer, Ginsberg, Geldenhuis Estate and Crown Reef. These will all probably have exhausted their good ore before six years are over. The lesser-known mines in the same position are Geldenhuis Main Reef, Balmoral, Spes Bona, York and West Rand Central.

When the good ore in these mines is exhausted, it is true that they can all turn to and work out the big Main Reef, if that should be found profitable. My idea is, however, that the Main Reef is not going to be an asset of much importance to these mines. As to its value, it is certainly low. In the Durban Roodepoort the average value of Main Reef samples is 4 dwt., while in the Bonanza the average of the samples taken in 1903 was 3.21 dwt., and the average of all the Main Reef samples to date is only 3.02 dwt. I believe, averaging the central Rand all along, that there is a great deal of Main Reef which will give a recovery of, say, 13s. per ton. This ore can be extracted and treated by a reduced staff, and at a minimum expenditure as rewards both capital account and development. As against this, you will have the proximity of the old stopes on the Main Reef Leader, which are likely to make the extraction of the Main Reef itself troublesome and often difficult. I would summarize this problem by saying that an extraction of 13s. per ton will no doubt pay expenses, and that it is possible some of the larger mills will be able to work for years on their richer patches of Main Reef; but I don't believe that there will be any real profit from the mining of Main Reef, and for all practical purposes the mines will come to an end when the reefs now being worked by them are exhausted. In regard to this question of the Main Reef, I am well aware that the Crown mine bought the ground of the Pioneer, when that property was worked out, and has made a profit by working the untouched Main Reef. But that is an exceptional case. The Pioneer was the richest mine on the Rand, and the local enrichment of even the Main Reef, near the surface, just at that place, is quite understandable.

And now a few words as to these shortest-lived mines. The Bonanza should be almost exhausted at the end of this year. With its small mill it could hardly hope to make a profit on 3 dwt. Main Reef, and would no doubt sell this either to the Crown Reef or the Robinson for a small figure. Its machinery ought also to be of some value. The Champ D'Or has a year or two of life at most. It has, I imagine, worked out its Main Reef already, and its machinery is inferior, so it will go into liquidation whenever exhausted. The Jubilee has, I believe, only two years of good ore left, but will mix poor ore with this, and carry on for some time longer. It has few remaining assets. The Jumpers has very little pay ore left in it, its real asset consisting of Jumpers Deep shares, to be received for its deep level claims. The Salisbury is expected to last for four years more, and has some outside assets of value.

The Durban Roodepoort has rather less than four years more good ore. After that it will work a payable patch of Main Reef, which will yield reduced profits for another two years. Then there will only be Main Reef, worth a bare 4 dwt., which, even if worked at no loss, will yield no real profit. The Wemmer will probably last another four to five years on good ore, and has a valuable asset of Village Deep shares and several water rights. The Ginsberg has, I believe, a bare six years more on good ore. The Geldenhuis Estate would appear to have six years more, and has an estate which is valuable. The Crown Reef is supposed to have five or six years more good ore, of value equal to that now being mined. It will then have its Main Reef, which is a doubtful asset, and its very valuable South Rand share interest. The remaining mines—Geldenhuis Main Reef, Balmoral, Spes Bona, York and West Rand Central—are small affairs, and several are shut down. Their fate should be incorporation into larger mines.

To my mind, this rapid exhaustion of so many of the well-known Rand mines is a very serious problem, for their shareholders as a rule don't realize the position. You may preach to people till you are black in the face about the lives of these or of any other given mines, but so soon as the next dividend arrives they go straightaway and forget all about it. But the time will come when there will be no dividend, only a circular to say that the company is gone into liquidation, and then these people will start in and curse the mining industry and everybody connected with it. But they will do more than this, for each one of these disappointed persons will become an active enemy to the Rand, and will do all in his or her power to influence their friends against the mines. It seems to me that in these days nothing will prevent the Rand from coming into disrepute, and you will see the old fashioned shareholders in England or on the

Continent clearing out their shares, good and bad alike, without rhyme or reason.

Now, this surmise of mine is no mere bit of gratuitous pessimism. The idea has haunted me for years that this will happen to the Rand, and shrewder men than myself have confirmed my ideas by their own. I am dealing with this delicate subject here, because I feel that it needs to be brought home forcibly to those who control the Rand mines, and because I believe that what I have to say may assist in a solution of it. My idea, briefly, is this: That no mine on the Rand, for the next 10 years at least, should absolutely come to an end, thereby antagonizing nearly all its shareholders. There must be amalgamations, wherever possible, into a series of big and fairly long-lived properties, and into these amalgamations must go, first and foremost, all the mines with the shortest lives. It is true that the shareholders in these nearly exhausted mines will get a rude shock in finding their holding in the bigger concern such a relatively small one; but a shock, followed by the probability of dividends for a long time to come, is better than a series of annihilations, throwing upon the world thousands of bitter-minded shareholders to propagate the "negation of the basket" as a gospel.

Of course, the directors of the A or B mine will kick at any talk of amalgamations, and will use all sorts of arguments to throw contumely upon such a scheme; but nature is ever ruthless where the individual is concerned, and it is better the Rand should be held in good repute by the many, and work out its salvation, than that a few dozen gentlemen should be clothed in fine linen and fare sumptuously.

Great Britain does not rank as a producer of petroleum, but occasionally small quantities are found in coal mines; and there is a production of oil from shale in Scotland.

In the manufacture of refractory brick in England, a highly silicious, fire-grained sandstone is employed, known as ganister. Ganister is found under the coal in the Yorkshire coalfield, the bed being sometimes 6 ft. in thickness. The percentage of silica is high, sometimes 98 per cent.

Kunzite, the new gem-mineral found in California, takes a static charge of electricity, like topaz, when rubbed with a woolen cloth. On exposing kunzite to the passage of an oscillating current obtained from large Helmholtz machines, the entire crystal grows an orange-pink, temporarily losing its lilac color. A well-defined, brilliant line of light appears through the center, apparently in the path of the current. On discontinuing the current, the crystal gives the appearance of a glowing coal. It is not hot, however, and the phosphorescence lasts for 45 minutes.

\*The Economist, London, Jan. 14, 1905.

**Mining Stocks.**

(Full quotations on pages 198 and 200.)

**New York.** Jan. 25.

The stock market is nervous, because of the unpleasant incidents at the Russian capital this week. A bright spot though has been the declaration of an extra quarterly dividend by Amalgamated Copper, putting that stock on a 4% annual basis—one-half what was 'guaranteed' at organization. Simultaneously, there has been a change in the directorate of the company, William G. Rockefeller resigning as secretary-treasurer on account of ill-health. Contrary to expectations, this occurrence has not had much influence on the stock market, at least momentarily, for Amalgamated rose to \$76 on declaration of its dividend. Later there was a reaction to \$73.125. Anaconda, sold at \$28@26.31. Tennessee Copper is steady at \$33.75@34, and Greene Consolidated Copper, the feature of the curb, stands at \$26@27.625.

A sale of Standard Consolidated, of California, is reported at \$1.55, Horn Silver, of Utah, at \$1.50, and of Portland, of Cripple Creek, Colo., at \$1.95. Otherwise the market is uninteresting.

**Boston.** Jan. 24.

A period of inertia has set in in this market and is followed up by weakness and a freer offering of mining shares. Copper is reported a trifle weaker, but no significance is attached to this. Late last week there was a temporary spurt in market prices, but it was short lived, and to-night the market closed decidedly weak, but with activity on declining prices. A savage attack was made on United States Mining late last week and the stock was depressed over \$2 to \$21.50. It recovered from this, but closed weak at the above price. Up to date no directors' meeting has been called for dividend action, although gossip insists that 50c. will be declared shortly and a financial exhibit will also be issued.

Centennial was also made the point of attack on rumors that another assessment will be levied. About a year ago a \$4 assessment was called, payable in two installments. The price broke \$4.37½ to \$20.12½ and shows very little rallying power. According to President Day nothing will be done about a Centennial assessment for the present. The company has about \$70,000 available cash on hand and 10,000 shares of treasury stock. Atlantic mining fell \$2 to \$16 during the week but rallied to \$16.75 to-day on the announcement that dividend payments had been resumed. A 50c. dividend has been declared, payable Feb. 15. This is the first dividend since Feb., 1901, when \$2 was paid on the then outstanding 40,000 shares. Since that time the capital has been increased to 100,000 shares.

Greene Consolidated is off \$2 to \$25.75 on rather free offering. After a rather smart rise in Michigan the stock fell back to \$11.25, which is \$2.25 below a week back. Bingham was freely offered to-day and the price broke \$2 to \$30.25. The price a week ago was \$33.25. Mohawk is off \$2.12½ to \$52 on rather light trading. Daly-West is \$2.50 lower for the week at \$15.50. A Boston gentleman claims to have proxies for 30,000 shares for use at the meeting next month.

The industrial shares did not attract much attention, and trading in them was of a character suggesting a waiting policy. Prices fluctuated fractionally. The feature was United States Steel.

**Colorado Springs.** Jan. 20.

The market in Cripple Creek shares has been decidedly active and the past week has seen advances in almost every stock, with livelier times than have been experienced for three years. The condition of the Cripple Creek district is the cause of the renewed interest in stocks, for never before has the production of the camp been greater, or a larger number of men employed, or as large an area of ground being prospected as at the present time.

El Paso has been the favorite of the week, advancing from \$1.39½ to \$1.70 with heavy sales. Acacia has advanced from 8½ to 11½. Dante has made a gain from 4½ to 7c. Elkton is selling for 69c. Isabella has gained from 27 to 30c. Portland sold to-day for \$1.85. Prince Albert has advanced from 2½ to 3¾c.; Work from 13 to 17c. On the prospect list Gold Sovereign has advanced from 9 to 11¾c., with almost every other cheap stock on the list showing advances of from 10% to 75% during the week.

**Salt Lake City.** Jan. 20.

The principal trading during the past week has been confined to a few stocks. After a spell of inaction lasting through a series of months, Ingot, of Mercur, displayed signs of life. Being cheap, the chances for a rise in price were first-class and a good many bought it as a 'flyer.' The stock sold up to 4¼, advancing from 2c. Bonanza has been active and improved conditions at the mine stimulated buying. Daly-Judge sold up to \$6.25, advancing from \$5 a share during the week. Butler-Liberal moved up several points. The 20c. assessment levied on Columbus Consolidated, has had a depressing effect. Daly-West has fluctuated considerably and one day \$18.50 was paid. Naildriver has enjoyed a sympathetic movement upward; due to the activity of Wabash and New York Bonanza. Yankee Con. has held its own. The directors for the ensuing year will be chosen next Monday. The January dividends of Utah mines will run close to \$600,000.

**San Francisco.** Jan. 19.

The Comstock shares during the week have been rather quiet, with some decrease in trading, but prices were generally steady. Ophir sold around \$6.50; Mexican, \$2.05; Consolidated California & Virginia, \$1.65; Hale & Norcross, \$1.55; Best & Belcher, \$1.10; Potosi, 47c. per share. Trading in the Tonopah stocks on the old exchange was moderately active.

On the San Francisco & Tonopah exchange business was good, and prices showed few fluctuations. Montana Tonopah sold at \$2.10; Tonopah Belmont, 73c.; Goldfield, 72c.; Jumbo, 64c.; MacNamara, 28c.; Original Bullfrog, 25c. per share.

On the California exchange trading in oil shares was very quiet. Kern River was quoted at \$10.50; Oil City, 70c.; Home, 46c.; Independence, 28c. per share.

**Monterey.** Jan. 18.

Exchange on New York continues at 202.125, though silver varied during the week from 59.875 to 60.75c. The mining stock market has improved, and sales reported are Dos Estrellas, at \$3,600; Victoria, \$63; Borda Antigua, \$20; Equidad, \$18; Augustias, \$53; Barreno, \$103.50; La Paz, \$231; San Rafael, \$2,200; Santa Gertrudis, \$75; Soledad, \$1,200, and Sorpresa, \$305.

**Coal Trade Review.****NEW YORK,** Jan. 25.**ANTHRACITE.**

The hard coal market remains without any new features. From now, until the next readjustment on a summer basis, the trade will be affected solely by fluctuations in temperature. The cold weather, that has stimulated buying in the vicinity of New York, still continues, but prices at harbor points remain at the old level, namely: Domestic, \$4.75 for broken, and \$5 for egg, stove and chestnut; steam sizes, about \$3 for pea coal, \$2.25@2.50 for buckwheat, \$1.45@1.50 for rice, and \$1.30@1.35 for barley.

The shortage in cars, of which the bituminous shippers have been complaining, has affected anthracite shipments to the Northwest, but not the deliveries to tidewater points.

**BITUMINOUS.**

The supply of coal for the Atlantic seaboard trade is shorter than it was in the previous week, and prices are accordingly advanced. The shortage has developed from a poor supply of cars, which has been prevalent at practically all mines, and from which the railroads do not expect to recover in the immediate future. The cause of this shortage is said to be the lack of motive power, arising from the retirement of a large number of engines which have lately been forced to the extent of their power and upon an insufficient supply of good water.

In regard to business for the coming year, nothing has been heard. This question is dormant, until after the labor unions have come to some conclusion as to their future action, and until the main-line railroads have intimated what rates they are going to offer on tidewater coal for the ensuing year.

Trade in the far East is taking a fair proportion of coal, although stocks on hand in that district are larger than in almost any other consuming territory. The supply along the Sound appears to be short, judging from the active demands from that region. New York harbor trade shows that most of the cheap coal is out of the market, and that the shortening of supply still continues. Coal is quoted at \$2.05@2.70 f. o. b. shipping points, for the ordinary steam grades, with the better grades ranging upwards. The outlook is for an advance in price on account of the bad weather and the shortage of cars.

Transportation from mines to tide is good, considering the circumstances, most coal taking only about a week to come through. The car supply is reported bad from all quarters; about one-quarter of the requirements being the most that can be furnished.

The coastwise trade vessel market shows that a great many vessels are laid up until winter is over, but a sufficient number to meet the demands seem to be on hand. Bad weather has caused an advance in freight rates. The Philadelphia rates quoted are 90c.@1 to around the Capes; 80@85c. to the Sound. New York harbor quotes 75@80c. to around the Cape.

**Birmingham.** Jan. 23.

The coal production in Alabama to-day is heavier than it has been in several months. The old mines, where the union miners have been out on strike since July last, are filling up with new men. The coke production, as a consequence, is improving also. There is a strong demand



for all the coal that can be mined outside of the furnace needs and good prices prevail. State Mine Inspector Gray and the examining board held an examination during the past week for first and second-class foremen's certificates.

Ohio parties have purchased 1,000 acres of coal lands in Walker county and, as soon as a railroad line to the property can be constructed, the work of development will be started. The Atlas Coal Co., with mines under development in Walker county, will install improved machinery, coal-cutting machines and air compressors. E. D. Stone is in charge of the work at the mines. The Merrimac Coal Mining Co., H. P. Gibson, president, is installing coal-cutting machines in Walker county. The company expects to have an output of not less than 800 tons a day. The Black Creek Mining & Manufacturing Co. has begun mining coal, and will produce between 300 and 500 tons of coal a day.

The Tutweiler Coal, Iron & Railway Co. is building a number of coke ovens in Jefferson county and expects to have them completed before Fall. The Republic Iron & Steel Co. will shortly light up a battery or two of ovens at Warner mines.

**Cleveland.** Jan. 24.

The coke trade of this territory continues to be the strong part of the fuel trade, aided somewhat by strength in the domestic coal situation. The railroads are finding that the movement of general merchandise and grain, has lessened the supply of box cars in which coke is shipped. Quotations are: \$3 at the oven for good 72-hour coke, with furnace coke selling at \$2.75 for spot shipment. There are few, if any, sales on contract now, since most of the consumers have covered their needs.

The domestic coal trade is steady and prices are strong, but with a good supply. The available supply, however, has little influence on prices since those are governed by association action. The ruling price is \$2.55 at the mines for Massillon selected lump.

The steam coal trade is still in the dumps. There is an abundance of cars for the movement of this material. Some of the railroads have stopped bringing quite so much coal to Cleveland, turning their cars into other channels, until there is an end of the plethora condition of coal here. The result is that the market may possibly be a little stronger, but still there is a superabundance and prices have not advanced. The market is steady at \$1 at mine for run-of-mine, Ohio and Pennsylvania coal.

**Chicago.** Jan. 23.

To dealers in both anthracite and bituminous, the present condition of trade is far from being satisfactory. The coldest weather of the season has been experienced in the last week, but there has been no general demand for anthracite in consequence, and it is evident that this business will be light for the rest of the winter. Only the mild weather of the winter, speaking generally, can be urged in explanation of the lack of demand for anthracite, for it is certain that consumers had no large stocks on hand at the beginning of winter. Some dealers explain the lack of demand by the extension of steam-heating plants in which bituminous coal can be used with profit; others say that knowledge of how to burn bituminous economically is spreading. It seems certain that the usual amount of anthracite is not being burned. There

has been considerable private coal sold under the established prices this winter, but this, it is said, is now disappearing, and standard prices will be the rule until spring. All grades of anthracite are in good supply, the previously reported scarcity of chestnut being no longer complained of. Railroad conditions, while not ideal, are not bad.

In the bituminous field, western coals continue very weak, and eastern coals only moderately strong. Illinois and Indiana are in over-supply and prices are low: Steam lump has sold at \$1.70@\$1.80; run-of-mine at \$1.45@\$1.85, and screenings at \$1@\$1.50. Domestic grades are selling best, but are not strong; dealers say that even the production of domestic should be restricted. Of eastern coals, smokeless continues to be troubled by delayed shipments, but brings low prices—\$2.85@\$3.15. Youghiogheny is in steady, but light, demand, at \$2.75@\$3.10; Hocking is about normal again, with the surplus of a week or two ago about gone and prices up to \$3@\$3.20. The prospects for eastern coals are not much brighter than for western, and unless care is used in shipping, there is likely to be demoralization with forced sales to escape demurrage, if mild weather continues.

**Pittsburg.** Jan. 24.

**Coal.**—Some additional river shipments of coal were made during the latter part of last week. The rivers are still navigable for light tows and the tow-boats are bringing back empty coal-boats and barges. There are now enough empties in the pools and harbors to permit the operation of the river mines for several months. The railroad mines are operating fairly well, but the market is not particularly active. Prices remain about the same, on the basis of \$1.10 per ton for run-of-mine at the mine.

**Connellsville Coke.**—All records for production have been broken and additional ovens are being put in operation. Prices of furnace coke remain at \$2.75@\$3 for prompt shipment, but for delivery through the first half, contracts have been made at \$2.50. Foundry coke is quoted at \$3@\$3.25 for any delivery. The Lackawanna Steel Co. is in the market again and has increased its contract for 1,000 tons daily for three years. The production in the Connellsville region for the week was 259,094 tons, an increase over the previous week of 11,679 tons. The shipments aggregated 10,595 cars distributed as follows: To Pittsburg and river points, 3,975 cars; to points west of Pittsburg, 5,550 cars; to points east of Everson, 1,070 cars. This was an increase of 876 cars.

**San Francisco.** Jan. 19.

Trade continues steady, with no change to report.

For Pacific coast coals, in large lots to dealers, quotations are: Wellington and New Wellington, \$8; Richmond, \$7.50; Roslyn, \$7; Seattle and Bryant, \$6.50; Beaver Hill and Coos Bay, \$5.50; white ash, \$5.25. For Rocky Mountain coals, also in large lots to dealers, prices named are \$8.50 for Castle Gate, Clear Creek, Rock Springs and Sunnyside; Colorado anthracite brings \$4. For Eastern coal, quotations are largely nominal, supplies being light. Pennsylvania anthracite is \$14 and Cumberland \$13. For English coal, quotations are, ex-ship; Welsh anthracite, \$13; cannel, \$8.50; Wallsend and Brymbo, \$7.50 per ton.

Mr. J. W. Harrison's circular, of Jan.

12, says: "Since last month there have been only two arrivals from Australia; total, 4,009 tons. Since the beginning of last month there have been but three arrivals here, with 5,860 tons, hence the quantity here in yard has been considerably diminished within the past six weeks. There are 17 vessels on the chartered list to load coal at Newcastle for this port, with a carrying capacity of about 43,000 tons, the major portion of which will not arrive before April or May next. The stormy weather prevailing here lately has materially increased the sale of Australian grades, they being in brisk demand for domestic uses. Prices remain unchanged, although 75% of the Colonial coal remains under the control locally of one firm. The existing rates of freight from Australia on coal for this market are ruling at full figures, 15s. per ton being present asking price; this leaves a very meager profit for the importer. This will probably lead to reduced shipments this year, as the British Columbia product can be delivered here at a much lower figure, and is eagerly sought for by large consumers of steam and house coals. The oil product for 1904 will aggregate 30,000,000 barrels, so it can be readily figured that the sale for steam fuel this year will be largely diminished. It is to be hoped that the importations for Colonial coal this year will at least equal the amount delivered here in 1904, as that is the smallest amount imported for several years."

**Foreign Coal Trade.** Jan. 25.

Exports of fuel from Germany for the 11 months ending Nov. 30, are reported as follows, in metric tons:

	1903.	1904.	Changes.
Coal . . . . .	15,978,849	16,233,062	I. 254,213
Brown coal . . . . .	21,145	20,818	D. 327
Coke . . . . .	2,316,889	2,491,319	I. 174,430
Total . . . . .	18,316,883	18,745,199	I. 428,316

The chief exports of coal were to Austria, Hoiland, Belgium and Switzerland; of coke, to France and Belgium. Included in the coke for 1904 is an item of 24,631 tons to the United States.

Imports of fuel into Germany for the 11 months ending Nov. 30, were as follows, in metric tons:

	1903.	1904.	Changes.
Coal . . . . .	6,252,863	6,644,708	I. 391,845
Brown coal . . . . .	7,377,329	6,963,485	D. 413,844
Coke . . . . .	390,396	482,857	I. 92,461
Total . . . . .	14,020,588	14,091,050	I. 70,462

The coal was chiefly from Great Britain; the brown coal, or lignite, all came from Austria.

Exports of fuel from Great Britain for the full year are reported as follows, in long tons:

	1903.	1904.	Changes.
Coal . . . . .	44,950,057	46,255,547	I. 1,305,490
Coke . . . . .	717,477	756,949	I. 39,472
Briquettes . . . . .	955,166	1,237,784	I. 282,618
Total . . . . .	46,622,700	48,250,280	I. 1,627,580

In addition to these exports there were 16,799,848 tons of coal sent abroad for the use of ships engaged in foreign trade in 1903, and 17,190,900 tons in 1904; an increase of 391,052 tons.

The coal shipped to the United States, included above, was as follows:

	1903.	1904.	Changes.
Atlantic ports . . . . .	1,070,230	33,394	D. 1,036,836
Pacific ports . . . . .	72,373	75,700	I. 3,327
Total . . . . .	1,142,603	109,094	D. 1,033,509

This year's returns show that no part of the trade taken in the strike period has been retained.

**Iron Trade Review.**

**NEW YORK, Jan. 25.**

The lull in buying, which affected the market during the first two weeks of the year, seems to be gradually passing over. In pig iron, especially, there has been considerable activity, and orders are being placed rather freely for the second quarter. Spot iron is not to be had, except at an advance. It is a little singular that, at the same time, contract prices are lower than on some grades of iron than they have been, although the difference is small. The purchases by some steel companies from outside parties, which are referred to fully in the Pittsburg letter, are said to be practically removing from the market all the speculative iron, which has been held for some time, and which has been the source of a little anxiety to makers. Both steel companies' furnaces and independent makers are running actively, and pig iron production is at a high level. The rail business is still slow, and not many orders have been placed, although the big contracts for the year should be in evidence by this time.

The Lake iron ore prices seem to be fairly well established by heavy buying. The present quotations are: \$3.75 at Lake Erie ports for bessemer old range, and \$3.50 for bessemer Mesabi; while non-bessemer ore sells at \$3.25 for old range, and \$3 for Mesabi.

**British Iron Trade.**—Exports of iron and steel, and manufactures thereof, from Great Britain for the full year are valued by the Board of Trade returns as follows:

	1903.	1904.	Changes.
Iron and steel ...	£30,399,261	£28,082,692	D. £2,316,569
Machinery	20,058,706	1,087,502	I. 1,024,296
New ships.	4,283,829	4,459,761	I. 175,932
Total . . .	£54,741,296	£33,624,955	D. £21,116,341

The total tonnage of iron and steel exported was 3,564,601 in 1903, and 3,266,648 in 1904; a decrease of 297,953 tons. Included in the machinery there was mining machinery valued at £781,773 in 1903, and £872,711 in 1904; an increase of £90,938, chiefly due to larger shipments to Australia.

The principal items of exports of iron and steel were as follows, in long tons:

	1903.	1904.	Changes.
Pig iron . . . . .	1,065,380	813,590	D. 251,790
Wrought iron bars, etc. . . . .	203,619	170,592	D. 33,027
Plates . . . . .	161,722	152,692	D. 9,030
Rails . . . . .	604,076	525,487	D. 78,589
Steel shapes, etc. . . . .	156,821	173,457	D. 16,630
Tin-plates . . . . .	292,800	359,510	I. 66,716

The only items showing gains were steel shapes and tin-plates. The latter gain was almost all due to larger exports to the United States.

Imports of iron and steel for the year were valued at £8,662,481 in 1903, and £8,215,555 in 1904; a decrease of £446,926. The chief items of the imports were, in long tons:

	1903.	1904.	Changes.
Pig iron . . . . .	136,646	133,733	D. 2,913
Wrought bars, etc. . . . .	186,630	104,242	D. 82,388
Steel blooms, billets, etc. . . . .	274,056	522,706	I. 248,650
Steel bars and shapes. . . . .	192,524	93,029	D. 99,495
Structural steel. . . . .	145,328	122,954	D. 22,374

The most notable increase was in steel blooms, billets, etc., which includes all forms of semi-finished steel. This material was chiefly from Germany and Belgium.

Imports of iron ore were, 6,314,162 tons in 1903, and 6,100,556 tons in 1904; a decrease of 213,606 tons. Of these imports Spain furnished 4,945,086 tons in 1903, and 4,648,335 tons in 1904; a decrease of 296,751 tons.

**Birmingham. Jan. 23.**

The pig iron market in Alabama is strong and prices are firm. The production is improving. The Sloss-Sheffield Steel & Iron Co. this week will blow in No. 1 city furnace in Birmingham. It should have a daily output of 200 to 250 tons of iron.

The following pig iron quotations are given in this district: No. 1 foundry, \$14 @ \$14.50; No. 2 foundry, \$13.75 @ \$14; No. 3 foundry, \$13 @ \$13.50; No. 4 foundry, \$12.50 @ \$12.75; gray forge, \$12 @ \$12.25; No. 1 soft, \$14 @ \$14.25; No. 2 soft, \$13.75 @ \$14.

The Tutweiler Coal, Iron & Railway Co. has broken ground for the erection of a furnace at Vanderbilt, three miles from the city, adjacent to their present furnace. It is proposed to put up a furnace which will have a daily capacity of 200 to 250 tons of iron.

N. O. Nelson, president of the Bessemer Soil Pipe Co., at Bessemer, will distribute stock in the company among the employees in the establishment, the scheme being to give stock to the men according to the length of service, thereby making the concern a co-operative industry.

**Chicago. Jan. 23.**

For the iron trade the last week has been a quiet, but fairly satisfactory period. Orders have not been large, but continue to be numerous; there is a good demand for small lots to be delivered within the first quarter of the year at premiums of 25c. @ 50c. Most of the business, however, is for the second and third quarters, and sales are in some cases running into the fourth quarter. Sellers of iron continue firm in their policy of the last month—not to contract largely for late deliveries except on premiums. General confidence is expressed in the future firmness of the market in all lines of the iron trade, though it is generally admitted that January business has not been altogether up to expectations.

Southern iron, which is the most active, is quoted at \$13.50 @ \$13.75, Birmingham, or \$17.15 @ \$17.40, Chicago, as last week. Northern brings \$17.50 @ \$17.75. Northern furnaces are well sold out for the first four months of the year. Inquiries are active at the beginning of this week, but there are no signs that there will be decided changes.

Coke is active and high, the best Connellsville being quoted at \$6, with standard furnace coke 10c. @ 20c. lower.

**Cleveland. Jan. 24.**

**Iron Ore.**—The market has been strong with good buying of iron ore of all grades during the past week. This has been fully up to the measure of the buying at this time of the year for at least three years, and far ahead of last year. The prices rule about as follows: Bessemer old range \$3.75; bessemer Mesabi \$3.50; non-bessemer old range \$3.25; non-bessemer Mesabi, \$3, f. o. b. Lake Erie docks. There is no present likelihood of a reorganization of the ore Association, since it is not thought to be needed. No movement has been made toward starting the chartering of boats for the transportation of ore during the coming season.

**Pig Iron.**—The Northern foundry iron situation has eased off, under seasonable dullness in buying. No. 2 iron is now selling at \$16 in the valley, both on spot shipments, and on buying on contract. The furnaces are well sold up for the remainder of the first quarter, but are looking for second quarter business. Southern iron has been sold in this market at

\$13.50 @ \$13.75 Birmingham for No. 2. Only one house is known to have sold and the aggregate was 1,000 tons. Most of this iron is to be used on mixtures. The bessemer sales have been heavier. Small buyers have been compelled to take small lots at \$16.50 at furnace, shipments being made both by Cleveland and by valley furnaces. Some of this iron has been held in stock against such a price and such a need.

**Finished Material.**—The market has been strong and steady, with deliveries the principal question except in the matter

**New York. Jan. 25.**

**Pig Iron.**—Demand for foundry iron is less pressing, but is still good. Prices show no change, though the tone of the market is not quite so firm.

For Northern iron, large lots, New York delivery, we quote as follows: No. 1X foundry, \$17.75; No. 2X, \$17.50; No. 2 plain, \$16.75; gray forge, \$16.50. Some Virginia basic has been sold at \$17.65, the highest price yet reported.

Southern iron seems to be held firmly on the basis of \$14 Birmingham for No. 2 foundry. We quote for large lots on dock: No. 1 foundry, \$17.75; No. 2 foundry, \$17.25 @ \$17.50; No. 3 foundry, \$16.75; No. 4 foundry, \$16.25; No. 1 soft, \$17.75; No. 2 soft, \$17.25; gray forge, \$16.25.

Trade in iron warrants on the Produce Exchange has been light. The following are the latest quotations on the exchange, the first figure named being the bid, and the second the asked price: January, \$16.90—\$17.10; February, \$16.80—\$17; March, \$16.50—\$16.85; April, \$16.50—\$16.90; May, \$16.50—\$16.65; June, \$16.70—\$16.75.

**Structural Material.**—Some new business is reported. Beams and channels up to 15 in. are quoted at 1.645c. for large lots, and over 15 in., 1.745c. Angles are 1.645c. in large lots.

**Steel Rails.**—The regular quotation continues \$28 per ton at mill for standard sections. Light rails are in good demand, and prices range from \$23 for 35-lb. sections, up to \$28 for 12-lb. sections.

**Philadelphia. Jan. 25.**

The hope of our pig iron buyers, who have not been fortunate enough to cover their wants for the next month or two, lie in the fact that the pig iron production is rapidly increasing. For this reason, most of our smaller buyers are purchasing only for immediate use and hope that the increasing production will come to their rescue by the opening of spring. Nearly all of the business that has been done during the past week has been made up of small lots. The bar mills are, for most part, rather short of stock and would gladly contract for large supplies, but they feel that the time is not propitious and, therefore, they are picking up what they can get. The users of basic pig iron are viewing the situation with some anxiety. The foundries have a fair amount of stock, and have contracts out that will see them along for perhaps a month. A good deal of work is coming along to bar mills, foundries and our engineering plants and the manufacturers quite anxious to buy iron to see them through this work, but they and one-half miles south of Spindletop are taking no action at present. Quotations remain just about where they were a week ago, and may be given at about \$18 for No. 1X; \$17.50 for No. 2X; No. 2 plain is worth \$17; standard gray forge \$16, with \$16.50 asked for certain brands. Basic can be had at \$16.50.

**Pitrg. Jan. 24.**

Some interesting pig iron transactions have been made during the week. The most important sale was 40,000 tons of bessemer iron by W. P. Snyder & Co. to the Cambria Steel Co., to be delivered at the steel plant at Johnstown. The price was \$15.50, Valley furnace, and of the tonnage, 5,000 tons is for delivery this month and the rest during the next three months. The Lackawanna Steel Co. closed a deal by which it obtains 7,000 tons of bessemer iron. The iron was originally bought several months ago by the Inland Steel Co., and the Lackawanna got it through the Ohio Iron & Metal Co. in exchange for scrap. The Ohio Co. could not buy the iron, as the Bessemer Pig Iron Association will only sell to consumers. It then bought through the Inland Co. This transaction, it was declared to-day, removes all speculative iron from the market, and there will be no more sales of bessemer iron at less than \$16, Valley furnace. The foundry and forge iron market was broken during the week by some sales at low prices made in Cleveland. Prices of foundry No. 2 ruled above bessemer, and sales of gray forge had been made at bessemer prices. This week these grades of pig iron were quoted at from 50 to 75c. a ton below last week's prices. One interest bought 5,000 tons of gray forge at \$16.10, Pittsburg, and 2,000 tons at \$16.25, Pittsburg. A sale of 3,000 tons to another interest was made at \$16.25, Pittsburg, which is now regarded as the minimum price. Several thousand tons of foundry No. 2 were sold at \$16.85, Pittsburg, and it is said that some sales were at a lower figure. The Lackawanna Steel Co. is in the market for more bessemer iron, but none is available for prompt shipment, and it is reported that a large contract will be closed for future delivery, if satisfactory terms can be arranged. While the United States Steel Corporation is operating nearly all of its blast furnaces, it is negotiating for additional outside iron, and is expected to place an order for at least 25,000 tons of bessemer iron for February shipment. It is now certain that the pig iron production will be at the rate of 21,000,000 tons annually within the next two weeks. Producers are paying the advanced prices asked for ore and are buying freely. The estimate made several weeks ago that fully 30,000,000 tons of ore will be brought down this season is not regarded as extravagant.

All the steel mills in the Pittsburg district are busy, production in every finished line being greater than at any time in the history of the industry. Most of the mills are sold up for from two to four months ahead. Prices in all lines, except wire, are not likely to be disturbed for some time, although premiums may be asked on new business. An advance in wire and wire products is expected to be announced at any time. Steel billets continue scarce and cannot be had at the pool price of \$21. Open-hearth billets are scarcer than bessemer. One consumer, who is unable to get deliveries on an existing contract, contemplates importing open-hearth steel from Germany and charging the difference in cost to the delinquent steel interest. Premiums for billets and sheet bars are from \$2 to \$3 a ton above pool prices. The production of tin-plate is remarkable, being at the rate of 15,000,000 boxes annually, which is more than the country ever consumed in one year. All of the mills of the American Sheet & Tin Plate Co., and nearly all of those of the independent concerns, about 325 in number, are in full operation. The cause of the unusual production of tin-plate apparently developed

to-day, through charges made by employees of the Whitaker-Glessner Co., of Wheeling, who are members of the Amalgamated Association of Iron, Steel & Tin Workers. The company has discharged its men and will close the plant on Saturday. The cause assigned is that it cannot compete with the leading interest, as the limit of production rule of the Amalgamated Association is not being observed at the plants in the Wheeling district. Members of the Amalgamated Association employed at the Whitaker works say the limit of output is 6,800 lb. a turn of eight hours, and at the mills of the American Co. the men make fully 9,000 lb. a turn. President T. J. Shaffer, of the Amalgamated Association, said violations of the limit of output rule had been reported to him some time ago, and, upon investigation, found them to be correct. Under a clause in the agreement, when any deviations are made from the scale, the same advantages are to be accorded to all manufacturers operating under the scale. If it is found that the limit regulation cannot be strictly enforced, it is understood it will be removed. A year ago the American Co. charged that the agreement was being violated, and, after several conferences, proved that independent concerns had several advantages. As a result a reduction of 18% in the wage scale was made.

**Pig Iron.**—Prices dropped during the week, but the market is very firm, and former prices and even higher prices are expected to prevail within the next few weeks. In addition to the purchase of 40,000 tons of bessemer by the Cambria Steel Co., and 7,000 tons by the Lackawanna Steel Co., other sales aggregating about 6,000 tons were made. The price on the small lots was \$16, the rate firmly maintained by the Bessemer Pig Iron Association, but the price paid by Cambria was \$15.50, Valley furnace. Sales of foundry and forge during the week aggregated about 15,000 tons. Foundry No. 2 is quoted at \$16.85@17.60, Pittsburg, and gray forge at \$16.10@16.35.

**Steel.**—Billets and sheet-bars continue scarce, and premiums of from \$2 to \$3 are offered. The pool price for billets remains at \$21, and for sheet bars \$23. The price of 1.40c. for merchant steel bars was re-affirmed by the pool at a meeting held here last week. Plates are firm at 1.50c.

**Sheets.**—The production is very heavy, and the leading interest is said to have booked business into the second quarter. Prices are unchanged, No. 28 gauge black sheets remaining at 2.30c., and galvanized at 3.35c.

**Ferro-Manganese.**—The market is improving, and 80 per cent domestic is quoted at \$44.50@45.50 per ton.

**Cartagena, Spain. Jan. 7.**

**Iron and Manganiferous Ores.**—Messrs. Barrington & Holt report that exports for the week one cargo, 4,850 tons magnetic ore to Rotterdam, and one cargo, 2,100 tons manganiferous ore to Great Britain. The market has been interrupted by the holidays, but is still strong. Freight rates continue favorable, the last charter being at 5s. 3d. to Middleboro.

Prices are a little higher. Ordinary 50% ore is 6s. 3d.@6s. 6d.; special low phosphorus, 6s. 9d.@7s. 6d.; specular ore, 58%, 9s. 2d. Manganiferous ores range from 9s. 9d. for 35% iron and 12% manganese, to 14s. 6d. for 20% iron and 20% manganese. All prices are f.o.b. shipping port.

**Chemicals and Minerals.**

**NEW YORK, Jan. 25.**

Prospects are good for continued improvement in demand and prices. It is authoritatively intimated that the domestic producers of sulphur will not shade prices, as they do not wish to interfere with the renewal of the Sicilian combination now under consideration. In nitrate of soda the situation is particularly strong, as 1906 contracts have been booked at \$1.75 per qtl, alongside steamer in Chile, and at \$1.66 for 1907—prices that are only fractionally lower than current deliveries.

It is learned that the Pacific Coast Borax Co. has abandoned the scheme to operate automobile trains over the 108 miles of macadamized road to its works at Daggett, Cal., because the contractors did not fulfil their agreement in time. Surveys have been made for a standard gauge railroad.

To enlarge its portland cement plant from 6,800,000 bbl., to 12,775,000 bbl. per annum, the Atlas Portland Cement Co., will on February 16, propose an issue of \$5,000,000 first mortgage 6% bonds, of which \$2,100,000 will be used to redeem outstanding debentures. The company pays annually 8% in dividends on \$1,500,000 preferred stock, and 4% on \$8,500,000 of common. It has six plants at Coplay and Northampton, Pa., and Hannibal, Missouri.

The lease of the by-product coke-oven business of the United Coke & Gas Co. to the Somet-Solvay Co., of Syracuse, has expired. Hereafter the United Co. will exploit its own constructing business, while the American Coal Products Co., of New York, will continue to act as selling agent for the tar and ammonia produced by both the United Otto and Somet-Solvay ovens. There are now in operation and in course of construction in the United States and Canada 2,603 Otto Hoffman and United Otto coke-ovens, which yield large quantities of sulphate of ammonia.

**Copper Sulphate.**—Second hands are at cross play, hoping to initiate buying. Makers are firm, quoting \$5.125@\$5.25 per 100 pounds.

**Acids.**—Some improvement is noticeable, and prices are generally firm.

Nitric acid, 36°, 100 lb. ....	\$5.00
38°, 100 lb. ....	5.25
40°, 100 lb. ....	5.50
42°, 100 lb. ....	5.75
Oxalic acid, com'l, 100 lb. ....	5.00@5.25
Sulphuric acid, 60°, bulk, ton. ....	13.50@14.50
60°, 100 lb. in carboys ....	1.05
60°, bulk ton. ....	18.00@20.00
66°, 100 lb. in carboys ....	1.20
66°, bulk ton. ....	21.00@23.00

**Sulphur and Pyrite.**—While brimstone is quiet, pyrite shows further large contracting for future delivery at quotations. Expectation is that the Sicilian combination will be renewed, and though the domestic producers are enlarging their plant, competition will not be keen in the interval, because all sellers wish to obtain remunerative prices. What the future will bring cannot be foretold, though there is a feeling that the Sicilian syndicate and the domestic producers may agree to a division of territory. Momentarily Sicilian best unmixed seconds for shipment are quoted nominal at \$21@21.25 per ton. Domestic prime, guaranteed 99.5% is worth \$21.75 per ton at New York, and seconds, 98%, \$21.45 per ton. Shipments to Baltimore and Philadelphia are quoted at an advance of 25c. over New York prices, and to Portland, Maine, 15c. per ton. Imported pyrite, analyzing 46@52% sulphur, is quoted at 10@11.5c. per unit for unwashed lump ore, and 9@10c. per unit for fines, f. o. b. New

York. Domestic lump ore, 42@44% sulphur, is quoted at 10@10.5c. per unit, and fines at 8.5@10c. per unit, f. o. b. shipping port.

**Nitrate of Soda.**—Although the market continues quiet, prices are maintained, and as the European consuming season approaches, the situation strengthens. Prices are 4c. per 100 lb. higher in all positions, \$2.35 being asked for 96% for February, March, April and May arrivals, and \$2.30 for June forward. Ordinary quality may be had at 2.5c. per 100 lb. less. It is calculated that this year's consumption in America will show a further increase, judging from the orders already in hand. The position of nitrate of soda in Europe for the full years 1904 and 1903 are, in long tons:

	1903.	1904.
Exports to Europe.....	1,148,733	1,218,647
Imports.....	1,028,300	1,133,630
Deliveries.....	1,139,650	1,112,580

Notable changes in 1904 were an increase of 69,914 tons, or 6%, in the exports to Europe, and a decrease of 27,070 tons, or 2%, in deliveries, partly explained by the continued high prices of nitrate of soda. Consumption during the coming spring is expected to be improved by the proposed increased planting by sugar-beet growers, as a result of last year's reduction in output.

Concerning the Chilean situation, Messrs. Jackson Bros., of Valparaiso, write under date of December 10, that the market has been very dull during the fortnight, producers still being firm at former quotations. Transactions have been limited to a monthly sale of 500 tons, for the year 1906, at 7s. 3½d. alongside, and another of the same quantity for 1907, at 6s. 11d. alongside. We quote 95 per cent December-January, 8s. 1½d., March, 8s.; April-June 7s. 10½d.; July-December, 7s. 9d.; for 96 per cent December-March, 8s. 4½d., all alongside. The price of 8s. 1½d. alongside, with an all-round freight of 20s. stands in 10s. per cwt., net cost and freight without purchasing commission.

**Sulphate of Ammonia.**—Uninterestingly quiet at \$3.15@3.20 per 100 lb. for good sack liquor.

**Phosphates.**—There is little animation in this market, and as exporters are supported by firm ocean freight rates and comparatively small stocks at mines, their views as regards prices are particularly bullish. Extensive preparations are being made to enlarge the facilities for handling Florida hard-rock for export at Port Inglis, and when the necessary improvements have been made on the Withlacoochee River, shipments will be greatly increased. In 1904 Port Inglis handled approximately 123,000 tons, while Savannah, which usually ships about one-third of the total exports of Florida hard-rock, reported for the year 152,456 tons. The difference of less than 30,000 tons in the tonnage of these two export points is suggestive, and affords a reason for believing that Port Inglis, though not quite 2½ years old, will eventually become of first importance. Already Port Inglis has shipped about 232,000 tons hard-rock, nearly all from the Dunnellon Company's mines, principally on account of German superphosphate manufacturers.

Ocean freights are firmer, about as follows:

Ports.	So. Car.	Bone Al-geria.	Sfax, Tunis.
Baltic.....	\$3.24@3.48		
Continental...	3.00@3.12		\$1.80@2.04
Mediterran'n.	3.24@3.36	\$2.88	2.04
U't'd K'gdom.	3.00@3.24	2.76@2.88	1.38@1.50

Charters are few, as exporters are wait-

ing to see how long European consumers will withhold orders.

Phosphates are quoted as follows, per ton:

Phosphates.	F. o. b.	C. i. f. Gt. Britain or Europe.
* Fla., hard rock.....	\$7.25@7.50	\$11.45@11.65
land pebble.....	3.75@4.00	7.70@ 8.40
† Tenn., 78@80%.....	4.00@4.25	10.27@10.67
75%.....	3.75@4.00	
75%.....	3.25@3.50	
‡ So. Car. land rock.....	3.25@3.50	
river rock.....	3.00@3.25	6.38@ 6.67
Algerian, 63@70%.....		7.04@ 7.71
58@63%.....		6.15@ 6.60
Tunis (Gafsa).....		6.00@ 6.60
Christmas Isle.....		13.28@14.11
Ocean Isle.....		13.60@14.45
Somme, Fr.....		11.39

\* F. o. b. Florida or Georgia ports. † F. o. b. Mt. Pleasant. ‡ On vessel Ashley River, S. C.

**Liverpool. Jan. 11.**

Messrs. Joseph P. Brunner & Co. write that there is no change to report in the position of heavy chemicals. Exports in December and the year 1904, as taken from the Board of Trade returns, were, in hundredweight:

	December.	Year
Bleach to United States.....	34,322	548,320
Other countries.....	21,497	229,785
Total.....	55,819	778,105
Soda ash.....	127,893	1,352,252
bicarb.....	35,836	345,824
caustic.....	129,597	1,366,766
crystals.....	15,392	210,987
sulphate.....	42,078	889,140
other sorts.....	32,365	348,588
Total.....	383,161	4,513,557

Compared with 1903, the exports of bleaching materials show a heavy falling off, especially to America; but sodas record an improvement, except in saltcake.

Soda ash for tierces, is quoted as follows: Leblanc ash 48%, £5@£5 10s.; 58%, £5 10s.@£6, per ton; ammonia ash, 48%, £4 5s.@£4 10s.; 58%, £4 10s.@£4 15s. per ton, net cash; bags, 5s. per ton under price for tierces. Soda crystals are in fair jobbing demand at generally £3 7s. 6d. per ton less 5% for barrels, or 7s. less for bags, with special terms for a few favored markets.

Caustic soda is quoted firm as follows: 60%, £8 15s.; 70%, £9 15s.; 74%, £10 5s.; 76%, £10 10s. per ton, net cash. Special quotations for the Continent and a few other export quarters.

Bicarbonate of soda is selling at £6 15s. per ton, less 2½%, for the finest quality in 1 cwt. kegs, with usual allowances for larger packages, also special terms for a few favored markets.

Sulphate of ammonia is dull on spot, at £12 17s. 6d.@£13 per ton, less 2½% for good gray 24@25% in double bags f.o.b. here.

Nitrate of soda is quiet on spot, but prices are firm at £11 5s. per ton for ordinary, up to £11 10s. for refined, in double bags f.o.b. here, less 2½%.

**Metal Market.**

New York, Jan. 25.

**Gold and Silver Exports and Imports. At all United States Ports in December and year.**

Metal.	December.		Year.	
	1903.	1904.	1903.	1904.
Gold				
Exp	\$1,454,656	\$13,429,415	\$44,346,834	\$121,138,415
Imp	17,290,298	3,336,184	65,267,696	84,803,234
Exc	\$15,765,642	\$10,093,231	\$120,920,862	\$36,335,181
Silver				
Exp	6,515,653	4,292,161	40,610,342	50,312,745
Imp	2,078,655	2,252,955	23,974,506	26,087,042
Exc	\$4,436,998	\$2,039,206	\$16,635,834	\$24,225,703

These exports and imports cover the totals at all United States ports. The figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

**Gold and Silver Exports and Imports, N.Y.**

For the week ending January 21 and for years from January 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week....	\$2,941,932	\$52,959	\$829,080	\$25,001
1905.....	8,016,432	111,885	2,294,318	61,746
1904.....	209,784	1,113,383	222,787	53,700
1903.....	20,905	583,629	1,012,436	105,362

Gold exports for the week were principally to France and Argentina; imports, chiefly from Central America. Silver shipments were largely to London; imports, mostly from Panama.

The statement of the New York banks—including the 53 banks represented in the Clearing House—for the week ending January 21, gives the following totals, comparisons being made with the corresponding week of 1904:

	1904.	1905.
Loans and discounts.....	\$965,064,900	\$1,098,811,500
Deposits.....	986,303,300	1,163,815,200
Circulation.....	43,141,200	42,950,700
Specie.....	195,207,900	224,029,800
Legal tenders.....	77,440,600	90,657,800
Total reserve....	\$272,648,500	\$314,687,600
Legal requirements.	246,585,825	290,953,800
Balance surplus..	\$26,062,675	\$23,733,800

Changes for the week, this year, were increases of \$34,474,700 in loans and discounts, \$44,655,100 in deposits, \$8,438,400 in specie, and \$1,999,900 in legal tenders; decreases of \$69,400 in circulation, and \$725,475 in surplus reserve.

The following table shows the specie holdings of the leading banks of the world at the latest dates covered by their reports. The amounts are reduced to dollars:

	Gold.	Silver.
N. Y. Ass'd.....	\$224,029,800	
England.....	165,973,015	
France.....	534,221,185	\$219,659,155
Germany.....	190,505,000	63,500,000
Spain.....	74,570,000	99,770,000
Netherlands.....	29,157,500	31,234,500
Belgium.....	15,923,335	7,961,665
Italy.....	111,845,000	16,139,000
Russia.....	511,565,000	31,590,000
Austria.....	241,205,000	61,955,000

The returns of the Associated Banks of New York are of date January 21, and the others January 19, as reported by the *Commercial and Financial Chronicle* cable. The New York banks do not report silver separately, but specie carried is chiefly gold. The Bank of England reports gold only.

The silver market has hardened this week upon better demand from India, and closes firm at 28 3-16d. in London.

The United States Assay Office in New York reports receipts at 78,000 oz. of silver during the week.

Shipments of silver from London to the East for the year up to January 12, are reported by Messrs. Pixley & Abell's circular as follows:

	1904.	1905.	Changes.
India.....	£564,789	£192,600	D. £372,189
China.....			
Straits.....	38,103	2,800	D. 35,303
Totals.....	£602,892	£195,400	D. £407,492

Receipts for the week, this year, were £170,000 in bar silver from New York, £8,000 from the West Indies, and £5,000 from Australia; total, £183,000. Shipments were £192,600 in bar silver to Bombay, and £2,800 to Shanghai; total, £195,400.

Indian exchange has been firm, though there appears to be no special pressure for money in India. The Council bills offered in London were all taken at an average of 16.06d. per rupee. Demand for silver on Indian account is only moderate.

The movement of gold and silver in France for the 11 months ending Nov. 30, is reported as follows:

	1903.	1904.
Gold: Imports	Fr. 300,048,000	Fr. 609,804,000
Exports	113,561,000	117,909,000
Excess, imports.	186,487,000	491,885,000
Silver: Imports	117,338,000	88,849,000
Exports	81,424,000	101,110,000
Excess	I. 35,914,000	E. 12,261,000

Imports of nickel and copper coins were 97,000 fr. in 1903 and 158,000 fr. in 1904. Exports decreased from 697,000 fr. in 1903 to 420,000 fr. last year.

The movement of gold and silver in Great Britain for the full year is reported as follows:

	1903.	1904.
Gold: Imports	£28,657,393	£33,876,588
Exports	27,766,512	33,039,138
Excess, imports	£890,881	£837,450
Silver: Imports	10,310,330	11,687,339
Exports	11,466,726	13,263,694
Excess, exports	£1,156,396	£1,576,355

The balance of gold imports was unusually low in both years. Of the silver imported last year, £8,413,273, or 72% of the whole, was from the United States.

Prices of Foreign Coins.

	Bid.	Asked.
Mexican dollars	\$0.47½	\$0.49½
Peruvian soles and Chilean pesos	.43½	.46
Victoria sovereigns	4.85½	4.87
Twenty francs	3.87	3.90
Spanish 25 pesetas	4.78	4.82

Other Metals.

Daily Prices of Metals in New York.

January.	Copper.		Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.			New York, Cts. per lb.	St. Louis, Cts. per lb.
19	15½ @ 15½	15 @ 15½	68½	29½	4.60	6.20
20	15½ @ 15½	15 @ 15½	68½	29½	4.60	6.20
21	15½ @ 15½	15 @ 15½	68½	29½	4.60	6.20
23	15½ @ 15½	15 @ 15½	68	29½	4.45	6.20
24	15½ @ 15½	15 @ 15½	67½	29½	4.45	6.20
25	15½ @ 15½	15 @ 15½	67½	29½	4.45	6.20

London quotations are per long ton (2,240 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 wire-bars. Cathodes are usually 0.25c. below the quotations for electrolytic.

SILVER AND STERLING EXCHANGE.

January.	Sterling Exchange.	Silver.		January.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
19	4.87½	60½	27½	23	4.87½	60½	28
20	4.87½	60½	27½	24	4.87½	60½	28
21	4.87½	60½	27½	25	4.87½	61½	28½

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, .925 fine.

**Copper.**—The market has been very quiet throughout the week, and we hear of but little business having been done. On the other hand, there is no pressure to sell on the part of producers, as they are all well sold up. Quotations are entirely unchanged at 15½@15¾ for Lake Copper; 15@15½ for electrolytic copper in ingots, cakes and wirebars, 14¾@14⅞ in cathodes; 14½@14¾ for casting copper.

The market for standard copper in London, which closed last week at £68 5s., suffered under the influence of the Russian news, and declined the beginning of the week to £67 12s. 6d. However, it showed considerable resistance, and the closing quotations on Wednesday are cabled as £67 15s. @ £68 for spot, £67 15s. @ £68 for three months.

Refined and manufactured sorts we quote: English tough, £70 10s. @ £71; best selected, £72 @ £72 10s.; strong sheets, £78 10s. @ £79 10s.; India sheets, £75 10s. @ £76 10s.; yellow metal, 6½ @ 6¾ d.

Exports of copper from New York and Baltimore for the week ending January 24 were, 5,162 long tons, making a total of 13,773 tons since January 1. Imports for the week were 175 tons.

Imports of copper and copper material into Great Britain, and exports of copper, were as follows for the full year; the totals giving the contents of all material in fine copper; the figures are in long tons:

	1903.	1904.	Changes.
Copper ore	83,995	79,499	D. 4,496
Matte and precipitate	76,657	66,672	D. 9,985
Fine copper	63,574	89,288	I. 25,714

Total, fine copper	110,303	130,574	I. 20,271
Exports	54,255	49,175	D. 5,080

Net imports	56,048	81,399	I. 25,351
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Of the imports, the United States furnished 557 tons of ore, 4,900 tons of matte and 20,727 tons fine copper in 1903; 188 tons ore, 5,057 tons matte and 48,395 tons fine copper in 1904. This shows a decrease of 369 tons of ore last year; an increase of 157 tons of matte, and an increase of 27,668 tons of fine copper.

**Tin,** in spite of the arrivals of fair quantities, continues to be scarce on the spot and brings a considerable premium over future delivery. At the close, we quote the market at 29½ for spot, 28.75 for February delivery.

The foreign market, which closed last week at £131, opened on Monday at £130, and closes a trifle higher, the closing quotations on Wednesday being cabled as £130 15s. for spot, £130 5s. for three months.

Imports of tin into Great Britain, with re-exports of foreign tin, were as follows for the full year, in long tons:

	1903.	1904.	Changes.
Straits	28,071	32,575	I. 4,504
Australia	4,476	4,156	D. 320
Other countries	2,962	2,572	D. 390

Total imports	35,509	39,303	I. 3,794
Re-exports	23,839	27,225	I. 3,386

Net imports	11,670	12,078	I. 408
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The re-exports were largely to the United States. The tin credited to other countries is chiefly from Bolivia.

**Lead.**—The market was treated to a surprise by the American Smelting & Refining Co., which reduced its price \$3 a ton, which established a price level of 4½ St. New York.

The foreign market has eased off somewhat further and closes at £12 13s. 9d. for

Spanish lead, £12 16s. 3d. for English lead. Imports and exports of lead in Great Britain for the full year are reported as follows, in long tons:

	1903.	1904.	Changes.
United States	39,612	36,748	D. 2,864
Spain	108,580	110,851	I. 2,271
Australia	59,018	73,967	I. 14,949
Germany	13,615	17,219	I. 3,604
Other countries	8,446	7,723	D. 723

Total imports	229,271	246,508	I. 17,237
Exports	35,583	35,039	D. 544

Balance	193,688	211,469	I. 17,781
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The lead credited to the United States is chiefly Mexican lead, refined here in bond.

**St. Louis Lead Market.**—The John Wahl Commission Co. telegraphs us as follows: Lead is demoralized, and \$3 per ton lower. Ordinary Missouri and desilverized are selling at 4.37½c. East St. Louis.

**Spanish Lead Market.**—Messrs. Barrington & Holt report from Cartagena, Spain, under date of Jan. 7, that silver has been quoted at 15.25 reales per oz. Lead is quoted at 71.75 reales per quintal, which, on current exchange of 33.79 pesetas to £1, is equal to £11 17s. 8d. per long ton, f. o. b. Cartagena. Exports for the week were 800 tons desilverized lead to Great Britain, 162 tons desilverized to Odessa, 224 tons desilverized and 2,973 kg. bar silver to Marseilles.

**Spelter.**—In spite of the still higher quotations for ore, the market for the manufactured article is entirely unchanged from last week, and we quote 6.20 New York, 6.05 St. Louis.

The foreign market has been dull and is quoted at £24 17s. 6d. for good ordinaries, £25 for specials.

Imports and exports of spelter in Great Britain for the full year were as follows, in long tons:

	1903.	1904.	Changes.
Spelter	85,173	88,169	I. 2,996
Zinc sheets, etc.	22,753	22,429	D. 324

Total imp.	107,926	110,598	I. 2,672
Exports	7,321	7,971	I. 650

Balance	100,605	102,627	I. 2,022
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**Spanish Zinc Ore Market.**—Messrs. Barrington & Holt report from Cartagena, Spain, under date of Jan. 7, that zinc ore continues steady, at 75 fr. per ton for blende, 35% zinc, and 54 fr. for calamine, 30% zinc. Shipments for the week were 4,906 tons of blende to Antwerp.

**Antimony** is unchanged. We quote Cookson's at 8¼ @ 8½; Hallett's, 8 @ 8¼; Hungarian, U. S., French, Japanese, Italian and Chinese, 8 @ 8½c. per pound.

**Nickel.**—Producers quote 40 @ 47c. per lb. for large quantities down to ton lots, according to size and terms of order. The price for smaller lots is higher, according to quantity, running up to 60c. for small orders.

**Platinum.**—Quotations are firm at \$19.50 per ounce.

Platinum in manufactured forms is strong. Messrs. Eimer & Amend, of New York, quote for different forms, as follows: Heavy sheet and rod, 72c. per gram; foil and wire, 74c.; crucibles and dishes, 78c.; perforated ware, 85c., and cones, \$1 per gram.

**Quicksilver.**—Quicksilver continues quiet but steady at \$40 per flask in large lots, while \$41.50 is the price for smaller orders. San Francisco prices are lower, \$39 @ \$40 per flask being quoted for domestic orders, with some discount for export. The London price continues steady at £7 15s. per flask, with the same figure quoted from second hands.

Imports of quicksilver into Great Britain for the full year were 2,616,498 lb. in 1903, and 2,491,442 lb. in 1904; a decrease of 125,056 lb. Re-exports of foreign metal were 1,413,498 lb. in 1903, and 2,045,863 lb. in 1904; an increase of 632,365 lb. The quantity consumed, or added to stocks, was 1,203,000 lb. in 1903, and 445,579 lb. in 1904; a decrease of 757,421 lb. last year.

**Cadmium.**—Metallic cadmium, guaranteed 99.5%, is selling in quantities of 100 kg. or over at 710 marks per 100 kg., packing included, f. o. b. Hamburg. This is equivalent to 76.6c. per lb. Prices are for net cash.

**Minor Metals and Alloys.**—Thalium is quoted at 60@65 marks per kg. at Breslau, Germany. Manganese metal is quoted at 360 marks per 100 kg., f. o. b. Bremen, Germany. Manganese tin alloy, 55%, is quoted 365 marks per 100 kg. for first quality and 225 marks for second quality, both f. o. b. Bremen.

For other minor metals and their alloys wholesale prices are f. o. b. works:

Aluminum.	Per lb.
No. 1. 99% ingots.	33@37c.
No. 2. 99% ingots.	31@34c.
Roller Sheets	4c. u. p.
Aluminum-Bronze	20@23c.
Nickel-alum.	33@39c.
Bismuth	\$2.10
Chromium, pure (N. Y.)	80c.
Copper, red oxide	50c.
Ferro-Molybdenum (50%)	\$1.00
Ferro-Titanium (20@25% N. Y.)	75c.
Ferro-Chrom. (74%)	.12½c.
Ferro-Tungsten (37%)	.45c.
Magnesium, pure (N. Y.)	\$1.60
Manganese, (98@99% N. Y.)	.75c.
Manganese Cu. (30@70% N. Y.)	40c.
Molybdenum, (98@99% N. Y.)	\$2.75
Phosphorus, foreign	.45c.
Phosphorus, American	70c.
Tungsten (best)	\$1.25

**Missouri Ore Market. Jan. 21.**

The highest price reported paid for zinc ore was \$60 per ton for three bins of the choicest output. Several sales were made at \$59, and \$58 was paid for a number of bins. The present price of zinc ore would be too high with spelter at 7c., yet a limited output and a spirited competition among the representatives of the smelting companies has brought about the present condition, and it now seems probable that there will be no receding in ore prices until some kind of crisis occurs either in the metal market, or in the smelting of zinc ore. Even were spelter now 7c., there would be no profit in the business of smelting zinc ore at \$60 per ton. The assay basis price ranges between \$52 and \$54 per ton of 60% zinc in the concentrates. Lead sold at \$60 to \$64 per ton. Prices are \$24 per ton higher for zinc and \$5.85 per ton higher for lead than a year ago, when zinc ore sold at \$36 and lead ore at \$31@33 per ton of 60% concentrates.

Following are the shipments from the various camps of the Missouri-Kansas district for the week:

	Zinc, lb.	Lead, lb.	Value.
Joplin	2,872,540	297,140	\$91,080
Crittville-Webb City	1,841,210	505,590	65,820
Badger	634,010	18,390	18,390
Galena-Empire	509,420	55,180	14,890
Neck	510,180	14,800	14,800
Duenweg	488,480	77,540	15,590
Oronogo	360,150	2,230	10,090
Aurora	330,410	8,590	8,590
Carthage	242,670	6,920	6,920
Prosperity	108,510	114,370	6,640
Granby	312,300	60,000	6,310
Alba	178,980	5,010	5,010
Baxter	129,890	67,860	4,750
Zincite	67,600	1,830	1,830
Sherwood	61,510	1,630	1,630
Reeds	42,200	1,060	1,060
Beef Branch	25,790	14,130	920
Spurgeon	11,660	12,670	640
<b>Totals</b>	<b>8,729,570</b>	<b>1,206,710</b>	<b>\$274,960</b>
Three weeks	22,116,930	2,776,480	622,120
Zinc value, the week	\$235,610		\$562,230
Lead value, the week	\$39,450		\$89,890

**Monthly Average Prices of Metals.**

Month.	SILVER.			
	New York.		London.	
	1903.	1904.	1903.	1904.
January	47.57	57.055	21.98	26.423
February	47.89	57.592	22.11	26.665
March	48.72	56.741	22.49	26.164
April	50.56	54.202	23.38	24.974
May	54.11	55.430	24.89	25.578
June	52.86	55.673	24.29	25.644
July	53.92	58.095	24.86	26.760
August	55.36	57.806	25.63	26.591
September	58.00	57.120	26.75	26.349
October	60.36	57.923	27.89	26.760
November	58.11	58.453	27.01	26.952
December	55.375	60.563	25.73	27.930
<b>Year</b>	<b>53.575</b>	<b>57.221</b>	<b>24.75</b>	<b>26.483</b>

The New York prices are per fine ounce; the London quotation is per standard ounce, .925 fine.

**COPPER IN NEW YORK.**

Month.	Electrolytic.		Lake.	
	1903.	1904.	1903.	1904.
	January	12.159	12.410	12.361
February	12.778	12.063	12.901	12.245
March	14.416	12.299	14.572	12.551
April	14.454	12.923	14.642	13.120
May	14.435	12.758	14.618	13.000
June	13.942	12.269	14.212	12.399
July	13.094	12.380	13.341	12.505
August	12.962	12.343	13.159	12.468
September	13.205	12.495	13.345	12.620
October	12.801	12.993	12.954	13.118
November	12.617	14.284	12.813	14.466
December	11.952	14.661	12.084	14.849
<b>Year</b>	<b>13.243</b>	<b>12.823</b>	<b>13.417</b>	<b>12.990</b>

Prices are in cents per pound. Electrolytic quotations are for cakes, ingots or wire bars; cathodes are usually 0.25c lower.

**COPPER IN LONDON.**

Month.	1903.	1904.	Month.	1903.	1904.
Jan.	53.52	57.600	July	56.64	57.256
Feb.	57.34	56.600	August	58.44	56.952
March	63.85	57.321	Sept.	56.82	57.645
April	61.72	58.247	Oct.	55.60	60.012
May	61.73	57.321	Nov.	56.30	65.085
June	57.30	56.398	Dec.	56.36	66.384
			<b>Av. year</b>	<b>57.97</b>	<b>58.857</b>

Prices are in pounds sterling, per long ton of 2,240 lb., standard copper.

**TIN IN NEW YORK.**

Month.	1903.	1904.	Month.	1903.	1904.
Jan.	28.33	28.845	July	27.68	26.573
Feb.	29.43	28.087	August	28.29	27.012
March	30.16	28.317	Sept.	26.77	27.780
April	29.51	28.132	Oct.	26.92	28.596
May	29.51	27.718	Nov.	25.42	29.158
June	28.34	26.325	Dec.	27.41	29.288
			<b>Av. year</b>	<b>28.09</b>	<b>27.986</b>

**LEAD IN NEW YORK.**

Month.	1903.	1904.	Month.	1903.	1904.
Jan.	4.075	4.347	July	4.075	4.192
Feb.	4.075	4.375	August	4.075	4.111
March	4.442	4.475	Sept.	4.243	4.200
April	4.567	4.475	Oct.	4.375	4.200
May	4.325	4.423	Nov.	4.218	4.200
June	4.210	4.196	Dec.	4.162	4.600
			<b>Av. year</b>	<b>4.237</b>	<b>4.309</b>

**SPELTER.**

Month.	New York.		St. Louis.	
	1903.	1904.	1903.	1904.
	January	4.865	4.863	4.689
February	5.043	4.916	4.681	4.717
March	5.249	5.057	5.174	4.841
April	5.550	5.219	5.375	5.038
May	5.639	5.031	5.469	4.853
June	5.697	4.760	5.537	4.596
July	5.662	4.873	5.507	4.723
August	5.725	4.866	5.550	4.716
September	5.686	5.046	5.514	4.896
October	5.510	5.181	5.350	5.033
November	5.038	5.613	4.886	5.363
December	4.731	5.872	4.556	5.720
<b>Year</b>	<b>5.375</b>	<b>5.100</b>	<b>4.931</b>	<b>5.191</b>

**Dividends.**

Company.	Payable.	Rate.	Amount.
Alaska-Mexican, extra.	Jan. 28	\$0.30	\$54,000
†Alaska-Treadwell	Jan. 28	.37½	75,000
†Alaska & Treadwell	Jan. 28	1.00	200,000
†Amalgamated Copper	Feb. 27	.50	765,439
Amalgamated, extra	Feb. 27	.50	765,439
Atlantic Copper	Feb. 15	.50	50,000
*Bartolome de Med.	Jan. 30	.70	1,400
Boston & Montana	Jan. 19	10.001	500,000
Cambria Steel	Feb. 15	.75	675,000
†Camp Bird, Col.	Feb. 4	.18	147,600
*Central Lead, Mo.	Jan. 28	.50	5,000
Consolidation Coal	Feb. 1	4.00	410,000
*Elkton Con., Col.	Jan. 24	.00½	12,500
Esperanza, Mex.	Feb. 11	.12	54,600
Fairmont Coal	Feb. 1	3.00	360,000
*Homestake, S. D.	Jan. 25	.25	54,600
†Jamison, Cal.	Jan. 18	.03	11,700
Jeff. & Clearf., c. pf.	Feb. 15	2.50	37,500
*Lightner, Cal.	Jan. 20	.05	6,250
*Mines Co. of Am.	Jan. 20	.01½	30,000
Mong. River Coal, pf.	Jan. 25	.77	77,000
Monte Cristo Oil, Cal.	Jan. 10	.01	5,000
†National Carbon, pf.	Feb. 15	1.75	78,750
†Nova Scotia St., pf.	Jan. 16	2.00	20,600
N. Y. & Hond., Rosario.	Jan. 21	.10	15,000
*Oil City Petroleum, Cal.	Feb. 1	.00½	2,500
Osceola, Mich.	Jan. 27	2.00	192,300
*Pacific Coast Borax	Jan. 29	1.00	19,000
†Phila. Gas, com.	Feb. 1	.75	398,888
†Pittsburg Coal, pf.	Jan. 25	1.75	519,771
†Portland, Col.	Jan. 25	.06	180,000
Providencia, Mex.	Jan. 4	.95	4,500
*San Rafael, aviador	Jan. 20	19.00	22,800
*San Rafael, aviada	Jan. 20	9.50	11,400
*Soledad, Mex.	Jan. 20	9.50	9,120
*Sorpresa, Mex.	Jan. 20	2.38	2,280
†Spearfish, S. D.	Jan. 15	.01½	22,500
†Tenn. C. & I., pf.	Feb. 1	2.00	4,960
Tenn. Copper	Jan. 25	1.25	218,750
Tilt Cove Copper, N. F.	Jan. 17	.24	21,360
*Twenty-eight Oil, Cal.	Feb. 1	.15	9,000
†Union Nat. Gas.	Jan. 15	2.00	45,000
†United Petroleum, Cal.	Jan. 16	1.15	16,882
†United Zinc, pf.	Jan. 15	7.75	14,247
Utah Con., Utah	Jan. 16	1.50	450,000
†Va.-Car. Chem., pf.	Jan. 16	2.00	360,000
†Victor Con., Col.	Jan. 25	.03	.....

\*Monthly. †Quarterly.

**Assessments.**

Company.	Delinq.	Sale.	Amt.
Andes, Nev.	Jan. 26	Feb. 17	\$0.10
Beck's Salt, Utah	Jan. 16	Feb. 2	.20
Big Casino, Cal.	Feb. 18	.....	.03
Bunker Hill, Cal.	Mar. 1	.....	.05
Caledonia, Nev.	Feb. 15	Mar. 8	.10
Canton Placer, Cal.	Jan. 30	.....	.01
Columbus Con., Utah	Feb. 11	Mar. 6	.20
Con. Cal. & Va., Nev.	Feb. 7	Feb. 28	.25
Confidence, Nev.	Jan. 17	Feb. 7	.20
Elsie, Utah	Jan. 2	Feb. 12	.04
Eureka Con. Drift, Cal.	Jan. 21	Feb. 13	.00½
Jenny Lind, Cal.	Feb. 13	.....	.01
Lower Mammoth, Utah	Jan. 21	Feb. 10	.05
Mayday, Cal.	Jan. 24	Mar. 7	.03
Mexican, Nev.	Jan. 10	Jan. 31	.05
Mohican, Cal.	Feb. 3	.....	.05
Petro, Utah	Jan. 18	Mar. 11	.03
Raft River, Utah	Jan. 11	Feb. 15	.00½
Rhodes, Cal.	Feb. 1	.....	.12
Seg. Belch. & Mides	Feb. 7	Feb. 27	.05
South Eureka, Cal.	Feb. 6	.....	.02
Union, Con., Nev.	Feb. 24	.....	.15
Utah Con., Nev.	Jan. 12	Feb. 2	.10
West Century, Utah	Feb. 20	Mar. 10	.00½
Yellow Jacket, Nev.	Jan. 11	Feb. 16	.10½

**Salt Lake City. Jan. 20.**

Company.	Par	High.	Low.	Shares.
Ajax	\$1	.10½	.10½	31,000
Beck Tunnel	1	.08	.08	1,000
Butler-Liberal	1	.14	.13	3,000
Carisa	1	.94	.09½	3,000
Con. Mercur	5	.35½	.35½	100
Columbus, Con.	1	.90	.90	200
Daly	20	2.61	2.55	125
Daly-Judge				

STOCK QUOTATIONS.

Colorado Springs (By Telegraph).

Table with columns: Company, Jan. 23 (H, L), Jan 24 (H, L). Rows include Anaconda, C. K. & N., Cripple Ck. Con., etc.

Duluth, Minn.

Table with columns: Company, Par Val., Bid., Ask. Rows include Black Mountain, Calumet & Arizona, etc.

t. Louis, Mo.\*

Table with columns: Company, Par Val., Bid., Ask. Rows include Am. Nettie, Colo., Center Creek, etc.

\*By our Special Correspondent.

Montreal.\*

Table with columns: Company, Par Val., High., Low., Sales. Rows include Dominion Coal, etc.

\*Montreal Stock Exchange.

Total sales, 1,872 shares.

San Francisco.\*

Table with columns: Company, Location, pening (H, L), Closing (H, L), Sales. Rows include MacNamara, etc.

\*San Francisco & Tonopah Exchange.

Total sales, 17,050 shares.

San Francisco (By Telegraph).

Table with columns: Company, January (23, 24). Rows include Belcher, Best & Belcher, etc.

New York.

Large table with columns: Company, Par Val., Jan. 18-24 (H, L), Sales. Rows include Alice, Amalgamated, Anaconda, etc.

Total sales, 352,846 shares.

Boston.

Table with columns: Company, Par Val., Jan. 18-24 (H, L), Sales. Rows include Adventure Con., Allouez, Amalgamated, etc.

‡Assessment paid. Total sales, 163,874 shares.

STOCK QUOTATIONS.

Coal, Iron and Industrial Shares.

Table with columns: Company, Par Val., Jan. 18, Jan. 19, Jan. 20, Jan. 21, Jan. 23, Jan. 24, Sales. Lists various companies like Allis-Chalmers, Am. Agri. Chem., etc.

\*Pittsburg Exchange; †Philadelphia Exchange; all others, New York Stock Exchange; Total sales, 608,946 shares.

London. Jan. 13.

Table with columns: Company, Par Val., Latest dividend (Amt., Date.), Quotations (Buyers, Sellers). Lists companies like American, Alaska-Treadwell, Anaconda, etc.

Mexico. Dec. 30

Table with columns: Company, Shares Issued, Prices, Mex. (Bid., Ask.), Company, Shares Issued, Prices, Mex. (Bid., Ask.). Lists companies like DURANGO, GUANAJUATO, GUERRERO, etc.

Paris. Jan. 5

Table with columns: Company, Location, Par value, Latest dividend, Prices (Opening, Closing). Lists companies like Anzin, Boleo, Courrieres, etc.

c-Copper g-Gold. i-Iron. l-Lead. n-Nickel. s-Silver. z-Zinc.

London (By Cable).\*

Table with columns: Company, Jan. 25, Company, Jan. 25. Lists companies like Camp Bird, Con. Gold Fields, De Beers, etc.

\*Furnished by Wm. P. Bonbright & Co., 24 Broad St., New York.



Questions and Answers.

Queries should relate to matters within our special province, such as mining, metallurgy, chemistry, geology, etc. Preference will be given to topics which seem to be of interest to others beside the inquirer. We cannot give professional advice, which should be obtained from a consulting expert, nor can we give advice about mining companies or mining stock. Brief replies to questions will be welcomed from correspondents. While names will not be published, all inquirers must send their names and addresses. Preference will, of course, always be given to questions submitted by subscribers.

**Sodium Silicate.**—How is this made, and what is it worth? Is the consumption large?—S. T. H.

**Answer.**—Briefly, commercial sodium silicate (water-glass) is prepared by melting together 15 parts of powdered quartz, 8 parts of sodium carbonate, and 1 part powdered charcoal, heating for 5 or 6 hours in a reverberatory furnace, and subsequently dissolving the mass by boiling in water. The market price is 1c. per lb. at New York, which is rather low and favors an increase in consumption. Sodium silicate is an excellent water and fire-proofing material, and has a quality which adapts it to the manufacture of certain soaps. Artificial stone and cement often contain sodium silicate, as does also earthenware, and compounds especially prepared for dyeing and printing fabrics. Among the leading dealers are the chemical firms advertising in the JOURNAL.

**Onyx.**—What determines a commercial onyx, and what is its value?—J. B.

**Answer.**—At least two qualities fix the value of onyx—fineness of grain and beauty of color. As this is an ornamental stone, used for cameos and for the luxurious interior decoration of residences, the market value is comparatively high, depending on quality and size. Samples must be seen before prices can be quoted, hence we would suggest that you write to George L. English & Co., 201 East 16th street, New York, and George F. Kunz, gem expert of Tiffany & Co., Union Square, New York. The consumption of onyx in the United States is increasing, and is met largely by imports from Mexico which pay a duty of 50 per cent ad valorem. A small quantity of onyx is quarried on the east bank of the Big Bug creek, about 30 miles southeast of Prescott, Arizona, and some has also been produced in California. There are several other States in which this mineral has been found, but the inconvenience of transporting long distances, or the smallness of the deposits, has discouraged their development.

In a new central station at Boston, the turbine generators are of the Curtis four-stage type. They have surface condensers in the base, and are equipped with emergency brakes, being the first machines to be installed with these features. Their rated capacity is 5,000 kw. The station will furnish 60,000 kilowatts.

Recent Decisions.

SPECIALLY REPORTED.

**DUTY ON BORATE OF SODA—BORAX.**—Certain borax in which there has been mixed mechanically, sufficient carbonate of soda to reduce the percentage of anhydrous boracic acid to less than 36% held dutiable under the provision in paragraph 11, tariff act of 1897, for borax, and not under the provision in the same paragraph for borate of soda containing not more than 36% of anhydrous boracic acid—Appeal of Charles E. Scholes Company from Collector of Customs at New York; Board of General Appraisers.

Platinum is soluble in barium cyanide under the influence of the alternating current.

A test for gold in cyanide solution, as recommended by A. Prester, of South Africa, consists of a simple application of the purple-of-cassius test. In substance, the cyanide solution, strengthened (by addition of a concentrated solution of KCN) to about 1 per cent, is precipitated by excess of zinc dust (1 gram to 200 c. c.). The zinc is filtered off, and dissolved in 10 per cent H<sub>2</sub>SO<sub>4</sub>. The residue from this is dissolved in aqua regia; and stannous chloride is added. With high gold, the color will appear immediately; with low, it may take some moments. It should be added that the test may be compared with a standard solution. For approximate work, it may be made quick and sharp.

There are four fundamental and material sciences: mathematics, physics, chemistry and biology. Mathematics is the study of number and quantity; it measures all the others. Physics is the study of matter and energy, and their relations. Chemistry is the study of the kinds (or phases) of matter, their properties and reactions. Biology is the study of living (transcendental) matter. Matter is that reality, external to, and subordinate to, mind, and which has weight, extension, and inertia as characteristic properties. Energy is the capacity for doing work; it is measured by the movement of matter; its characteristic symbol is ½MV<sup>2</sup>. Other sciences are composites and blendings of these four. Thus geology is a make-up of physics, chemistry and biology. Two chief concrete branches of biology are botany and zoology; biology in the abstract, is the comparative study of life. Life is not yet defined. It seems to be an unconscious, supernatural directing agency, controlled by and controlling matter and energy. Mind centers in consciousness, with memory, anticipation, and comparison as cognate powers. Mind can be measured by the ability to adapt means to ends more or less remote.

Abstracts of Official Reports.

Tomboy Gold Mines Company, Ltd.

This London company owns two groups of mines at Telluride, Colo., among which the Mountain Chief and the Argentine are the most active. The original Tomboy mine is in the hands of tributers, who make a scanty profit by dint of excessive application. Development in the other properties is being pushed with vigor, the year's work having accomplished 3,022 ft. of drift, 533 ft. of raise, and 191 ft. of shaft.

Labor union troubles kept the mill idle for three months towards the end of 1903, and interfered, also, with underground operations, although mining was at no time discontinued. During the year ending June 30, 1904, the tonnage mined and treated was 69,580. The costs, per ton, were distributed as follows: for mining and development, \$3.90; milling, \$1.34; general, including unusual expense due to the strike, \$1.17. Bullion worth \$330,278, and concentrate valued at \$156,323, was the gross outcome of the year's work. The profit and loss account expressed in sterling, follows:

From bullion and concentrate.....	£100,124
Sales of ore.....	1,697
Sundry.....	3,569
<b>Total receipts.....</b>	<b>£105,390</b>
Mining, milling and general expenses in Colorado.....	£86,140
Strike expenses.....	8,016
Depreciation.....	5,000
Office and management.....	3,017
Income tax.....	2,461
<b>Total expenses.....</b>	<b>£104,634</b>
Net income for the year.....	£756
Balance from previous year.....	46,986
<b>Balance available for dividends.....</b>	<b>£47,742</b>

Of this balance, £25,000 has been applied to the reduction of capital expenditure, £15,000 has been distributed at the rate of 1s. per share of the £300,000 capital stock issued, and £7,742 will be carried forward.

Le Roi No. 2, Ltd.

This London company owns two mines, and a mill, at Rossland, B. C. Attention has recently been attracted to the mill through an installation of the Elmore process of oil concentration; as to the results of the experiment we quote below. Ore and concentrate are shipped to smelters at Greenwood. The report covers the year ending Sept. 30, 1904.

Only one mine, the Josie, is worked actively, the only pay ore in the other mine not having the fluxing qualities required by the smelters.

Development during the year has comprised 1,556 ft. of drift and cross-cut, 135 ft. of raise and winze, and 3,617 ft. of diamond drill holes, the latter costing \$2.22 per foot. The only conclusion warranted is that the mine will hold out for another year at an extraction of 1,600 tons per month. The output for the year was sorted into shipping ore, 23,020; second class, or milling ore, 10,331; waste, 17,151 tons; total, 50,502 tons, at a cost of \$4.22 per ton of ore including sorting. By allow-

ing for depreciation, and adding the cost of development, the cost was brought up to \$6.28, on the basis of 33,351 tons of ore.

The shipping ore—23,020 tons—carried 0.909 oz. gold, 1,426 oz. silver and 2.37 per cent copper, and was valued at \$24.80 per ton.

To the milling ore was added 1,270 tons of high grade waste from the dumps, raising the tonnage sent to the mill to 11,601, averaging 0.191 oz. gold, 0.279 oz. silver and 0.522 per cent copper. The ore was crushed in rock-breakers and Trent Chilean mills and concentrated on Wilfleys. The tailing from the tables was treated by the Elmore process, with the result stated in the following quoted paragraphs:

"Even with the whole expenses of crushing charged to it, the water concentration has yielded a profit of about 50c. per ton. The concentration of the tailing by oil, however, in a plant of 50 tons capacity, while reducing the average value of the Wilfley tailing from \$3.23 to \$2.10, has not proved a commercial success. It has, moreover, necessitated fine crushing, which increased the expenses and decreased the efficiency of the water concentration plant.

"The oil concentrator, working from October, 1903, to May, 1904, treated 4,578 tons of Wilfley tailing, averaging 0.107 oz. gold, 0.227 oz. silver, and 0.394% copper, a gross assay value of \$3.23 per ton. In all, 136¾ tons of concentrate have been produced, averaging 1.129 oz. gold, 3.244 oz. silver, and 6.532% copper (a gross value of \$40.35 per ton), and the final tailing has contained 0.076 oz. gold, 0.135 oz. silver, and 0.206% copper, or \$2.10 per ton. The total costs have been \$8,325, and the net smelter returns \$3,601, showing a loss of \$4,723, or \$1.03 per ton.

"The cost of oil when the concentrator was started was exceedingly high, amounting to \$0.40 per gal., but this has now been reduced to \$0.29 per gal., and the consumption of 3 gal. per ton reduced to 1.3 gal. per ton. The grade of the Wilfley tailing has latterly been reduced to such a figure, approximately \$2.20, as to leave no margin for profitable oil concentration at the present time."

The profit and loss account, in sterling, follows:

Net returns from sales . . . . .	£75,961
Interest, etc . . . . .	350
<b>Total receipts . . . . .</b>	<b>£76,311</b>
Mining and general expenses . . . . .	£30,567
Development . . . . .	9,547
Depreciation . . . . .	2,933
Deficit in milling account . . . . .	1,064
Salaries and audit fees . . . . .	2,484
Office, etc . . . . .	2,437
Royalties on Elmore process . . . . .	367
Income tax . . . . .	1,093
<b>Total expenses . . . . .</b>	<b>£50,492</b>
Net profit for the year . . . . .	£25,819
Balance from previous year . . . . .	15,471
<b>Balance available for dividends . . . . .</b>	<b>£41,290</b>

Of this, £25,200 has been, or will be, distributed, leaving £16,090 to be carried forward.

### Indiana Oil Industry.

In working the high grade oil-fields for the year 1904, Indiana leads the States. During the first few years of drilling for oil in the State, much territory was needlessly condemned because the wells were small producers. The average operator was in search of gushers, or big wells, and turned down in disgust much territory where wells came in for less than 10 barrels. With slight knowledge of the conditions governing the accumulation of oil it was thought that a dry hole condemned a square mile or more of the area about it. Experience in sinking of thousands of bores, has, however, proved that a single well is a test for but one location and only for an area of a few acres about the well. As a result, much of the condemned territory was re-drilled during the year, and, in most instances, good producing wells were developed in formerly abandoned territory. When oil was selling at 50 to 60c. a barrel it did not pay to pump wells which averaged from three to six barrels a day. Now that the price is over \$1 per barrel, small producing wells are grouped together and operated from a single power. In a number of places, leases, previously abandoned as non-productive, or as not paying the cost of operating, were taken up by new parties during the year and found to be very productive. But experience in oil development goes to show that the operator in the Indiana oil-field is taking chances, in a measure, with every well he sinks. There is no way of knowing beforehand what the result will be. He may pierce the center of a reservoir and get a 300-barrel gusher; he may strike near its outer rim and get a 10-barrel well, or he may miss it altogether and get a dry hole.

The following table shows the number of wells completed each month in the Indiana field for the year 1904:

Month.	Completed Wells.	Product, Barrels.	Dry Holes.
January . . . . .	307	4,681	37
February . . . . .	238	3,637	36
March . . . . .	256	4,553	39
April . . . . .	282	4,204	36
May . . . . .	306	4,283	58
June . . . . .	353	4,939	63
July . . . . .	389	7,021	59
August . . . . .	439	9,355	70
September . . . . .	396	9,254	55
October . . . . .	377	9,801	46
November . . . . .	385	9,886	40
December . . . . .	321	7,521	38
<b>Total . . . . .</b>	<b>4,049</b>	<b>79,115</b>	<b>577</b>

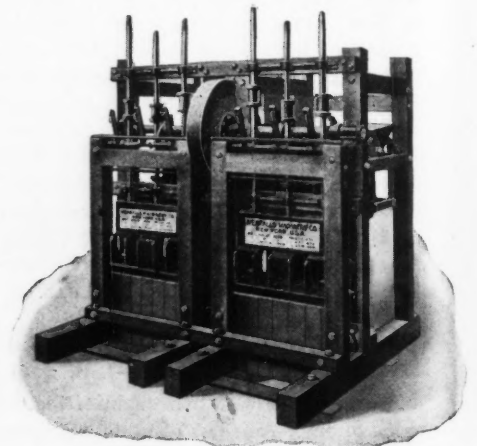
The year 1903 maintained its record and set a new high water mark in the history of Indiana oil industry. There were 4,239 wells completed against 4,049 for 1904. The price of Indiana oil was above \$1 all the year and this stimulated the operators. On January 1, 1904, there were 16,975 wells operated and during the year 4,049 wells were added, making 21,024 wells, which produced 10,240,446 barrels, a gain of 2,079,115 barrels over 1903.

Mr. Sydney Conger, State oil inspector, estimates that a total of \$4,000,000 was paid to Indiana land owners in leases, royalties and bonuses during 1904. There

are nine oil producing counties, Delaware county being the leader. There were 909 wells drilled in that county at a cost of \$1,400,000 and the average initial production was greater than 50 barrels a day. This record is unequaled by any other oil-field in the United States.

### New Ore-Reducing Machinery.

Some years ago, Wm. A. Merralls, of San Francisco, began to devise and put into practical operation, as a manufacturer, an improved stamp mill which so pleased the mining fraternity as to come immediately into practical use in many camps. The important features about the mill, many of which, we believe, are patented, are: (1) Each stamp is separated from the other stamps in the mortar by a diaphragm, which not only strengthens the mortar but separates each individual stamp



MERRALLS' STAMP MILL.

from the splash and swish of the other stamps in the battery. (2) Each stamp has its own separate ore feeder and water supply. (3) Each stamp has a quadruple discharge, that is, it has screens on all four faces, permitting the pulp to escape from the mortar the moment it is fine enough to pass a screen, which not only prevents sliming but makes room for incoming ore.

These improvements enable each stamp in a battery to handle from six to eight tons per day (24 hours) of hard quartz through a 40-mesh screen, wet, at an expenditure of about 2 horse-power for a 1,200 lb. stamp. An improvement growing out of the quadruple discharge is, that outside of each screen a battery plate is inserted, and these battery plates secure from 60 to 90 per cent of the free gold right in the battery. These plates can be changed frequently and easily without even stopping the stamps. The mills are built with 1,000 to 1,500 lb. stamps and in batteries of two, three and five stamps.

Mr. Merralls also found that a combination of machines for reducing ore by a gradual-reduction process could be used to advantage on this class of ores, and in harmony therewith developed a special line of ore breakers for preparatory crushing to half-inch size, using the stamp mill to re-

duce still further to 8 or 10 mesh and a specially improved Chile mill for fine grinding. By the use of this system of milling a comparatively inexpensive mechanical plant, cheaply operated, is made to handle, in a very efficient manner, up to 125 tons per day. Complete units can be so placed, one along side of another, in a mill as to make a very large production possible in a comparatively small building and effecting an important saving in first outlay of both plant and buildings. Two companies have been formed in the East to manufacture Mr. Merralls' machinery—one in New York, the Merralls Machinery Company, having the manufacturing done by the Quintard Iron Works, and the other, Merralls Engineering Company, of Toronto, Canada, who are manufacturing under the Canadian patents for the Dominion, and whose mechanical work is done by the William Hamilton Manufacturing Company, Peterboro, Ont. Several score of these Merralls plants are in practical operation, and the results obtained appear to justify the large claims of the inventor.

It is not practicable to harden a steel correctly until one becomes familiar with that grade, its fracture, etc.

In the Marsh test for arsenic, copper sulphate is the best exciting agent to control the development of hydrogen from pure zinc and pure sulphuric acid.

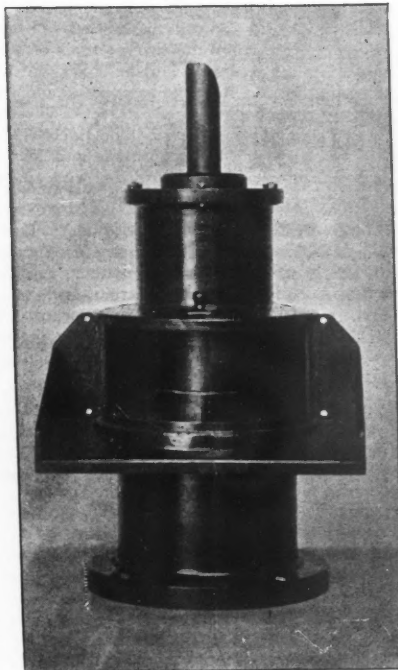
The world's water-power installation, generating electricity, is approximately as follows: United States, 527,467 h.p.; Canada, 228,225 h.p.; Mexico, 18,470 h.p.; Venezuela, 1,200 h.p.; Brazil, 800 h.p.; Japan, 3,450 h.p.; Switzerland, 133,302 h.p.; France, 161,343 h.p.; Germany, 81,077 h.p.; Austria, 16,000 h.p.; Sweden, 71,000 h.p.; Russia, 10,000 h.p.; Italy, 210,000 h.p.; India, 7,050 h.p.; South Africa, 2,100 h.p.; Great Britain, 11,906 h.p.; total, 1,483,390 horsepower.

**NEW SOURCE OF AMMONIA AND FERRO-CYANIDE.**—By heating nitrogenous refuse, such as leather, wool, hair, horn, etc., at about 300° C. with 30 to 50 per cent of sulphuric acid (waste from petroleum refining) and later extracting with water, considerable quantities of ammonium sulphate may be obtained, while the carbonized residues, according to the nature of the substance employed, may be utilized as a decolorizing agent, or, if unsuitable for this purpose, for the production of potassium ferro-cyanide. E. Donath cites (*Chemische Zeitung*, 1904, 28, 1153-1154) an experiment in which leather-meal (220 grms.) was treated with sulphuric acid; 3.36 grms. of ammonia were obtained; and of the total nitrogen only 2.5 per cent was lost. In another experiment, however, the loss was much greater. The carbonized residue contained from 4 to 10 per cent of nitrogen.

#### A Circular Mortar.

The accompanying illustration shows a new form of mortar for stamp mills, which is made by the Nissen Engineering Company, of Los Angeles, Cal., for use with its independent stamp. The distinguishing feature in this device is its circular form. The mortar being circular, no corners exist in which the ore can bank; therefore, all ore fed to it, falls directly on the die. The screen, being the same distance from the stamp in all its surface, presents itself at right angles to the discharge, and it has an area of 12 by 39 in., giving the mortar great capacity.

The screen is simply and positively held in place by bands, and can be changed quickly. As the screen is under tension,



NISSEN STAMP MORTAR.

no constant bending takes place to break the metal. The wear in crushing is provided for by a liner of cast steel, which extends above the crushing face of the die. As this liner is in one piece, and is held down by the die, no bolts nor keys are used. The screen therefore, does not receive severe wear from the crushing.

Where inside amalgamation is practiced, a circular conical shaped copper plate is provided, which is effectually protected from scouring, the protection being fastened to the plate and removable with it. The plate can be removed when loaded with amalgam and replaced by a spare one with ease, and with very little loss of time. In the case of the inside amalgamating mortar, false dies are placed under the crushing die as it wears down. With the chuck-block type, the discharge is kept constant by the use of chuck-blocks as in an ordinary five-stamp chuck-block mortar. The wearing plate for the feed is held by bolts extending through the casting to the

outside, so that the nuts can be kept always tight.

The mortar weighs 2,400 lb. and the stamp 1,300 lb. Amalgamating plates are used also on the mortar shelf, and an apron plate 38 in. wide, and of any length, is provided. Each stamp is fed by its own independent feeder, of the improved challenge type, and is operated by the cam and tappet method. From one to six stamps are placed on a cam shaft, all being set and securely bolted on a concrete foundation. The setting of these stamps is the special feature. The cam shaft posts are provided with as solid a foundation as the mortar, thereby eliminating, to a great extent, breakages of the cam shaft.

These mills are crushing from 8 to 12 tons each 24 hours, using screens from 40 to 20 mesh, with 3-h.p. per unit. All the material used in the mill is first class in every respect; all wearing parts being of forged and cast steel, and all carefully machined.

#### California Petroleum.

We are indebted to the California Petroleum Miners' Association for a careful estimate of the production of petroleum in the State during the year 1904. Of the 13 recognized oil districts in the State, four produced over a million barrels each. These were the Kern River, 17,500,000 bbl.; Coalinga, 4,544,160 bbl.; McKittrick, 1,650,000 bbl.; Los Angeles, 1,080,000 bbl. Four others report between half a million and a million each; these being the Fullerton, 876,000; Whittier, 780,000; Santa Maria, 750,000; Newhall and Ventura, 540,000 bbl. The five remaining districts have the following record: Sunset and Midway, 376,000 bbl.; Puente, 204,000; Summerland, 80,000; Sargents, 42,700; Half Moon Bay 1,000 barrels.

The total output of the State in 1904 was 28,423,860 bbl. crude oil. This puts California high up in the list of producers of petroleum.

#### Patents Relating to Mining and Metallurgy.

##### UNITED STATES.

The following is a list of patents relating to mining and metallurgy and kindred subjects, issued by the United States Patent Office. A copy of the specifications of any of these will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. In ordering specifications correspondents are requested to name the issue of the JOURNAL in which notice of the patent appeared.

Week Ending January 10, 1905.

719,406. APPARATUS FOR CONVERTING HEAT DERIVED FROM FUELS INTO ENERGY FOR UTILIZATION.—Baxter M. Aslakson, Oil City, Pa. In an apparatus of the character described, a working cylinder, an air-compressor arranged to slightly compress the air and to force the same into the working cylinder, a piston arranged in the working cylinder and adapted to compress the air highly in said cylinder, a combustion-chamber arranged adjacent to one end of the cylinder and communicating therewith, an incandescent body located in said combustion-chamber, a

pump arranged to compress gaseous fuel to a pressure higher than the maximum pressure of the air compressed in the cylinder and to feed the same into and through the compressed air and in contact with the incandescent body in the combustion-chamber, a shaft driven by the piston of the working cylinder, and means actuated by said shaft and arranged to control the inlet of air into said working cylinder.

**779,442. EXCAVATING APPARATUS.**—Joseph T. Richmond and Norman H. Beebe, Anthony, Kan. The combination with a power mechanism and an excavator, of a carrier mechanism from which the excavator is supported, said carrier being adjustable vertically, horizontally and longitudinally.

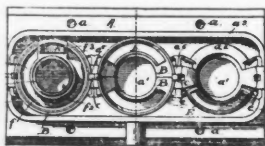
**779,456. LIQUID-RAISING PROCESS.**—George R. Young, Ridgewood, N. J., and Clifford Shaw, New York, N. Y., assignors to the Bacon Air Lift Company. A process of raising liquid, which consists in introducing a lighter fluid into a column of the liquid and causing the liquid to rise with the lighter fluid, upon its way to the point of discharge, subsequently separating the lighter fluid from the liquid at greater than atmospheric pressure and while the liquid is on its said way to the point of discharge, discharging the separated liquid at substantially said pressure, and again forcing the lighter fluid down and into the column of liquid, and maintaining the continuous circulation or cycle of the said fluid.

**779,465. CONVEYER.**—Wesley Carr, Port Sunlight, England. A conveyer comprising a stationary and a movable part, the end of said movable part adjacent the stationary part being so formed and pivoted as to admit of the said movable part being raised and lowered relatively to the stationary part, and guide-blocks disposed at the junction of the stationary and movable parts, the upper blocks being fixed and the lower blocks adapted to oscillate with the movable part of the conveyer.

**779,493. LOADING OR UNLOADING MACHINE.**—John McMyler, Cleveland, Ohio. In a hoisting-machine, the combination of a scow, a tower carried thereby, and having a suitable track, means for raising and lowering the tower, a pair of booms pivoted to the sides of the tower and adapted to form a continuation of the track thereon, means for raising and lowering said booms and a trolley on such track.

**779,512. CLAM-SHELL BUCKET.**—Gurdon H. Williams, Cleveland, Ohio. In a clam-shell bucket, the combination of two scoop members, a pair of opposed sectors, and links connecting the front or inner ends of the scoop members with the sectors respectively, the rear or outer ends of said scoop members being also connected with said sectors respectively.

**779,521. MORTAR FOR STAMP-MILLS.**—Martin P. Boss, San Francisco, Cal. A solid bed, having the mortar-bottom formed in it, and



779,521.

having integral cantilever columns at opposite ends of a diameter of said bottom, said columns converging downwardly to a flange of like internal slope which surrounds said bottom.

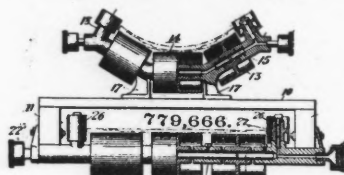
**779,530. CONVEYER OR CARRIER.**—Henry D. Conway, Jackson, Mich. The combination of a suitable frame, a circular hanger having an outwardly projecting flange-like way thereon, side pieces, forked at their lower ends, having inwardly-projecting flange-like bearing-segment resting upon said way; a retainer for said bearing-segment secured thereto, projecting upwardly inside of said hanger; a roller and shafts.

**779,535. SAFETY DEVICE FOR MINE-SHAFTS.**—Norval W. Dickerson, Derwent, Ohio. The combination with an elevator-shaft, a landing, and an elevator-car movable in the shaft; of a movable device for stopping a car and preventing the passage of the same toward the shaft, means for moving said device to and normally holding it in position to bar the passage of a car, a trigger arranged to be engaged by the elevator-car, a connection between the trigger and the said movable device for moving the latter by the former; said connection comprising parts, one of which is movable out of engagement with the other to break the connection, and a movable device arranged in advance of the first-mentioned movable device and adapted when operated by a car to move the movable part of the said connection out of engagement with the complementary part of the connection.

**779,566. ROLL CRUSHING-MILL.**—Thomas L. Sturtevant, Quincy, and Thomas J. Sturtevant, Wellesley, Mass., assignors to the Sturtevant Mill Company. In a roll crushing-machine, the combination with a pair of crushing-rolls and shafts by which said rolls are carried, of bearing supports or carriers the rear portions of which are suitably recessed, bearing-boxes movably mounted in said supports or carriers, and nests of coil-springs housed in the rear recessed portions of said supports or carriers and yieldingly holding the said boxes in working positions, said bearings supports or carriers being provided with tie-caps hooked over ribbed portions thereof.

**779,623. ELECTRIC PUMP.**—Edwin F. Porter, Boston, Mass., assignor, by mesne assignments to Porter Air Compressor Company. A pump, a source of power for operating said pump, and means operated by the flow of the fluid through the pump and by the pressure produced by the pump for varying the action of said pump.

**779,666. BELT-CONVEYER APPARATUS.**—Thomas Robins, Jr., New York, N. Y., assignor to the Robins Conveying Belt Co., New York, N. Y. In a conveyer-belt support, the com-



bination of a set of supporting-pulleys and supporting-bearings therefor, said bearings carrying the said pulleys in a common plane transverse to the travel of the belt in position to support the belt, and pulleys for bearing against the edge of the belt to laterally guide it, said guide-pulleys being mounted in the same transverse plane with the supporting-pulleys.

**779,671. WELL-DRILLING MACHINE.**—Frank E. Simpkins, Allegheny, Pa. The combination of a shaft having a crank, an arm mounted to oscillate in the plane of the crank and operatively connected thereto, and a beam and spudding mechanism adapted to be actuated by said arm interchangeably.

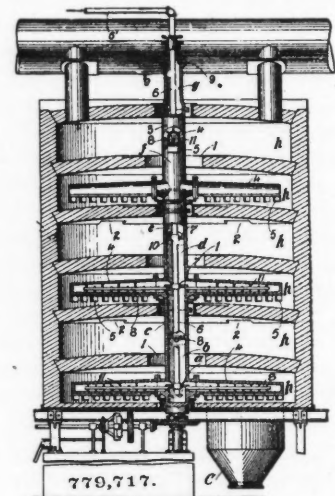
**779,705. METHOD OF TREATING ALKALINE SOLUTIONS OF CHROMATE OF SODA.**—William T. Gibbs, Buckingham, Canada, assignor, by mesne assignments, to the National Electrolytic Company, New York. A method of treating alkaline solutions of chromate of soda, which consists in removing the free alkali therefrom and then treating the solution by electrolysis to produce bichromate of soda.

**779,733. ELECTRODE.**—Edgar F. Price, Niagara Falls, N. Y., assignor to Union Carbide Company, Niagara Falls, N. Y. An electrode, comprising a carbide and a binder, as set forth.

**779,735. ELECTROLYSIS.**—Giovanni Rambaldini, Miniera di Boccheggiano, Italy. A non-

conducting vessel, an insulating-partition liquids in said vessel upon opposite sides of said partition an electrode in each compartment in contact with the liquid therein, metallic conductors supporting said electrodes, a lighter and conducting liquid in said vessel and covering the liquid in its compartments, said partition terminating in said lighter liquid beneath the surface thereof, and a source of electrical energy externally connected with said metallic conductors.

**779,717. ROASTING FURNACE.**—Frank Klepetko, New York, N. Y. In a furnace having



one or more hearths, a hollow rabble-shaft and hollow arms thereof, and ribs formed on the inner surfaces of the rabble-arms.

**779,743. PUMP.**—David L. Shaffer, Pittsburg, Pa. In a pump, the combination of a drum, axial journals therefor one of which is hollow, bearings for said journals, and one or more spirals surrounding said drum and having their inner edges secured to said drum for their entire lengths, said spirals having large open mouths disposed radially with reference to the drum and gradually narrowing from said mouths and having restricted inner ends opening into the drum.

**779,758. CONVEYER.**—Angelo Becchi, Genoa, Italy. In an unloading apparatus, the combination, with substantially horizontal ways, and means for adjusting the same longitudinally and laterally, of substantially vertical ways, means for adjusting the second ways vertically, a universal joint between the two ways, wheels mounted on the ways, an endless chain carried by said wheels and carriers secured to the chain.

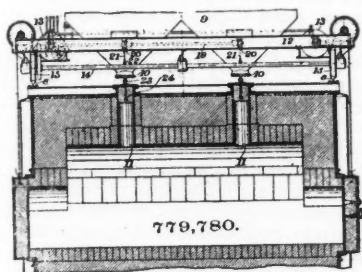
**779,760. EXPLOSIVE.**—Christian E. Bichel, Hamburg, Germany. An explosive, containing nitroglycerine and a gelatinous substance.

**779,769. MEANS FOR UTILIZING THE WASTE GASES FROM FURNACES.**—Corydon L. Cole, Minneapolis, Minn., assignor, by direct and mesne assignments, to the Waste Heat Utilizing Company, Minneapolis, Minn. The combination, with a steam-boiler, of a shell or casing having tube-sheets or heads and having one end open to the atmosphere, a pipe for delivering the products of combustion direct from the boiler to the shell or casing at a point removed from the air-receiving end of said shell or casing, an escape-pipe for the products of combustion near said receiving end, means for inducing currents of air through the tubes, and means for conveying the heated air from the tubes.

**779,776. APPARATUS FOR MANUFACTURING GAS.**—Peter Eyermann, Beloit, Wis., assignor of one-half to Julius R. Wemlinger, Westmont, Pa. In apparatus for manufacturing or improving gas, the combination of a gas-generator with gas-holders having interdependent motions or lifts and separate connections with said generator.

**779,777. PROCESS OF PRODUCING SILVER EMULSIONS.** Johannes Gaedicke, Berlin, Germany. A process of producing silver-salt emulsions of unchanging sensibility, which consists in first washing a non-matured emulsion, then treating the washed emulsion with an alkali, and finally neutralizing the excess of alkali with an acid.

**779,780. CHARGING-MACHINE FOR COKE-OVENS.**—John Haug, Philadelphia, Pa. In combination with a coke-oven, a charging-car, a



motor on said car, drums on said car operative to raise the oven-doors and the charging-plugs, and suitable connections between said motor and said drum and between said motor and the running-gear of the car.

**779,782. DREDGE.**—James Henderson and Harry G. Peake, Oroville, Cal. In a dredge, the combination with a wheel provided with a plurality of separable plates arranged about its periphery, of a bucket having a removable contact-plate cooperating with the wheel.

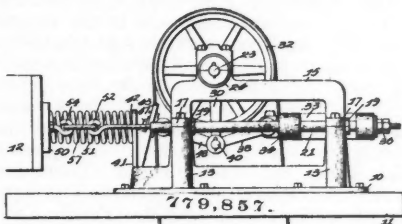
**779,839. PICK.**—John Chevallard, Millersburg, Ohio. A pick comprising a transverse enlarged or elongated flat outer-surfaced eye portion having the opposite front edges of the pick-arms curved upwardly therefrom to the terminal points of the arms, said front portions of the arms being provided with wedge or V-shaped cutting edges which extend continuously from the eye to said ends, and the opposite back edges of the arms being constructed of the same configuration of V-shaped cutting edges as those of the front edges, and the ends of the V-shaped portions of the front and back edges of the two arms merging one into the other at their opposite ends to form a four-cornered tapering drive-point.

**779,844. ELECTRIC FURNACE.**—David R. S. Galbraith, Auckland, New Zealand, assignor of one-half to William Steuart, Auckland. In an electric furnace for treating iron-sand and other refractory ores and substances comprising an incased furnace recessed to accommodate electric connections in circuit with a source of electric energy and having the sides of its fusing zone stepped internally with inclined chutes, a plurality of non-conducting interceptors mounted within the furnace at the stepped fusing zone and arranged in superposed relation and adapted together with such stepped parts of the furnace to deflect the material under treatment successively to the next lower interceptors and with electric conductors leading into the fusing zone at the ends of each interceptor, and a plurality of V-shaped troughs perforated at their bottoms and serving to direct the material in thin streams longitudinally central of the under series of interceptors and conductors, whereby, the shower charge of the material will be caused at the time of each of its interceptions to complete and act as part of the electric circuit.

**779,853. MEANS FOR ELEVATING ACIDS.**—Samuel Hughes, Summerville, S. C., assignor of one-half to Edward F. Lowndes, Charleston, S. C. The combination with a well-casing, an acid-supply tank, a removable acid-resisting pipe located inside the well-casing, said pipe being closed at its bottom and extending above the well-casing and as high as the top of the supply-tank and a pipe connecting the supply-tank and acid-resisting pipe, of a delivery-pipe extending

to nearly the bottom of the acid-resisting pipe, said delivery-pipe being open at its lower end and communicating at its upper end with a receiving-tank, and an air-pressure pipe, the lower end of which communicates with the lower end of the delivery-pipe.

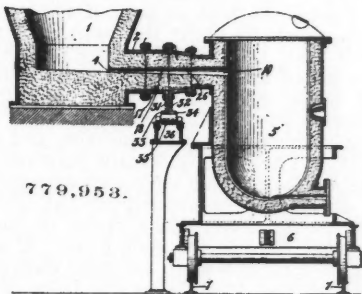
**779,857. SHAKER FOR CONCENTRATING-TABLES.**—John Klein, Desloge, Mo., assignor of two-thirds to Charles D. McLure and Paul A. Fusz, St. Louis, Mo. In a shaker for concentrating-tables: reciprocating rods slidingly mounted; a crank-shaft mounted above and transversely of the rods; a driving-rod operated by the crank-shaft; a sliding head rigidly mounted



upon the reciprocating rods; an arm rigidly mounted in an inclined position; a toggle-joint head adjustably mounted upon the arm; the links connecting the toggle-joint head to the sliding head and to the driving-rod; a concentrating-table; eyes rigidly secured to the forward ends of the reciprocating rods; the eyes rigidly secured to the concentrating-table, links loosely connecting the eyes, and an expansive coil-spring between the concentrating-table and a rigid portion of the frame.

**779,907. MOTOR AIR-PUMP.**—Edward Cheshire, Milwaukee, Wis. The combination of a frame member, containing a pump-cylinder and a motor-housing, both of which are open at both ends, and two caps removably secured to the ends of said frame member thereby closing the cylinder at one end and inclosing a chamber at the other end of the housing with which said cylinder and motor-housing communicate, with a pump-piston in the cylinder, an electric motor in the motor-housing, and power-transmission mechanism connecting said motor and pump-piston, a portion of which mechanism lies within said chamber and a portion of which passes through the opening which connects said chamber with the motor-housing.

**779,935. GAS-PRODUCER.**—James A. Herrick, Philadelphia, Pa. A gas-producer having a



blast-pipe extending across the base thereof, said pipe having one end connected with a blower and the other end provided with a test-valve.

**779,952. DIFFERENTIAL GOVERNOR FOR FLUID-COMPRESSORS.**—George Macloskie, Schenectady, N. Y., assignor to General Electric Company. In combination, a plurality of fluid-compressors, a common receptacle supplied thereby, check-valves between the several compressors and said receptacles, and governors controlling the several compressors, each of said governors comprising two diaphragms, one of said diaphragms being arranged to respond to a difference between the pressures of its compressor and of said receptacle, and the other diaphragm being arranged to respond to a variation in one of said pressures.

**779,953. SMELTING-FURNACE.**—Alfred E. Manchester, Newburgh, N. Y. The combination with a furnace and a forehearth, of an interposed separable cut-off valve arranged to open and close communication between the two.

**779,985. MEANS FOR THE UTILIZATION OF CRUDE OIL AS FUEL.**—James O. Alwood, Richmond, Va. In combination, a vapor-generator coil, a steam-superheater coil concentric with the vapor-generator coil, means for supplying a hydrocarbon to the vapor-generator coil, means for supplying steam to the steam-superheater coil, a heater common to both coils, a mixing-chamber independent of said heater and coils, a radiator-coil within the mixing-chamber, connecting means between the vapor-generator coil and the mixing-chamber, a connection between the steam-superheater coil and the radiator, a valved connection between the opposite end of the radiator and the mixing-chamber, and a burner for the aforementioned heater receiving its supply of gaseous mixture from said mixing-chamber.

**779,995. CORE-LIFTER FOR DIAMOND DRILLS.**—David Dupuis, Salt Lake City, Utah, assignor of one-half to D. A. Carpenter, El Paso, Tex. A core-lifter consisting of two interlocking members one of the members having ears and the other recesses which the ears engage, the engaging edges of the ears and the walls of the recesses being circular in shape, whereby the members are permitted a rocking movement.

**779,998. PROCESS OF MAKING HYDROCHLORIC ACID.**—William T. Gibbs, Buckingham, Canada, assignor to the Electric Reduction Company, Limited, Buckingham, Canada. The method of combining hydrogen and chlorine gases, which consists in bringing them into contact in suitable proportions in a combustion-chamber, one or both of said gases being heated before contact to a temperature above that at which combustion of hydrogen and chlorine commences.

**780,002. AMALGAMATING APPARATUS.**—Julius Jean and William C. Schmitt, Denver, Col. The combination of a bottom receptacle having outwardly-flared walls, an amalgamated tray located in said receptacle and having correspondingly-flared side walls, a bottomless casing mounted above the tray and projecting thereinto, the said casing being suitably supported and vertically adjustable, and a feed-receptacle suitably supported and provided with a rearwardly and downwardly extending conduit having a forwardly-curved discharge extremity terminating in suitable proximity to the bottom of the tray, the said receptacle being also provided with depending open-ended tubes extending downwardly into the forward extremity of the tray, the upper extremities of the tubes communicating with openings in the receptacle whereby the tubes receive their supply.

GREAT BRITAIN.

The following is a list of patents published by the British Patent Office on subjects connected with mining and metallurgy:

Week Ending December 24, 1904.

**25,550 of 1903. ELECTROLYTIC APPARATUS.**—F. E. Clotten, Frankfort, Germany. Improved electrolyte and diaphragm used in recovering tin from tinplate scrap.

**1,721 of 1904. ROCK DRILL FEED.**—C. H. Champion, Sheffield. Improved automatic feed for ratchet rock drills, to provide for cases where the drill meets extra hard rock.

**3,136 of 1904. BINDER FOR BRIQUETTES.**—V. Conti and A. Levy, Paris, France. Use of oxychloride of magnesium as a binding agent in briquetting.

**22,459 of 1904. COKE LOADER.**—F. L. J. Gregovie, Seraing, Belgium. Improved apparatus for loading coke from furnaces into trucks and for the simultaneous removal of ashes.

## Special Correspondence.

San Francisco. Jan. 18.

Few people except those directly interested in the companies or the lands, have a proper idea of the very rapidly growing importance of the gold dredge mining industry of California. Even the men engaged in quartz and other branches of mining in the State, have as yet scarcely realized how rapid are the strides being made by the new branch of gold mining. It has eclipsed already, both the hydraulic and drift mining interests, and, indeed, its yield is now greater than both of those industries combined. One of the prominent dredger men of the State informed the writer a few days since, that from the Yuba river district, alone, eight new dredges, of the largest type ever built, had been ordered or were being constructed.

The original dredgers built at Oroville had a three cubic-foot bucket capacity. After the first two or three, this was increased to five feet. Then a seven and one-half foot one was built, and finally a nine foot one was provided for the Folsom district. Now, at the same place, arrangements are being made for a dredge of 13 cu. ft. bucket capacity. By strengthening the various parts of the machinery, they find they can use dredgers of much higher capacity, or yardage. Under the favorable conditions existing in the Sacramento valley, at Oroville, Folsom and on the Yuba, these changes will be the cause of reducing the cost of working the gravel per cubic yard, from seven or eight cents, to five cents. In fact, it is thought that, with proposed improvements in the strength of the machinery, the cost may eventually be as low as three cents per cubic yard, which is about the cost of hydraulic mining—the cheapest form of gold mining known.

One of the heaviest costs for dredge mining, is that of repairs, and the companies have to provide and maintain at each central point, fully equipped machine shops. At an average, the machines intended to work 24 hours a day, seldom exceed 20 hours, if as much as that. They run steadily some days and are then laid up a day or two for repairs. In fact, about one third of the cost of dredge mining is for repairs and renewal of parts. Improvements in the machinery will, therefore, make the greatest saving in cost of working per cubic yard. In the first six months or so, the cost of repairs and renewal is small, but after that it gradually increases.

In increasing the size of the machines, another point is also gained, as the larger the dredge the greater surface of gold saving tables and sluice boxes, which can be provided. If these tables can be increased to a larger proportion than the increase of yardage, there will be a larger proportion of values saved. So far, there is no definite data as to what proportion of gold and platinum actually in the gravel, is being saved. The most intelligent operations place it all the way from 60 to 70 per cent.

The borings from gold-bearing sands along the tule borders (or swamp regions), of Sutter county on the Smith, Lee, Phipps, Brittain and other branches, have proved that the deposits are richer than was supposed. The channels appear to run in zigzag course across the county to the tule basin, but until now, it was not supposed that the marsh lands near the tules could possibly carry any gold. All the ranchers from Yuba City to the tules are now looking out for a mining man to bond the land with a view to dredging it.

The proposed electric road from Yuba

City through Marysville and up the Yuba river, to the place where the dredgers are at work, will soon be built. The other end of the same system from Grass Valley, Nevada county, to Marysville, Yuba county, will be built at the same time. It costs some \$7 per ton to haul material by teams to the dredgers, and that adds from \$5,000 to \$7,000 to the cost of the machines. As not less than 30 dredgers will be at work there in a year or two, the electric road will be an important factor in the cost. The freighting alone will pay the road, not counting the passenger traffic.

The American Magnesite Co., owning extensive magnesite deposits in the mountains back of Livermore, has purchased a large tract of land at Session's basin, fronting the Oakland harbor. At this point there will be both rail and deep-water transportation, for the manufacturing plants to be established. Magnesite brick, tiling, etc., will be made. There are three sub-corporations which will occupy the site referred to, viz., the Pacific Carbonic & Gas Co., to manufacture carbonic acid gas; the Plastic Construction Co., to make tiling, building material, etc., and the Rose Brick Co., to manufacture magnesite brick. At present what magnesite brick is used on this coast, at the smelters, etc., is made in Pennsylvania from imported mineral, principally from Austria, and cost from \$155 to \$200 per thousand in New York. The parent corporation, the American Magnesite Co., will mine the crude material and sell it to those companies, which will prepare the manufactured products.

The famous South Yuba Water Co., which has for years supplied many mines and towns with water and power, has been absorbed by the California Gas & Electric Corporation. The Central California Electric Co., adjunct of the South Yuba, has also been purchased. The South Yuba company was organized 52 years ago, to furnish water for irrigation, municipal supply and for various power purposes. The range of its operations covers the larger part of Nevada and Placer counties. Its properties consist of water rights, reservoirs, aqueducts, canals, tunnels, flumes, pipe lines, town water works, and extensive acreage. Its natural resources are the rivers and creeks of the Sierra Nevada mountains. The company's watershed embraces an area of 105 square miles, which lie about the sources of the South Yuba river. The storage reservoirs are situated in the watershed, and are natural basins shut in by dams, and thus converted into lakes. These reservoirs are 20 in number, and of ample size and capacity. The most important reservoir is Lake Fordyce, which covers an expanse of 474 acres, and is situated on the North fork of the South Yuba river, 16 miles above the head of the main canal. It was built in 1873, and since has been enlarged. The principal other lakes are Lake Meadow, Lake Stirling, Lake White Rock, Peak lakes, Lost River lake, Omega lakes, Fall Creek lakes, Lake Van Norden and Lake Spaulding. The storage capacity of these lakes is 14,525,000,000 gallons. The 50 distributing canals of the company equal 450 miles in length. Along the important places supplied by this company are the mining centers of Grass Valley, Nevada City and Auburn. The available horsepower is 50,000. The Central California Electric Co. has been supplying those and other places with electric power.

The California Gas & Electric Corporation, which has bought out these companies, is now one of the largest electric corporations in the world. It controls distributing centers in 14 cities and towns

in California, and its operations cover 21 counties in this State. The power and lighting distribution circuits 575 miles, and the main pole lines constructed are now 992 miles in length. The corporation owns the following power houses: Colgate, capacity 12,675 h.p.; De Sabla, 12,000 h.p.; Nevada, 1,760 h.p.; Yuba, 1,320 h.p.; Centerville, 2,266 h.p.; Electra, 13,333 h.p., and Folsom, 5,000 h.p. In addition to these, the plant at Electra is being increased 13,333 h.p., just doubling its capacity; and the plant at De Sabla is being increased 8,000 h.p., making its capacity 20,000 horsepower.

A bill has been introduced in the State Legislature, providing that every person, firm or corporation, owning and operating pipe lines in this State, not exclusively used for oil, owned or produced by such person or corporation, is declared to be a common carrier. The bill is intended to benefit the oil producers in the Coalinga, McKittrick, Santa Maria, Midway, Sunset and Kern river fields, and also in a measure, producers in the Los Angeles and Fullerton fields. Under present conditions, the small producers are forced to make contracts with the Standard Oil, for the sale of their oil at low prices, or else close down their wells. If pipe lines are declared by law to be common carriers, they can be made to take the commodity offered for transportation from any person offering it, and transport it in the order in which it is offered. When the Standard company, some months since, ceased buying oil in the Kern river field, the price dropped as low as 11 cents per barrel, and many wells closed down for quite a period. The company had its tanks all full and did not ship any except its own oil.

Denver Jan. 21.

President Ripley, of the Atchison, Topeka & Santa Fe railroad, has withdrawn his request for a rehearing of the case involving the charges of his road having given rebates to the Colorado Fuel & Iron Co., and the Interstate Commerce Commission has cancelled the arrangements.

According to the report of the United Mine Workers, for the past year, \$1,087,000 was spent for the relief of strikers and Colorado received \$437,355 of this amount.

Considerable property has lately been purchased in Eagle county by the Pittsburgh Gold Zinc Mining Co., which has lately filed articles of incorporation, and in which it is said Captain Hicks, of Pittsburgh, is largely interested.

A very peculiar accident in a mine, and the first on record of its kind, occurred a few days ago. A miner drilled a hole, deeper than is customary, in order to break a large quantity of rock and charge it with such an amount of powder that its explosion heated the adjoining rock to a high temperature. Water was used to cool it, but when he placed a stick of powder in another hole, the heat was still so great that it exploded and it killed him. The writer, during 27 years among mining camps, has never heard of a similar occurrence.

It is stated on good authority that the Colorado Springs & Cripple Creek District railway, the so-called "Short Line," has been purchased by B. F. Yokum, president of the St. Louis & San Francisco railroad, and a director of the Rock Island system. President Howbert is now in New York at present.

## Salt Lake City. Jan. 20.

The directors of the Columbus Consolidated Mining Co. have submitted a statement to the shareholders setting forth, in detail, the financial condition of that corporation. The directors recently levied an assessment of 20c. a share—delinquent on Feb. 11—which is to be applied to the liquidation of an indebtedness of \$50,286. The pending assessment should net the company \$50,473. Receipts from Dec. 20, 1903, to Dec. 31, 1904, aggregated \$165,284, which includes a balance of \$81 on hand at the time of the issuance of the last annual report. The ore sales amounted to \$10,447; receipts from treasury stock sales, \$48,550, and from assessment No. 1, \$56,440. Principal among the items of expense were: \$27,814 for new ground and obtaining titles, \$11,453 for mine supplies, \$26,387 for mine pay-roll, \$26,315 for electric power plant, \$36,007 for construction of concentrator. The mill was placed in commission in November, but owing to the unusually dry winter weather there has been a shortage of water and the plant has been running only at about one-third of its capacity. In the month of December, 326.98 tons of concentrate, which averaged \$21.39 per ton, were produced, the same netting the company \$7,017. When the water supply increases sufficiently, which will not be later than April 1, the directors say, the mill will turn out 1,000 tons of concentrate per month of a gross value of \$26,000. Alta is the location of the Columbus mine.

The members of the staff of Samuel Newhouse have completed an exhaustive examination of the properties of the Majestic Copper Mining & Smelting Co. in Beaver county and have submitted their reports to William B. Mucklow, president of the Majestic company, who will lay them before the board of the directors of the company next week. At the same time a proposition will be received from Samuel Newhouse, the acceptance of which will immediately place Mr. Newhouse in charge of the operations of the mines in the capacity of managing director. Under his administration the smelter at Milford will probably be blown in before April 1.

W. C. Thomas, a member of the Newhouse staff, who examined the Old Hickory mine, reported that this mine has enough ore blocked out and in sight to keep the plant going for a year. M. M. Johnson, mine manager for the Newhouse interests, who examined the O. K. mine, of the Majestic group, reported that no less than 200,000 tons have been blocked out between the second and third levels. The general run of O. K. ores will require concentration before smelting.

The stockholders of the South Columbus Mining Co., operating at Alta, have elected the following officers for the ensuing year: Tony Jacobson, president; Charles H. Bodel, vice-president; Arthur E. Snow, secretary and treasurer; who, with C. H. Young and H. S. Tanner, constitute the board of directors. A tunnel is being driven to tap the Columbus lode, which is completed to a little more than 800 ft. Since Oct. 7, 1903, the company has spent more than \$15,000 in development and equipment purposes.

A station is being cut on the 800-ft. level of the Eagle & Blue Bell mine in Tintic, from which a cross-cut will be run for a distance of 150 ft. to tap the main body of ore. The shaft will be sunk from the 800 to the 1,000-ft. level.

A new air compressor will shortly be installed on the mine. Captain Duncan McVichie, of Salt Lake, is manager.

Four mining bills have been introduced in the State legislature now in session. Among them is one providing for the establishment of a department of mines and mining, which will be charged with the supervision of the execution of mining laws, the care and publication of annual reports of inspectors of coal and all other mines. The chief of the department, to be eligible to the position, must have had at least 10 years' practical experience in Utah mines, and is to draw a salary of \$3,000 per annum and his assistant, \$1,800. Another bill introduced provides for the taxation of coal as well as metal and all other classes of mines. The proper ventilation of mines is aimed at in another bill introduced. An act to amend the coal and hydro-carbon laws, to prohibit the use of explosive oil and to regulate the use of powder in coal and hydro-carbon mines is the title of H. B. No. 16.

## Duluth. Jan. 24.

One of the most important operations of the new year is to be that of stripping Hull and Rust, of the Oliver Iron Mining Co., south of and adjoining Mahoning, at Hibbing. Arrangements have been made to carry this forward at once, and a large part of the stripping equipment recently bought by the company, was primarily for this purpose. The two mines have been worked by the square set system underground, for some years and a comparatively small product has been made thereby. Now the Oliver company will be able to furnish these ores, in a big way.

Corrigan, McKinney & Co., have a force of men at work opening a mine on land they bought some time ago, west of the Stevenson. So far, operations are confined to clearing the land of timber and preparing to sink a working shaft. They hope to mine from this property this year.

By reason of the new steam shovel cut at Fayal mine, the Duluth & Iron Range road is to rearrange all its tracks in that vicinity, and instead of coming into Eveleth through Fayal, will go around to the south through a deep cut between Fayal and Troy. For this work the removal of 70,000 cu. yd. of earth is necessary, and this has started, with one shovel day and night. This is the third time the road has been forced by the growth of Fayal mine to rebuild and rearrange its yard and trackage system about Eveleth.

Cole & McDonald, of Duluth, are doing a large amount of diamond drilling on iron ore properties in other districts around the lake. They have two drills working in the old Rolling Mill mine, Negaunee, for Jones & Laughlin, who have it under option. Two deep holes have been completed and both drills are working in others. So far, nothing of importance has been found. They may soon have two drills on the property of the Penokee Development Co., which lies west of the Montreal river, in the Gogebic range, though this is uncertain. They are operating at least one drill near Aitkin, and two on the Vermillion range. These are in addition to the work going on along the Mesabi range, which is increasing in quantity.

At Ashland, the Chicago & Northwestern road is making a new dock, in its rebuilding operations at No. 1 dock. The new dock will be 13 ft. wider and three feet higher than the old one, bringing it up to a par with most of the newer and more modern ore piers on the upper lakes.

About 1,000 men will be added at once to the mining force in Ishpeming, nearly half of them for each of the two big com-

panies, the Oliver and Cleveland Cliffs, and 100 at Jones & Laughlin's mine. The Oliver company is working night shifts at all its more important mines. Cleveland Cliffs has resumed at the Moro, put on night crews at Lake mine, is filling other properties with men, and the whole situation is in direct line with the activity shown on all lake ranges and mine centers, where the companies are doing much in the way of increased business.

## Deadwood. Jan. 23.

The Lexington Hill company's tunnel, driven to intersect the quartzite ore-bodies at a depth of nearly 500 ft., has encountered that stratum at a distance of 1,375 ft. from the portal. The mouth of the tunnel is on the hill immediately to the rear of the company's 20-stamp mill, and ore can now be delivered quickly and cheaply to the plant, while in the past a wagon haul of a mile, over very rough roads, was necessary for the delivery of ore. Pending the blocking out of the ore-bodies by means of this tunnel and its accompanying cross-cuts, the mill of the company has been shut down, but the work of placing it in order for continuous operation will soon be under way. It is probable that the company will either increase the capacity of the present plant, or construct an entirely new one. It is desired to bring the daily tonnage up to at least 300. The combination amalgamation-cyanidation process is employed. The Lexington Hill company is controlled by Boston parties. Henry F. Wells is treasurer and the moving spirit in the affair of the company.

The property of the Ohio-Deadwood Gold Mining Co., at Rochford, has reverted to the former owners, default being made in the payments of the purchase price. The property includes a large acreage, and a long tunnel discloses some bodies of low-grade ore. Machinery is on the ground for a 50-ton mill, a portion of which has been erected. The equipment includes a first class compressor plant, blacksmith shop, etc. I. B. Murphy, who was the general manager for the company, is said to be negotiating with Ohio gentlemen for a reorganization of the company.

The Spearfish company is sinking a new shaft 500 ft. from the present openings, with the idea of exploiting the lower contact which was disclosed some time ago. In the shaft where discovered it shows a thickness of 30 ft. of milling ore. The company has not yet paid its quarterly dividend, notwithstanding rumors to the contrary. A statement of the exact financial condition is being prepared by the officers, and will be forthcoming within a short time.

The Anaconda company has encountered a vein of good ore in the bottom of the shaft, and the management is highly encouraged. The ore is free-milling, besides carrying a heavy concentrate, which assays well. The company is employing two shifts of miners and is making good progress.

The Leroy company, operating near Custer, recently made a fine strike of ore. Assays show values up to \$100 a ton. The values are in a bismuth telluride. Preparations are being made to make a shipment to one of the smelters.

The Saginaw company, near Custer, is employing two shifts of miners in development work. Drifting is in progress at the 250-ft. level, and sinking is being steadily carried forward.

**Spokane. Jan. 18.**

Charles Dempster, representing Eastern people, has bonded the No. 3 and the mine on Silver Cup slope, near Trout Lake, B. C., from the Gold Belt syndicate. About \$5,000 has been spent on the property.

The Lucky Boy, in the Lardeau district of British Columbia, is expected to ship another car of high-grade ore in a few days. Other properties in the same camp are being actively developed. The Mohican has its crosscut tunnel in 300 ft. The Horseshoe is producing some \$150 gold ore. The Spyglass company is starting to develop the Homestake group on Rapid creek. The lower level on the Triune is being extended and an upraise made. The Nettie L., is under development. The Silver Cup is producing high-grade ore with a large crew. A contract tunnel is being driven on the Handy mine. A contract has been given for driving a long tunnel on the John L., the adjoining property. The Mother Lode has been worked all winter. Six men are at work on the Surprise. Three men are developing the Big Five. The tramway to be erected for the Triune by the Riblet company, of Spokane, will arrive in a few weeks.

James Cronin, of Spokane, manager of the St. Eugene Mining Co., of Moyie, B. C., has been named as general manager of the War Eagle and the Center Star Mining Co., of Rossland, B. C., to succeed Edmund B. Kirby, resigned. Mr. Cronin assumed his new duties Jan. 16. He says that reconstruction of the concentrator at Trail, B. C., will not be started until spring, since work will be cheaper then. As regards his policy at the mine, it is decidedly liberal. He says he will not consider whether miners are married or single, nor will he consider their affiliations. That is taken to mean an open shop policy, such as he has followed in running the St. Eugene. He says he will not permit the forcing of miners to board at the company hotel, nor will he dictate who shall serve as company doctors. He will give the men their own choice. As a souvenir of high regard for Mr. Kirby, the miners of the Center Star presented him with a magnificent gold watch, and the miners of the War Eagle gave him a fine shotgun.

The Sunnyside mill in Thunder Mountain district, of Idaho, has closed after a trial run, on 180 tons of low-grade ore. The superintendent, E. L. Abbott, says the saving was satisfactory. The ore was crushed to 20 mesh. The tram, which has a cable 7,348 ft. long, made trouble at first, through the method of attaching the buckets, and several of them broke loose with disastrous results. Modified grips to connect the buckets to the cable, are being put in. The rock crusher at the mill, driven by power, afforded by the descending ore on the tram, proved too small for handling the large pieces of ore coming from the stopes, and it was determined to take in another crusher. Development in the upper works has stopped. The Burr tunnel is being driven to develop the ore blanket deeper. It will catch the lode by a raise of 175 ft. The tunnel is in 1,650 ft., and should be finished with 200 ft. more driving, by June 1. A shaft is being sunk on the H. Y., a neighboring property.

The compressor for the Black Pearl, in southern Idaho, is on the ground. A mill will be built in the spring. Cross-cutting for the north and the south ledges will be pushed.

The sale of the American Eagle Mining Co.'s property near Elk City, Idaho, for

debts, has been cancelled, as Dr. C. K. Merriam, the secretary, of Spokane, has paid liens of \$950, and says that the remaining debts of \$5,000, including receivership costs, will be met. The property was a good producer, but expenses of mining and milling proved excessive.

Patrick Clark of Spokane, has bonded the Queen group from John A. Turner, Wm. Walde and Michael Scully, for \$80,000, due in 60 days; and he has bonded the Kootenay Belle from Bennett & Billings, of Salmo, B. C., for \$100,000, with a first payment of five per cent to be made May 1. The properties are neighbors at Salmo, B. C., in the Nelson mining district. The Queen has been a steady gold producer and the ore is milled at the Yellowstone plant. William Waldie had a bond on his partner's interest, and paid \$30,000 on it, from profits. He assigns his bond to Mr. Clark. The Kootenay Belle is a recent location, and three cars of ore netted over \$50 a ton. Mr. Clark secures the Yellowstone mill.

**Butte. Jan. 20.**

The Speculator Mining Co., of which John A. Creighton, of Omaha, is president, has bought the Edith May copper-silver mine, paying for it \$150,000 in cash. The mine was owned by P. J. Brophy, George H. Casey, Thomas F. Newton, of Los Angeles, and the C. W. Newton estate of Butte. Messrs. Brophy and Casey received \$130,000 as their share, the former \$75,000 and the latter \$55,000. The other \$20,000 was divided between the Newtons. The Speculator company intends to work the mine through the shaft of the Speculator mine. The purchase of the Edith May is the second acquisition that the company has made during the last two months and it is now fairly well equipped with producers. Its first purchase was the Jesse, owned by the Lewisohn estate, for which it paid \$300,000. Since the acquisition of that property the company has increased its output of copper-silver ore 150 tons per day, making a total of about 350 tons. The Edith May is a short distance north of the Speculator, and is considered one of the good claims in that district.

The Guardian Copper Mining Co. is the latest corporation to enter the Butte field. It is organized under the laws of New York. Max E. Schultze, Frederick Eckstein and Henry Brunssen, of New York, are the organizers. The former is president and Mr. Eckstein secretary. The capitalization is \$100,000, divided into 1,000 shares of \$100 each. Its only asset is a 50th interest in the Minnie Healey mine, which contains only 4.19 acres, just the fifth of a full claim. It values this interest at \$100,000, which is equivalent to a total valuation of \$5,000,000 for the 4.19 acres. If the claim were a full one, it would be equivalent to a total valuation of \$25,000,000. The Minnie Healey is being worked by the Hypocka company and its product is treated in the smelter of the United Copper Company.

John D. Ryan, managing director for the Amalgamated, says that the company will equip the smelter of the Boston & Montana company for greater treatment capacity during the year. This plant is at Great Falls, 183 miles from Butte, and reduces all of the copper-silver ore produced at the mines of the Boston & Montana in Butte. More ore is being sent to it now than ever before. Amalgamated has been engaged in experimenting with Butte ores in its Washoe plant recently, and success has practically crowned its efforts.

The company is maintaining its average daily output of ore, about 10,000 tons.

The Butte Sampling Works, owned by George H. Casey, is receiving 2,000 tons of ore per month from various mines in the Butte district. This ore is shipped to the plant of the American Smelting & Refining Co. in East Helena.

The Alice company is working its mines on a larger scale than it has for years, the increase being the result of a demand from the Montana Zinc Co. for zinciferous ores. The output of the property is between 100 and 150 tons per day. An increase will be made in a short time.

Henry Knippenberg, of Indianapolis, president of the Hecla Mining Co., and manager of the property, has been in Montana since the first of the year, in the interest of the company. The property is located at Glendale, about 50 miles from Butte, and has yielded its shareholders \$2,250,000 in dividends. Last summer a portion of it was sold to satisfy a judgment, and the time for redemption will expire Aug. 4. Mr. Knippenberg says that after that date the company will be reorganized and open up eight or 10 claims on which no work has ever been done. He says, also, that he hopes to again make the property a dividend payer.

The Reins Copper Co. has resumed the extraction of copper-silver ore at its mine in East Butte. The product is rich in copper and silver. The 800-gal. pump is in place on the 800-ft. level, but is not yet in operation. The flow of water in the workings is heavy, averaging 450 gal. per minute. It is being handled by the old pumps.

At the Southern Cross gold mine, 45 miles west of Butte, the new concentrator is complete and will be placed in commission next week. It has a capacity of 60 tons per day. The ore averages \$25 per ton. The property is owned by the Southern Cross company, the majority of the stock in which is held by H. L. Frank, of Butte.

Machinery designed for raising the water from the workings of the Lexington property is being placed, but it will not be ready for work until the middle of March.

The Alex Scott mine, owned by James A. Murray, a Butte banker, and located near the West Colusa of the Boston & Montana company, is being worked under lease. It is opened to a depth of 800 ft., but has never yielded much rich ore.

The work of equipping the Mountain View with heavier hoisting machinery is progressing rapidly. This mine is one of the Boston & Montana company's large producers of copper-silver ore. The new plant will work to a depth of 3,000 feet.

**Bisbee. Jan. 20.**

The year's production of Calumet & Arizona was 31,700,000 lb. copper, and about \$200,000 in gold. The mine is now making copper at the rate of 2,650,000 lb. a month, and is selling it at about 15 cents. It is generally supposed that its costs are in the neighborhood of six cents a pound, including a large sum in construction expense. During the past few weeks discoveries at the Oliver shaft have been of the greatest importance, and on the 1,050 ft. level, as well as above and below, there is now blocked out a large tonnage of sulphide ores of exceedingly high grade. Some of these ores are running up to 40 and 45 per cent copper, in quantities. This is especially the case in drifts running from the shaft on the 1,050 ft. level. The Oliver is now being equipped for producing, but it is



not likely to make much in the way of tonnage for some time. It is now determined that there are in the Senator claims, where this shaft is located, as large bodies of ore as on the Irish Mag, which has been the sole producing shaft.

The Junction shaft is to be enlarged soon, and will be a large producer before another year. A drift running off to the east from this shaft, is along the contact and has been for some 500 ft. in leached ore, which is an indication of what may be shown at greater depth. The pumps for this shaft will be in operation in a month or less.

At Calumet & Pittsburg there has been no change other than that the main shaft is going down about five feet per week. At the Shattuck-Arizona shaft they made a record for sinking last week, by cutting out and timbering 40 ft. It is the management's hope that 140 ft. can be completed during a 30-day period. This is a three-compartment shaft and is in hard lime. The management expects to be in mineralized ground in a month or less, and already there are changed conditions underground that are considered very favorable.

Saginaw Development Co.'s shaft is now more than 600 ft. deep, and has been going down at the rate of 90 ft. per month recently. The bottom is in a lime formation, showing some copper stain and is considered exceedingly favorable. A diamond drill is at work 850 ft. southwest from the shaft, and is to go down about 1,000 ft., in order to show what is under the lime there.

The Huachuca Consolidated gold property, west of here, is to put in a 30-stamp mill, and expects it to be running this year. The company claims to have a large amount of ore blocked out, and that it is able to mine considerable tonnage daily, that will assay up to \$50 and higher per ton.

Recent floods at Clifton have been nearly as bad as anything known in the southwest, and the loss of life and property has been great. Water six feet deep swept through the smelters of the Arizona Copper Co., and it is expected the work of cleaning out debris and starting the plant will take several weeks. The tracks of the ore-carrying road from Morenci to Metcalf were washed out and it was several days before it could be repaired, and the concentrators of both the Arizona and Shannon copper companies are idle, because of lack of surplus bin capacity. The Shannon smelter has no converters and its matte has been blown up at the works of the Arizona company. All roads in the region, including that to Morenci, were covered by boulders and made impassable for teams.

Ore shipments from Bisbee mines to smelters at Douglas, now amount to about 2,500 tons a day, which is an increase of about 50 per cent over a year ago, and is far less than the amount soon to be sent there daily. The Copper Queen is sending daily, about 12 cars of ore to the Old Dominion smelter at Globe. This is a very large increase over the amount sent there up to a short time ago, as the operation of the new smelter has added to the requirements of this ore.

Copper Queen mine has closed its Holbrook shaft temporarily to instal new and heavier machinery, and is sending most of its product from the upper part of the district through its Czar.

Fee owners of the last of the claims bonded by the Mitchell Development Co., of Michigan, in the Huachucas, have taken action to oust the bonding company, and

have taken possession of the company's machinery and property. There were some 60 claims on which the company was to do development work, but refused in December to carry out the assessments then due. It has spent more than \$80,000 in the district, and is now without standing there.

#### Toronto. Jan. 20.

W. G. Miller, Provincial Geologist, is to deliver a series of lectures on 'Economic Geology' at the School of Mining, in connection with Queen's University, at Kingston.

A five-stamp mill with rock and ore crushers, has been installed in the machinery department of the new Chemistry and Mineralogy Building, of Toronto University. A supply of ore has also been obtained and students will now be in a position to make practical tests of mineral ores.

In accordance with a winding-up order issued by the High Court against the Manxman Gold Mining Co., the assets of the company are advertised for sale, by tender. These include the property known as the Manxman mine in the Michipicoten mining division, with buildings and plant. Tenders are received until Feb. 14.

Harold A. Richardson, of New York, has come to Winnipeg to establish a peat manufacturing industry, having purchased from Walter T. Griffin, patents for a peat excavating and compressing machine, taken out by the latter in 1904. It is claimed that this machine is free from the defects and imperfections of other plants in use. Mr. Richardson estimates that peat-fuel produced by his process can be supplied to Winnipeg consumers at \$5.50 per ton, and will compare favorably with anthracite. The unique feature of the process is that the expense to which peat companies have hitherto been put, in draining the bog before operating on it, is avoided. The machine is built entirely on a scow and peat taken at one end from the bog, by a series of buckets on endless chains, is dumped into a hopper, and in from 28 to 45 minutes comes out at the other end in the form of perfected briquettes. It is claimed that by avoiding the air-drying process, some of the best elements, usually lost, are retained in the peat. Each machine can take 500 tons of peat from the bog daily, and turn it into 100 tons of briquettes. A company will be organized in Winnipeg, but the details have not yet been decided upon. The machine was designed by Benjamin W. Tucker, of New York.

Construction work on the harbor of Glace Bay, N. S. will be re-commenced in April, in order to provide for the shipping of coal from that port. The Dominion Coal Co. is desirous of discontinuing sailing-vessel shipments from Sydney Harbor and confining them to Glace Bay, which will facilitate the handling of small orders from maritime province ports. Much delay has been occasioned in the past by the sailing craft engaged in the coast traffic having to give precedence to steamers in Sydney Harbor, which it is hoped to avoid.

The following companies have secured charters of incorporation under the laws of Ontario: Buffalo & Leamington Oil & Gas Co., Ltd., capital, \$100,000; head office Windsor; provisional directors, Edwin Wigle, of Leamington; Charles L. Meyer, of Pelee Township, and Lawrence J. Gemmell, of Perth.

Canadian Corundum Wheel Co., Ltd., capital, \$40,000; head office, Hamilton, to

manufacture corundum wheels and mine and manufacture emory, corundum and other abrasives; provisional directors, Levi Sherk, Harley E. Sherk, George F. Webb, Wm. Bell and Andrew S. Devine, all of Hamilton.

St. Mary's Quarries, Ltd., capital, \$200,000; head office, St. Mary's; provisional directors, Alex. Douglas, Theophilus T. Garner, and James W. Graham, all of St. Mary's; David Bonis, of Blanshard Township, and Alex. Calley, of Toronto.

The official returns of the output of the Dominion Iron & Steel Co.'s plant, at Sydney, N. S., during 1904, are as follows: pig iron, 96,601 tons; steel ingots, 62,842 tons; steel bloom slabs, etc., 54,673 tons; billets, 14,850 tons; wire rolls, 10,748 tons; tar, 1,650,153 gallons; sulphate of ammonia, 3,546,557 gallons; sulphuric acid, 2,631 tons. They used 385,000 tons of coal from which 170,000 tons of coke were made.

#### Victoria. Jan. 21.

*East Kootenay.*—The year has opened with the St. Eugene and North Star shipping silver, lead ore and concentrate; construction work at the Sullivan Group lead smelter at Marysville, well forward towards completion; the Crow's Nest Pass coal mines taking advantage of the increased facilities provided by the extension of a branch of the Great Northern railway to Fernie, this giving the Coal Creek colliery an outlet to Washington, Idaho and Montana for its coal and coke products, and several smaller mines and associated enterprises being operated, so that the outlook for the year is a favorable one.

*Ainsworth.*—Development work is being pushed at the Highland mine, at Ainsworth. Up the south fork of Kaslo creek the concentrating mill at the Cork mine is nearly completed, and the Province and Bismark mines are being steadily developed. Near Bear lake, the Lucky Jim is shipping zinc and silver lead ores and has lately paid its owner a good dividend out of the proceeds of the sale of 2,000 tons of zinc ore, made late in December.

*Slocan.*—Negotiations have been proceeding lately for the sale of about 2,500 tons of zinc ore and concentrate produced at the Slocan Star mine. Recent additions to equipment at the concentrating mill of this mine include four Wilfley tables, four 6-ft. Frue vanners, six 4-compartment jigs, a trommel system, and other plant, the whole having involved an outlay of about \$15,000. The Rambler-Cariboo Mines, Ltd., is increasing its capital to provide money for completing the 4,300-ft. adit now being driven with the object of cutting the vein at a depth of 1,400 ft., or 600 ft. below the main shaft of the mine, now down 800 ft. The estimated cost of this work is about \$60,000. The adit is already in about 1,500 ft. The revised figures showing the output of the silver mines of the Slocan City mining division in 1904 have been published. The total production is placed at 2,375 tons of a gross value of about \$200,000. More than half this ore was produced by the Ottawa mine, owned in Pittsburg, Pa.

*Rossland.*—It is stated that provision has been made for the payment of the liabilities of the Giant mine, other than debentures held in England, and that an application is to be made to the courts to stay the liquidation proceedings ordered several months since. A change in the general managership of the Centre Star and War Eagle mines has taken place, Jas. Cronin, a director of both companies, hav-

ing been appointed general manager to succeed E. B. Kirby, whose resignation was recently accepted by the directorate. Ore shipments from eight Rossland mines totalled about 13,000 tons for the first fortnight of the new year. The principal shippers were Le Roi, Center Star, War Eagle and Velvet-Portland. The Spitzee has resumed work after a short suspension. It is intended to do about 1,000 ft. more development in this line, and install a larger hoisting engine, before entering on a regular monthly output of ore.

Monterey. Jan. 18.

A new company reported formed in London, for operating in Mexico, is called the Mexico Silver & Lead Mines Co., Ltd., with a capital of £500,000. It is said to have a sweeping concession, covering mining, smelting, farming and a general promoting business. Who are behind the enterprise is not yet given out.

In Chihuahua, W. C. Greene is pushing his plans in connection with the recently purchased Sierra Madre & Pacific railroad, and has organized under the laws of Connecticut, with a \$15,000,000 gold capital, the Sierra Madre Land & Lumber Co., which will open up the land, held along the line of railroad, and establish sawmills at the new town of Deidrick, with the principal object of furnishing timber to meet the enormous demands of the Cananea Copper Co., of Sonora, and other properties in Arizona, estimated at about \$10,000,000 per month. It is quite possible that the old Federal smelter at Juarez may be rebuilt as the mining lands are opened up and developed along the road. It will be the endeavor of Col. Greene, to make it the greatest industrial enterprise in Mexico. He will be assisted by liberal concessions from the Chihuahua government. The State has offered a bonus of \$10,000 and exemption from taxation for 10 years, to the first bona fide discovery of petroleum in commercial quantities, within its borders. In Parral, A. L. Rossen is negotiating with W. R. Dickenson and A. Hattenback, of Los Angeles, for the sale of his Maria mine. The Capuzaya, on which work has been more actively carried on, since the visit of the president, Eugene Davis, last month, is down 350 ft. with the new shaft, and is drifting on the 200-ft. level, to connect with the old workings, where it is believed that the vein of the famous Palmilla mine, of Pedro Alvarado, has been found.

In Durango the holdings of the American Mexico Mining & Development Co., at Velardeña, were visited last week by W. A. Arens, M. B. Spayd, and other members of the advisory board from Chicago, together with W. S. Dillon, the general manager, and it was definitely decided that as soon as the present smelting plant, a McDonald pyritic of 160 tons capacity, is completed and blown in, which is expected to occur about March 1, plans would be inaugurated for increasing to 500 tons, in order to be in a position to handle the custom work of the district. It is understood that the sale of the holdings of Otto Wahrenund and Matt Dahlgren, in the Velardeña district, which included the Jimulco Mining Co., at Jimulco, Coahuila, to Boston and New York people, at \$1,000,000 gold, has fallen through, because of some demands of the Eastern people. Other enterprises contemplated are the building of a 1,200 h.p. storage battery plant for the Peñoles Mining Co., at Mapimi; the erection of a 50-ton lixiviation plant by Ed. Williams,

at La Parrilla or Vacas; and the extension of the Coahuila & Pacific railroad from Torreon to Durango, in addition to its proposed branch from Saltillo to Monterey.

London. Jan. 14.

A very unusual action at law has been brought in the British courts by the Risdon Iron Works, of San Francisco, against Sir Christopher Furness, with the object of making him pay his share of the debts of the Copper King, Ltd., a British company, in which he is the largest individual shareholder. It comes as a surprise to Englishmen to find that under the laws of California there is no such thing as limited liability of shareholders, and that, consequently, individual members are liable for their proportion of the debts of the company. As is well known, the Copper King, Ltd., which owned the mine in Fresno county, Cal., came to grief recently, owing money in several directions, among others to the Risdon Iron Works, for machinery and plant. As the Risdon company could not hope to get anything out of the Copper King, Ltd., they decided to tackle the chief shareholder. The action could not be brought in the California courts, as Sir Christopher was out of its jurisdiction, so it had to be brought in London. The plaintiff's argument was that, though the Copper King, Ltd., was a British corporation, it had complied with all the necessary formalities required by the California laws relating to foreign corporations desirous of doing business in the State, and that, as a member of the social and business community, it was necessarily subject to the laws of the State. The English judge ruled that, though the company could be sued in California according to California laws, yet in suing in an English court the English laws would have to be the basis of all litigation. It is probable that the plaintiffs will appeal, and get the opinion of the higher court.

While writing on this subject, I ought to mention that people in California have an entirely wrong impression with regard to Sir Christopher Furness, and appear to look at him as the villain of the Copper King. As a matter of fact, he is the chief victim in the tragedy, and has lost a small fortune over it. The company was formed just five years ago by Frank Gardner and Davison Dalziel (the latter is the head of Dalziel's News Agency). Each of them received 125,000 £1 shares, as purchase price. An inspection of the share registers shows that they were steadily parting with their shares until the company came to grief. At that time Mr. Dalziel had parted with practically all his shares, and Mr. Gardner with three-quarters of his. All this time Sir Christopher had been buying shares in the open market, at advanced prices. We will not take the trouble of speculating whether he knew that they were vendors' shares that he was absorbing. Anyway, he was buying on the express recommendation of Messrs. Gardner and Dalziel. These gentlemen had rendered services to him in connection with the reorganization and consolidation of various coal, iron, engineering and shipping businesses in the north of England; and as a sort of *quid pro quo* he went in with them in mining schemes. He also invested largely in the shares of Great Boulder Perseverance, of which Mr. Gardner was controller, and has been a heavy loser owing to the recent collapse of the company. I think I have said enough to show that it is very hard lines on Sir Christopher to be held responsible by California law for the debts of a company over which he has lost so much money.

Perth. Dec. 19.

*Kalgoorlie.*—The Ivanhoe is opening up well at the 500-ft. level, where the Boulder lode is yielding high-grade ore for a length of 250 ft.; latest assays being 25 dwt. per ton. Other points are are looking well to the Great Boulder. Average assays of the ore from the main lode, 1,900-ft. level, is about 15 dwt. per ton, for a width of 12 feet. Lake View Consols, November returns, show a profit of £13,622. Working costs averaged 28s. 7d. per ton. So far the sum of £22,235—out of the balance of profit and loss account carried forward from June 30, 1903, has been expended on new plant—leaving a balance in hand on Nov. 30, of £31,699.

Another surprise has taken place in the removal of Mr. Gleisberg from the management of the Associated, by the visiting director, Mr. P. Ledoux. It is said the late manager's estimates of ore reserves are found to be much over the mark, and that the discrepancy is £180,000 in value.

Very satisfactory developments continue in the northern parts of Kalgoorlie belt, and promise to add soon to the payable area of leases. At the southern end also, some good discoveries are coming to light. A good crushing has been obtained from a lease adjoining Boulder Deep levels.

The Princess Royal group of mines, at Norseman, are opening up very satisfactorily. The Central mine main shaft is down to 639 ft., and will shortly reach the main lode. The Cumberland mine has crushed for November, 525 tons, for a yield of 763 oz. of gold.

At Kookynie, the Cosmopolitan working costs for November, were 13s. 5d. per ton. 8,306 tons crushed for 3,038 oz. fine gold.

The Davyhurst district is receiving much attention; the Golden Pole continues its good returns and monthly dividends. Shares are being dealt in largely at higher figures. The Westralia-Waihi mine is erecting its battery, and should shortly make good returns.

In Muchison the Great Fingall Consolidated's November output was 14,236 tons, yielding 13,542 oz. gold. The Great Fingall Associated, main shaft, is down 210 ft. The purchase of the Salisbury mine has been completed at a satisfactory figure.

The Undaunted, at Black Range, has crushed 132 tons for 160 oz. At Meckatharra, the recent rich find has yielded the prospectors 1,171 oz. gold, from a parcel of 15 tons crushed, besides a quantity of gold obtained by dollying, etc.

The mines department has issued a report by its geologist, on the Great Northwest fields. This vast country is still almost unknown, except to a few adventurous men, owing to the difficulties of transport, and great want of fuel. In spite of difficulties, the Pilbarra goldfield alone, has produced 185,886 oz. of gold and tin, to the value of £92,984. The known area containing tin is about 900 square miles. Deposits of iron, copper, etc., are also known to exist.

At Nullagine are the large banket formations, owned by the British Exploration Company of Australasia. It is hoped that the proposed railway may soon be arranged for. The survey is now completed.

A healthy tone is noticeable in Perth mining circles, and many local syndicates and companies are being formed.

### The United Mine Workers' Convention.

The 16th annual national convention of the United Mine Workers opened January 16 at Indianapolis. Six hundred delegates were present, which is a little over half the number that usually attends a national convention. President John Mitchell, in his annual address, counseled the miners to prepare their organizations, and especially their treasury for a crisis that may arise in the anthracite and bituminous districts at the expiration of the strike commission awards and the two-year bituminous district contract on April 1, 1906. He spoke of the two-year settlement made last April and declared that no one familiar with industrial conditions that have since prevailed would undertake to say that the settlement was not the best obtainable under the circumstances, and that the union had gained by having agreed to the compromise.

According to the secretary's report the membership has materially decreased during the year. There are 25 districts, 11 of which show an increase of 21,516, while the other 14 show a decrease of 46,415, a net decrease of 24,900. This is said to be due to irregular work and the demoralization of the coal trade. Many mines were closed down and the members dropped out when forced to seek other employment. Particularly was this true in the anthracite region, where there has been a lack of interest on the part of the mine workers. President Mitchell reviewed the result of the numerous strikes during the year and said that "in no other year since our organization begun have there been so many men continuously on strike, and at no previous time, except in 1902, have we been compelled to expend so much money in support and maintenance of those involved as in the year just closed."

Mr. Mitchell advised against child labor and referred to the improved conditions of the American miner and his family by reason of better sanitary conditions, moral and educational advancements, largely due to the standard insisted upon by the union. He closed his address with an appeal to the local unions to prepare for war in time of peace; to strengthen their membership and especially their treasury, and make adequate preparation for the next interstate convention so as to be able to resist any attempts to reduce wages in the outlying districts or any efforts to weaken the strength and influence of the union. The convention held two sessions each day and much of the time was taken up with discussions of resolutions, grievances and appeals, constitution, railroad transportation and officers' reports. When Treasurer Wilson reported that there was a deficit for 1904—the income being \$851,773 and the expenditures \$1,354,019—the members were astonished. There was paid out in relief to strikers during the year \$1,067,300, of which \$437,575 went into the Colorado strike district.

The two days' conference of the commissioners and secretaries of the bituminous operators' associations was held Jan. 19 and 20. Preliminary steps were taken to organize a joint movement between the miners and operators, for which plans will be presented to the former within a few months. The conference adjourned to meet in Chicago in April, when the operators hope to perfect their plans and get them ready to present to the miners' representatives. The interstate district disputes may be given up to an umpire for settlement. The convention adjourned on Jan. 23, with the election of officers.

### Personal.

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

Mr. S. Herbert Cox, of London, is in Italy.

Mr. Gardner F. Williams is at Washington.

Mr. Arthur Thomas has returned to Suakim, Egypt.

Mr. N. C. Bonnevie is in Virginia, on professional business.

Mr. H. J. Thompson is in Mexico on professional business.

Mr. D. W. Brunton has returned from New York to Denver.

Mr. Edwin C. Homersam has returned to London, from Egypt.

Mr. Eugene Coste is investigating a coal oil property in California.

Mr. Theo. F. Van Wagenen is expected in London, from Rhodesia.

Mr. C. W. Purington has left Washington on his return to Denver.

Mr. W. S. Lecky sailed for London by the *New York* on January 21.

Mr. Frederick H. Minard, of Denver, has been recently in New York.

Mr. T. J. Holmes has returned to Colorado, from a trip to Mexico.

Mr. W. E. Defty, of Phoenix, Arizona, will be in Mexico during February.

Mr. A. D. Maloy is investigating mining properties near Parral, Mexico.

Mr. Frank Nicholson, of Joplin, has been buying machinery in New York.

Mr. W. J. Cartan, of Oaxaca, Mexico, has returned from a trip to New York.

Mr. Edwin Packard, of New York, will return from New Orleans on January 27.

Mr. T. Wain-Morgan Draper, of San Francisco, was in New York for a few days.

Mr. Wallace A. Stephens, of Henry Wood & Co., Denver, has been in New York.

Mr. Walter F. Ferrier passed through New York on his way from Idaho to Mexico.

Mr. B. B. Thayer, assistant to the president of the Amalgamated Copper Co., is in Montana.

Mr. William Orr is general manager for the Gold & Silver Extraction Company of America, Ltd.

Mr. S. S. Arentz is superintendent of the Black Rock Mining Co., Constellation, Arizona.

Mr. E. A. H. Tays has returned to Mazatlan, after a two months' trip to the west coast of Mexico.

Mr. William Thompson is now manager for the Waterson Gold Mines, Ltd., at Ocambo, Mexico.

Mr. Edward Hooper has been appointed consulting engineer to the Great Boulder Perseverance mine.

Mr. J. D. Audley Smith has been appointed general manager of the Queensland Copper Co., Ltd.

Mr. F. J. Enderle, of the Rey de Cobre mines, Mapimi, Mexico, is visiting at Burlington, Iowa.

Mr. Henry M. Crowther, general manager of the Mines & Smelters Corporation, of Utah, is in New York.

Mr. W. R. Rust, general manager for the Tacoma Smelting Co., in Tacoma, Wash., was recently in Denver.

Mr. William Sauntry of the Yaqui Copper Co., of New York, is at the company's mines at Sonora, Mexico.

Mr. E. R. Bush has been examining the property of the Philadelphia & Arizona Mining Co., at Chloride, Arizona.

Mr. James V. Dignowity, who is operating near Parral, in Chihuahua, Mexico, has returned thither from New York.

Mr. F. V. Bodfish has returned to Denver from Socorro county, N. M., where he has been engaged on professional business.

Mr. James James, of Chicago, has been at Salt Lake City. He has recently returned from professional work in Mexico.

Mr. Fred W. Atkinson has been chosen president of the Brooklyn Polytechnic Institute. He is a graduate of Harvard University.

Mr. Harry Simons has been appointed superintendent of the Reforma mine and smelter plant at Campo Marado, Guerrero, Mexico.

Mr. John Gross has been appointed superintendent of the mill of the Horse-shoe Mining Co., at Deadwood, South Dakota.

Mr. James T. Hollow, recently manager of Oroya-Brownhill in Western Australia, is going to South Africa to manage mines at Barberton.

Sir Sandford Fleming has been elected president of board of directors of the International Portland Cement Co., of Ottawa, Canada.

Mr. Richard B. Stanford, of Columbia, California, was in New York last week, to attend the annual meeting of the Ranch Mining Company.

Mr. Winthrop W. Fisk, of Boston, Mass., has gone to Sinaloa, Mexico, to install a 10-stamp mill for the Oro Fino Mining Company.

Mr. James McEvoy, formerly chief geologist for the Crow's Nest Pass Coal Co., has been appointed land commissioner for that company.

Mr. Fred C. Alley, formerly with the Guanacevi Mining Co., in Mexico, is now with the Bacis Gold & Silver Mines, Ltd., at Sapioris, Mexico.

Mr. T. A. Rickard sails for London by the *Campania* on January 28, to preside at the annual dinner of the alumni of the Royal School of Mines, on February 9.

Mr. W. E. H. Carter has resigned as secretary and inspector of the Ontario Bureau of Mines, to engage in business with the firm of E. T. Carter & Co., of Toronto.

Mr. F. M. Simonds and Mr. E. Z. Burns, of the firm of Simonds & Wainwright, New York City, started this week on an examination of coal properties in Colorado. They expect to be absent several weeks.

Mr. E. Jacobs has become managing editor of the *British Columbia Mining Record* to succeed Mr. H. Mortimer Lamb, who has resigned. Mr. Jacobs is an experienced journalist and has a wide knowledge of mining matters in British Columbia.

Mr. Jesse Simmons has become managing editor of the *Black Hills Mining Review*. The *Review* has assumed a new and handsome dress, and gives evidence of a commendable intention to be a high-class journal.

Mr. H. Mortimer Lamb has resigned as managing editor of the *British Columbia Mining Record*, in which position he has served for about seven years. Mr. Lamb has rendered valuable service to the *Record*, and to the mining interests of British Columbia. His resignation will be sincerely regretted.

**Obituary.**

George S. Lee, a mining engineer, died at Middletown, N. Y., Jan. 13.

A. A. Heim, a pioneer coal operator of the Shamokin region, Pennsylvania, died on Jan. 13, aged 76 years. In 1855 he began the business of constructing coal breakers, of which he built and operated many.

J. K. Mackenzie, of Chicago, a well-known mining engineer, has been killed by Indians near Hermosillo in the State of Sonora, Mexico. He was inspecting mines in that vicinity. Mr. Mackenzie was 42 years of age, and a graduate of the Sheffield Scientific School.

Jacob Ridgway Wright of Wilkes-Barre, Pa., died from a pistol wound at the Imperial Hotel, Jan. 20, aged 50 years. He was the owner of coal lands and mines in Pennsylvania. Mr. Wright was a graduate of Princeton College. He was a prominent figure in the anthracite coal strike of 1898 as the organizer of the Citizens' Alliance.

Robert Weir, who for many years was consulting engineer of the Union Subway Construction Co. of New York, is dead in Montclair, N. J., aged 69 years. Mr. Weir was born at West Point, N. Y., and was the son of Prof. Robert Walter Weir of the United States Military Academy. For a number of years he was associated with the construction department of the Croton Water Works.

**Societies and Technical Schools.**

*Colorado School of Mines.*—A carload of gifts consisting of machinery and ore has been received by this institution at Golden, for the new technical museum, from the St. Louis exposition. The gifts were all exhibits at the fair and were secured by the School of Mines as models for the students to experiment with. Seven tons of valuable specimens are coming from all over the country. The gifts of machinery include gas and gasoline furnaces, fans, testing trays, engines and machinery of that nature.

**Trade Catalogues.**

The Stanley Electric Manufacturing Co. of Pittsfield, Mass., in its bulletin No. 142, describes single-phase induction motors, including the repulsion motors, condenser motors, and hand-starting motors.

Catalogue No. 17, issued by the H. D. Crippen Manufacturing Co., of New York, describes, with illustrations, the Jackson hand-power rock drill. The catalogue contains testimonials from many of those who have used this drill with satisfactory results.

A beautiful example of catalogue making is 'Record of Recent Construction No. 49,' issued by the Baldwin Locomotive Works, of Philadelphia. There are excellent photographs of many of the most remarkable engines recently made by this company, with detailed descriptions.

The Midvale Steel Co., of San Francisco, has issued a catalogue of mining wearing parts and smelter castings. It illustrates, in a comprehensive way, some of the more important steel wearing parts in general use in mines and smelters, which the company manufactures.

Volume No. 1 of *Air Power* to be published quarterly by the Rand Drill Co., of New York, has been received. It contains much interesting information about important operations on which the Rand drills have been used, as well as articles of a more general nature bearing upon rock drills. It is handsomely illustrated.

**Industrial.**

The Mine & Smelter Supply Co., through its New York office, has received orders from El Cobre mines for 24 Wilfley tables and 6 Wilfley slimers for its works at Santiago de Cuba.

The S. H. Harmon Lumber Co., of San Francisco, has completed and shipped a set of 11 tanks 30 by 12 in. and also some smaller tanks to the Charles Butters Syndicate at Mazatlan, Mexico. This syndicate has one of the largest cyanide plants in operation. John Ainsworth is the manager of the tank department for the above firm.

The Broderick & Bascom Rope Co., of St. Louis, Mo., received five highest awards at the Louisiana Purchase Exposition, including a grand prize for wire ropes in the Mines and Metallurgy Building; grand prize for wire ropes in the Manufacturers' Building; grand prize for underground wire rope haulage. This company was the only one to receive such a prize and has a letter from the official award ribbon committee, advising it of this fact.

Following are the newly elected officers of the Bethlehem Steel Corporation, the successor of the United States Shipbuilding Co.: President, Charles M. Schwab; vice-president, Edward M. McIlvain; treasurer, Henry S. Snyder; assistant treasurer, John A. McGregor; comptroller, B. H. Jones. The directors chosen include the following: Charles M. Schwab, chairman; George R. Sheldon, Thomas F. Ryan, Pliny Fisk, John E. Borne, C. W. Wetmore, Oliver Wren, Archibald Johnston and Edward M. McIlvain.

Messrs. Adam Cook's Sons, of New York City, the makers of Albany grease, recently received a letter from Geo. Burroughs, chief engineer of the New York State Reformatory, at Elmira, in which he states: "We are regular users of your Albany grease, and there is hardly a month passes by that it is not placed on my regular estimate. I consider Albany grease has excellent lubricating qualities." Geo. S. Smith, Baldwin, N. Y., states: "The grease and cup sent for trial worked satisfactorily in every respect. I purchased some of your compound and have used it ever since on all the bearings."

The Westinghouse Electric & Manufacturing Co. has sold to the Detroit United Railway Company, of Detroit, Mich., a 1,500-kw. railway generator, and a 250-kw. booster set. These machines are in addition to four other large railway generators of an aggregate capacity of 5,000 kw. which the Westinghouse company has already installed for the Detroit company. Other street railway contracts just closed by the Westinghouse Company include fifty four-motor car equipments, to be used by the Cleveland Electric Railway Company, of Cleveland, Ohio, for city and suburban service. The motors will be of the new Westinghouse type, No. 101-B.

The United Coke & Gas Co. announces that the lease of its by-product coke-oven business to the Semet-Solvay Co., of Syracuse, N. Y., has terminated. This puts The United Coke & Gas Co. in its former position of exploiting by-product coke-ovens of the Otto-Hoffman and United Otto types. The great number of these ovens now in operation or contracted for (2,603 ovens in the United States and Canada), demonstrates that the by-product recovery in the manufacture of coke is now permanently established. The American Coal Products Co., of New York, will continue to act as selling agent for the tar

and ammonia produced by both the United-Otto and Semet-Solvay ovens.

The growth of the modern system of heating by a forced circulation of warm air, presents an interesting example of the influence of commercial practicability upon the introduction of a given method or system. For fully a century prior to 1870, various means—many of them extremely crude—had been adopted for forcing heated air through pipes from a central heater, and thereby warming distant apartments. In the period from 1848 to 1870, large fans moving air over steam-heated surfaces, were introduced here and there in large buildings such as hospitals and asylums. But such applications were distinctly limited, because both fan and heater had to be specially designed and constructed for the work. It was not until 1869 that such a heating apparatus became commercially practicable. At that time B. F. Sturtevant, of Boston, Mass., having been for some years engaged in the manufacture of fan blowers, conceived the idea of attaching a small tubular heater, through which air was drawn and heated, and forced by the fan to the distant points. The entire arrangement was compact, portable, and easily applied, particularly to small apartments. Large installations, however, required a sectional type of heater, and in course of time there was evolved the present type of Sturtevant heater, consisting of a series of cast-iron sections, into which a system of steel pipes are screwed, and through which the steam circulated. The sections, made in quantity in standard sizes, are grouped to conform with the requirements, and connected to the fan in such a manner as to insure its most efficient action. Without some such simple and marketable arrangement, it is doubtful if even to this day the benefits of mechanical ventilation and heating would have been realized. As it is, however, no large building is to-day considered complete unless thus equipped with a system that both ventilates and heats.

Queen & Co., Inc., of Philadelphia, the makers of scientific appliances, have, to meet the increased demands of their business, removed their instrument factory from Filbert street, to the spacious Cornelius Building, 817-831 Cherry street. This move supplies the greater space and improved facilities required at the present time. The improvement distinguishing the new 'Queen' explorers' transit, made by this firm which is especially adapted for preliminary surveying in connection with locating railroads and mining operations in rough country, is reduction in size and weight while retaining all the advantages of the Queen City and Bridge transit. It is the smallest complete transit made. It measures, over all, eight inches high, the outer diameter of the horizontal limb is four and one-quarter inches. Transit and tripod complete, weigh 11 lb. The achromatic telescope is six and a half inches long and has power of 18 diameters; it is fitted with dust cover to draw tube. Fixed Stadia wires; ground and graduated level, mounted under telescope, two and three-quarter inch vertical circle, graduated to half degrees on solid silver, and reading by vernier to single minutes; horizontal circle three and a half inches diameter, graduated to half degrees on solid silver, reading by double verniers to single minutes, the graduations on the circle are figured in two rows, from 0 to 360° in opposite directions. The shifting plate tripod head makes it possible at all times, to center over plumb bob. The accuracy of Queen & Co.'s City and bridge transit is reproduced in this instrument with the great reduction of weight and size.

## General Mining News.

## ARIZONA.

## COCHISE COUNTY.

*Grayson Mining Co.*—A good strike on the property of this company owning the Gold Nugget claims is reported. A 10-stamp mill has been ordered.

*Wolverine & Arizona Development Co.*—The directors of this company have decided to reorganize the company as the Wolverine & Arizona Mining Co., the functions of the development company having ceased to be material. The work which has already been performed is said to have revealed a formation identical with the proven properties of the Bisbee district. The capitalization of the new company is \$3,000,000 divided into 200,000 shares of the par value of \$15 each.

*Paradise.*—The first of the year has witnessed a number of important deals and much work in this district. The Chiricahua Development Co. has cut through 70 ft. of commercial ore, the base of which is metamorphosed lime, heavily impregnated with chalcopryrite of copper and iron pyrites. A depth in this shaft of 400 ft. on the incline has been reached, and having proven this ore body in this portion of the mine, it is now sinking vertically and will tap the orebody at about the 500-ft. level. At the Cochise Consolidated Copper Co. work is progressing well, and fast; 50 men at work, three shafts and an adit are being driven. This adit, which will be about 400 ft. long, is to cut the zinc vein at a depth of about 300 ft. Mr. James, the manager, reports all going well and development showing much better results than anticipated at this time. Mr. Harry Alexander, the president of the company, has been at the mine for the past two weeks.

At the Savage Mining Co.'s property, at the extreme eastern end of the ore zone of this district, work is being pushed. The company is operating under the management of Mr. Lewindowsky.

Mr. Johnson is surveying a townsite about two miles east of Paradise, on what is known as Chiricahua Flat. He reports that his work is the advance of a railroad from Rodeo to Paradise, to connect with the El Paso & Southwestern railroad. At the Scanlon property, at a depth in of about 75 ft., an orebody that extends as far as exposed, has been struck, five feet across the bottom of the shaft. The extent has not been determined. The ore is in blue lime and is a heavy chalcopryrite. Its value is stated as 16 per cent. copper, some silver and some gold.

C. S. McHenry, former superintendent of the Greene Consolidated Mining Co., at Cananea, has been a visitor in camp for several days, looking over some property with a view of becoming interested in them. William G. Rice, of Houghton, Mich., to whom S. S. Badger sold the Rieder group, has since bonded the Smith group of eight claims, making 19 claims in his ground, the Smith ground adjoining the Rieder. He has agreed to start work on the property within 60 days, and is now in the East completing his arrangements. At the Copperopolis group, the Duluth & Chiricahua Development Co. has seven men at work completing their assessment work, and it reports that as soon as arrangements are completed, that it will start work on the property. At the Sullivan group the company has completed its assessment work and paid for the property according to contract.

At the Leadville, operations have ceased

for the present. The company has an abundance of \$25 per ton lead-silver ore, but reports that the El Paso Smelter allowed them so little for its product that it has been decided to close down for a time.

## GRAHAM COUNTY.

*Arizona Copper Co.*—The directors state that they have recently received advices from Clifton, which entitle them to expect that, owing to improvements in concentrating plant and recent developments in the mines, the output of copper will be materially increased after May 1 of the present year.

*Shannon Copper Co.*—It is feared that the operations of this company may be retarded for some weeks by prevalent floods.

*Arizona Copper Co.*—This company has recently installed a new Hancock jig, which is also a concentrator, taking the place of 35 Frue vanners. The company now has two of these jigs in operation, and very satisfactory results are reported. The two machines are now handling 600 tons of ore per day, but their capacity is greater than that amount.

## PINAL COUNTY.

*Lake Superior & Arizona.*—A good strike is reported on this company's property on Superior. The ore-body was found in the Carleton tunnel, 320 ft. below the outcrop.

*El Dorado Mining Co.*—Good ore is reported found on this company's property near Dudleyville. Values in gold, silver, copper and lead are found.

## YAVAPAI COUNTY.

*Copper Basin.*—A discovery of mercury is reported at this place. The ore is in the form of red sulphide of mercury or cinnabar.

*United Verde Copper Co.*—The Supreme Court of the United States has decided the case of the United States against this company, which was a proceeding to recover \$38,000 on account of timber cut from the public lands and used in roasting ore, in favor of the defendant. A regulation of the Interior Department directed that timber should not be used for smelting purposes, whereas the law authorizes miners to cut public timber for "domestic purposes." The opinion was by Justice McKenna, who held that the words "domestic purposes" included the roasting of ore and that the mining company was entitled to cut timber on the public land for that purpose. He also held that the secretary had no authority to promulgate a regulation extending the scope of the law, as would be the effect in this case, if ore roasting was to be construed as ore smelting.

*Treadwell.*—The smelting plant on this property at Mayer has been blown in. It has a capacity of 250 tons daily, and will be used to treat the company's ores.

## YUMA COUNTY.

*War Eagle.*—A strike of unusually good ore is reported on this company's property.

## CALIFORNIA.

## AMADOR COUNTY.

*Argonaut Mining Co.*—The 40-stamp mill of this property, at Jackson, has started up after a long period of idleness, due to litigation.

*Wildman-Mahoney Mining Co.*—Ten stamps of the Wildman mill have been started on ore from the 1,400-ft. level.

*South Eureka Mining Co.*—The new 20-stamp mill of this mine, to take the place of the old one of similar capacity, has been completed.

*Empire.*—From this mine, Murphy's Gulch, R. S. Green superintendent, good ore is being taken out, some of it running up to thousands per ton in value. No very large quantity is being mined, however.

## CALAVERAS COUNTY.

*Nelson Contracting Co.*—The hydraulic mine of this company near Calaveritas, has started piping with plenty of water. The ditches and reservoirs have all been enlarged and improved.

*Mahala.*—At this mine, Rich Gulch, a 4-ft. vein of ribbon quartz, showing free gold and sulphurets, has been encountered.

*Casinelli.*—Mr. Taylor, who has a bond on this gravel mine near North Branch, will actively develop the property.

*Barnasconi.*—This mine at Fourth Crossing is being equipped with a hoisting plant.

## INYO COUNTY.

*Darwin and Coso.*—A new company has located a group of claims near the Lane mine and is taking out ore for shipment. Power drills are being installed at Coso to more thoroughly prospect the claims.

## NEVADA COUNTY.

*Union Consolidated Mining Co.*—The pumping rig is nearly completed at this mine, and the work of deepening the shaft will shortly begin.

## RIVERSIDE COUNTY.

*Fano.*—Work has been resumed at this gem property 10 miles from Thomas. There are 12 claims in the group. Tourmalines, green beryl and spodumene are found.

## PLACER COUNTY.

*Three Stars-Almont.*—Superintendent Hartley is considering the advisability of doubling the milling capacity of these mines at Ophir.

*Buckeye.*—At this mine, Forest Hill, a Huntington mill is to be put in and the force of men is to be increased.

## SAN DIEGO COUNTY.

*Amblygonite.*—Captain Farnsworth, of San Diego, has discovered, in Grapevine district, a large deposit of this ore.

*Stonewall Mining Co.*—Two new shafts have been started on this property at Cuyamaca, one of them being of three compartments. A new hoist is being put in place.

## SAN BERNARDINO COUNTY.

*Ord.*—In this district, 35 miles east of Victor, the Elsie, Clara, Helen, Chip and Dickey Bird mines, are to be extensively developed, a large body of ore having been found on the 200-ft. level of the Elsie.

## SHASTA COUNTY.

*Mountain Copper Co.*—All five of the McDougall roasters are now in operation, some of them having been closed down for months. At present the smelters at Keswick are engaged in working ore from Tonopah, Nevada.

*Bully Hill Mining Co.*—A new orebody has been encountered in the lowest level of this property at Winthrop.

*Gladstone.*—At this mine, owned by Hazel Mining Co., French Gulch, 125 men are now regularly employed. The company now runs its own electric generating plant.

## TRINITY COUNTY.

Within the past few months a number of tracts of land along the Trinity river have been bonded for dredging purposes, and are being prospected with drills.

*Yellow Rose Mining Co.*—The lower tunnel, now in 1,200 ft. is supposed to be within 40 ft. of where they expect to strike the rich shoot of ore found on the upper levels.

## TUOLUMNE COUNTY.

*Bell.*—At this mine, Tutletown, unwatering is in progress and the machinery is being overhauled.

*Golden Gate.*—The new company which has taken hold of this property will soon resume operations, and extensive development work is to be done.

*Omega.*—Much surface work is being done on this mine, getting ready for the buildings and hoist. Work on the new shaft is to commence this month.

## VENTURA COUNTY.

*Frazier.*—This company is considering the advisability of shipping its borax from Lancaster in future, instead of from Bakersfield.

## COLORADO.

## CLEAR CREEK COUNTY.

*Pittsburg Mining, Milling & Transportation Co.*—This company, owning the Brighton group at Freeland, the Dover group on Fall river, are carrying on extensive operations at its Brighton group and is opening up bodies of medium grade ores. It will soon ask for bids for erecting a concentrating mill on its own mill site at the junction of Fall river and Clear creek. David Ellis, Idaho Springs, is manager of the Pennsylvanians' interests.

*Little Mattie.*—Developments have been kept up on this property and the workings show large bodies of low-grade ores as well as some high-grade ores. Extensive improvements have been made in the shape of equipment. The mine hoists, drills, etc., are driven by compressed air generated at the mill on the creek, the power plant being one of the largest and best arranged in the county. A tramway is to be installed to convey the product from the mines to the mill by gravity system and the property is expected to make a large showing in 1905. W. S. Leebrick, Idaho Springs, is manager.

*Ward.*—This property will be started up in a few days after a shut down on account of improvements. Electric power for running the mill, the mine hoist, drills and pumps have been installed. Ten new stamps have been added to the mill and it is as automatic as it can be made. Leaching tanks have been installed and the cyanide process will be carried out and contracts are being let for new buildings for the latter process.

*Morning Star.*—This property in Georgia gulch is being equipped with a gasoline hoisting plant and arrangements are being made to sink the shaft a further depth of 200 ft. Eastern capitalists have recently become interested. C. O. D. Halverson, Idaho Springs, is in charge of operations.

*United Gold Mining Co.*—This company is driving a tunnel to its holdings on Bellevue mountain from Fall river and is installing an air compressor at its mill. Water power is to be used for operating the new plant.

## GILPIN COUNTY.

Mining districts in the northern part of the county are being revived by the com-

pletion of the Moffat road. Shipments and developments have been retarded on account of remoteness from shipping points, but they now promise to furnish employment to a large number of miners as well as millmen in the early future, and a large amount of new machinery both for mines and mills, is talked of for this year. A movement is well under way for the erection of a custom milling plant of either 50 or 100 tons capacity at Rollinsville, with Iowa capital behind the enterprise, and in all probabilities other plants will be erected along South Boulder creek within the next year or so.

*Gold Dirt.*—At this property, large orebodies have been blocked out, and sinking is being carried on and preparations are under way for erecting a 100-ton plant of the cyanide process in Gambell gulch, to be running by April 1. J. R. Anderson Perigo, Colo., is manager.

*Twolon Mining Co.*—A seven inch streak of smelting ore has been opened up, carrying values of 21.80 oz. gold, and 70 oz. silver, or a value of \$467 per ton, alongside of which there is a good body of mill ore. This vein has been cut in the Newhouse tunnel at a depth of 1,300 ft.

*Wilkes-Barre Mining & Milling Co.*—Pennsylvanians have taken a lease and on a group of claims in Lake and Illinois-Central districts, including the Gladstone and five other claims, the bond being \$56,000, and extensive operations are being planned. J. F. Harrington, Central City, Colo., is manager.

*None-Such.*—Denver parties have taken a three years' lease and bond in sum of \$10,000 on this property in Enterprise district, and already have begun shipping to smelters. M. O'Hara, Black Hawk, is superintendent.

*Big Five.*—A transfer has been made from W. B. McLeod to this company of the Becky Sharp and Keystone claims in Russell district. The company is driving the Central tunnel from Idaho Springs to tap the well-known veins of Russell Gulch and Quartz Hill, and they are quietly purchasing claims along the route of their tunnel.

*Otto Shatz.*—At a depth of 160 ft., a nine-inch streak of smelting ore has been opened up, carrying values of over \$100 to the ton, and early shipments will be made to sampling works. R. H. Hastie, Central City, is manager.

*Travis Gulch Syndicate.*—This company owns a large group of claims in Travis gulch, on which it will install machinery and carry on heavy operations, with A. M. Willard, Gilpin, Colo., as manager.

## LAKE COUNTY—LEADVILLE.

*Arkansas Valley.*—Eight furnaces at this plant are in full blast and all of the roasters are going day and night; still the capacity is not sufficient to handle the output from the district. To accommodate the shippers the ore is being piled in the yards.

*Sunday.*—This property is situated above Timberline and at this season of the year it is hard and expensive work to haul in supplies and take out ore on the return trip; for this reason the owners are working only a small force of men and shipping about four carloads per month. With the opening of spring the mine will be thoroughly developed.

*Yak Tunnel.*—This property is producing 350 tons of ore daily coming from the Cord-Rowe lease and the Tankerstown. In the latter the ore shoot is now well into the Bob Ingersoll ground and the end has

not been found yet. The completion of the mill is delayed on account of the foundries being unable to fill their contracts. It is expected, however, that the mill will be running in full blast by the middle of February. At present the company is installing two 450-h.p. boilers.

*Daisy Lode.*—This property at the head of Big Evans gulch has resumed work after being idle for a number of years. Dower and Dennis have secured a five years' lease on the ground and will drive the tunnel, which is in 650 ft., further into Mosquito range. Considerable ore has been shipped from the claim in the past and on the surface there are large bodies of ore and it is to catch this body that the tunnel will be driven ahead.

*Elk-Johnny Hill.*—The air became so bad in the 200-ft. level that it was found necessary to go to the 300-ft. level and start a drift to get under the orebody that was dipping rapidly to the east. When this drift is completed and connections made considerable ore will be shipped.

*Bessie Wilgus.*—The trestle across the gulch has been completed and the first shipment of ore from the property went out during the week. Drifting on the ore shoot continues, but the extent has not been ascertained yet.

*Lecompton.*—Rudolph Stecker, who has a lease on this property, is driving the tunnel ahead and the ore recently struck is holding out. The tunnel is being driven directly towards the Nisi Prius ore shoot on Rock hill and another 100 ft. should prove whether any of the Rock hill ore shoots have been cut by the tunnel.

*Dolly B.*—It is more than probable that this property, which has been idle for several years on account of litigation, will resume operations shortly. Influential people will take a lease on it for a number of years and develop the property.

## SAN MIGUEL COUNTY.

*Butterfly-Terrible Gold Mining Co.*—This company's 30-stamp mill, near Ophir Loop, 14 miles from Telluride, is operating steadily, and treating an average of 75 tons in 24 hours. The values are 95 per cent gold, most of which is saved on the mill plates by amalgamation, the product being free milling to a high degree. The mine is employing 35 to 40 men. The new mill tunnel, being driven on the Butterfly vein to intersect and get under the ore-shoot in the Ida vein, from which the mill has been supplied for the past two years, has been projected between 150 and 200 ft. Upon reaching the objective point, it is expected this bore will be 2,500 ft. in length, and it is estimated it will require one year to drive it. There is sufficient mineral in the upper workings to last, at the present consumption, for two years, so that the new tunnel will have been completed, and stoping ground blocked out above, before it is exhausted. The company has paid no dividends for the past two years for the reason, it is said, that the profits are being put into a fund to pay the expense of driving the tunnel. J. F. Keating, of Ames, is resident manager.

*Ella Leasing Co.*—Fire recently destroyed the boarding and bunk house, blacksmith shop, upper terminal building of the wire rope tramway, and other structures, at the mouth of the main working tunnel of the Nellie and Ella mines, which this company has been operating for the past two or three years. There being no other accommodations near the property for the men, the force of 35 to 40 was discharged, and it is said there will be no

further operations until spring, when the burned buildings will be replaced and the tramway rebuilt, the burning of the upper terminal releasing the cables from their anchorage, permitting them to go flying down the mountain side with tremendous force, knocking down and partially demolishing 15 towers. Until the fire, the mines were producing enough ore to keep 25 to 30 stamps of the Bear Creek 120-stamp mill, located one and one-quarter miles distant, dropping regularly. Cooper Anderson, of Telluride, is manager of the company. The property is owned by the North American Exploration Co., composed largely of French capitalists.

**Japan Mines Co.**—Development work was recently resumed on this company's group of mines, located near the Tomboy in Savage basin, five miles from Telluride, with the intention of continuing it indefinitely. For almost a year scarcely any work has been done on the property. About 18 months ago, the vein was cut by a cross-cut tunnel, 2,600 ft. in length, at a vertical depth of 640 ft. below the lowest of the upper workings. The development outlined consists of running drifts in either direction on the vein, from the intersection of the cross-cut, and making an upraise from the south drift to connect with the bottom of a shaft sunk from the lower level of the upper workings. Before the ore in the upper workings became exhausted, the Japan was considered one of the most substantial and profitable producers in the district. It has been demonstrated that there is fully as good mineral between the cross-cut and lower level as there was between this level and the surface, and after the necessary development has been performed, it is thought, the property will resume its former place in the front ranks of the valuable producers. About two years ago the company purchased an excellent mill-site at Pandora, where the Smuggler-Union mills are located, one and one-half miles from the group, and it is said to be planning to construct, this summer, a milling and concentrating plant, and connect it with the property by a wire rope tramway. T. Walter Beam, of Denver, is manager of the company.

**Smuggler-Union Mining Co.**—The three principal lessees of this company's mines, in Marshall basin, four miles from Telluride, are sending down over the company's tramway nearly 400 tons of mineral every 24 hours, to the Smuggler-Union mills at Pandora, for treatment. This output is almost as great as that produced by the company at any time in its history. The aggregate force employed in the mines by the lessees and the company, numbers between 350 and 400 men. In the spring the production will be much larger, probably 600 tons daily, and the force will be correspondingly increased. Bulkeley Wells, of Telluride, is general manager.

**Yellow Mountain Mines Co.**—The Caribou-Montezuma group of mines, at Ophir, 16 miles from Telluride, is now owned and operated by this company, the majority of the stock being held in New York City. The 10-stamp concentrating plant is treating 35 to 40 tons of ore daily, and turning out from four to six carloads of concentrate per week, which return as high as \$1,200 to the car in gold, silver and lead. In addition to the milling ore, shipments of high-grade mineral are made at frequent intervals. Recently, a carload of 22 tons of this character was made to a smelter, which it is expected will run from \$100 to \$150 per ton, being almost solid gray copper. The property is temporarily under the management of Otto Erickson, of Ophir. Drifts are being ex-

tended on the vein in both directions from the shaft and upraise, and contracts will be let for the driving of others. Among the improvements contemplated for the year, is the building of an addition to the milling plant, to enable the treatment of a larger quantity of ore, the completion of the development now in progress rendering immense areas of stoping ground available.

## IDAHO.

### BLAINE COUNTY.

**Wood River Zinc Co.**—The company has been incorporated under the laws of Oregon to mine and treat zinc-lead ores near Hailey. The capital is \$150,000. Following are the directors of the company: W. E. Prudhomme, president; J. J. Chamberau, Charles H. Gleim, H. R. Plughoff, E. G. Starr and John Williams. John Williams is manager of the company's operations.

### BOISE COUNTY.

**Copper Queen.**—The shaft at this tunnel on this property at Pearl has been enlarged and re-timbered, and sinking has been resumed.

**Lincoln.**—A cyanide plant is contemplated for this property at Pearl. A test run on a 10-ton plant made recently is said to have given favorable results. The ore is to be treated without concentration. David Kennedy is the owner.

**Osborne.**—J. A. Richardson has sold his interest in this property at Pearl. A mill will probably be erected in the spring.

**National Mining & Milling Co.**—This company has resumed development on the Big Creek group of claims near Pearl. A contract for clearing the tunnel has been let.

### IDAHO COUNTY.

**Lawson.**—This placer property at Resort has been sold to the Boise Exploration & Mining Co.

### SHOSHONE COUNTY.

**Kenney.**—E. W. Conrad has purchased these properties, two miles east of Borax. He, with associates, has formed the National Mining & Smelting Co. Equipment is under way.

**Great Western Mining Co.**—Ore is reported found on this company's property.

**Bell Brothers.**—T. N. Barnard and E. J. Hunter have bonded this property a mile below Osburn for \$15,000. There are four claims in the group.

## ILLINOIS.

### MACON COUNTY.

**Decatur Coal Co.**—Three miners were suffocated by fire at this company's mine at Decatur on Jan. 17.

## INDIANA.

House Bill 153, introduced in the Indiana legislature by Representative Carry, of Sullivan county, provides additional safeguards for the health and safety of miners working in Indiana mines.

### ADAMS COUNTY.

**Geneva Coal Mining Co.**—This company has incorporated with a capital stock of \$15,000. The company will mine and sell coal. Wm. A. Aspey, W. A. Aspey and Samuel Egly, incorporators.

### GREENE COUNTY.

**Vivian Coal Mining Co.**—This company has incorporated with a capital stock of \$25,000. The company will sink shafts and engage in the business of mining coal.

The principal office will be in Jasonville, Greene county, near the place of operation. Thos. J. O'Gara, L. J. Walsh and Chas. R. Campbell, all of Chicago, incorporators.

### PARK COUNTY.

**Lincoln Coal & Mining Co.**—This company has incorporated for the purpose of engaging in mining coal in this county. The capital stock is \$100,000. The company will sink shafts and carry on the business of mining coal near Clinton, in Park county. The principal office will be in Clinton. C. R. Campbell, L. J. Walsh, and T. J. O'Gara, all of Chicago, incorporators.

**John Heaston Mining Co.**—This company has incorporated under the laws of Indiana, with offices in Indianapolis. The capital stock is \$25,000. The object of the company is to mine lead and zinc in the State of Missouri. John Heaston, C. M. Heaston, and Wilbur Christian, incorporators.

## LOUISIANA.

### CALCASIEU PARISH.

**Jennings.**—The Jennings Oil & Refining Co., has taken over the refining plant of the Union Oil & Refining Co. J. O. Haber is secretary.

The Jennings Heywood Co. is constructing a 1,000,000 bbl. earthen storage tank, which will be the largest in the south. The Crowley Oil & Mineral Co., No. 11, which was a failure last year, has been deepened and is flowing freely. The Foley Oil Co. is drilling a well three miles north of Iota and The Heywood Oil Co. is putting down two more wells on the Arnandet tract.

The daily output has fallen to about 35,000 bbl. and crude is selling in tanks as low as .17c. Cars are scarce and shippers complain to the Railway Commissioners that the Southern Pacific railway will not supply cars, but are using every available tank car to ship its own oil.

## MONTANA.

### FLATHEAD COUNTY.

**Snowshoe.**—This mine at Libby has resumed operations after an idleness of several months on account of a shortage of water.

**Batchelor.**—Good ore is reported found on this property 15 miles southeast of Libby. It is owned by N. G. Turney, of Spokane, Wash.

### MISSOULA COUNTY.

**Copper Bell Mill & Mining Co.**—This company's property at Clinton was sold at sheriff's sale on Jan. 10 to satisfy the claims of the holders of various bonds of the corporation. The stockholders have one year in which to redeem the property, and during this time it cannot be worked by the purchasers without the consent of three-fourths of the stockholders. It is thought that this will be given.

### RAVALLI COUNTY.

**Verdi.**—A strike in copper ore of unusual richness is reported at this mine, 16 miles from Hamilton. The property consists of five claims. The ore is said to contain 26 per cent copper, with a trace of gold. J. C. Carter is superintendent.

## NEVADA.

### ESMERALDA COUNTY.

**Goldfield Reduction Co.**—This company is erecting a 10-stamp mill at Rabbit Spring, about one mile from Goldfield. It will be ready for operation early in February. The ores will be treated by amal-

gamation only at first, but should results justify the capacity will be doubled and concentrating and cyaniding appliances will be added.

*Dean & Jones.*—This firm is constructing a mill for the reduction of Goldfield ore about a mile from the town. The machinery is being hauled overland from the coast.

## ORMSBY COUNTY.

*Pinenut.*—A strike of considerable richness is reported in the placer ground of this district, about five miles from the Buckeye placer diggings.

## STOREY COUNTY—COMSTOCK LODGE.

*Ophir.*—An important strike is reported on this property in Virginia City. It was made in the 2,000-ft level, 680 ft. from the boundary line, and at a depth of 40 feet.

## WASHOE COUNTY.

*Reno Reduction Works.*—This plant at Reno has resumed operations after an idleness of several years. The property was recently leased by the Progressive Concentrating & Milling Co., of Colorado, which has installed machinery and put the plant in readiness for operation. It will be operated as a custom mill. A. Tetro is superintendent.

## WHITE PINE COUNTY.

*New York & Nevada Copper Co.*—Vice-Chancellor Stevenson, of New Jersey, has entered an order confirming the report of the receivers of this copper company's property at Ely, and discharging them from further duty. The report showed that the property had been sold to Edward T. Toland and others for \$452,100, and that all the creditors were paid in full.

## OREGON.

## BAKER COUNTY.

*Oregon Smelting & Refining Co.*—This company's smelter at Sumpter, has been working steadily. The single stack is now able to handle the output of the district, but another will be added if it should be found necessary.

*Sagamore.*—It is reported that this group, 40 miles northeast of Baker City, has been bonded to Eastern capitalists for \$50,000. The formation is slate and porphyry and the property has been developed by tunnels, shafts and open cuts, aggregating 1,000 ft. of work systematically done. There is a three-stamp mill on the property with necessary buildings, etc. There is also an abundance of fine timber on the property.

*Blair.*—The January payment of \$10,000 on this placer property has been paid. This is the final payment of the \$30,000 for which the group was sold.

*Golden Drift Mining Co.*—A five-step centrifugal pump, made by the Byron Jackson Machine Works, of San Francisco, has been received at this company's property on Rogue river.

*Huntington Mining Co.*—This company has started operations on the Connor creek placers 17 miles from Huntington.

## JOSEPHINE COUNTY.

*Rogue River Quicksilver Co.*—It is reported that eight pounds of fine mercury were recently produced from 200 lb. of Cinnabar ore, taken from the company's mine. A retort is used in which 1,400 lb. of ore can be treated daily.

## LANE COUNTY.

*Oregon Securities Co.*—The 10-stamp mill and the tramway on this company's property, in the Bohemia district, will soon be ready for operation.

*Uncle Sam.*—It is reported that a reduction plant will be installed on this property in the spring.

*Lucky Boy.*—The 40-stamp mill and tramway on this property, were shut down recently, on account of a break in the machinery.

## PENNSYLVANIA.

## ANTHRACITE COAL.

*Lehigh Valley Coal Co.*—In the suit of Madden against this company to recover damages on the surface caused by a cave-in of the company's mine the court decided that the coal company is not responsible for the damage to the surface.

*Pennsylvania Coal Co.*—This company has opened up a large new coal-field about a mile from its Old Forge breaker at Wilkes-Barre, and engineers are laying out the plan of work.

*Miners Mills Coal Co.*—The following have been elected officers and directors of this company at Wilkes-Barre for the ensuing year: M. J. Healey, John McGahren, C. D. Foster, Dr. N. J. Graeber, P. Reilly. M. J. Healey was elected president; John McGahren, vice-president; P. Reilly, treasurer; Dr. N. J. Graeber, manager.

*Phoenix Park.*—Work has been resumed at this colliery near Pittsville after an idleness of several weeks.

## BITUMINOUS COAL.

*Washington County Coal Co.*—This company has purchased 300 acres of coal land in Jefferson township at a reported price of \$100 per acre.

*Monongahela River Consolidated Coal & Coke Co.*—At the annual meeting of this company the former board of directors was elected as follows: Francis L. Robbins, A. W. Mellon, M. H. Taylor, J. B. Finley, S. S. Brown, George I. Whitney, George W. Theis, John A. Bell and W. R. Woodford. The annual report showed that on October 31, 1904, the preferred stock earned a dividend of 77c. a share. The report states that the properties are now in better physical condition than ever before.

*Pittsburg Coal Co.*—This company has begun a suit against the Verner Coal Co., of Pittsburg to recover nearly 500 acres of coal land in Smith and Robinson townships, Washington county. The Pittsburg company asserts that the Verner company is mining coal owned by the plaintiff.

*United Coal Co.*—This company has purchased the property of the Naomi Coal Co. near Fayette City. The price paid for the works and leases on over 100,000 acres of coal land is said to have been \$1,250,000.

## TEXAS.

## HARDIN COUNTY.

*Saratoga.*—Moonshine Oil Co.'s No. 4 is down 1,100 ft. If a producer it will extend the proven field 1,000 ft. southerly. Santa Fe No. 2, near the Guffey tract, is in and flowing well. Two more wells are expected in daily. The production is holding up well and development is very active, crude being .26 to .27 cents.

## HARRIS COUNTY.

*Humble.*—This field has finally produced a gusher. Beatty No. 2, has been brought in and is said to be good for 66,000 bbl. daily. Humble is 14 miles northeast of Houston, and the topography is similar to the other south Texas fields, and the petroleum also shows similar characteristics, its gravity being 24 Baume. The Guffey Petroleum Co. and the Texas company are rushing work on their pipe-lines,

but it will be at least 30 days before the oil will be on the market. A big field here will be an important factor and crude oil uses in Galveston, Houston and central Texas will draw supplies here on account of the reduced freight. The only other producers outside of the Beatty, are the Mary Ellen Oil Co. and the United Oil Co., whose wells produce about 400 bbl. daily.

## JEFFERSON COUNTY.

*Beaumont.*—In spite of a declining market, several wells are being drilled. The Guffey Co. is drilling Nos. 53 and 54 at Spindletop. E. H. Power, one well, one and one-half miles south of Spindletop and the Texas Oil Fields, Ltd., at Big Hill. Crude oil prices have had a big slump as a result of the increased Saratoga output, and the new Humble field. Crude quotations are, Sour Lake and Saratoga, 27 cents; Batson, 25 cents; Beaumont, 29 cents. These are minimum prices, but the market is unsteady, demand slow and cars scarce.

## Foreign Mining News.

## ASIA.

## INDIA-MYSORE.

*Kolar Goldfield.*—The output for December is reported at 52,690 oz. bullion, which is 1,026 oz. more than in November, but 1,767 oz. less than in December, 1903. For the full year the total was 623,688 oz. bullion, against 600,060 oz. in 1903; an increase of 23,628 oz. The bullion reported in 1904 was equal to 561,319 oz. fine gold, or \$11,602,464 in value.

## CANADA.

## BRITISH COLUMBIA—BOUNDARY DISTRICT.

*Boundary Ore Shipments.*—Shipments for the week ending Jan. 14 were as follows, in tons: Granby, 10,620; Mother Lode, 3,616; Brooklyn, 1,531; Sunset, 6,500; Mountain Rose, 122; Emma, 561; Oro Denoro, 33; Senator, 231; Skylark, 20; total for week, 16,799 tons; total for year, 28,279 tons.

## MEXICO.

## SONORA.

*La Blanca.*—This mine property has been purchased by John B. Walton. Machinery will be installed at once.

## NEW CALEDONIA.

*Bakoum.*—Work on the extraction of cobalt ore from this mine, near Koumac, has been temporarily suspended, in order to put the shaft and levels in good order. The mine has been shipping about 50 tons a month, the ore averaging 5 per cent cobalt.

*Janville-Goro.*—These mines, owned by Mm. Tomasini and Aston, are the largest and best equipped cobalt mines in the colony. The principal mine, the Charlotte, is opened by three adits at different levels, the lowest one being a drainage tunnel, the others the working adits. The total development to date, including adits and cross-cuts, is about 1,000 meters. A large body of cobalt ore has been exposed. The deposit is in a basin largely composed of hard clay. The nature of the ground makes heavy timbering necessary. The ore runs from 3 to 8.5 per cent averaging 5 per cent cobalt. The mine is 2.5 km. from the bay of Goro. The ore is carried to the bay in wagons, and a good road has been built for this purpose. About 50 men are employed in the mines.



**THE ENGINEERING  
AND  
MINING JOURNAL**  
MINING AND METALLURGY ESTABLISHED 1866

**The Technical School and the University.\***

BY HENRY M. HOWE.

Will technical schools serve the interests of the community better if they are parts of great universities, or if they are isolated institutions? Is association or isolation more to the public good?

Let us assume that the university in question deserves its name, having first, a college or academic department and a department of pure science, and second, other important departments, such as schools of law and medicine.

First, let us consider the interaction of the teachers. The practice of the arts taught in technical schools, arts with a scientific basis but still arts, is more nakedly for money-making than that of the other professional arts. Medicine heals and raises, law protects the oppressed, dispenses both justice and wisdom from the bench. Even as the servant of finance, it has to do rather with the protection and the transfer of wealth already existing, than with the creation of new wealth, with the fruits of industry rather than with their growth.

But the technical man is always occupied with questions of profit and cost, of making money for his employer, or of building as cheaply as his standard of quality will permit. The merit of every plan is measured in dollars, be it mining and smelting, manufacturing, transportation or agriculture. The subject must be taught from this standpoint. Our graduates must be sufficient money-makers; but it is still more important for the community that they should be liberal citizens.

Surely, it is for the good of the community that the technical teachers should have the softening and broadening influence of contact and work with teachers of the humanities and of pure science, with men to whom the ever-present money question is of secondary importance, to whom beauty is more and money less; for so will they in turn influence their students more broadly and humanly; so will their light be whiter and their precepts and example nobler.

Conversely, it is for the good of the public that the teachers of pure science, and more particularly those of the humanities, should, in turn, be broadened by contact with the technical school. Their twist toward scholasticism and away from their students, can be lessened by contact with the technical teachers, especially if, as in the schools of law and medicine, these are in part chosen from the active practitioners. For these technical men are generally

of broader and closer experience with men as distinguished from boys, with the mature as distinguished from the adolescent human being. They have striven with men in work in which they have been helped only indirectly by their education, in the great tasks which are before men in a field of human endeavor probably more normal than the scholastic one, that of winning wealth from nature, of first surpassing and then directing their fellows.

Indeed, no argument should be needed to show that every added class of teachers should add to the broadening effect of the environment, and should thus make the attitude of each more just. Each class may, indeed, attack its problems in its own way; but the solution which one finds should aid others.

Here a word as to the interaction of different classes of students. The serious technical student unexpectedly learns from his fellow of the college, of the delights of this or that writer; of the existence of this or that school of philosophy; his interest in things beautiful is awakened; a chat with the student of architecture sets him thinking about the genesis and meaning of logical finished Doric and soaring spiritual Gothic. Each student from another department cries "*Audi alteram partem*"; however good and healthy your interests may be, they are only one group out of many." The technical student's horizon is broadened; and truly it needs broadening. According to my observation, narrowness is the chief defect of the isolated technical school.

Like students of the other learned professions, the technical students, are as a class more earnest, more zealous, than their fellows of the college; they are more mature, and they see more clearly than the college student the bearing of their studies upon their life's work. These contagious qualities, zeal and earnestness, should by intercourse with the technical students be caught in some degree by those of the college students who are not thoroughly immune.

But the matter may not be so simple under other conditions, as for instance if, in creating a new technical school, the choice should lie between isolation and association, not with a university, but with some long established college which has as yet no professional schools, and thus is itself isolated. Since the broadening effect of association is here at its weakest, while the zeal-chilling influence of the college students is at its strongest, this influence is likely to receive preponderating weight in the minds of those interested in the welfare rather of the projected technical school, than of the general public.

The counsel and learning of the professors of the school of pure science, and of certain professors of the college, should directly benefit the technical school associated with the university by helping to plan and to interpret the researches, both

of its teachers and of its advanced students. This widens the field of usefulness of the technical school. Its investigators go farther and deeper, and see more clearly. The better planned research is the better aimed artillery of science; we throw ourselves on the hinge, not on the solid wall. Wise interpretation of results houses the harvest; false interpretation rots it, making poison where food should be.

As with men, so with instruments. Many of the more costly of these are needed imperatively but intermittently. The technical school readily lends hers to the associated school of pure science, and vice versa. So, too, with books.

And here we reach the general question of economy. Nobody will deny that increase of scale permits greater economy in administration; even if the locomotive were no faster than the stage-coach, its economy would insure its use. Nor are we to fear that our present universities have reached the limit of economical human administration; the history of our great industrial and railroad combinations instructs us here. We do not here ask whether their vast scale has increased their benevolence or beneficence; for our immediate purpose their lesson is that the present university scale does not approach the limit of the economical and efficient.

To sum up, wisely guided association, while it need neither deprive the technical school of character and individuality, nor injure any of those in interest, should benefit the community, whose welfare here deserves our chief thought, through the broadening interaction of the teachers of pure science and of the college, representing scholarship and culture on one hand, and the technical teachers, with their closer contact with active life, on the other hand; through the interaction of the more earnest technical students and the more broadly-studying college students; in a word, through the broader environment which the university offers, with diversity of life and interests, of teachers and students, of museums and galleries. For the adolescent, this environment is to that of the isolated technical school as city life is to village life. Further, the teachers of the school of pure science and of the college should help the technical school in its investigations materially. Finally, the grand scale should effect great economy, not so much in saving salaries and in widening the use of the more expensive instruments, as in fitting work to worker, and best of all, in more fully supplying the eminent with work on their own plane.

Of the Parson steam turbines, about 1,000,000 h.p. are already in use; of the Laval turbines, about 3,500, with a total of 100,000 h.p.; of the Curtis turbine, about 300,000 h.p.; of the Rateau, 15,000 h.p.; and of the Zoelly, 20,000 h.p. are in service.

\*Extracts from a paper presented on January 13, to the Association of American Universities, Baltimore.

## The Hauraki Goldfields, New Zealand.

BY WALDEMAR LINDGREN.

The Hauraki peninsula, in the North island, is one of the most interesting gold-mining regions of the world, and has lately acquired additional prominence by the wonderful production of the Waihi gold mine.

The peninsula is chiefly of volcanic origin; it is made up almost wholly of Tertiary igneous rocks, mostly andesites, resting on a little-exposed basement of Paleozoic sandstones and slates. The andesites are accompanied by a vast amount of volcanic agglomerate, ranging in size of grain down to tuff, the whole often exhibiting rudely stratified forms. In

by the topography of the scarp, by the narrow and picturesque gorge which the Ohinemuri river has cut through it, and by the capture of much drainage formerly belonging to the eastern part of the peninsula. The faulting took place after the formation of the veins. Submerged forests and other indications point to faulting movements continued to recent times. Throughout its length this andesitic range is goldbearing; even the bleak and misty cliffs of the Great Barrier island, the northern prolongation of the peninsula, are intersected by veins carrying gold and silver.

and ferro-magnesian silicates by formation of calcite, chlorite, serpentine, quartz and pyrite. They strike NNE-SSW, while the dip ranges upward from 40°, and is directed either WNW or ESE. The vein system is thus in all probability conjugated and due to compressive stress. Great masses of low-grade quartz occur containing only \$2 to \$5 per ton. The veins are intersected by many small stringers or 'leaders'; the bulk of the production was obtained from shoots following their intersection with the main reefs. The ore mineral is chiefly native gold alloyed with 30 to 40 per cent silver, and worth \$12 to \$14 per ounce. Associated minerals are dolomite, pyrite, chalcopyrite, zincblende, galena, stibnite and ruby silver.



PROSPECTING IN THE THAMES GOLDFIELD, NEW ZEALAND.

the vicinity of the mining districts the andesites are greatly altered or 'propylitized' over large areas. Mr. James Park gives good evidence for regarding these rocks as of late Eocene and early Miocene age. In certain places they are extensively covered by rhyolites and rhyolitic tuffs of early Pliocene age.

Structurally, the most important feature of the peninsula is the great fault line which marks its western side, producing an almost continuous scarp facing the bay of Hauraki, and indicating a throw of 1,000 or 2,000 ft. The bay represents the downthrown area—a moat or *graben*, to use the German expression—between the peninsula and the mainland at Auckland. At the Thames, several of these faults have been exposed by mining operations; at Te Aroha, near the southern end of the range, its existence is clearly indicated

In the early days, the Thames, almost opposite Auckland, was the most important district, but operations are now centered in the Ohinemuri country, further south near Paeroa, which includes the Waitekauri, Karangahake and Waihi districts. The vein systems have, as a rule, a NNE strike, differing slightly in direction from the great fault at the western foot of the range.<sup>1</sup>

The Thames district has produced about \$30,000,000 out of a total of \$50,000,000 for the peninsula. The veins are contained in broad belts of soft rock which has suffered extensive propylitization, that is, decomposition of feldspars

<sup>1</sup> Several careful investigations of the rocks and deposits of this range have been made. The earlier examinations were made by F. W. Hutton, Sir James Hector and S. H. Cox. A later and excellent account is given by James Park in the *Transactions of the New Zealand Institute of Mining Engineers*, 1897.

Arsenopyrite and native arsenic are known from Coromandel. The presence of tellurium in small quantities was shown by Mr. Park. None of these accessory minerals occurs in large quantity.

Rich 'specimen stone' has been found, frequently forming great bonanzas. From the celebrated Caledonia shoot, 9 tons of gold are said to have been produced in 15 months. Some of the veins of Thames have been followed from a height of 1,500 ft. above sea level, to a depth of 640 ft. below it, but owing to several intervening faults belonging to the great zone of dislocation, described above, the real vertical extent is only about 1,200 ft. The productive zone seems to be limited to a range of from 400 to 600 ft. from the surface.

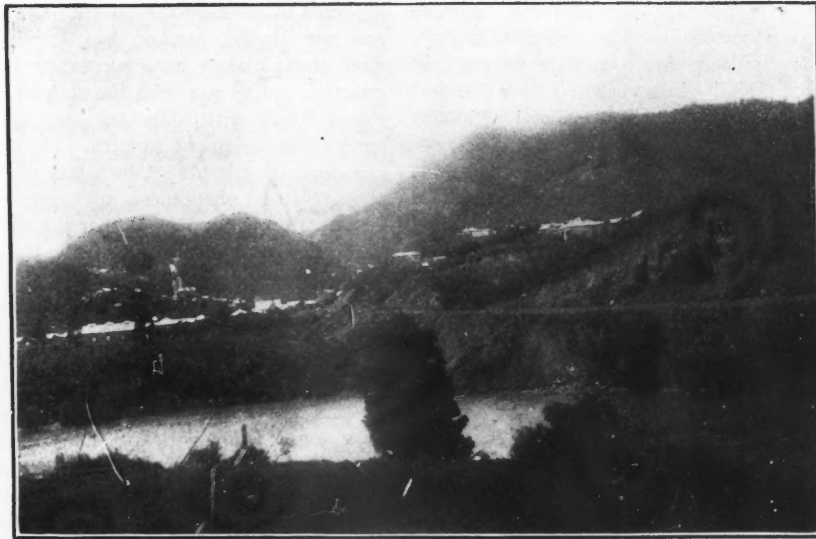
Looking over these facts (chiefly obtained from Mr. Park's paper), the ques-

tion of possible secondary enrichment at once suggests itself. Not being familiar with this part of the Hauraki peninsula, I dislike to express too definite an opinion, but the occurrence of shoots of coarse gold following intersections of feeders with the main vein, appears rather to indicate primary deposition by ascending waters than secondary changes produced in the already formed vein by descending waters. If this is so, we would here have a case in which the metalliferous solutions deposited the bulk of their load near the old surface, which is roughly indicated by the summits of the andesitic hills.

The Karangahake mines are situated about 40 miles south of the Thames, at the point where the Ohinemuri river emerges from its gorge in the andesites. The rocks are generally brownish and oxidized, fresh specimens being rarely obtainable. In part, they are breccias and probably andesitic in character. There are two principal veins, the Talisman and the Crown, both striking north-south, and the former traceable high up on the hills, which culminate in Talisman peak, 1,780 ft. above the sea. The Talisman has been worked with good success on several levels, the lowest now being opened by an adit near the river. The vein is 3 to 4 ft. wide, the foot- and hanging wall often

a peculiar lamellar or hackly structure, showing open spaces as if partly dissolved. Often it is coated with oxides of iron and manganese; sometimes it is

of gold to silver by weight is 1 to 20; the plate amalgam is 500 fine. A branch vein contains a higher grade of gold associated with stibnite and calcite, with



KARANGAHAKE AND THE OHINEMURI RIVER.

chalcedonic with concentric structure and narrow wavy bands of finely distributed argentite; this, together with about 1 per cent pyrite, constitutes the sulphide

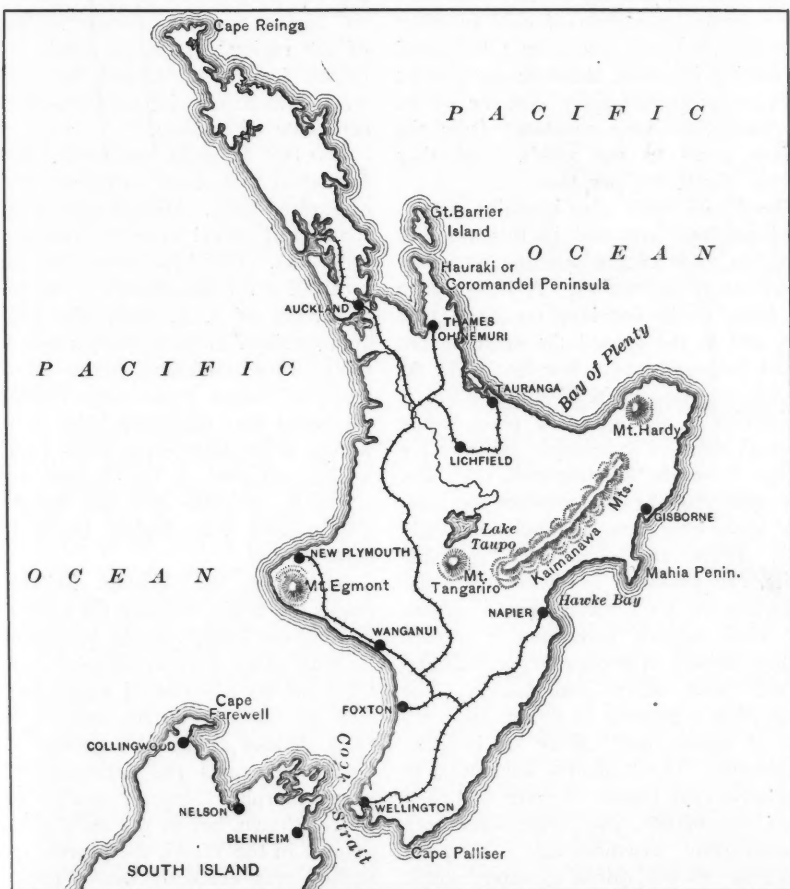
some siderite; a little cobalt is also present. A careful examination of the bottom level soon shows that the ore originally contained much calcite in lamellar and rhombohedral form, and that the hackly appearance of the quartz is caused by the dissolution of this calcite. The Crown mine, close by, has installed pumps, and is still reported to be working on oxidized ores 200 ft. below the river level.

For the last year or two, the Talisman has been producing \$400,000 per annum from 53,000 tons, at a working cost of \$7.50 per ton, the process consisting of crushing through 25-mesh screen, amalgamating on plates, concentrating on vanners to obtain the argentite, separating the slime in spitzkasten and agitating for 25 hours, with 0.2 per cent cyanide solution.

The idea prevails that in depth these mines will change to calcite ore of low grade; this is said to have actually been the experience at the Waitekauri mines, some miles to the northeast.

From Karangahake a wagon road leads up to the Waihi, a distance of ten miles, first through the picturesque cañon of the Ohinemuri, then over a bleak and hilly, fern-covered plateau, only about 300 ft. above the sea, and sloping toward the east coast. The central topographic feature at the Waihi is Martha hill, containing the croppings of the Martha lode and rising to 500 ft. above sea-level.

Cropping conspicuously, the Waihi lodes were discovered in 1878 and rich ore was found near the surface; but it proved difficult to amalgamate by plates or by pans, and only about two-thirds of the value was recovered. Important developments began in 1890, when the ground was acquired by the Waihi Gold Mining Company, Ltd., of London, and more especially, in 1894, when the cyanide process



THE NORTH ISLAND, NEW ZEALAND.

being indistinct or marked by brecciated zones. The ore has certain peculiarities which at once arrest attention. It consists of drusy, fine-grained quartz, with

part of the ore, which also contains finely divided free gold. The average value of the ore, in two well-defined shoots, is said to be \$10 per ton; the proportion

was introduced. The total production from 1890 to the end of 1903, has amounted to \$15,000,000.

During 1904 the production has continued at the rate of about \$250,000 per month, or \$3,000,000 per year. In 1903 the ore averaged \$12 per ton; the expenses were \$1,500,000, leaving a profit of \$1,675,000; dividends for 1904 were 60 per cent on a capital of \$2,500,000, or 10 per cent on present share values. Total dividends paid by the company add up to \$6,775,000, and ore-reserves are estimated at 583,000 tons. Of the 330 stamps, the larger number drop on oxidized ores. Wet-crushing has recently been introduced; 40-mesh screens are used, and the duty is consequently rather small; the pulp is separated, the sand cyanided directly, and the slime, by aid of filter-presses. A small number of stamps run on sulphide ore, the pulp of which is further treated on plates and vanners, while the tailing is again separated and the slime cyanided.

The geological features are simple. Martha hill forms a projecting small area of andesitic rock which contains the gold veins, and is surrounded by later non-mineralized rhyolite tuff. After the veins were formed, some erosion took place, and over this accentuated topography the rhyolites were poured out. The mine developments prove this, for in many places the drifts suddenly run out into the barren rhyolite, often containing carbonized wood; this is especially noteworthy on the second level, where the old surface is shown to have been steep.

At the time of my visit, the depth attained was only 500 ft.; however, the total length of the drifts must aggregate many miles. There are half a dozen veins within a short distance, dipping steeply and striking NNE, but with slightly radiating directions; the most important is called the Martha; one, the Albert, intersects the principal system. Pay-shoots of great length and width, have been developed on all of the veins. On the 500-ft. level, the Martha is said to be payable for 1,700 ft., the width ranging up to 40 ft., and the ore averaging about \$15 per ton.

The country rock in the upper levels is generally brownish and oxidized like that of the Karangahake mines, but in the deeper levels fresher rock is found, although it is greatly altered by metasomatic processes and contains much pyrite. Mr. Park determines it, on authority of Mr. Hutton, as hypersthene-andesite; all of it, however, is not of that character, for specimens collected on the 500-ft. level in the foot-wall of the Martha lode consist of a dark green porphyritic rock with recognizable phenocrysts of corroded quartz and orthoclase. The ferro-magnesian silicates, probably pyroxene, are altered to serpentinite aggregates. Lime-soda feldspars could not be definitely recognized, while the groundmass is

micropoikilitic and certainly contains much quartz. The rock is thus either a dacite or is intermediate between a dacite and a quartz-bearing trachyte.

The Martha is a wide lode, consisting chiefly of quartz-filling, with subordinate amounts of metasomatic quartz. The walls are not always marked by sharply defined shear planes, because near them the quartz is apt to mix with the rock in brecciated zones with abundant and sharply outlined inclusions of country. The whole vein formation indicates, by a lack of compressive stress phenomena, that large cavities were probably opened near the surface at the time of vein formation. On the 500-ft. level, the lode is 80 ft. wide, the first 40 ft. near the shaft being practically barren, and the next 40 ft. said to average \$15 to \$20. The quartz of the upper levels is like that of the Talisman, peculiarly lamellar and hackly, sometimes consisting of a loose framework of quartz blades coated by small quartz crystals, or again chalcedonic with concentric structure. Very commonly it is coated by black oxide of manganese.

The normal 'oxidized' ore contains free gold and argentite, as at the Talisman. The gold is rarely visible to the naked eye, and has a fineness of about 645. The silver exists as argentite, in minute particles, and often appearing as thin wavy lines in the quartz, just as in the Talisman. The average proportion of gold to silver by weight is about 1 to 3 or 1 to 4, and the bullion is worth about \$4 per ounce; there are great variations. On the whole, the values are very constant; from the surface down to the 500-ft. level they average about \$15 per ton.

The Waihi mine also contains unoxidized sulphide ore, and in this we find a key to some of the puzzling questions of secondary alterations. A little pyrite was found at the first level on the Martha lode, and at the second the sulphide ore on the foot-wall was a few feet wide. At the 500 ft. level, 20 ft. of sulphide ore is exposed at a corresponding place, while an equal width of thoroughly oxidized ore adjoins it on the hanging-wall side. The rock adjoining the sulphide ore has suffered great alteration, although seemingly fresh. Pyrite and a carbonate, probably calcite, are abundant in metasomatic development, as is a brownish-green serpentine. The veinlets traversing it contain much secondary orthoclase or valencianite together with quartz and calcite. The ore itself is a product of filling, and consists of quartz and calcite in intimate intergrowth. The sulphides, amounting to about 3 per cent, consist of pyrite and dark brown zinc-blende, the latter sometimes in concentric crustification. Incipient dissolution of the calcite is often noted. *The value of the sulphide ore is very nearly the same as that of the oxidized ore.* If anything, the grade is somewhat higher, but the assays seem to indicate that it contains more gold and less silver.

A little cobalt and tellurium occur. Elsewhere in the oxidized zone, on the 500-ft. level, calcite is abundant in places, and the development of lamellar quartz from the mixture of quartz and calcite is most plainly shown in all stages, by the dissolution of the latter mineral with attendant deposition of admixed manganese.

What has taken place is probably this: descending surface waters have dissolved and carried away the calcite; secondary deposition of quartz and chalcedony has accompanied this process; simultaneously the pyrite and zinc-blende have been oxidized and carried away as sulphates. The gold has remained in finely divided state; the silver has been re-deposited with chalcedonic quartz as argentite.

These developments in the Waihi emphatically contradict the opinion often heard on the Hauraki goldfield, that impoverishment necessarily follows the appearance of the primary calcitic ore, and they must be accepted as a favorable sign for the permanence of the orebodies to greater depth than yet attained.

The Waihi has been pumping water for some time, beginning from the upper levels, but there is apparently little surface water, most of the workings being practically dry. It comes in, however, in large quantities from certain parts of the veins, and is probably in part ascending, for its temperature is 73.5° F., or some 20° higher than the average temperature of the region.<sup>2</sup> It is not likely that the calcite has been leached by ascending water which must be well saturated with carbonate of calcium.

On the Hauraki peninsula, the vein formation succeeded extensive eruptions of surface lavas. Hutton and Park favor the idea of lateral secretion from the igneous rocks. This hypothesis, however, has received a serious setback by the careful researches of J. R. Don, who found no gold or silver in the country rocks, except where they contained pyrite introduced from the veins. I am rather inclined to the belief that the metal-laden ascending waters which formed the veins were originally contained in the magma and released by pressure upon the irruption of this magma into higher levels of the earth's crust.

In closing, the striking similarity between the Waihi and the De Lamar mine in southern Idaho<sup>3</sup> should be emphasized. In both cases Tertiary effusive rocks are traversed by a series of veins characterized by lamellar quartz, and containing finely divided gold and argentite. In the De Lamar veins the derivation of this 'pseudomorphic' quartz could not be clearly shown, but in the light of the exposures in the Waihi, the process just described was evidently active there also. The ore-shoots of the De Lamar veins ceased about 600-ft. below the surface.

<sup>2</sup> This JOURNAL, Sept. 15, 1904, Percy Morgan. 'Water in the Hauraki Gold Field.'

<sup>3</sup> W. Lindgren's '20th Annual Report.' Pt. III, United States Geological Survey, pp. 67-89.

and were probably produced by the damming of ascending solution, and more abundant deposition against the clay seam of the so-called 'iron-dike' against which the veins abutted. Both at Waihi and De Lamar the orebodies were deposited within short distance of the surface existing at the time of vein formation. Both are also characterized by 'propylitic' alteration of the rock, and by the presence of water-deposited orthoclase or valencianite, which lately has been shown to exist in many Tertiary gold-silver veins, among others in those of Cripple Creek and Tonopah. More examples of the class to which the Waihi and the De Lamar veins belong, will probably be found in Mexico.

The last word has not been said concerning the secondary changes of veins by surface waters; apparently, the formation of secondary sulphides does not always imply enrichment. There is, at Waihi, a magnificent chance for a detailed study of the conditions roughly indicated in this article, and it is to be hoped that it will be undertaken by the Geological Survey of New Zealand, in such a way that the chemical, mineralogical and petrographic features shall receive their full share of attention.

Carborundum, silicon carbide, is made in quantity in the electric furnace, and is used as an abrasive. It has been supposed that this was a substance first produced artificially; but it now appears that it is also a natural mineral, as it has been recently detected by Henri Moissan in the celebrated Cañon Diablo meteorite; here, it occurs in nodules of crystallized iron phosphide and sulphide. If carborundum is found in iron meteorites, it also presumably occurs in the unknown depths of the earth; and so another clause is written in the missing page which is to fill in the gaps in the history of carbon *de profundis*.

Two Baltimore architects have drawn plans for a building entirely without wood. It will be six stories, and will have a frontage of 41.5 ft. The entire structure is to be of reinforced concrete and steel. Even the doors, trims, window sashes and door-jambes are to be of metal. The windows will be glazed with wire glass. The frame for the show-windows will be of steel, into which the plate glass will be fitted. The side walls, columns and rear walls, as well as the supporting columns of the front walls, will be of concrete. The floors will all have a top-dressing of cement one and a half inches thick. The stairs will be of concrete, with slate treads and wrought-iron balustrades. The elevator shaft will be of concrete, as will also the inclosure around the stairway and the elevator hall. The cellar and roof are to be of cement. In order to eliminate all wood, even the flag-staffs on top will be of steel.

**Crude Oil for Fire Assaying.\***

By F. C. BOWMAN.

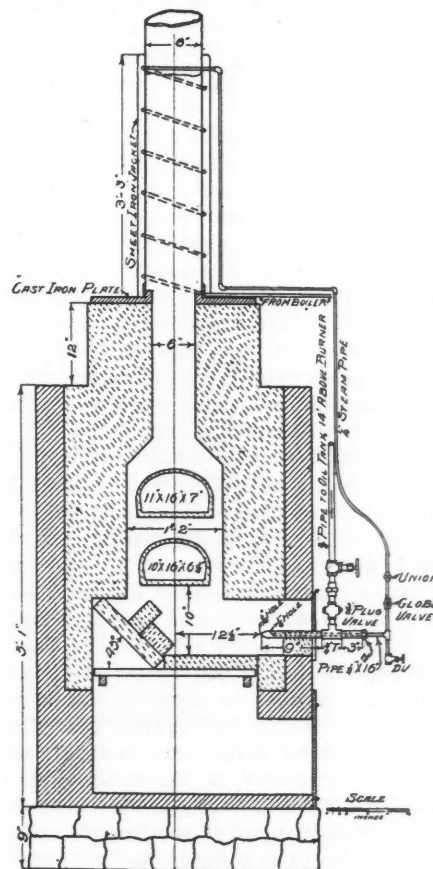
The principal fuel used in assaying is coal, though coke, charcoal and wood are used in special cases, and in some portable furnaces, gas and gasoline are employed. In some portions of the country, the high cost of fuel and the difficulty of obtaining a good quality often lead one to adopt the gasoline furnace where the work is light. In view of these facts I was led to experiment with crude oil. A new 2-muffle furnace, which was constructed to burn coal, had just been completed, and comparatively few additions were found necessary. The general result recommends the breaking of the oil into fine particles by the use

determined by experiment. The grate bars are covered the full width of the fire-box, the other brick (as shown in the section) extending the full width of the fire-box. The successful working of the furnace depends largely on the arrangement of this fire-brick.

In starting the fire, a piece of oil waste is lighted in the fire-box, just back of the burner nozzle. When this is burning well, oil and steam are turned on at the same time, until the oil ignites; the oil valve is set to give the proper flow, after which it is regulated by the steam valve. Plenty of waste should be used to furnish a blaze, and until the furnace is hot enough to ignite the oil, otherwise an explosion is likely to take place. The valve (*DV*) at the end of the steam line is left slightly open, to let the water of condensation drain off, which, if passed into the furnace, would cool it and perhaps crack the muffle. To obtain the best results, the steam should be absolutely dry, and for this reason the steam is passed through a coil around the stack before going to the burner. A small steam coil is placed in the oil tank to heat the oil and make it flow more evenly, and also to keep the heavier oils from settling. About 15 minutes after the fire is started, the muffles are red; and after from 30 to 45 minutes, the crucibles are ready to pour. With this furnace, I have run through 25 to 30 assays in one and a-half to two hours, and from 50 to 60 assays in two and a-quarter to three hours, including cupeling. This time is counted from the time the oil is turned on until it is turned off. The amount of oil used varied from 4.2 gal. per hour to 5.3 gal. per hour, varying with different lots of oil, and also with the quality of steam furnished. With oil at 8.7 cents per gal. delivered at the burner, the cost per assay was 2.2 to 2.8 cents.

In a coke furnace with a single muffle (11 by 16 by 7 in.) and using forced draft, the average consumption of coke per hour was 34 pounds. The time was counted from the lighting of the fire until the heat was too low to be used for cupelation. With coke costing \$2.25 per cwt. delivered at the furnace, the cost per assay for fuel was 7.1 cents. In a No. 31 Cary combination gasoline furnace, from F. W. Braun & Company, using a 2-in. Cary burner of the same make, the average consumption of gasoline was 0.65 gal. per hour, the gasoline being delivered to the burner under an average pressure of 10 lb. The time was counted from the moment when the gasoline was turned on until it was turned off. With gasoline at 40 cents per gallon delivered at the burner, the cost per assay for fuel was 5.2 cents.

One difference between the common steam engine and the steam turbine, is that in the former the steam acts almost wholly by pressure; while in the latter, it acts by its motion.



CRUDE OIL ASSAY FURNACE.

of steam or compressed air, and at the same time forcing it into the fire-box.

The burner is shown in the section of the furnace, and consists of a 3/4-in. pipe, connected by a T with the oil line, through which passes a 1/4-in. pipe connected with the steam line. This steam pipe passes through a packing nut (*N*), which allows of the adjustment of the distance between the opening of the nozzle and the opening in the steam pipe, this distance affecting very materially the flow of the oil, even when the inlet valves of both steam and oil are set. A slotted hole was first used in the nozzle, but a round one was found to work better in such a small fire-box.

The arrangement of fire-brick was only

\* Abstract of a paper read before the Colorado Scientific Society, Sept. 3, 1904.

## United States Mining Laws.\*

BY C. W. GOODALE.

A Commission was appointed by President Roosevelt on October 22, 1903, "to report upon the condition, operation and effect of the present land laws and on the use, condition, disposal and settlement of the public lands, . . . and especially what changes in organization, laws, regulations and practice affecting public lands are needed, first, to effect the largest practicable disposition of the public lands to actual settlers, who will build permanent homes upon them; second, to secure in permanence the fullest and most effective use of the resources of the public lands; and it will make such other reports and recommendations as its study of these questions may suggest."

The mining laws of the United States are of such importance in connection with the development of the public land resources, that the Commission would have been given additional strength if a mining engineer had been included in the list of appointments, but the Commission has adopted a plan to get opinions and suggestions from those who have had experience in the administration and in the effects of existing laws.

Among published discussions on the subject of our mining laws, which have appeared recently, Dr. R. W. Raymond's article in THE ENGINEERING AND MINING JOURNAL of June 16, 1904, was of great interest, and other engineers in later issues of the same JOURNAL have contributed valuable suggestions.

The debate in the United States Senate on December 15, 1904, on the mining laws enacted for the Philippine Islands, gave Senator Heyburn, of Idaho, an opportunity to defend extra-lateral rights, but let us see if there is not a good and sufficient answer to his arguments. The Philippine law, which was passed July 1, 1902, provided for mining locations 300 meters, or approximately 1,000 ft., square, giving rights to all the mineral therein contained, but with no privileges of following the veins on their dip into adjoining territory. The Senate Committee endeavored to unite the best features of the British Columbia and Mexican mining laws, but Senator Heyburn maintained that the laws as passed would retard the development of the mineral resources of the Philippines, and that American capital would not undertake mining operations under such laws. This is certainly refuted by the fact that capital from the United States has eagerly sought mining investments in Mexico and British Columbia, and, on the other hand, there is not the slightest doubt that English and other foreign capital would have been invested in our mines in much larger amounts, if the dangers of litigation, arising from extra-lateral rights, had not held it back.

\*Abstract of paper read before the Montana Society of Engineers, Jan. 15, 1905.

Complaints from American mining operators in British Columbia are not based upon the restriction which says "The holder of a mineral claim . . . shall not be entitled to mine outside the boundary lines of his claim continued vertically downward," but upon the uncertainties, due to frequent amendments, regarding other requirements of the law. Prior to 1884 there were no laws in British Columbia in relation to lode claims, placer locations alone having received attention in legislative acts of the Province, but in 1864 a mineral claim was defined as 1,500 by 600 ft., with surface and extra-lateral rights. In 1891, new provisions were inserted in the law as to record, annual assessment work, etc. On April 23, 1892, the statute was repealed, and a new one enacted, allowing no surface rights except for mining purposes, and doing away with extra-lateral rights. The size of the location was fixed at 1,500 by 1,500 ft. Numerous amendments have been made since that year in regard to the method of location, number of posts, certificates of annual assessment work, etc., and it is probably true that an ordinary miner would have difficulty in interpreting the present law, but there has been no going back to extra-lateral rights, and mining communities have no desire to do so after a test of nearly thirteen years.

Senator Heyburn intimates that with a United States law giving no extra-lateral rights, a man, after making one *legal* location, could steal twenty more pieces of land from the Government by making flanking locations to protect his rights on the dip. How could it be called stealing if, in getting his patent title from the Government, he had to pay \$5 per acre, the rate now required in patenting any lode locations? Under the present law the wise prospector makes side locations, as well as 'extensions' on the strike of the vein, and if he has not protected himself against litigation before he offers his mine for sale, the prudent buyer does not overlook the possibilities. We all know of instances in Montana, where individuals and companies hold under locations, or have patented large areas around a lode claim, and sometimes on rather questionable discoveries of a "well-defined crevice," or of "mineral in place"; and we cannot see how a law similar to that in force in British Columbia would give any greater opportunities for the acquisition of mineral lands "by those who want to acquire vast areas of surface ground and deprive the miner of the right to prospect upon it."

Can anyone question the statement that a law which made possible the notorious Copper Trust litigation should be revised? The Copper Trust lode claim, 0.009 acre in extent, was located upon a triangular piece of ground in the heart of the Butte

district, and its owner asserted title to a portion of the Anaconda-St. Lawrence vein, this portion having its apex 1,265 ft. from the ground located, and an injunction was issued by the District Court which shut down the Anaconda and St. Lawrence mines, throwing more than a thousand miners out of employment. This is only one example of the dangers incident to our present law, but many others could be mentioned.

With a law in force giving no mineral rights outside of vertical boundaries of the ground located, controversies between adjoining claims could be settled with mathematical precision, but under our law mining cases frequently require many weeks for trial, and "lawsuit geology" and theories are explained to judges and juries who are utterly unable to understand the statements made, and the maps and models exhibited. Many of us know that hundreds of thousands of dollars have been spent in this district alone in underground lawsuit work, or in "war measures." Then again, after large ore-bodies have been opened up, the *prima facie* owners have been enjoined from working them because the claim adjoining asserted adverse rights, and while waiting for the "law's delays" to settle questions of ownership, workings have caved in, and ore and waste have become so hopelessly mixed, that little, if any, profit can be realized when title has at last been quieted.

Senator Heyburn says that the present law "gives a man a definite estate, which no man can take away from him," but, on the contrary, is it not true, as Dr. Raymond contends, that there is nothing definite about the rights granted by a United States patent? If locations were always properly made, if veins were not variable in dip and strike, if intersections or unions did not occur, if there were no faults, and if expert witnesses could agree as to vein definitions, owners of adjoining claims could settle their disputes, and there would be no uncertainty regarding the rights granted by a United States patent. The only wonder is, that a law so fruitful in litigation in nearly every mining district of importance in the United States, has been allowed to stand for more than thirty years.

Dr. Raymond and other writers have called attention to a defect or omission in our law which is very important, and should be remedied; the Federal government should have prompt notice of all locations on its public lands. Where locations are made on unsurveyed lands, the records would not be satisfactory, but the locality could be described with sufficient accuracy to decrease the chances of conflict between agricultural and mineral claimants when the surveys are extended.

In considering the question of a revision of our mining laws, a brief review of some of the conditions in the laws of other countries would be of assistance. The

principal features of the mining laws of British Columbia may be stated as follows:

1. Any man desiring to prospect for minerals takes out a Free Miner's certificate, paying therefor \$5 per year, and the privileges under this certificate expire on May 31 of each year. This certificate is not transferable.

2. It gives the right to locate minerals other than coal.

3. The dimensions of a full claim may be 1,500 by 1,500 ft., but fractional claims are permitted. The locator is entitled to all the minerals which may lie within his claim, but he has no right to mine outside of his boundaries.

4. The holder of a Free Miner's certificate is not permitted to locate more than one claim on the same vein or lode, but he can acquire, by purchase, additional claims on the lode which he has located. He is allowed to take up claims on separate veins or lodes.

5. The surface right is only acquired for the purpose of mining, all other surface rights are vested in the Crown.

6. Record may be made within 15 days with the mining recorder, if the location is within 10 miles of the office of said mining recorder. One additional day is allowed for each 10 miles of distance. The record must give the name of the claim and of the locator, also the number of the Free Miner's certificate, under which the claim is taken up; locality, direction of location line, length and date of location must also be specified.

7. Location holds for one year; \$100 worth of work required on each location after that, and an affidavit of this work must be filed with the recorder.

8. If work to the extent of more than \$100 is done in one year, such excess will apply to succeeding years by paying the recording fees for the additional affidavits.

9. A payment of \$100 to the mining recorder takes the place of assessment work.

10. After doing \$100 assessment work, or paying \$100 as above provided, and application has been made for certificate of improvement, no more work is required.

11. No re-location of an abandoned claim is allowed, without first obtaining permission from the gold commissioner, and a fee of \$10 is paid for such permission.

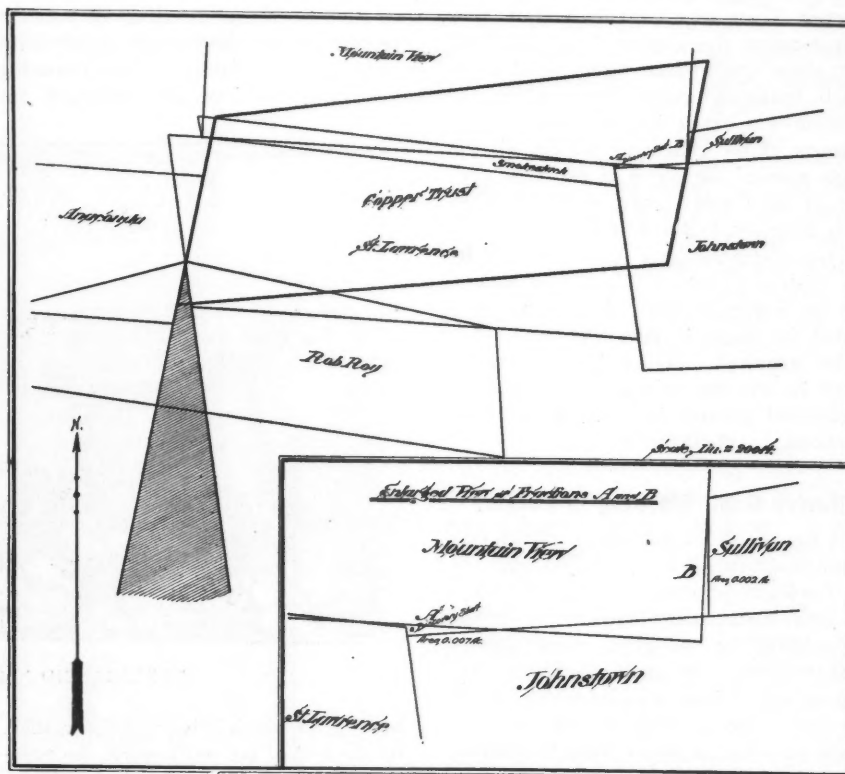
12. Crown grants are issued for mining locations after work to the extent of \$500 has been done, or after a payment of this amount has been made to the mining recorder. If less than \$500 worth of work has been done, the locator can obtain a crown grant by paying the difference between the value of work performed and \$500.

Without going into full details regarding the Mexican mining law, the following notes will show what is required in that Republic: A mining claim is called a *pertenencia*, and is 100 meters square, embracing an area of 2.47 acres. A notice of location, or, as it is called, 'denouncement,' is filed in the office of the *Mineria*, and

from there the notice is sent to the Federal office in the City of Mexico. No discovery patents are given for mining ground, but owners of claims are compelled to pay \$10 a year in taxes to the Government. This may be all paid at once, or divided into three instalments, but on default of the third payment the claim is subject to re-location.

In Western Australia, claims may be staked out in any shape or size, but not in excess of 24 acres, nor can they be over twice as long as they are wide. Application for registration must be made without delay; the government then

cated April 30, 1899. The only unpatented ground within the lines of the Copper Trust, as located, consisted of two small fractions, one of which is shown on the map at *A*, where the discovery shaft was located, being a triangular piece of ground 10 ft. wide at the base, extending east a distance of 75 ft., and containing an area of 0.007 acre; it was a piece left vacant upon the correction by patent surveys of the north side-line of the Johnstown, and the south side-line of the Mountain View lode claims; also a small triangle located at the point *B*, containing 0.002 acre, which lay between the west end-line of the Sulli-



LOCATION OF COPPER TRUST CLAIM.

sends a surveyor to correct the location very soon after it has notice, and at charges which are very moderate. The claims thus obtained carry all ores within vertical boundaries. Litigation over title is unknown. The tendency in Kalgoorlie has been to develop a claim systematically, whether there were favorable indications at the surface or not, as the title to all ore found within the claim boundaries is assured. The administration of all matters pertaining to mining is placed in the hands of a warden appointed by the Crown. The warden acts as judge in all cases of mining questions, such as breach of regulations, 'jumping,' etc. These cases are tried without a jury, and the inspector of mines is the official source of information regarding the facts, so the mine inspector is really the assistant to the warden.

THE COPPER TRUST LOCATION.

The following account of this case has been contributed by a legal friend:

The Copper Trust lode claim was lo-

van, and the east end-line of the Mountain View as surveyed for patent. With the exception of these two tiny fractions, all of the ground embraced within the Copper Trust location, or with which it conflicts on the surface, or the extralateral rights claimed for the Copper Trust, had been, for many years prior to the Copper Trust location, patented ground. The Copper Trust owners contended that their discovery was made upon what is known as the Anaconda vein, which extended through their point of discovery, and west through the west end-line of the St. Lawrence lode claim, and the east end-line of the Anaconda lode claim.

That the owners of the Anaconda and St. Lawrence lode claims, being confined to the planes of the east end-line of the Anaconda and the west end-line of the St. Lawrence, respectively, in following said vein upon its dip to the south, acquired no rights in the said vein, after the same

on its dip passed through the said end-lines respectively, and entered the apex of the triangle shown on the map in hatched lines; and that under the exclusions obtained in their patents, the owners of the Rob Roy, and other claims to the south, obtained no rights in said vein, as its apex was without their ground; and that, therefore, there was left a segment of this vein, shown by the triangle in hatched lines upon the map, which increases as the vein descends into the ground to the south, upon which neither the Anaconda, nor the St. Lawrence, nor the Rob Roy, nor any one, but the government, had any rights at the time that the Copper Trust was located; and that by this location the Copper Trust acquired, not alone the surface rights in the two small triangular pieces upon which the location was based, but also acquired the segment of the vein lying within this triangle east of the plane of the west end-line of the Copper Trust, extended in its own direction to the south.

This contention was fully sustained by the District Court of Silver Bow county, but the Supreme Court of Montana repudiated the claim, holding that the Copper Trust acquired nothing but the rights given by the two triangular fractions of unpatented ground, included within their locations.

#### Native Gold Washing in Assam.

In his report of geological exploration in northeastern Assam, J. M. Maclaren, of the Geological Survey of India, describes the crude methods employed by the natives in washing the low-grade river gravels of that district. As a rule, washing is carried on only during the cold season, when the rivers are at their lowest. A spot is always selected where some concentration has taken place, as on a beach opposite, or below, a gravel bank in process of erosion. After some rough tests of richness and depth of deposit, the overlying sands are removed either by a large wooden scraper drawn by two men, while pressed down by a third, or preferably, and always, when the stream is small, by damming a part of the current and directing its flow over the sand to be removed. The flow is sometimes continued after the gravel bed is exposed, in order to concentrate it somewhat. If the gravel lies above the river level, it is brought down in baskets to a sluice, made by confining the stream to a narrow channel, and is washed there. When a sufficient quantity of concentrated material has accumulated, the water is diverted to another similar and parallel sluice, where washing is continued while the material is being removed from the first channel for hand washing.

The *duruni*, in which hand washing is done, is an elliptical wooden trough 4 ft. long, 16 in. wide and 4 in. deep. The bottom is mostly flat, but slopes upward towards one end, and at this point, a

groove 9 in. long and 1.5 in. deep extends longitudinally. At the opposite end, a 2 in. opening is left in the marginal rim. When in use, the trough is supported on three stones, the upper end being slightly raised. Gravel is scraped from among the stones into a basket, and is dumped onto a bamboo screen straddling the upper end of the trough, where it is worked through with the assistance of a stream of water from a gourd.

Water is added in a constant stream with one hand, while with the other the sands are kept in motion. The fine material is carried off, leaving the gold with the black sand. When 40 or 50 baskets of sand have been concentrated, the value is collected into as small a bulk as possible, by working the heaviest material steadily towards the upper end, and finally into the



DURUNIS AND NATIVE WASHERS, ASSAM.

groove, from which it is carefully washed.

At the end of the day's work, the accumulated concentrates are washed again to reduce the bulk of black sand. This residue is then rubbed with quicksilver in a bowl until the gold is amalgamated, the excess of mercury being removed by squeezing.

The method of retorting is primitive in the extreme. A lump of amalgam is put into a clam shell and heated on a charcoal fire. When the shell is reduced to lime, and the mercury volatilized, the residue is thrown into water, and the gold collected.

The term 'geology' was first used in the modern geological sense by De Saussure in 1779 in writing on the Alps. De Luc one year earlier had suggested the term geology in a preface; but he actually used the term cosmology. This is stated on the authority of Geikie and Emmons.

In the earlier forms of the Laval steam turbines, a 5-h.p. motor, with a diameter of 12 cm., made about 30,000 revolutions per minute.

#### Coal Business in Illinois.

SPECIAL CORRESPONDENCE.

The coal business in Illinois, as a rule, was quite dull during most of the past year. Most of the mines in operation have been those large ones located on railroads, which furnished a good daily supply of cars. Many small mines, without steady contracts, and which generally sell their coal in open market, have not been in operation since last April, except during the last month or two. In August last, it was said that some operators in southern Illinois had quoted prices in Chicago which were less than the cost of production in many of the mines in the central and southern portion of the State. As in previous years, the mines in the Southern field, with their great natural advantages

and long freight haul, have been disturbing causes in the Chicago market. As is usually the case, in this State, in dull seasons, the better coals from Ohio and West Virginia took precedence in the market over the inferior Indiana and Illinois coals.

Accumulated stocks of fine coal in cars in St. Louis and Chicago—a never-failing sign of a dull coal market—gave the railroads trouble as late as November. Owing to labor troubles, this surplus was worked off rather sooner than it would otherwise have been, and trade conditions were improved. The trouble with the hoisting engineers, who refused to accept a reduction, served to stimulate the market. Heretofore the hoisting engineers have been very well managed, and they have in times past driven some excellent bargains with the operators, but their decision to stand out against a reduction, after the miners had accepted one, seemed ill-advised. The miners generally thought that the hoisting engineers should be members of their organization, and have, in times past, made many efforts to force them to join, but heretofore without success. In this case the miners' officials



were in duty bound to keep the mines in operation, and undoubtedly lent their efforts toward that end. As there are numerous engineers in the miners' organization, possessing hoisting engineers' certificates, but not members of the Hoisting Engineers' Brotherhood, they were probably available in the emergency. The incident shows that labor organizations cannot afford to ignore market conditions.

Several large tracts of coal land lying in the central portion of Illinois have lately been purchased by people identified with some of the larger railroad systems, and these railroads have, in several instances, built branch lines to open up the new coal-producing territories. Some coal land has evidently been bought without regard to immediate development.

Considerable coal land is being optioned by Illinois coal men who are selling the land to Eastern people. Recently, men identified with large Eastern coal companies have been buying up producing mines and incorporating several mines under one management. A commendable effort is apparently being made to put a stop to the ruinous competition among the smaller mines.

The prosperous condition of the coal trade in the Middle West, during the last four or five years, has been an incentive toward the investment of outside capital in the mines and coal lands of this region, and a considerable amount has been expended.

Nowhere is the recent prosperous condition of the trade better shown than in an examination of the large amount of improvement work done about the mines. A considerable sum has been expended in mining machinery, in improved surface equipment and electric haulage. A few years ago a steel tippie was a rare sight in the Middle Western coal-field, whereas at the present time most of the new plants are being equipped with steel tippies. The Capell ventilating fan has also been introduced, and has made a favorable impression.

The great majority of the new haulage plants are operated by electricity, as the shaft mines of this region are peculiarly adapted to the use of this power. In the larger mines the over-head trolley system seems to be preferred, but the third rail system has found more favor in the small mines. A cheap and satisfactory system of underground haulage is something desired by mine operators at the present time. Since the differential between hand and machine mining has been reduced to such a small amount, there is little inducement for the operator to install mining machinery, aside from the better quality of coal usually produced, but there is a decided movement towards the installation of cheap and efficient mechanical haulage.

Among the best of the indications of improved conditions is the sinking of a new shaft by one of the largest mining companies in the State.

**Lake Superior Iron Ore.**

In the JOURNAL for Jan. 5 we gave a statement of the iron ore from the Lake Superior ranges, estimating at the time the rail shipments at 500,000 tons. We have now received the complete statement of the shipment from all the mines and ranges, which is compiled each year by the *Iron Trade Review*, of Cleveland. The rail shipments slightly exceeded our estimate, having been 528,095 tons from the Lake region proper; while, if we include the shipments from the Baraboo range in Wisconsin—which has rail connection only and does not ship by lake—the total rail movement was 596,175 tons. The following table shows the total shipments by ranges for three years past, 1902 having been the record year:

Range.	1902.	1903.	1904.
Marquette . . . . .	3,868,025	3,040,245	2,843,703
Menominee . . . . .	4,612,509	3,749,567	3,074,848
Gogebic . . . . .	3,663,484	2,912,912	2,398,287
Vermilion . . . . .	2,084,263	1,676,699	1,282,513
Mesabi . . . . .	13,342,840	12,892,542	12,156,008
Total . . . . .	27,571,121	24,271,965	21,755,359
Baraboo . . . . .		17,913	67,480
Total . . . . .	27,571,121	24,289,878	21,822,839

The shipments given above for 1904 do not include the ore from the Michipicoten range in Canada, which were 117,153 tons, practically all of it from the Helen mine.

The notable point in the above table is the constantly increasing proportion of the Mesabi. The shipments from that range were 736,534 tons less than in 1903, and 1,186,832 tons less than in 1902; nevertheless, they constituted a higher production of the total, having been 55.7% last year, against 48.4% in 1903, and 48.4% in 1902. In the old ranges, and on the Vermilion, there was little change in proportion. The list of shipping mines in 1904 includes 135, which is 7 less than in 1903, but two more than in 1902. On the Marquette range last year 20 mines reported; on the Menominee, 30 mines; on the Gogebic, 22 mines; on the Vermilion, 6 mines, and on the Mesabi, 55 mines. There are, however, several names which stand for more than one mine. Thus, the Hull, Burt and Rust on the Mesabi are all reported under the head of the Lake Superior group; in the same way the Norrie, East Norrie, and Pabst on the Gogebic are counted as one; while the Cleveland Cliffs Iron Company reports together all of its mines on the Marquette range with the exception of the Negaunee.

The record for shipments this year is held by the Stevenson mine on the Mesabi, which shipped 1,652,021 tons. For the two previous years the record was made by the Fayal, also on the Mesabi, which shipped 1,919,172 tons in 1902, and 1,656,973 tons in 1903, but fell to 975,102 tons in 1904. Other large shippers on the Mesabi were the Mountain Iron, 1,168,855 tons; the Adams, 940,105 tons; and the Mahoning, 706,325 tons. The Lake Superior group shipped 1,415,

884 tons; but, as noted above, this was the product of three mines. On the Vermilion range the largest shippers were the Pioneer, 505,432 tons, and the Chandler, 422,162 tons. On the Gogebic the only mine shipping more than half a million tons was the Norrie group, which reports 618,638 tons. On the Menominee one mine only exceeded the half million; the Chapin, with 541,324 tons; other large shippers being the Pewabic, with 372,791 tons, and the Aragon, with 374,944 tons. On the Marquette the Cleveland Cliffs group reports 743,263 tons, and the Lake Superior 590,339 tons.

The total shipments of all the ranges from the first record of mining up to the end of 1904 were as follows: Marquette, 72,590,112; Menominee, 49,071,686; Gogebic, 43,129,473; Vermilion, 22,020,718; Mesabi, 78,796,357; a grand total of 265,696,359 tons of iron ore.

The United States Steel Corporation's shipments last year were 51.3% of the total, which compares with 55.5% in 1903; and 58.5% in 1902. The Corporation's shipments, however, were somewhat above the normal in 1902, since in that year it adopted the policy of accumulating a large stock of ore at its furnaces and at the Lake Erie docks.

**Iron in Belgium.**

At the close of the year 1904, there were 34 blast furnaces in operation in Belgium, with 6 furnaces idle. The output of pig iron for the year is reported as follows, in metric tons:

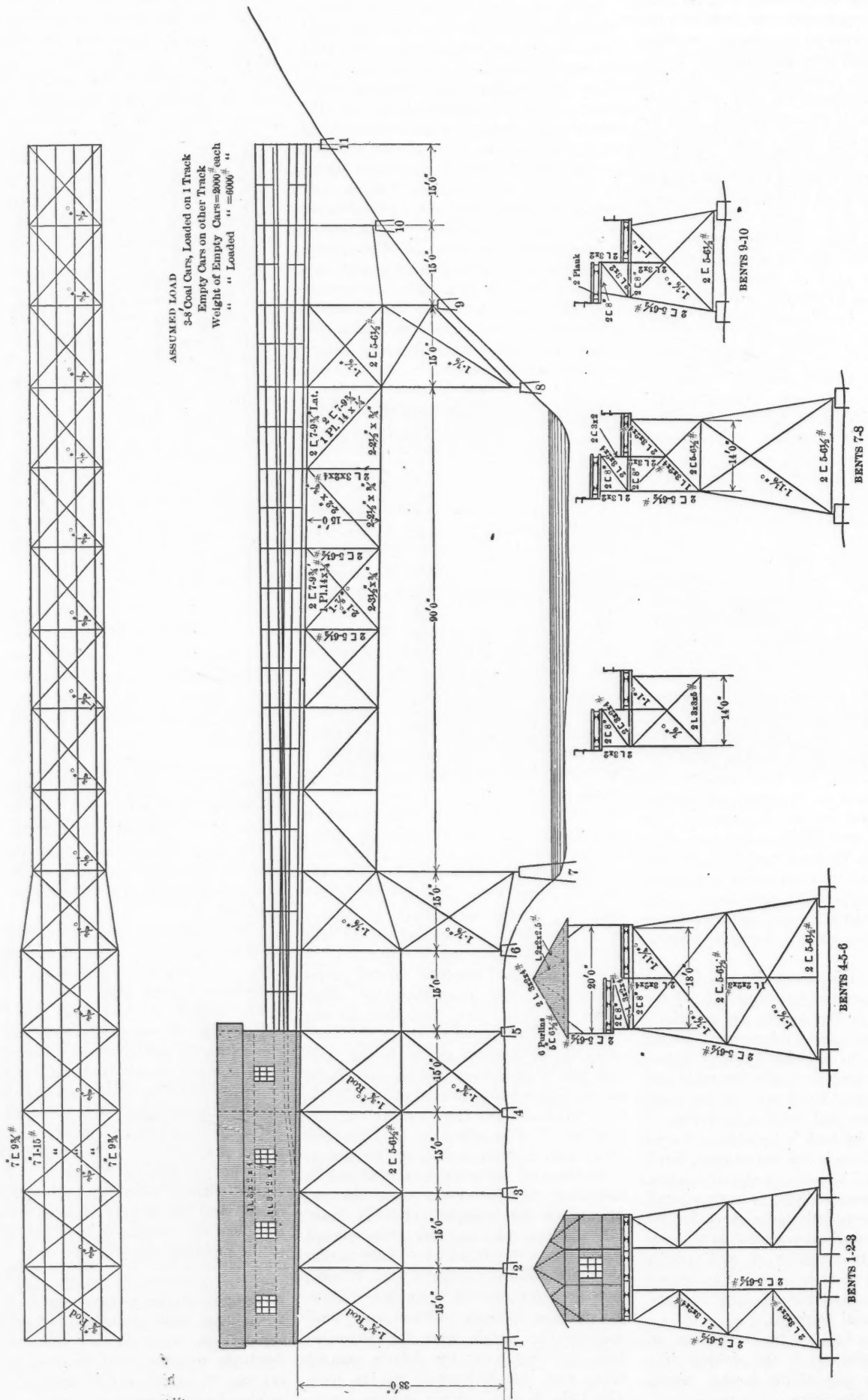
	—1903.—		—1904.—	
	Tons.	Per ct.	Tons.	Per ct.
Foundry iron . . . . .	99,902	7.7	105,830	8.1
Forge iron . . . . .	268,498	20.7	243,287	18.6
Bessemer and basic . . . . .	930,811	71.6	958,282	73.3
Totals . . . . .	1,299,211	100.0	1,307,399	100.0

The total increase was 8,188 tons, or 0.6%, as compared with 1903. The average output per furnace last year was 38,453 tons.

The imports of iron ore in 1904 were 2,823,265 tons, an increase of 240,340 tons over 1903. The larger part of the imports were from Luxemburg.

The exports of iron and steel were 642,324 tons, a decrease of 5% as compared with the previous year. The notable point in these exports is that 446,000 tons, or nearly 70%, were of wrought iron in various forms—bars, plates, shapes, etc. No other iron-making country shows so high a proportion of wrought, or puddled, iron in its finished products. In the United States, Great Britain and Germany, steel has largely replaced wrought iron; but the Belgian makers still adhere to the puddling furnace.

Apropos of the recent suggestion that a shaft be sunk 12 miles, for scientific exploration, it is figured that at that depth the pressure must be about 40 tons per sq. in., which would prohibit shaft-sinking by any known method.



DESIGN FOR COAL TIPPLE.

FIG. 1.

**Coal Mine Tipples.**

By H. G. TYRRELL.

The accompanying illustrations show two designs for steel coal tipples, of different capacities, such as are generally used at the coal mines in the Kanawha region, and elsewhere throughout West Virginia. The object of these tipples is to deliver the coal from the mines to the cars for shipment, to screen and weigh it, all at the least possible cost. Throughout the mountain re-

batter posts, and two center vertical posts about 10 ft. apart, so as to leave a clear, vertical, open space for the screens and chutes. Clear open space must likewise be left in the side bracing for at least three lines of tracks and cars. In the tipple design herewith illustrated (Fig. 1), the railroad tracks are situated across the stream from the mine, and it is, therefore, necessary to bridge the stream. The entire deck of the structure is floored over with 2-in. plank, and on each side is pro-

vided a hand-railing for the safety of the workmen. The mine-cars run on four wheels, and are 8 ft. long. They weigh 2,000 lb. when empty, and 6,000 lb. when loaded. The design illustrated is designed for three loaded cars only, on one track and empty cars on the other track.

Steel joist cost . . . . .	\$800 or \$3.50 per linear foot,
Concrete pedestals cost 500 "	2.20 " " "
Fence cost . . . . . 120 "	0.50 " " "
Floor plank cost . . . . . 300 "	1.30 " " "
Steel rails cost . . . . . 280 "	1.20 " " "
Machinery cost . . . . .	1000
House cost . . . . .	800

The total cost is, therefore, \$7,300; the total weight is 66 tons.

The estimate for coal tipple, wood construction (Fig. 2.), is as follows:

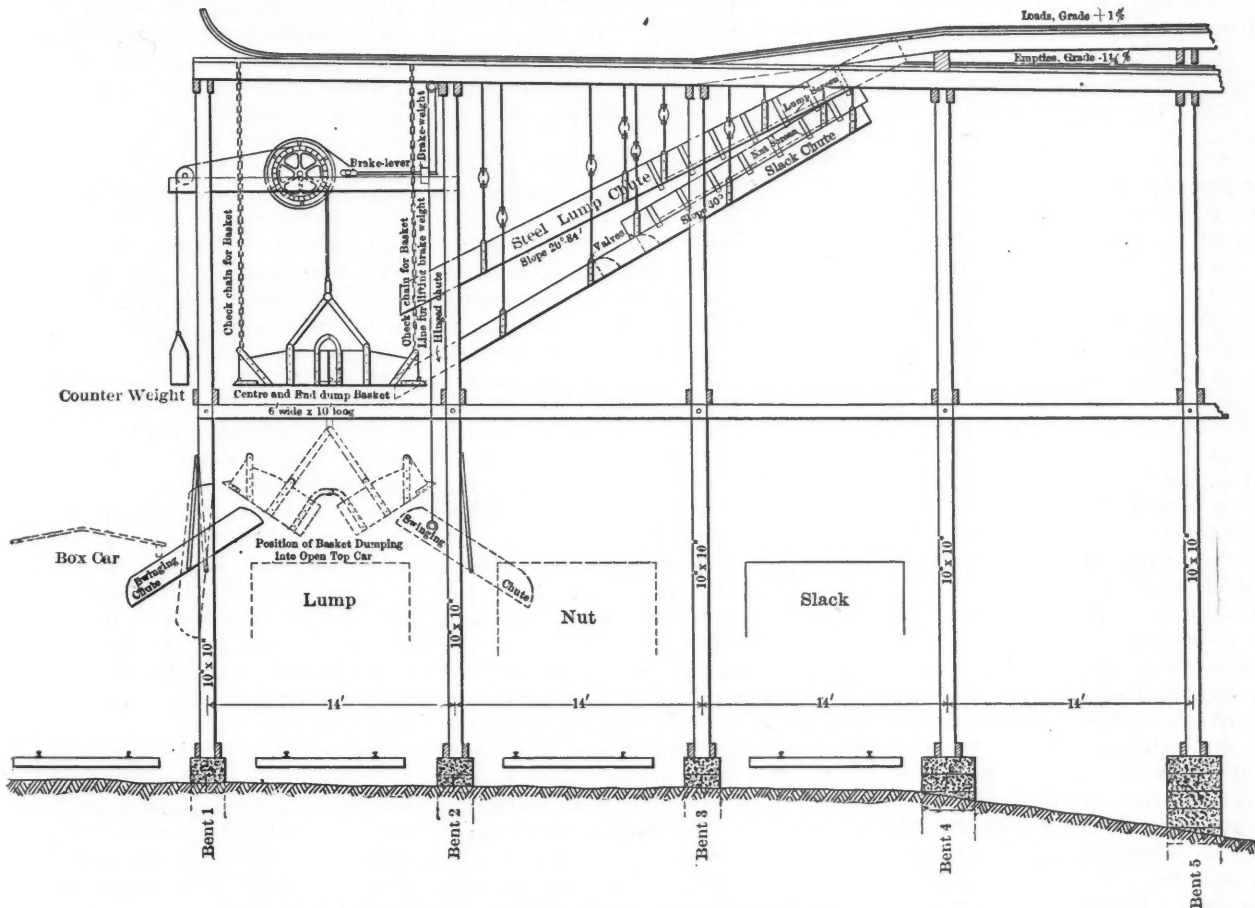


FIG. 2. SIDE ELEVATION OF TIPPLE, SHOWING SCREENS AND CHUTES.

gion of West Virginia, the railroads follow the water-ways or the valley-bottoms. As the entrance to the coal mine is usually up on the hillside, it is necessary to bring the coal down and load it on cars in the valley. The tipples are made about 40 ft. high, in order to accommodate the various screens, chutes and weighing baskets above the cars. The small mine-cars are run from the mine onto the tipple, and down a grade by gravity to the outer end, over the cars or hopper, where they are dumped. They then come back again to the mine on another track on a down-grade, and on reaching the hillside are elevated to the mine entrance. At the end of the trestle over the screens, there is erected a shelter-house, to protect the operator from the weather.

After being screened into the various sizes of slack, nut and lump, the coal is delivered into bins or cars. Several of the bents at the outer end must be built with

provided a hand-railing for the safety of the workmen. The mine-cars run on four wheels, and are 8 ft. long. They weigh 2,000 lb. when empty, and 6,000 lb. when loaded. The design illustrated is designed for three loaded cars only, on one track and empty cars on the other track.

The following estimates give the weight and cost of both steel and wood construction. The tipple illustrated, is 230 ft. long, 40 ft. high, and contains, besides the trestle bents, a river span of 90 ft. The width of the deck varies from 14 ft. over the river, to 20 ft., at the outer or loading end. Foundation piers are made of concrete.

Most of the coal-tipples in West Virginia are made of wood, but a few are of steel.

An estimate for the tipple (Fig. 1), shows that the steel frame costs \$2,200, equal to 25c. per sq. ft. of vertical profile. Other

Wood frame cost . . . . .	\$1,100 or \$0.13 per sq. ft. of profile.
Wood joist cost . . . . . 200 "	0.87 per linear foot.
Concrete pedestals cost 650 "	2.80 " " "
Wood fence cost . . . . . 80 "	0.35 " " "
Plank floor cost . . . . . 250 "	1.10 " " "
Steel rails cost . . . . . 280 "	1.20 " " "
Machinery cost . . . . .	1,000
Wood house cost . . . . .	250

The total cost of the tipple in wood construction is, therefore, \$3,810, or about \$3,500 less than the steel frame.

According to S. D. V. Burr, in the *Iron Age*, a Newark, N. J. inventor has evolved a new method of generating electricity, which he calls a dynelectron. It is a new form of cell, depending upon heat to produce a chemical action, that is claimed to be cyclic. The battery built develops nearly 1 h.p. per cell, but the mechanism is by no means ready for commercial use.

### Electricity in Coal Mining.

BY GEORGE E. WALSH.

The entrance of electricity into general mining has naturally stimulated the application of steam and compressed air to a point that shows much greater economy of operation and efficiency than ever before. This is particularly evident in the anthracite regions of Pennsylvania and in the bituminous fields of the West. At the present moment, steam, compressed air and electricity are employed in the coal mines with varying success, and often all three are found in use in one mine. Practical miners and engineers are specializing the different forms of prime movers, and it looks as if no one would gain complete ascendancy for some time to come.

The mining engineer aims at practical results; it is immaterial to him how they are gained. When it comes to obtaining more efficient service at less outlay of capital, he can no longer hold to old favorites unless they can prove their worth. In certain departments of mining, electricity has demonstrated its superiority over steam and compressed air, and, to that extent at least, its general adoption is assured.

Coal mining, as conducted by the large anthracite companies, furnishes an excellent field for the adoption of electricity on a large scale, with all the machinery operated from some central power station. The practice in the past has been to distribute power-units over a large area to run hoists, pumps, coal-cutting machines, and underground locomotives. Both underground and surface steam plants have been a part of the coal companies' property. It has been considered more economical to operate several steam engines than to attempt to distribute steam through long pipes. Where the plant is scattered over a wide territory, a number of independent units is demanded.

But the modern idea of power operation is to cut off as many separate auxiliary units as possible and to consolidate them in one system. In this respect electricity has the advantage. With a central generating station, the power can be distributed underground or at surface as needed, at less loss of energy than by steam and compressed air. This has been the aim of several of the large companies in both the anthracite and bituminous regions of Pennsylvania. The Delaware, Lackawanna & Western Company has slowly developed the 'central station' idea, and it is apparent that the company intends to operate all of its machinery by electricity. This practical test is of the greatest interest to engineers in other mining regions. In the first place, the collieries of this company are peculiarly well situated for central-station development, because they are compact. The distribution of the power from a central station is thus less wasteful than in many other coal mines where the collieries are

scattered over a wide territory. A 5,000 h. p. steam-plant for the generation of electricity was established by the company for its collieries at Hampton some time ago, and more recently an additional 2,000 h. p. equipment was completed, while plans are being drawn for a further extension. It is the object of the company to electrify the whole of the plant so that a thorough test can be made. The generating station is installed with Curtis turbo-alternators, and the current generated by them is distributed by wires to several sub-stations in the mines. At these sub-stations the voltage is transformed down to the amount required for operating the hoists, pumps, cars, and breakers.

So far, an electric power plant has been used chiefly for hauling, hoisting and pumping, but the collieries are to be completely equipped for electric operation. Locomotives have already supplanted the mine mule, and the electric mine-locomotive in the Keyser valley has proved the most efficient method of transport. The electric locomotives gather current from ordinary overhead trolley arms; in addition to this they are supplied with a winding drum which enables them to run on temporary tracks and switches several hundred yards from the regular trolley line. A cable is unwound from this drum, and power is fed through it to the motors; the locomotive thus enjoys an amount of independent action superior to one taking its feed only from overhead wires.

The operation of coal-breakers by electricity is a novelty even in the anthracite coal regions; at the best, the breaker is a rather complicated plant, and when driven by a steam engine it must be supplied with a vast amount of mechanism to control it. The Lackawanna Company installed an experimental breaker with electricity some time ago, and its operation ever since has shown greater efficiency and economy than those run by steam. There has been a gain in efficiency of 40 per cent, and a saving of nearly 20 per cent. Another important factor is the simplicity of operation and construction. With individual motors for driving the different parts of the breaker, the various belts, shafts and gears are not needed. The operator has his machinery under control, so that any particular part of it can be stopped without shutting down the rest of the plant. The simplicity of the arrangement naturally lessens the cost of construction, and as the initial expense of a breaker is considerable, this will prove an attractive feature. Other electrically-operated coal-breakers are in the course of building now, and the Delaware & Hudson Company has just completed one of the largest in the anthracite region.

Electric hoists have not received as much attention in this country as in Europe. There are no large electric mine-hoists in this country comparable to those installed in Germany. The largest used

here is of only 300 h. p., while in German mines there are a number of several thousand horsepower each. Experiments in that country with steam-pipes from 1,000 to 4,000 ft. long showed such a wastage that electricity has been pretty generally adopted. Electric hoists with two and three thousand horsepower capacity on their main shafts have proved economical, and their adoption has grown rapidly in the larger mines. Even the Lackawanna Company has been slow to adopt electricity for this purpose, but it is taking up the question now through its engineers and a series of experiments is being made.

Pumping and hoisting by electricity have been in use for some years, but few large units have been installed. The larger pumps and hoists are nearly all confined to steam operation. But the electrification of the collieries requires the adoption of motors for nearly all work; the small electric hoists employed on underground slopes and shafts have given satisfaction, but it is the large installation of powerful electric units that must solve the problem. The distribution of electric power from some large central station to all parts of the mine is a problem which engineers are rapidly solving in the anthracite region. Such distribution must be in variable amount, so that the demand for large and small current at different points can be met readily. No power equals electricity in economy of distribution, where large and small machines along the route of the distribution are in operation. The stepping-down of the current to suit the individual needs of each unit is simple and easily obtained.

The operation of rock-drills in shafts and slopes opening from one cross-cut to another by electricity has proved satisfactory, so that their further adoption is likely. Likewise small and large pumps have been operated by electric power in the Wyoming and Keyser valleys of the anthracite region with great success. Manufacturers now furnish such types of machinery equipped with electric motors of almost any size; the present demand for large units for important and heavy mine work is stimulating them to design and equip machinery with motors of great capacity. Those in charge of the mechanical arrangements advocate the adoption of larger electric equipments, especially where the collieries are large enough to warrant the construction of central generating stations.

The general increase in the number of electric mine-locomotives in Pennsylvania is noteworthy. A few years ago there were only a few experimental electric mine-locomotives employed in the anthracite region, but in the spring of 1904 the number in use was 113. As indicating the relative value of the different types, 36 of these were equipped with the cable-reel, and were employed in gathering coal cars from the room faces. The others were of the usual overhead-trolley type,

and were employed in a variety of ways for hauling. The average size of the former type is 6.5 tons in weight, but the pulling capacity is out of all proportion to the size; their tractive energy is so great that a single one can haul loaded cars up grades which four mules working in tandem could barely walk up with an empty car behind. Their efficiency is thus so great that the saving obtained in the end increases profits and enlarges the daily output.

In the bituminous region, the electric mine locomotive has proved even more popular. The number has steadily increased in the past two years. Five years ago there were only a few crude machines in use. These, however, paved the way for their successors.

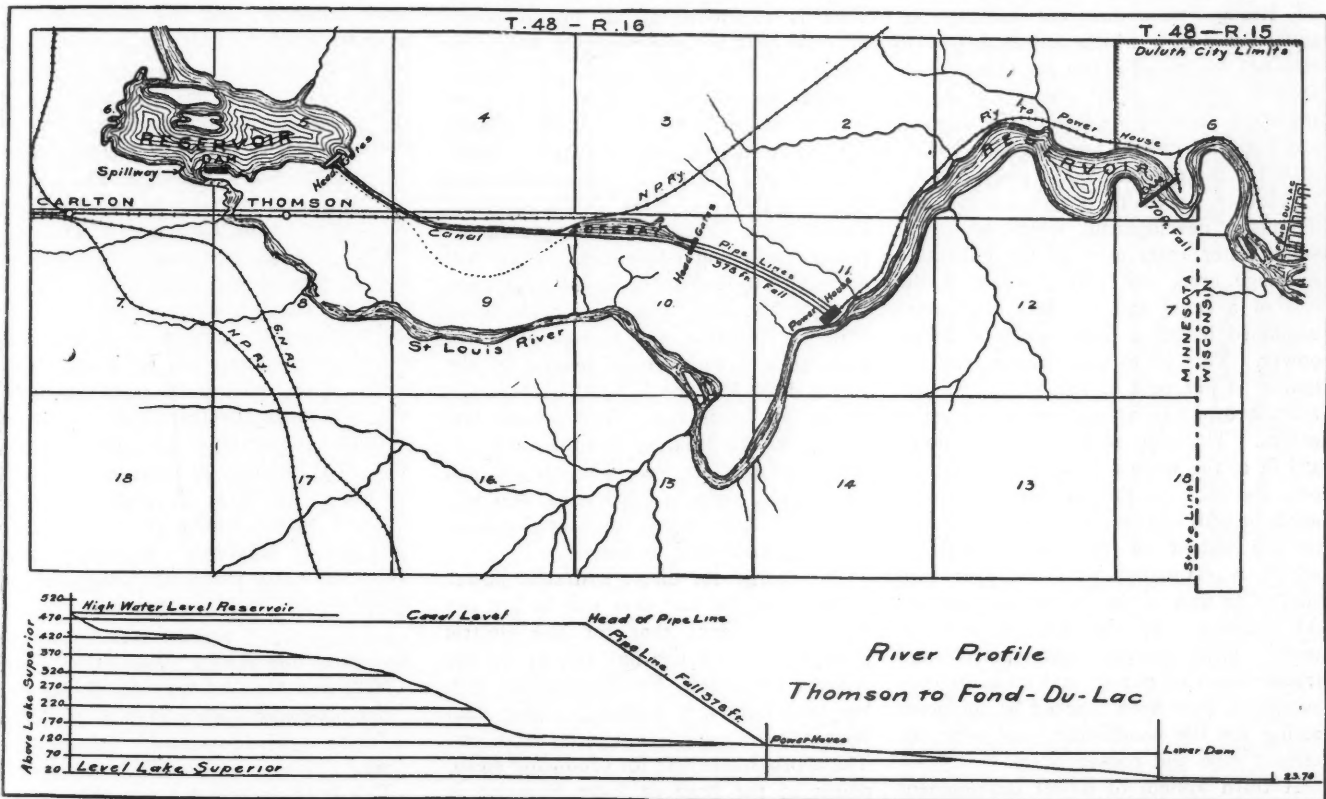
**Water Power for the Mesabi.**

The Great Northern Power Company, of Duluth, Minn., has made arrangements to utilize a total of 200,000 horse-power from the St. Louis river and tributaries, near Duluth. Upon the plans necessary to carry out this immense operation, work begins immediately.

In many ways this is to be excelled in interest by no power development in this country. The high head possible, and the great drainage area covered by the water-courses flowing into Lake Superior at this point, permit a concentration of development. The power proposed to be developed is greater than that of any single company in the world. The situation with reference to steam plants, already located at Duluth and vicinity, is such that it per-

successfully, no matter what the cost of fuel, within reasonable limits of price. The cost of development of this Great Northern power is far below \$300 per continuous horse-power.

Thirty years ago, Jay Cooke, then engaged in financing the Northern Pacific road, realized the future importance of the cities that were to spring up where Duluth and Superior now are, and he gathered in the lands along the dales of the St. Louis, where within six miles there is a fall of about 400 ft. Since that time he has had frequent opportunity to associate himself with power development of this splendid fall; but either promoters, methods or the times did not appeal to him. The present plan takes advantage of the latest developments in power transmission,



PLAN OF DEVELOPMENT AT GENERATING STATION, ST. LOUIS RIVER.

In 1901 the number had climbed to 231, and the year following 326 were in operation. It is a notable fact that while the number of electric mine locomotives increased in these mines over 40% in 1902, the number of steam mine locomotives decreased 3%, and compressed-air locomotives about 44%. This change of power in the bituminous region has steadily advanced until there are upward of 500 electric mine locomotives in operation there.

The earlier types of electric mine locomotives installed in some of the mines are in use now. Even some of the early 'terrapin backs' installed in 1891 are in operation in the Erie collieries near Scranton and at Forest City. But compared with the modern type these pioneers appear antiquated and inefficient; they serve, however, to indicate the rapid changes that are being made in electrical equipment.

mits the immediate utilization of a large power, and it will not be necessary to cast about for industries that may require it. The units of power are to be equal in size to any ever contemplated, and some interesting engineering problems have been worked out by the experts employed by the company. In the final consumption of 200,000 horse-power from this power plant, there will doubtless be inaugurated the most extensive and important freight railroad haulage by electricity that has ever been seriously considered—that of iron ore from the Mesabi range; also the electrical equipment of mining plants aggregating more than 50,000 horse-power. The statement has been made by competent engineers, that development for continuous power at a cost not exceeding \$300 per horse-power, produces energy at a rate with which steam cannot hope to compete

is backed by men of wealth and influence at Duluth, and presents an array of contracts for power. Mr. Cooke's original idea was for a series of dams along the river, ten in number, to utilize, step by step, portions of the fall over and over again, for direct hydraulic power, and to line the river for six miles with factories. The present plan calls for the delivery of all power developed at transforming stations in Duluth or other centers of distribution, to be used where the consumers now exist.

The St. Louis river drains an elevated plateau, lying 600 to 800 ft. above Lake Superior, and coming very close to the shores of the lake before it drops away. The drainage area covers about 3,700 square miles; and it is a series of swamps and timbered ridges, affording a favorable situation for the natural conservation of

the flow, and also for what storage reservoirs are required for the full operation of the system. At one point, by the construction of a few side dams, and the cutting of two or three short channels through gravel and drift, the flow of the river and its tributaries may be brought to within two miles of the harbor at Duluth, and 600 ft. above the city. At this point will be the main power development; though it is not to be undertaken until after two others have been completed and fully utilized. This is called the Duluth Heights development, and by the diversion of 30 per cent of the rainfall from 1,300 square miles, with an effective drop of 740 ft. through steel pipe to wheels in the power house, 105,000 horse-power will be generated. This will require the provision of storage reservoirs for holding 397 square-mile-feet, which are estimated to cost not to exceed \$1,000 per square-mile-foot of capacity. This low cost is due to the small value of the lands to be covered, and the character of the ground, which is ideal for the construction of reservoirs.

Another system of power is called the Thomson development, which will consume water from most of the remaining drainage area, and will generate at the end of a canal and pipe-line of 3 miles combined length a total of 93,000 horse-power. This is 10-hour power, and requires 30 per cent of the annual rainfall from a drainage area 2,400 square miles extent. The pipe will lead water down 378 ft. to the wheels, and for the continuous operation of this system there must needs be provision for the storage of water to the extent of 712 square-mile-feet, which is estimated at a cost per foot similar to that of the larger development. All estimates, by the way, whether of water, flow, storage, development and transmission of power, and probable consumption, have been checked by engineers acting for the bondholders and with the utmost care and conservatism.

A third system of power development is to be direct hydraulic. It will take water that has gone through the Thomson wheels or has come unimpeded down the river, and pass it over a dam 70 ft. high. Here 12,500 horse-power will be generated for use in paper and pulp mills, or similar plants, arrangements for the location of which are now pending. This dam will be within the city limits of Duluth, as will also be the generating station for the Duluth Heights system. The Thomson station is some three miles outside the city limits. Power transmission from any of these stations to the center of the city will be short. It is 50 to 60 miles from generating stations to the Mesabi range, where 40,000 horse-power are required for mine operation, and it is 75 miles to the group of great mines on the Vermilion range, which consume about 5,000 horse-power. Doubtless the greater portion of these mines will be equipped electrically within a brief period. Negotiations toward

that end have been pending, and estimates of costs have been made. The three railway lines, yearly moving fifteen to eighteen million tons of ore from these mines to Lake Superior, require something like 100 heavy steam locomotives. Estimates upon the adoption of electricity on these lines indicate a saving by such substitution of more than \$500,000 annually for each of the three roads interested. There is little question that this change will ultimately take place. It is the most magnificent scheme for the alteration of steam roads to electric that has been seriously considered.

The power stations of this company will be about 125 miles from Minneapolis and St. Paul, and that distance is no bar to the economical transmission of power by wire. Fuel is expensive at all inland points near the head of Lake Superior, and is not especially low-priced even at Duluth; though the cost of bringing it to Lake Erie is less than the expense of carrying it from the sidewalk to the adjacent cellar.

The wheels, in their general arrangement, will be similar to those of the Cataract Construction Company, of 12,500 horse-power each, water-balanced. They will be coupled to internal revolving generators of 7,500 kw. each, similar to those being built for Niagara, the houses of which were such a conspicuous feature of the recent display of the General Electric Co. at the St. Louis fair. Both wheels and generators are of larger size than have yet been placed in service. The current will be 25-cycle, 3-phase, 6,600 volts, and will be stepped up to 30,000 volts for transmission to distributing stations.

The charge for direct hydraulic power at the Fond du Lac dam will be \$10 per horse-power-year; that for the electric power will be somewhat similar to the Niagara schedules. For installations with low load factors, it is slightly higher than Niagara; for a high load factor it is less. The approximate cost for producing steam power at the head of Lake Superior is from \$65 per horse-power, for say, 100 horse-power to \$32 for a 1,000 horse-power plant. The equivalent rates established by the Great Northern Power Company, based on its franchises, vary from \$33 to \$23, or from 12.78 to 9 mills per kilowatt-hour. Considering the actual effective power produced at machines, the difference is from 5 to 30 per cent greater, thus further reducing the cost of electric power in comparison.

*Han yü* was the name the Chinese applied to the jade which was used in ancient times to be put into the mouth of a corpse before burial, but the name has gradually been extended to include all kinds of jade found at the present day in ancient tombs. The Chinese cultivate the greatest reverence for antiquity, and they classify pieces of ancient jade as the rarest and most precious of their archaic treasures.

### Books Reviewed.

*Ordinary Foundations. Including the Cofferdam Process for Piers. Second Edition.* By Charles Evan Fowler. New York; John Wiley & Sons, London; Chapman & Hall, Ltd. Pages, 340; illustrated. Price, \$3.50.

The first edition of this book has been well known as an excellent summary of knowledge and practice relating to foundations, which form an essential part of all engineering structures. The necessity for a second edition has made it possible to make valuable additions to the text, by which the subject of ordinary foundations is more comprehensively covered. The construction of piers by the use of metal cylinders; with timber caissons by open dredging; and the construction of ordinary-sized foundations by the use of pneumatic caissons, has furnished another chapter. A chapter has been added on the subject of foundations, which covers the bearing capacity of soils. A new chapter on building stone, masonry, and the design of piers is intended to supplement the old chapter on the 'Location and Design of Piers.' Enough new matter has been added on cement and concrete to form an additional chapter, which includes valuable tables giving the amount of material required for concrete of different proportions. The building of piers of timber and pile bents, together with the subject of timber preservation, has been discussed in a final chapter, as fully as a general knowledge requires. A large number of old and recent works are described, as examples of practice. The book is illustrated by many views and diagrams, and numerous useful tables are given.

*Secrets of the Rocks. The Story of the Hills and the Gulches.* By S. M. Frazier. Denver, Colo.; Hall & Williams. Pages, 432; illustrated. Price, \$1.60, net.

This book is intended to be "a manual of hints and helps for the prospector and miner," according to its sub-title. The author makes no claims to professional or literary excellence, but says that he writes for practical men in a practical way. His object is to guide the prospector by giving him hints drawn from his own experience, with such additions as can be drawn from more scientific works, expressed in a general way, easy to be understood by the reader having little or no technical knowledge. The book therefore includes some chemistry, some geology and some mineralogy. No attempt is made to teach assaying, beyond the use of ordinary blow-pipe and chemical tests, which can be made with limited equipment, and which will identify the better-known minerals.

The book is written in an off-hand way, without any pretensions to style, and is of a readable kind. Its deductions are fairly made and fairly stated; though they

cannot always be accepted without hesitation. Interwoven in it are many narratives of personal experience, given by way of illustration; and these are not the least interesting part. Mr. Frazier is evidently well versed in the stories and traditions current in the Rocky Mountain region. He gives, for instance, a number of those floating tales of wonderful lost mines, which are familiar to every old prospector—and gives them as though he believed most of them.

Doubtless this book will find many readers. Though it cannot be considered an authority, it contains much that will be useful to a prospector; and much that will be interesting to the man who is not a miner, but is still susceptible to that peculiar fascination which attends the search for the precious metals.

*The Colliery Managers' Handbook. Fifth Edition.* By Caleb Pameley. New York; the D. Van Nostrand Company. London; Crosby Lockwood & Son. Pages, 1,208; illustrated. Price, \$10.

In the fourteen years since this book was first published, it has established its place as a standard work. In fact there is no other single book which contains such a complete summary of the science and art of mining coal, though some others may equal it on special points. A new edition was needed, however, to bring it up to date, especially on such points as the use of mining machines and the various applications of electricity to mining. To do this, several of the chapters have been re-written and over 200 pages of entirely new matter added, with many new illustrations. The new information covers many important points, including pumping, rock and coal drills, coal cutting machinery, safety lamps and explosives; while the chapters on mine ventilation and its regulation have been re-written in accordance with the latest experience.

Mr. Pameley is manager of an English colliery, and his work is naturally based largely on British conditions; he has not neglected German and American practice, however, and both receive fair consideration. Especially in the matter of machinery, we find many illustrations of American machines and devices. Thus a considerable part of the chapter on mining machines is devoted to American practice, and we find much about American work in the section on pumping machinery. In a general way, coal mining methods are based on the same principles everywhere, and the modifications in national practice are little more than those required by local conditions.

Especially valuable in the present edition are the sections on ventilation, on mine explosions and on safety lamps, which embody the latest results of work and experiment. The chapter on underground haulage, while comprehensive on the subjects of rope and chain haulage, has little or nothing on the use of elec-

tric and compressed-air locomotives in mining, which is important in this country. In a few points like this, the book falls short of what it should be. With these exceptions, however, it is a valuable compendium of coal mining experience, which can be studied with profit both by the beginner and the manager.

*Geological Survey of Canada. Bulletins of the Section of Mines. Platinum.* By Theo. Denis. Pages, 28. *Apatite.* By R. W. Ells. Pages, 32. *Graphite.* By R. W. Ells. Pages 32. *Manganese.* By Elfric Drew Ingall. Pages, 28. *Infusorial Earth.* By T. Denis. Pages, 16. *Asbestos.* By R. W. Ells. Pages, 28. *Mica.* By R. W. Ells. Pages, 32. *Salt.* By Elfric Drew Ingall. Pages, 36. *Zinc.* By Elfric Drew Ingall. Pages, 16. *Molybdenum and Tungsten.* By R. A. Johnston, and C. W. Willimott. Pages, 16. *Peat.* By R. Chalmers. Pages, 40. Ottawa, Canada: Public Printer.

The scope and object of this series of bulletins is expressed in Mr. Ingall's introduction to the first one—on Platinum—which is as follows:

"It represents a reprint with additions of the article with that title forming a portion of the 'Annual Report' of the Section for 1901. The material has been collected and prepared by Mr. Theo. Denis. Pursuant to a policy suggested some years ago and now carried out, this pamphlet is intended to be the first of a series giving, in condensed and popular form, information regarding the mineral resources and possibilities of the country, together with any data regarding similar occurrences in other countries which may be of use to prospectors and operators in Canada."

The plan thus outlined has been carried out through the series. Information given in the reports of the Survey has been combined with other data and with general notes on the uses of the different metals and minerals, the demand for them, and other points useful to the operator. In each case notes are given relating to literature on the subject, so that the reader who desires extended information, is told where he can obtain it. Statistical information is also given, covering production in Canada and elsewhere, and the conditions of trade. The general plan is a good one, and it is well carried out. The series will be exceedingly useful to prospectors and miners in Canada, and we believe that they will be appreciated.

Of the seventy or more elements, the following twenty-seven occur 'free' in or on the globe, namely: Oxygen, nitrogen, hydrogen, sulphur, selenium, tellurium, arsenic, antimony, bismuth, carbon, iron, nickel, copper, silver, gold, mercury, platinum, iridium, osmium, ruthenium, rhodium, palladium, and the five argonoids—helium, neon, argon, krypton, and xenon.

### Books Received.

In sending books for notices, will publishers, for their own sake and that of book buyers, give the retail price? These notices do not supersede review in a subsequent issue of this JOURNAL.

*Socialism.* By Henry Apthorp. Cleveland, O.; published by the Author. Pamphlet, 32 pages. Price, 10 cents.

*Annual Report of the Commissioner of Internal Revenue. Fiscal Year 1904.* John W. Yerkes, Commissioner. Washington; Government Printing Office. Pages, 276.

*Geologic Atlas of the United States. No. 115. Kittaning Folio, Pennsylvania.* Washington; Engraved and published by the United States Geological Survey. Seven plates and 16 pages text.

*Western Australia. Report of the Department of Mines. 1903.* L. L. Crockett, Acting Secretary for Mines. Perth, W. A.; Government Printer. Pages, 280; with maps and illustrations.

*United States Department of Agriculture. Bulletin No. 30. International Sugar Situation.* By Frank R. Rutter. Washington; Government Printing Office. Pages, 98; with maps and diagrams.

*United States Geological Survey. Bulletin No. 253. Comparison of Wet and Crucible-fire Methods for the Assay of Gold Telluride Ores.* By W. F. Hillebrand and E. T. Allen. Washington; Government Printing Office. Pages, 32.

*Protective Inoculation against Asiatic Cholera.* By Richard P. Strong. Prepared for the Biological Laboratory of the Philippine Islands. Manila, P. I.; Bureau of Public Printing. Pages, 52; with diagrams.

*United States Commission of Fish and Fisheries. No. 554. Report of the Special Commission for the Investigation of the Lobster and the Soft-Shell Clam.* Pages, 84; illustrated. No. 255. *The Commercial Fisheries of the Interior Lakes and Rivers of New York and Vermont.* By John N. Cobb. Pages, 24. Washington; Government Printing Office.

The cold blue-green light of the Hewitt tube is well known, and the desire to improve this has led to open experiment. Several years ago Gumlich constructed a lamp, using cadmium-amalgam, which warms the tone of illumination. One serious weakness, however, was the short life of the glass. This has been remedied by the work of Heraeus, and especially of Lummer and Gehrcke, who substitute quartz for glass. The amalgam used contained 14 parts of cadmium in 100 of mercury. It is a suggestion of what may be done by the blending of lights from various elements.

The power going to waste at the Victoria falls on the Zambesi river, in South Africa, is calculated at 25,000,000 h.p., or five times that of Niagara.

## Correspondence.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested. Letters should be addressed to the Editor. We do not hold ourselves responsible for the opinions expressed by correspondents.

*The Killing of John K. Mackenzie.*

Sir—John K. Mackenzie, of the firm of Dickson, Mackenzie & Potter, mining engineers of Chicago, was killed by the Yaqui Indians in Sonora on Jan. 19. Mr. Mackenzie was in company with Dr. R. C. Coy and H. L. Miller, of Chicago, respectively president and manager of the Libertad Mining Company; M. A. Call, of Toledo, Ohio, and C. E. Tolerton, of Salem, Ohio, who are interested in the Yaqui Smelting & Refining Company's plant at Toledo, Sonora, and Walter Stubenger, of Hermosillo, who was making a social visit to the Libertad camp with Mr. Miller. The party was returning to the railroad at La Colorada from visits to the respective properties. They occupied two carriages and, at 5 p. m. on Jan. 19 had reached a point on the Tecoripa road, about 8 miles east of Cobache ranch and some 45 miles east of La Colorada, in a region of heavy mesquite timber and thick brush. Without warning they received a terrific fusillade from the brush 15 or 20 ft. distant. Mr. Miller, who understands the conditions, shouted to them to jump and run. He escaped with a slight flesh-wound, and in company with his driver. The others all jumped into the brush, and the horses of the rear carriage, unharmed, took fright and dashed past the first carriage. Mr. Tarleton jumped into it as it passed and, taking the lines from the dead driver, made his escape unharmed through a rain of bullets. He reached Cobache ranch, where the other two survivors met him later. The other four Americans were wounded as they jumped from the carriages, and fell fighting to the end. The bodies of the four Americans and one driver were recovered that night. They had been stripped of everything, and none of them had received less than three shots. The remains have been sent to their homes.

This is the most outrageous attack the Yaquis have ever made on Americans. Their usual custom has been to hold up travelers and rob them, without inflicting injury, unless they met resistance, and it is only occasionally that Americans have been subjected to even those attacks.

Practically all of the Yaqui depredations have been committed on the three roads running east from La Colorada—one to Matape, and the other two to Tecoripa, known as the Cobache road and the San José de Pimas road, with an occasional attack on the road east from Ortiz, which is a short distance to the south—yet no patrol of these roads is maintained. The feeling is very strong, among both Mexicans and foreigners, that the military au-

thorities are culpable in not taking more radical means to protect travelers.

Although the depredations are confined to this small but important area, the general impression is created in foreign countries that the entire State is unsafe, which is not the case. Business is suffering greatly, and is in a fair way to be paralyzed if means are not found to suppress the Yaquis.

TRAVELER.

El Paso, Tex., Jan. 22, 1905.

*The Buss Concentrating Table.*

Sir—In your issue of Oct. 6, 1904, you published a letter from Mr. E. Ferraris, of Monteponi, in which he claims to be the original inventor of the concentrating table having the upward oblique throw somewhat similar to that of the vanning shovel. I had no wish to rake up an old controversy which had been amicably settled, and have not so far replied to his letter. It occurs to me, however, that, in justice to your JOURNAL, I should not allow the idea to go abroad that your contributor who sent the article describing the Buss table had supplied you with inaccurate information.

The weakest point in Mr. Ferraris' letter is his statement that he filed his United States patent on Dec. 5, 1898, while I did not file mine until Feb. 12, 1900. This is true as far as it goes, but it is quite misleading, for he omits to mention the important fact that his application was either not granted, or not proceeded with, and that he has no United States patent at all. My application was granted, and my patent number is 657,393.

The history of the evolution of the table shows that three engineers were concurrently working out the idea unknown to each other. I obtained the idea from the Kreiss corn conveyor, which I saw at an exhibition at the Agricultural Hall, London, long before Mr. Ferraris' application. I applied for a British patent on June 1, 1899, and a patent was granted on Sept. 1, 1900, and is numbered 11,440 of 1899. Mr. Ferraris applied for his British patent some months before me, on Oct. 31, 1898, and it was granted Sept. 9, 1899, being numbered 22,874 of 1898. As his patent was not published until after I applied for mine, I had no knowledge that he was working on lines similar to myself until my attention was called to his English patent, in December, 1900.

I first heard that the Grusonwerke, in Magdeburg, were also working on these lines when they communicated with me after the publication of my United States patent. They then proposed to buy my patent, but as I had already engaged with the Luhrig Company, in London, I could not accept their proposition, and they subsequently obtained control of the Ferraris patent. In order to combine these varying interests a vast amount of negotiations took place, and eventually an

amicable arrangement was made between all parties concerned, who are now working under reciprocal agreement.

My claim as an inventor rests upon my application of the well-known movement and mechanism of the Kreiss corn conveyor to the purpose of ore concentration and separation, and I claim that my method of producing this motion has been the best in practice for tables of this type. By placing my table on clamped ash springs, forming resilient supports, which I believe is entirely novel in this connection, I have practically eliminated joints and wearing parts, and produced an even and smooth swing. Mr. Ferraris, as can be seen from his patent specification and drawings, originally supported his table on levers working in joints, which, as can be easily understood, wear out soon at the joints and produce a jerking, uneven motion, quite fatal to the effective action of the machine.

Another point in Mr. Ferraris' letter that I should like to refer to is his statement that in the spring of 1898 he sent his table to Frongoch, and that it was used in the dressing works there. If this were correct, it would be a very unwise admission, having regard to the date of his British patent; but, as a matter of fact, I think he is in error, as his table was not used in practice there.

J. Buss.

London, England, Jan. 11, 1905.

A high carbon steel should not be used for making taps, dies, or other threading tools.

Agricola (A. D. 1494-1555) was the father of modern mining and metallurgy in print. One of his most important books was 'De Re Metallica'; it is characterized by keen observation, clear description, and temperate judgment, fortified with great learning. There is as yet no English translation, but it is whispered that such is in progress, and from a union of most competent scholars. The original was full of quaint and detailed illustrations.

Of the harmful accidental ingredients in steel, phosphorus is most noxious, because it makes the metal brittle at ordinary temperature, or cold short. In basic steel it should be below 0.04 per cent; in acid steel below 0.08. This contaminating phosphorus receives great attention from bridge contractors, as it affects the strength of steel construction when it is in place. Sulphur does not seriously affect the quality of steel at ordinary temperatures, but it makes the metal brittle and hard to work at high temperature, or hot short. Hence sulphur is especially unfavorable to the interests of the manufacturer of steel; while phosphorus is equally unfavorable to the interests of the consumer of the manufactured product.